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Electrical World

New York, Saturday, July 2, 1921

Labor and the Problem of Its Unhelped Thinking

WHENEVER two or three are gathered together nowadays some man is sure to bring the conversation round to labor. *When is it coming down? What is the matter with labor anyhow?* It would be good for all of us if we could realize and keep in mind the fact that the present troubles of labor are as much our fault as the fault of the workingman.

For labor's difficulties today are more than anything else matters of thinking and of understanding. Labor, through the generations, has been bred and trained to work, not to think. And when the unfolding of industrial evolution brought the organization of labor, with need for mass thinking and the control of a great, unaccustomed power, is it surprising that laborers failed to display wisdom? Labor was organized when it knew nothing about organization. It began to think when it knew nothing about thinking—that is, thinking in broad terms of economics, finance and social welfare. And nobody taught it *in time* how to think or what to do.

Now, no workingman is sufficient unto himself alone. For if he could combine the highest skill with the utmost human strength and was capable of working twenty-four hours a day without fatigue, and if he applied himself perpetually to production, still he could not produce enough to maintain himself alone under present standards of living—to say nothing of his family or of making a profit and contributing to the world's wealth. Yet labor does not appreciate all this; it has not been thinking about it.

Labor by itself is not wealth. Wealth is the product of labor plus capital plus ideas. Without labor capital cannot apply itself. Without capital labor cannot be utilized. Each is a major element, yet each must encourage and assist the free progress of the other or its own development will be limited. But labor does not realize this; it has not been thinking of it.

The time has come when the thinking man should stop talking about the organized workingman and talk *to* him—about these things. Labor is not an abstract theory merely to be discussed. It is a vast, encompassing condition in which we all must work out our own practical, harmonious relationship. And labor must be taught and helped to think before its thinking can improve.

The function of the ELECTRICAL WORLD is to gather and present for use the best thinking of the electrical industry. The engineer and man of business will both serve their interests well if they will work to bring this clearer thinking to the minds of labor, that we may sooner learn to reason together in the same terms of interdependence.

William McClellan

Engineer and executive, whose educational and professional experience, combined with the work already performed by him for the American Institute of Electrical Engineers, renders him especially qualified to serve as its president

IN THIS day, when the engineer is beginning to feel a public consciousness, what could be more appropriate than the election as president of the American Institute of Electrical Engineers of one whose work has always conformed to the profession's highest ideals concerning the engineer's obligation to the public? Dr. William McClellan, the new president, is also admirably fitted for this office because of his intimate touch with Institute affairs and his knowledge of committee work gained through years of experience. In addition to the more technical committees dealing with standards, railroads, traction and transportation he has served on the following committees: Meetings and papers, Edison medal, educational, membership, service classification, intermediate grade of membership, constitutional revision, records and appraisals of property, economics of electric service, the Pan-American engineering committee, the United States national committee of the International Electrotechnical Commission and the board of examiners. For two years he was a representative of the Institute on the joint committee on legislation relating to the registering of engineers, for four years on the conference committee of national engineering societies and for six years a member of the A. I. E. E. public policy committee. The last-mentioned committees have dealt with subjects to which he has devoted considerable study. His A. I. E. E. paper in 1913, in which he proposed the formation of a national body representative in its membership of all national engineering societies, in order to assist in the realization of the ideals of the engineering profession and to extend the usefulness of the professional engineer as a servant of the community, brought prominently forward the idea which later crystallized into the Engineering Council and the Federated American Engineering Societies.

William McClellan was born in Philadelphia, Nov. 5, 1872, and was graduated from the University of Pennsylvania with the degrees of B.S. in 1900 and Ph.D. in 1903. He was instructor in physics from 1900 to 1905 and dean of the Wharton School of Finance and Commerce at the university from 1916 to 1919. Although much of his time has been spent in university work, yet his practical and professional experience has been quite extensive, especially in electric railway construction and in executive lines. An account of his professional career will be found in the ELECTRICAL WORLD for Feb. 19 on page 447. Since 1907 he has been continuously associated in construction engineering with H. T. Campion of Philadelphia, and he is now a member of the firm of McClellan & Campion, with offices in Philadelphia and New York. In 1919 he became vice-president of the Cleveland Electric Illuminating Company. During the world war he was director of the Intercollegiate Intelligence Bureau in Washington, an association of all the principal colleges of the United States, organized by him to assist the government in obtaining trained men, and later taken over by the government.

Dr. McClellan, who has already served as manager and vice-president of the A. I. E. E., is a member of other engineering and economic associations and is at present chairman of the finance committee of the executive board of the American Engineering Council.

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The Other Way to Guard Against the Tactless Meter Reader

THERE are two practical ways to reduce the hurtful influence of unrepresentative employees of central-station companies. One way is to pick meter readers and service men more carefully. The other way is to decrease the amount of contact between these agents of the company and the householder. There has been much complaint of the harm done by untactful or discourteous metermen, but it is hard to select these employees on strict qualifications of refinement and courtesy. It is far easier to install the meter on the porch or in some such place where it may be read without the reader meeting the customer at all. In addition this practice completely obviates the return call. No reading need ever be missed. No man has to call twice, thus more than doubling the cost of reading the meter.

By all means let the idea of courtesy and service be instilled into the mind of every employee. Let these men be chosen as carefully as possible. But if in spite of this valuable friends are lost and harm is done because these lesser functionaries do not exhibit the true spirit of the company, it would be well and profitable to lessen their opportunity for doing harm by putting meters out of doors and keeping the men away from customers. There is sometimes more than one way to curtail a cat's career. Why not act on the proverb in a case like this?

An Insidious Form of Attack on Public Utilities

ALL OVER the United States electric light and power companies are spending time and money in the effort to promote public relations built on mutual confidence and respect. This work involves not only the constant proclamation of the truth about utility functions and utility earnings but also a readiness to answer attacks from whatever source they come. When the critics are honest, they can be convinced; when they are dishonest, they can be exposed and thus disarmed. No source of hostile propaganda should be overlooked, however contemptible from an intellectual or literary point of view it may seem. There is, for instance, the writer of fiction who, under the cover of a conventional plot, assails the honesty of the utility companies. One of the numerous magazines filled with short stories of a sensational or trashy type recently printed a tale in which the head of a local light and traction company plays the villain's rôle in the character of an unscrupulous franchise grabber after the pattern fashioned by our yellow journals and possibly existent in the almost prehistoric past. This man's nefarious attempts to control a public election in the interest of his company are thwarted by the hero, a town official, assisted by a young telephone engineer. The writer of the tale, who knows enough about electric and telephone companies to allude incidentally to the problem caused by joint use of poles and to misrepresent the voltage limitations on light and power circuits, places both these classes of utilities in the false light of public enemies.

Fiction mongers of so paltry a type may hardly seem foemen worthy the steel of company executives and publicity directors. None the less they address a multitude of readers of a kind easily deceived—some already voters and others future voters with minds in a formative state. These readers, too, are utility customers or at least prospective customers. Such attacks are the more vicious when they appear in periodicals ostensibly designed solely to entertain. Wherever it is possible to show their readers "how a plain tale shall put them down," the refutation is worth while.

A. I. E. E. Expresses Confidence in Superpower Transmission

CONFIDENCE in the success of 220,000-volt superpower systems was the outstanding feature of the two transmission sessions of the convention of the American Institute of Electrical Engineers last week in Salt Lake City. Discussion on the wide variety of papers offered through the committee on transmission and distribution turned invariably to their bearing on the notable paper by F. G. Baum proposing that at least 220,000 volts be adopted for transmission systems longer than 200 miles. It was further proposed that such systems be operated at constant potential by means of synchronous condensers installed at intervals throughout the system, with automatic adjustment for variations in the amount and direction of the flow of power. It appears to be generally accepted that with the use of synchronous condensers such systems will be free from abnormal voltage variations and, owing to the high value of the voltage and to a grounded neutral, free also from lightning and other transient troubles.

There was much good discussion on insulators. Evidence was presented of the increased reliability of units in which the cement was impregnated with oil or paraffine to prevent the absorption of moisture. Although the increased structural complication of the arcing ring designed to relieve the strain on the insulator units next to the line conductor was considered a possible limitation to its use, it was evident that the arcing ring is in the background of all the confident expression that insulators of the requisite strength will be forthcoming when required.

It was shown that corona will cause a pronounced triple harmonic in the grounded neutral of a star-connected system such as is proposed for the superpower lines. No objection was seen here, however, since it is not contemplated that the system would be operated at or above corona-forming voltage.

An interesting paper on the balancing of the internal reactances in transformers having tertiary coils contributed to the general topic because such windings must be provided in star-to-star transformers to supply the triple harmonic of the magnetizing current and because they offer a convenient means for connecting synchronous condensers.

As was to be expected, Western opinion was to the fore and Western service requirements were reflected in the discussion. There was little or no reference to the important question of steam stations as sources of energy supply in superpower systems. Nevertheless, the confident prediction of the satisfactory operation of superlines is certain to give added momentum to the stupendous projects now being studied for the more economical supply of electrical energy on both the Atlantic and the Pacific Coast.

Checking Results in Steam Production

IT USED to be said that the most important instrument in a boiler room was a good fireman. Such in fact was and is the case with hand-fired boilers. No instrument can take the place of skill and judgment, although it may serve as an excellent guide to proper operation. When, however, we deal with plants operated under the modern system, where all the firing is mechanical and the human element is in a great measure eliminated, it becomes increasingly necessary to check up what the machine is or ought to be doing.

In these days the fundamental thing is the economical use of fuel to turn out the maximum amount of steam at the requisite temperature and pressure from the minimum quantity of combustible. Three things are necessary to carry out this desirable purpose—fuel of uniform quality and of a kind suitable for the plant as operated; an operating force, mechanical or human, that insures proper burning of the fuel, and finally, instruments for the guidance of this operating force.

First of all, the amount of fuel is the fundamental quantity to be determined. Whatever the method, it must be consistently and thoroughly applied so that the actual combustible used will become a known quantity. Its heating value is equally important as determining the conditions of economy. It must be ascertained in order to plan and work the furnaces to the best advantage, and every efficiently run plant systematically samples the fuel to see whether the quality is up to standard. Given the amount of fuel and its heating value, the boiler-feed water next comes to attention. The measurement of this is a fairly simple affair, a variety of reasonably accurate and simple meters being available. The one most conveniently fitted to a given plant is usually the best, although, of course, meters like everything else require more or less inspection. The average temperature of the feed water is an important item, and indicating or recording thermometers find a place in this service. In late years it has proved very desirable to install steam-flow meters as a check on the fuel and water measures between the boiler and the prime mover. These instruments are now both convenient and reliable, and they are finding their way into plants of much smaller size than used to be the case. Finally, the combustion requires instrumental control in order to co-ordinate the furnace performance with the results obtained from the other instruments. Draft gages for the gas, thermometers and CO_2 samplers or recorders tell the story at this end of the line.

Such are the fundamentals of the situation. Many large plants carry them to a considerable degree of elaboration. The quantities to be measured are, however, essentially the same, to whatever degree the actual methods may be modified to suit the convenience of a particular situation.

The Industrial Electrical Engineer an Efficiency Expert

EQUIPPED with adequate measuring apparatus, the industrial electrical engineer with a bent toward analytical investigations has exceptional opportunities to study production economies in the application of electric service. The study of process work and of material routing, of factory records and scheduling operations may be assigned as a specialty to a process department, but in utilizing the services of efficiency specialists a wise management will not fail to "cash in" upon the services obtainable from its own electrical engineering talent. The influence of electric service upon modern production is so far reaching and effective that the interest of the factory electrical engineer cannot safely be overlooked by works managers in carrying forward investigations leading to the lowest possible cost of producing a unit of product. Here is a potential source of ideas that is too frequently overlooked. The industrial electrical man who is invited to share the opportunities to increase his usefulness by co-operating with the management in striving to secure more efficient production will not be found wanting if a chance is given him to exercise his initiative and training and if he receives sufficient recognition and credit for the results he secures.

Effects of Corona Indicate Need of Caution in Line Design

THE occurrence of corona on transmission lines has for some years been recognized as objectionable, principally on account of the attendant power loss. This loss increases rapidly, in fact as the square of the excess voltage above the initial corona-forming point. This law, first announced by F. W. Peek, Jr., has received reasonably close confirmation from a number of other tests. Two papers presented last week before the annual convention of the American Institute of Electrical Engineers at Salt Lake City contain new data on this interesting question, one of the papers being by Mr. Peek and the other by W. W. Lewis. These papers are particularly interesting in that one describes tests in the field and the other tests on a laboratory basis and both arrive at much the same conclusions. The power-loss tests are on an unusually long line and are carried to exceptionally high values of voltage and loss; consequently their approximate agreement with the accepted laws will increase the confidence of engineers in the use of these laws.

The most striking features of the papers are the indication of the increased capacity of the lines with corona formation and the fact that the presence of corona causes a large harmonic current in the neutral of the system. It has long been suspected that the presence of corona increased the effective diameter of the conductor, which would naturally lead to increased capacitance. Until this time, however, this supposition has not been definitely proved. The fact that the third harmonic current in the neutral may reach a magnitude comparable with that of the charging current of the line in one case and 40 per cent of the total line current in another is a matter of serious moment. Triple-harmonic currents are very objectionable for well-known reasons, consequently we have here an added reason why engineers should go slowly in designing lines for operation even slightly above the corona-forming voltages.

Definite Schedules for Maintenance

KEEPING all kinds of equipment in good operating condition is probably one of the greatest needs that the electric light and power industry now faces. Though it is recognized in most places that maintenance is both economical and necessary for good operation, this recognition has often failed to produce systematic effort to obtain the required results. Undoubtedly the emergencies of the last few years have militated greatly against expenditure in this direction. Moreover, the rapid growth of the country and its large resources have tended toward waste. However, conservation and maintenance are constantly filling a larger part in the thought and discussion of the industry.

A complete and rigid system is necessary—one where the equipment is examined at definite intervals in a definite manner and by which these regular inspections are recorded on definite forms. Furthermore, the system must be made compulsory by a regular schedule. Systems of this kind are what are needed to crystallize theory into definite methods of action and to produce the desired operating economies.

Opportunity for Co-ordination of Cable Research

THE recent unusual activity in research as to the properties of high-voltage cables in this country has been paralleled by cable research of a somewhat different type in Great Britain. The American studies, it will be remembered, concern themselves chiefly with the properties of the materials of the cable itself, as regards safe operating voltages, limiting temperatures as affecting life, and permissible loads. The British investigations, on the other hand, have studied the performance of cables when laid under different conditions. Some of this work has been done in the National Physical Laboratories, and the tests have measured the temperatures reached for cables in the air, laid direct in the ground at different depths, and when laid in solid stoneware. It is of special interest to note in connection with the British tests that they are being conducted by an association formed for research purposes especially, and in which the National Physical Laboratories, the Institution of Electrical Engineers and the various electrical industries have representation. Similar bodies in this country have contributed from time to time largely to our present knowledge in this field, but it may be questioned whether greater progress would not be made by such an association as that referred to.

American research engineers have apparently concluded that tests of temperature under different soil conditions are not profitable. This is probably due to the apparent impossibility of ever foretelling the conditions under which a cable will operate. Many observations of duct temperatures are going on continuously, but the attitude in this country seems to be to accept a certain range of limiting base temperatures and soil conductivity and to adjust the cable capacities to these limiting values, recognizing that in the nature of things they may only occur over a relatively short length of the cable.

A valuable recent paper by R. W. Atkinson will be recalled, in which, proceeding from this limiting base temperature outside the duct, the successive steps in the calculation of the safe carrying capacity of a cable were given. British expressions in a recent number of the London *Electrician* on this subject point to the possibility of reducing the cost of cables per unit of capacity as an additional ground for urging further research. It appears, however, that radical improvements and increases in capacity will be necessary before the saving on this ground will be equal to that due to the increased economy in the use of ducts.

The possibility of parallel lines of work in this field on both sides of the Atlantic are very great. Although soil conditions may vary widely and in a most erratic fashion, it is a fact that probably this field is the least known of all those bearing on the operation of cables. It would be a highly desirable thing if the association engaged in this matter on the other side of the ocean could be brought into conference with representatives from this country, looking to a common program converging to certain knowledge and standardization in this highly complex and important problem.

Working Toward Distribution Economies

THE consideration by W. D. Woodhouse of distribution of electricity from an economical standpoint, in a recent paper before the Institution of Electrical Engineers, has brought forth a great deal of discussion in England. This discussion is of interest in that it shows plainly the conflict between the old-fashioned rule-of-thumb method of designing transmission or distribution systems and the desire among progressive engineers to apply sound engineering and economic methods. The value of Mr. Woodhouse's paper lies in the fact that it presents in a broad manner the fundamental necessity of systematic study as a means of obtaining the most economical transference of power from the station to the customer. It remains now to bring forth more detailed studies of the various factors that affect both the individual parts of the system and the relation that these individual parts sustain toward one another.

Knowledge of Conditions Makes for Understanding

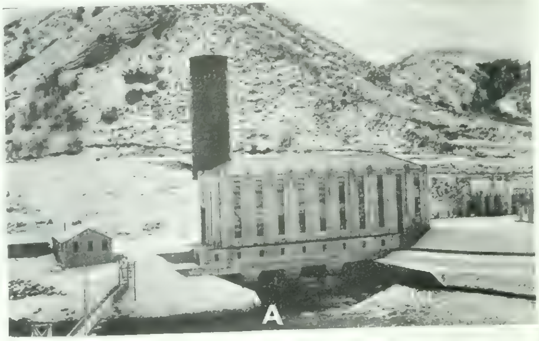
THAT there is a great deal to be done toward fostering better understanding between electric service companies and their customers is unquestionable. That complete knowledge of the actual conditions will result in benefits to both is equally undeniable. It is therefore the duty of the central-station company first to analyze and then so thoroughly to know the various factors affecting its costs that it will be in a position to present its case simply and effectively to the customer. The burden is on the central-station engineers. Such knowledge is the surest way to bring about rates that will mutually satisfy and also benefit the server and the served.

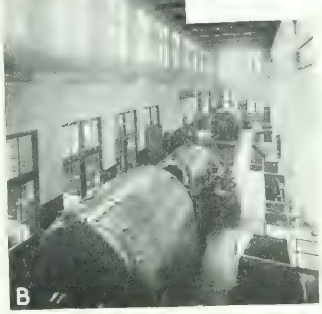
Scenes of Electrical Interest Which Were Afforded A.I.E.E. Delegates Last Week

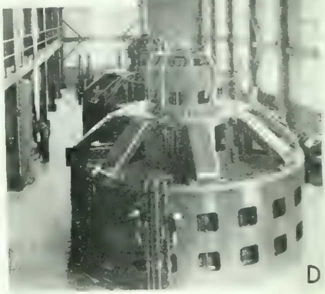
Engineers attending the convention at Salt Lake City last week had an excellent opportunity to see how one natural resource — water power — is being utilized to recover other natural resources such as metal ores through the agency of electrical energy. The system serving this district comprises some thirty interconnected hydro-electric plants and a transmission network that assures reliabl service to all industries situated in Utah.

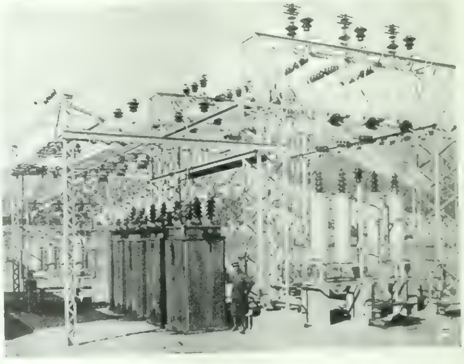
The system is operated by the Utah Power & Light Company.

A — Oneida station, rated at 30,000 kw., is the newest plant. B—Turbine hall of only steam station on system. C—Two of three 11,000-kw. generators at Grace station. D—Two generators in Oneida plant. E — Portion of switchyard at Grace. F — Typical coal-mine substation. G—Terminal substation, the distributing center near Salt Lake City.









Interconnection and Bulk Supply

Engineering problems involved are given particular consideration at Salt Lake City Convention of A. I. E. E.—Voltage regulation, power-factor control, prevention of harmonics, effect of corona, and insulator problems are chief subjects of discussion.

AT SALT LAKE CITY on June 21 to 24 the American Institute of Electrical Engineers held for the first time an annual convention in a city in the western half of the United States. This was a joint meeting of the parent body and the Pacific Coast Section and was the thirty-seventh annual and the tenth Pacific Coast convention. There were four sessions, one devoted to hydro-electric plant developments, the second to operating problems in connection with the transmission of power over long distances, the third to problems involving line characteristics and insulation and transformer construction, and the fourth to problems of general engineering application.

It was particularly fitting that in its Western setting the convention should be largely concerned with problems of the transmission of bulk power over long distances and at high voltages since these problems are the particular ones now being worked out in the building of the 220,000-volt transmission lines in northern and southern California. The discussions in the papers of the symposium on long-distance transmission by Messrs. Baum, Lewis and Elden and on the papers dealing with related subjects by Messrs. Peek, Creighton, Peters and Skinner, Whitehead, Lee and others brought out the relationship between engineering and economics in the transmission of large blocks of power to fulfill future service requirements.

The paper by Mr. Baum was presented in considerable detail in the last issue of the ELECTRICAL WORLD, which also contained features of President Berresford's address, the two papers on hydro-electric developments and abstracts of thirteen technical committee reports. In the current issue are presented abstracts of the remaining papers and discussions which took place at Salt Lake City.

It was the consensus of opinion that the subject of line regulation is of prime importance. It was also pointed out that sufficient information has resulted from the studies of line insulation to justify great confidence and that the way to achieve line reliability and to solve the troublesome problem of inductive interference can be satisfactorily worked out from the standpoints of power transmission and the operation of low-voltage circuits. The papers and discussions contributed much new data to justify these opinions. It is interesting to note that these data were derived from the studies conducted by the engineers of insulator manufacturers, by scientific investigators in research laboratories and by consulting engineers and from the practical experiences of engineers associated with power-transmission and telephone companies.

Transmission and Interconnection

Superpower Service Possible Through Long Lines

TRANSMISSION of energy over two-circuit tower lines, each circuit of which would be capable in an emergency of transmitting the entire load, would insure the character of service required by the metropolitan district of New York, according to L. E. Imlay of the Superpower Survey in his paper, "Long-Distance Transmission of Electrical Energy." This conclusion was based on an analysis of replies from a number of prominent engineers on the feasibility of transmitting large blocks of power for distances ranging from 100 miles to 300 miles.

In his study of long-distance transmission Mr. Imlay considered the subject from three angles—first, economic conditions which justify such transmission; second, the plant involved, and third, the service that may be expected. The economic conditions which justify long-distance transmission of electrical energy are a cheap source of power, with an insufficient local demand to absorb it, and a distant market to which the energy can be delivered cheaper than energy can be supplied at that point from any other source. Among the important physical considerations entering into transmission-line design are arrangement of conductors, voltage, right-of-way, tower spacing, grading of insulators, switching, use of overhead lines, ground wires and lightning arresters. Graphic methods of solving transmission-line problems were presented. The author

EFFECT OF DIVIDED CONDUCTORS ON CONDENSER CAPACITY REQUIRED

	Single Conductors	Divided Conductors
Length of line (miles)	350	350
Size of conductor (circ.mils)	605,000	302,500
Energy transmitted per circuit (kw.)	150,000	150,000
Voltage of transmission (kv.)	220	220
Losses (kw.)	14,900	18,180
Synchronous condenser capacity required at full load (kva.)	76,000	40,350

also showed how the reactance of the line may be greatly reduced by use of divided conductors. The arrangement suggested enables the line to transmit a much greater amount of energy without increasing the synchronous condenser capacity necessary to insure proper regulation.

Neither overhead ground wires nor lightning arresters should be provided on circuits of 220 kv. or higher in the opinion of Mr. Imlay, who asserted his belief that they will cause more trouble than they will prevent. Induced high-frequency charges will be absorbed by the large capacity of the lines and dissipated by corona.

Strings of strain insulators should be graded or other means provided so that excessive voltage strains will not be impressed on the units nearest the conductors, when lines are operated at 220 kv. or higher. The objection has been raised that linemen will not install the correct units when it is necessary to make replacements, but the author expressed the belief that an effective organization will prevent failures of this sort.

Switching should be reduced to its simplest form. There should be no taps from the transmission line between the step-up transformers at the generating station and the step-down transformers at the point of delivery. Where possible, switching should be done on the low-tension side of the transformers, but a certain amount of switching to shift the load from one circuit to another on high-tension lines will be unavoidable. Manufacturers have successfully provided oil switches for 150,000-volt circuits involving comparatively large amounts of power, and switches for 220-kv. circuits will have no heavier duty as the currents are smaller. High reactance inherent in transformers and lines contributes to limiting the currents at time of short circuit to a comparatively small amount, thus minimizing the duty imposed on oil switches.

Transformer Connections for High-Voltage Systems

THAT star-star transformer connections with a tertiary winding have many advantages when interconnecting high-voltage transmission systems was maintained in the paper by J. F. Peters and M. E. Skinner. The advantages enumerated for the star-star connection include the following: (1) It reduces the average insulation stress between the windings and the core of the transformer. (2) It offers an opportunity to ground either or both the system neutrals at the transformer. (3) It results in a cheaper and smaller transformer. (4) It offers an opportunity for further reduction in first cost when the neutrals are grounded by the use of graded insulation. (5) It offers an opportunity for further reduction in first cost by the elimination of one high-voltage bushing.

When the star-star connection is employed it is necessary to have an auxiliary or tertiary winding connected in delta to obtain satisfactory operation. This may be used to supply energy for a synchronous condenser employed for connecting power factor. When the tertiary is not designed to supply a load its capacity is determined by the heating conditions imposed by short circuits. For this reason the short-circuit conditions should be carefully investigated.

When transformers tie together three systems where the flow of power may be from any one to the other two or vice versa, one of the first requirements is that the reactance between any two windings be of about the same magnitude. If this be not the case, there will be large differences between the regulation, with varying conditions of power flow between the interconnected systems. Moreover, with power supply on all three systems, if the reactance is low between any two of them, the currents flowing under short-circuit conditions will become dangerously large and there will be danger of mechanical injury to the transformer. Thus the problem is one of getting high enough reactance between any two windings without making that between any other two excessive.

An auto-transformer offers a decided saving in first cost over an equivalent transformer with separate windings, but it can only be applied under certain conditions. These conditions are fulfilled with the star-star connection when the neutral point is directly and permanently grounded. If the neutral of the three-phase star-star-connected auto-transformer is not directly and permanently grounded, serious stresses will be imposed on the system having the lower line voltage in the event of one of the lines with higher voltage grounding accidently.

Interconnected Systems Offer No Unusual Difficulties

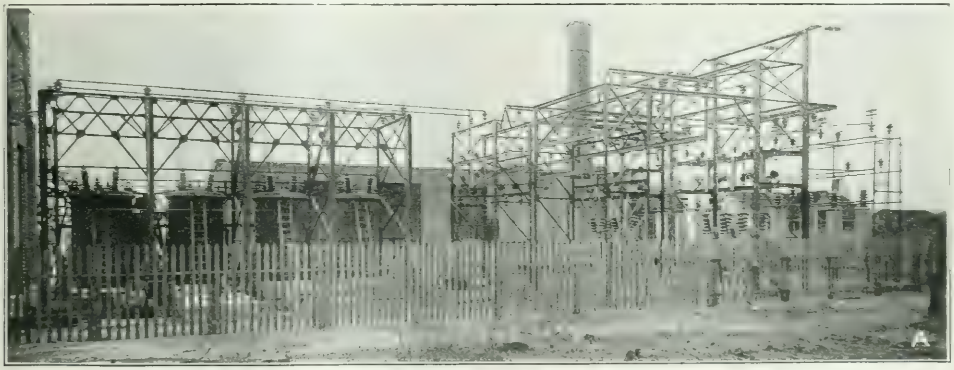
THROUGH close co-operation of system load dispatchers and slight modifications of operating methods, interconnected systems may be operated without unusual disturbances, L. L. Elden asserted in his paper, "Operation of Large Interconnected Systems." In the operation of the Edison Electric Illuminating Company of Boston, the Eastern Massachusetts Electric Company and the New England Power Company some trouble was experienced at first due to violent fluctuations on both systems caused by short circuits on either. Since then experiments with various relay adjustments have effected some relief, although it is not possible entirely to eliminate these troubles without unfavorably affecting the voltage regulation of the tie line. Some difficulties were also experienced with frequency adjustment due to the fact that the Boston company maintained time-keeping service with Warren clocks whereas the other companies interconnected with it did not. However, it was found possible to keep errors in time to small values and then correct them by minor variations of frequency.

With transformers connected to deliver power to the New England system conditions are rather unfavorable for the reverse operations as regards voltage regulations and control of power factor. However, the use of induction regulators or synchronous condensers will improve this condition if the interchange of power justifies the installation.

Control of Power Factor and Voltage on Tie Lines

FACTORS which led to the selection of induction regulators for the control of power factor and voltage on the 66,000-volt tie line between the Schuylkill and Chester stations of the Philadelphia Electric Company were outlined by Raymond Bailey as follows: First, the fixed type of regulators were considered to be of sturdier construction than synchronous boosters; second, the ability to withstand greater short-circuit stresses was very important as the generating capacity of the stations at the end of the line would in the event of a short circuit at the bus deliver a maximum of 700,000 kva.; third, greater simplicity of operation; fourth, higher efficiency; fifth, lower first cost; sixth, suitability for outdoor installation, which greatly facilitated the arrangement of equipment; seventh, the induction regulator is not a rotating machine; eighth, less inspection and maintenance is required.

Two 1,750-kva., three-phase, 60-cycle, oil-insulated, water-cooled, motor-operated, induction regulators, designed to give 9 per cent buck and boost on a 13,600-volt circuit, were installed to take care of the regulation of this tie line. Operating experience with these regulators for control of voltage and power factor has been very satisfactory and verifies the result of the analysis made to determine the capacity and characteristics of the regulating equipment. There are no rapid fluctuations of load on these lines under normal conditions and therefore no difficulty is experienced in maintaining the desired power factors. Some apprehension was felt at first as to the form of instructions which would enable the operators to regulate and load the lines as desired, but it was found that position indicators used with the other instruments on the line made satisfactory operation possible.



THIS CONNECTION WITH THE LINE JOINING THE NARRAGANSETT AND NEW ENGLAND POWER COMPANIES SAVED ENLARGING THE FALL RIVER STEAM PLANT AND HAS AFFORDED ECONOMICAL AND RELIABLE SERVICE TO A LARGE INDUSTRIAL TERRITORY

Economics of Voltage Selection and Use of Condensers

THE foregoing papers called forth several comments on the economics of voltage selection, use of synchronous condensers and the connection of transformers, extracts from which are given below.

J. P. Jollyman, Pacific Gas & Electric Company, in explaining the economical basis for the selection of 220,000 volts for the Pit River line, pointed out that for 110,000 volts the economical load per circuit would be 30,000 kw.; for 220,000 volts, 120,000 kw., and for 440,000 volts, 480,000 kw. From this he showed that a voltage above 220,000 might have been used except that no generator unit of sufficient size to charge such a line has as yet been developed and that it would not have been desirable to carry a larger percentage of the ultimate capacity of the project on one line than could be transmitted at 220,000 volts. On this project it will not be necessary to use more than a double-circuit 220,000-volt line for a number of years. Mr. Jollyman also gave an interesting explanation of the principle of the application of synchronous condensers. He likened the transmission line to a long shaft extending from a bearing with a pulley driving a load at its far end without a bearing. Under such conditions the power that could be taken from the pulley would be limited by the bending of the shaft and not by the torsion. The location of an outboard bearing would increase the power that might be taken from the pulley. In a similar way the placing of a condenser at the load end of a transmission line stabilizes the voltage of the line and increases its capacity. Carried further this analogy would mean that the placing of a synchronous condenser at the center of a line would be the equivalent of a bearing placed at the center of a long section of shafting between bearings.

J. A. Johnson, Niagara Falls Power Company, referred to the economy and the service to industry at large achieved by the use of power at its source in the production of raw materials that are widely and universally used and can be more economically transported than electrical energy.

C. L. Fortescue, Westinghouse Electric & Manufacturing Company, pointed out that the regulating effect of synchronous condensers is limited to the fundamental frequency and that at higher frequencies they act simply as reactors. He asserted that transformers and synchronous condensers should be considered an integral part of the line. In his opinion the point of greatest importance in insulation is to reform the field between the conductor and ground by shields.

A. W. Copley, Westinghouse Electric & Manufacturing Company, said that star-star transformers can be successfully used without serious inductive interference. The advantage of the auto-transformer in connection with 220,000-volt and 110,000-volt lines is in the reduction of costs in making the connections between the systems. In referring to line regulation by synchronous condensers Mr. Copley pointed out that consideration must be given to no-load conditions, in view of the fact that the synchronous condenser when selected to handle lagging conditions will carry but 40 to 50 per cent of its rating when the line is carrying a load at zero power factor.

L. P. Ferris, American Telephone & Telegraph Company, assured that interference trouble is not expected from 220,000-volt lines, nor is corona a source of trouble from a line normally operating below the corona limit. The inductive interference he attributed to the transformer, maintaining that while the star-star transformer is satisfactory, this does not apply to the star-star transformer with a tertiary-delta winding. He also contended that three-phase shell-type transformers possess no advantages over core types so far as inductive interference is concerned.

Insulator Production and Problems

Impregnation of Cement Prolongs Insulator Life

FAILURES in cemented insulators have been considerably reduced by impregnating the cement with pitch, according to the conclusions advanced by Dr. E. E. F. Creighton and F. L. Hunt in a paper on "A Solution of the Insulator Problem." One of the principal causes of insulator failures, in the opinion of the authors, has been the fact that portland cement shrinks when it drys and expands when wet to even more than its original size. In each cycle of drying and rewetting the cement increases in volume until it tightly fills the entire space between the hardware and the porcelain. When this condition is reached a hot day will cause an unusual expansion of the metal and the resulting strain will be transmitted directly through the portland cement to the porcelain and a crack will result.

The solution of the problem lies in arresting the expansion of the cement by removal of the moisture and preventing it from re-entering. This, according to the authors, was thoroughly done by impregnation under vacuum of a large number of the insulators and was less thoroughly done on a portion of the insulators with the idea of determining the difference in life, if any, due to difference in thoroughness of the impregnation.

In the endeavor to reach 100 per cent results it was necessary to study the characteristics of portland cement when impregnated by different substances. It was found that a chunk of portland cement which had been thoroughly impregnated with paraffin by vacuum and heat treatment and then broken would still absorb moisture through the broken surfaces. However, portland cement impregnated with pitch could be broken into small pieces and soaked in water for days without the slightest indication of absorption of the water.

Tests were made on these insulators by changing from boiling water to freezing water every half hour. By these methods the authors claim that they satisfied themselves that the impregnation was effective and that the insulators were ready for installation.

Eleven hundred of these insulators, carefully marked, were installed on a 66,000-volt transmission line near the seashore in New England in July and August, 1918, and put into operation in November, 1918. Up to the present time there has not been a failure among the lot.

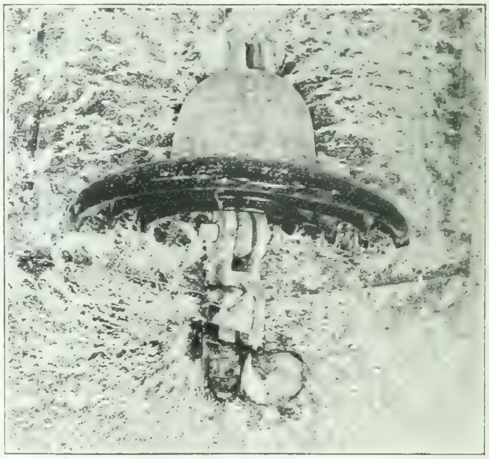
A test made on the whole line about a year after it was put into operation showed 13½ *per cent of failures among the insulators* which came direct from the insulator factory and *no failure at all on those which had received the treatment described above.* The insulators were then about two years old.

Up to the present time there have been additional failures, amounting to 2 or 3 per cent, among the insulators which came direct from the factory, but no failures whatever in the insulators in which the cement was treated.

Improvements in Porcelain Insulators

AN ANALYSIS of the mechanical stress transmitted to the porcelain by the cemented hardware indicates clearly that the expansion of the eyebolt is probably the most serious factor, according to E. H. Fritz and G. I. Gilchrest, in their paper "Modern Production of Insulators." Among other things emphasized in their paper are methods of making tests on insulators for mechanical flashover, effect of cement and influence of physical characteristics on electrostatic fields.

Porcelain which is highly resistant to abrasion will resist weathering conditions, the action of acid, moisture, etc., the authors pointed out. Another conclusion was that the cap-and-pin suspension insulator or the interlinked insulator does not represent ideal electrical design when considered on the basis of the electrostatic field. A typical dielectric field for a cap-and-pin insulator is shown in the accompanying illustration. Insulators assembled with a cement made up of one part ground porcelain and three parts portland cement gave the same ultimate mechanical strength as when assembled with neat portland cement. Flashovers are being studied by means of a high-speed camera.



TYPICAL DIELECTRIC FIELD FOR CAP-AND-PIN INSULATOR

To definitely determine mechanical stresses caused by temperature changes, porcelains assembled with caps alone, with eyebolts alone and without hardware were tested by alternate immersions in hot and cold water baths. The porcelain parts assembled with eyebolts alone failed under the same severity of tests as the assembled insulators. The porcelain parts without hardware and with caps alone did not fail under any of the temperature change tests.

Several modifications of the solid eyebolt were then considered and two special types were produced and tested. These were assembled with identical porcelain parts and metal caps and under the same conditions.

The two modifications consisted of (1) an eyebolt having two drop forgings assembled with a porcelain sleeve, (2) an eyebolt having a one-piece drop forging with a metal sleeve into which the eyebolt could be turned. Insulators equipped with both special and standard type eyebolts were then tested by immersing them alternately in water baths maintained at zero and 100 deg. C. It was found that the insulators having a separable metal sleeve resisted the mechanical stresses from temperature changes more successfully than the insulators having the solid eyebolt or the eyebolt with the porcelain sleeve. Besides, the insulators having the eyebolt with a porcelain sleeve resisted the mechanical stress better than the insulators with the solid eyebolt.

Insulator Problem Is Not Solely Electrical

THE subject of insulator depreciation aroused considerable discussion as usual. It was emphasized that mechanical characteristics affect the life of units considerably, but dielectric flux distribution assumes particular importance on extra high voltage strings.

A. O. Austin, Ohio Insulator Company, held that the real insulator problem has been that of depreciation, but he said that he had no fear of its ultimate solution.

K. A. Hawley, Locke Insulator Corporation, said that test data have not been sufficient to do away with the idea of grading since there is no corona formation on insulator parts in graded strings. He pointed out that while portland cement has caused trouble it has been of some advantage in providing for the necessary expansion of the metal parts. He called attention to the fact that the cracking which has been experienced has been annular at the top and bottom of the head and not vertical.

R. H. Marvin, R. Thomas & Sons Company, referred to tests started in 1916 with paraffin-treated cemented insulators. Both treated and untreated insulators were subjected to a loading of 3,000 lb. for two and one-half years and then tested with 50,000 volts for one minute. These tests showed no marked difference in the depreciation of the insulators.

G. I. Gilchrest, Westinghouse Electric & Manufacturing Company, pointed out that insulator production involves mechanical engineering as well as ceramic engineering owing to the production and assembling of the insulator parts. The insulating quality of the porcelain depends on its condition when coming from the kiln. He referred to the fact that grading of insulators has been carried out in Sweden on 66,000-volt lines—a refinement not now considered necessary in this country.

E. E. F. Creighton, General Electric Company, stated that the ceramics of insulators call for craftsmanship in which the personal equation is a varying factor. Since the raw materials vary in quality it is necessary to use great diligence to insure uniformity.

F. W. Peek, Jr., General Electric Company, said that insulator shielding performed four functions—reduction of voltage duty on line units by one-third to one-fourth, removal of corona, reduction of surface leakage stresses, and reduction of high local stresses due to transients. Referring to transients on transmission lines, he expressed the opinion that high frequency does not cause insulator troubles. Tests conducted in Colorado duplicating lightning disturbances furnished many data on this point. He expressed confidence in the success of 220,000-volt transmission.

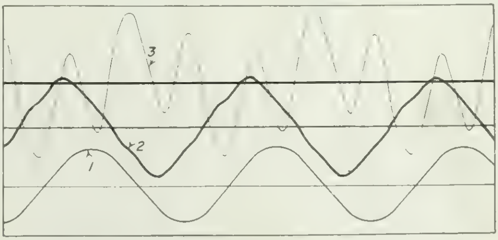
H. J. Ryan, Stanford University, referred to the exhaustive series of tests conducted under the auspices of a special committee of the N. E. L. A. in which the service conditions of ten years have been duplicated as far as temperature cycles are concerned. All insulators stood the test with equal satisfaction. He also emphasized the importance of the relation of the primary field to the auxiliary field formed at the inception of a flashover and pointed out that the time element is the essential in this relationship.

In reply to this statement F. G. Baum, San Francisco, said that difficulty is likely to be experienced due to the bringing down of the ground potential along the insulator strings when they are covered with dust and moistened by dew, particularly after the line units have become dry from the heat of the excessive charging currents at such a time.

Harmonics and Air Strength

Voltage and Current Harmonics Caused by Corona

REFERRING to the very large triple-frequency currents in the neutral of the grounded Δ-Y transformers, described in the paper by W. W. Lewis, F. W. Peek, Jr., had the following explanation to offer. He said that this current was in every respect similar to the triple-frequency excitation current found in Y-Y grounded-neutral transformers. One explanation for its existence would be the amplification of slight residual triple-frequency excitation voltages in Δ-Y transformers by the high capacity of the line, although the corona loss over each half cycle is most likely the primary cause, Mr. Peek said. In explanation he pointed out that when an alternating voltage higher than the critical corona voltage is applied to a conductor the loss starts at a given point during each half cycle as the voltage increases, continues over part of the half cycle, and finally ends at a given point as the voltage decreases. A varying amount of corona and loss thus occurs during a given part of each voltage wave. The conducting corona, in effect, makes a conductor which periodically varies in diameter. The capacity and loss, therefore, vary during parts of each wave. It follows



TRIPLE HARMONICS IN THE NEUTRAL OF A Δ-Y TRANSFORMER BANK CONNECTED TO LINES WITH NO STEP-DOWN TRANSFORMERS

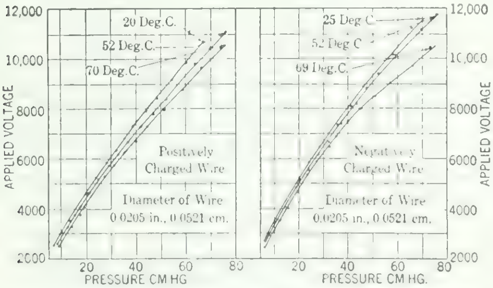
1—Low-side voltage between lines. 2—High-side line current. 3—Current in the neutral circuit that if a sine-wave voltage high enough to cause corona loss is applied to conductors the current cannot follow a sine wave but must be distorted or contain harmonics.

To check the conformity of actual results with this reasoning tests were made on short three-phase lines of very fine wire so that the corona loss would be excessive and exaggerate conditions. The transformers were of such size that the corona loss was an appreciable load and there was a large triple-frequency current in the neutral. After curves were made on the line similar curves were made on Y-connected glass-plate condensers of approximately the equivalent capacity of the line and of very small corona loss. The neutrals of the condensers and the transformers were connected. These tests indicated that the capacity of a line free from corona loss would not cause high triple-frequency currents by amplification of residual triple-frequency magnetizing voltage harmonics in the Δ-Y transformers.

J. B. Whitehead, Johns Hopkins University, observed that while corona forms at a definite point on the ascending side of the voltage wave, there is evidence to believe that it does not disappear at an equal voltage on the descending side of the wave but that it continues visibly to a lower point and invisibly to a still lower point, approaching the zero line of voltage.

Effect of Temperature on Electric Strength of Air

A SERIES of experiments in which corona voltages have been measured at several temperatures within the range of 5 deg. C. to 70 deg. C. were described in a paper by Dr. J. B. Whitehead and F. W. Lee, the pressure being varied in each case from that of atmosphere downward, and in extreme cases to 6.03 cm. of mercury. Continuous potentials were used throughout the work since it has been shown that continuous-current corona voltages have the same values as the peak of the wave of alternating voltages. The observations showed that under constant conditions as to pressure and temperature a higher value of negative potential than positive potential is required to form corona. Within the range of values investigated the general form of the law of corona, as developed experimentally by a number of other observers, is found to be fulfilled, thus substantiating the empirical laws developed by Messrs. Whitehead and Peek, although the constants of the equations involved are higher than any heretofore observed. There is some indication that at temperatures in the neighborhood of 70 deg. C. a departure from the empirical laws mentioned may occur. Three sizes of wires were investigated with diameters of 0.0521 cm., 0.0813 cm. and 0.0993 cm. respectively. The critical surface intensity at which corona started on these wires can be summarized in the relation,



CRITICAL CORONA VOLTAGES ARE LOWERED BY INCREASING TEMPERATURE. CORONA-FORMING NEGATIVE POTENTIALS ARE HIGHER THAN POSITIVE

$E = 39.8\,\delta + 10.36\sqrt{\delta/d}$ for + corona,

$E = 40.3\,\delta + 11.96\sqrt{\delta/d}$ for — corona,

in which δ is the density factor as defined by the equation $\delta = 3.92\,P/T$, P being absolute pressure in centimeters of mercury and T absolute temperature in degrees centigrade; d is the diameter of the wire in centimeters. It is said that the results of the investigation are in accord with Townsend's theory of secondary ionization.

Results of Line Tests Conducted at 220,000 Volts

RESULTS of operating a 140-kv., 100-mile line in Michigan at 220 kv. were explained by W. W. Lewis in his paper. The line, which extends from Junction to Grand Rapids, consists of three conductors each of seven-strand medium hard-drawn copper with a cross-section of 110,000 circ.mils. The conductors are virtually in a vertical plane 12 ft. (3.6 m.) apart and the average elevation of the line is about 750 ft. (230 m.) above sea level. In general the corona losses followed Peek's law, with some deviation especially at lower voltages. At the higher voltages a current in the grounded neutral was encountered which was about 40 per cent of the line current. This current, which began at about the normal line voltage, was apparently due to corona which caused a pulsation in the voltage wave and a triple-frequency current to flow through the capacitance to ground and back through the grounded neutral. The line-charging current, the current in grounded neutral and the rise in voltage along the line were all greater than was calculated from the geometrical capacitance. This may be accounted for by an increased capacitance due to increased diameter of conductor caused by corona. Harmonics introduced into the voltage wave by the corona also may have contributed to the effect noticed. The tests indicated a difference in corona loss with the neutral grounded and isolated, probably due to the flow of triple-frequency current in one case and the distortion of the voltage by triple-frequency component in the other. The danger of overvoltage across legs and between neutral and ground with Y-Y connection was shown by the test.

In one case with the transformers connected Δ-Y with neutral grounded at the generator end only and Y-Δ with ungrounded neutral at the load end, one corner of the low-tension delta at the load end was open and a voltage was read across the corner which amounted to 13,500 volts with 203 kv. at the generator end. One-third of this appeared across each leg of the low tension. The triple-frequency phase voltage multiplied by the ratio of transformation gives the triple-frequency voltage across each high-tension leg (75,000 in this case) between the neutral and ground. Such voltages may be expected with Y-Y connection without tertiary winding, it was said by the author, who also stated that the tests clearly indicate the desirability of operating the transmission line below the corona voltage, thus avoiding corona loss and its accompanying effects.

L. P. Ferris pointed out that values of charging current and neutral current departed from calculated values.

M. E. Skinner, Westinghouse Electric & Manufacturing Company, stated that test conditions indicated that in the calculation of line impedance the image conductor should be taken as being from 500 ft. to 1,000 ft. below the surface of the ground. He also said that oil switches between the transmission line and the transformers and synchronous condensers at intermediate points on a line tended to increase the effective length of line and produce unfavorable operating characteristics.

Miscellaneous

Electrical Development in Italy

GUIDO SEMENZA, local honorary secretary of the A. I. E. E. for Italy and consulting engineer of Milan, gave a most interesting and instructive address on some of the outstanding developments in his country. Italy, like other European countries, did not feel the need of greater industrial development until recently, but now the lack of essential raw material resources is forcing the rapid expansion of the electrical industry. Before the war Italy had an installed hydro-electric capacity of about 1,500,000 kw.; at the present time stations are under construction which will add 500,000 kw. To this more than 2,000,000 kw. of projects have been thoroughly studied.

Having two watersheds of different run-off characteristics, one in the northern part and one further south, Italy will benefit considerably by interconnection. In the Alps the run-off is heavy in the summer because of the melting glaciers, while further south in the Apennines the greater run-off is in the winter; at this time the several stations in the two sections are interconnected and lines to connect the two divisions are under construction. This interconnection is being made without the pressure of law, said Mr. Semenza, because Italians are of the opinion that private control is best. One of the interesting problems in southern Italy is that of supplying power to Sicily. Although this island is separated from the mainland by only 2½ miles by the Strait of Messina, the swift currents preclude the laying of submarine cables. Consideration is therefore being given to the construction of a tunnel in which to run supply lines to the island.

European and American practices differ principally because in America the number of manufacturers is comparatively few and the designs more standardized, while in Europe the greater number of individual manufacturers tends to maintain a greater range of special design. Hence the prime factor in Italian design is the need of the greatest possible efficiency in operation. This causes the most intensive study of all the surrounding conditions.

Both isolated and grounded neutral systems are in use in Italy, engineers there being inclined to favor grounded systems because of the lessened troubles resulting from accidental grounds. Few outdoor stations are in operation. Three reasons were assigned for this: First, European manufacturers have given little consideration to the development of this class of apparatus; second, the extreme severity of the weather conditions would render repairs difficult and, third, until recently the cost of the necessary buildings to house the apparatus was so low as not to be a determining factor in the total cost. Mr. Semenza expressed the opinion that the use of overhead ground wires was of questionable value. Several forms of lightning arresters are in use, principally horn-type and multi-gap, while aluminum arresters have not met with much application. The difficulties experienced with the first suspension insulators received in Italy have mitigated against their widespread adoption.

The electrification of railways has proceeded rapidly. Of the 467 miles now electrified, one-ninth use 600 volts and the third-rail system. The remainder are almost entirely three-phase, 3,700 volts. Three hundred and fifty miles additional are under construction now. One interesting installation is that of a branch line which operates in mountainous country. The locomotives, which are rated at 300 hp. and operate at 4,000 volts direct current, are remarkable for the simplicity of their control. The eight months' operation of this line has proved very satisfactory.

Synchronous Motors for Ships

TESTS on the steamship Cuba, the first vessel to be propelled by a synchronous motor, were described by E. S. Henningsen. This is a fast passenger and express boat which has been in successful operation since November, 1920. These tests showed the most satisfactory methods of stopping and reversing the vessel and the effect of single and double amortisseur windings. The motor used for this service differs in the following particulars from those designed for land practice: The diameter is smaller and the length correspondingly greater; the bearing is of the end-shield type; the air-gap clearance is somewhat greater; special precautions are taken to make the insulation moisture-proof; the amortisseur winding is so constructed that the poles may be removed without removing the rotor; jacking bolts are provided in the bearing housings for taking the weight of the rotor when it is desired to remove a bearing.

The discussion on the use of synchronous motors brought out the point that synchronous motors may be found less suitable on small ships than direct-current motors and Diesel engines. Marine synchronous motors are easily controlled and may be stopped more quickly than steam engines, however.

Magnetic Properties of Powdered Iron

THE magnetic properties of compressed powdered iron were declared to be very similar to those of solid iron in which air gaps are cut according to Buckner Speed and G. W. Elmen. Their paper contains curves and tables indicating these properties and a description of measurements of inductance and effective resistance of coils with powdered-iron cores at frequencies within the audible range of 500, 800, 1,200, 1,600 and 2,000 cycles per second.

Heat Losses in A.-C. Machines

SOLUTIONS for the distribution of alternating current within conductors that are embedded in open rectangular slots were worked out by Waldo V. Lyon with the aid of hyperbolic functions of complex angles. This method, according to the author, is simpler than methods formerly used, which usually employed trigonometric and hyperbolic functions of real angles.

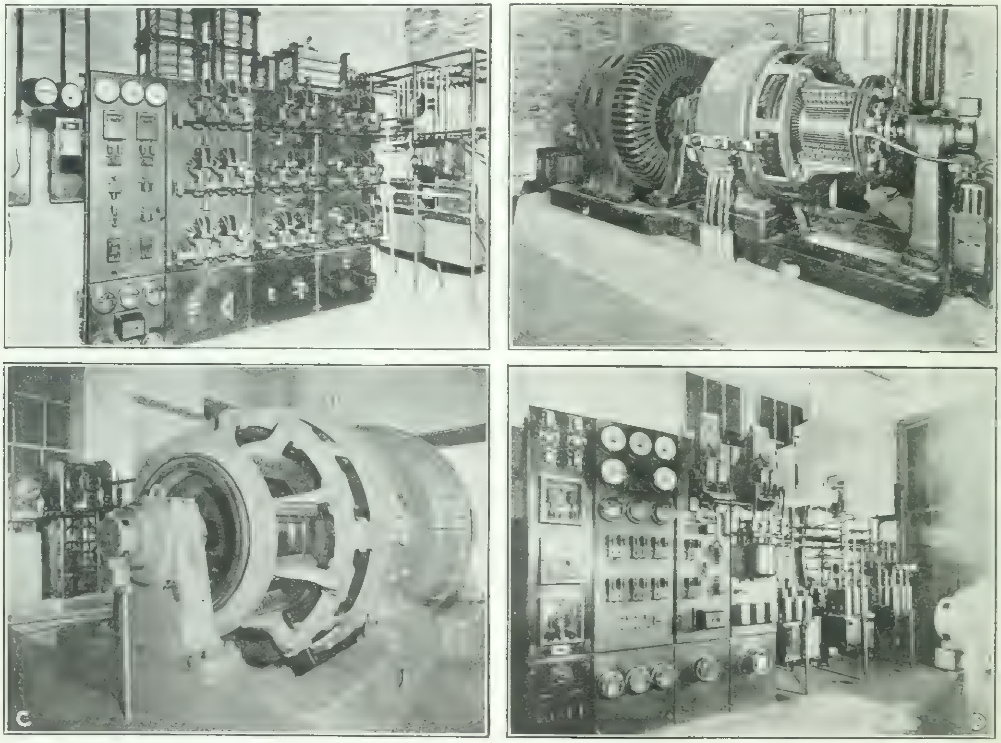
Automatic Substations Entering Electric Service Field

Have Definitely Proved Success in Industries and Edison System—Saving in Feeder Copper and Good Service Rendered Are Characteristic

BY R. J. WENSLEY

Switchboard Engineering Department Westinghouse
Electric & Manufacturing Company

AUTOMATICALLY controlled substation equipment, first developed for railway service, has now definitely assumed a place in the light and power field. During the past year progress in the application of automatic control for use by central stations is shown by the starting of the first full automatic substation applied to an Edison three-wire system by the St. Paul Gas Light Company. In the industrial field there has been the starting of the first of the 250-volt, two-wire automatic substations by the Packard Motor Car Company of Detroit. In mining work, also, there has been the starting of the first full automatic control in the mine of the Lincoln Coal Company at Nanty Glo, near Johnstown, Pa., and the purchase of twelve automatic substations by the Consolidated Coal Company of St. Louis for its mines at Mount Olive and Staunton, Ill.



FIRST AUTOMATIC SUBSTATIONS FOR EDISON THREE-WIRE SYSTEM AND INDUSTRIAL PLANTS NOW IN SUCCESSFUL OPERATION

A and B—Automatic synchronous motor-generator set (500 kw.) and switchboard serving three-wire system of the St. Paul Gas Light Company.

C and D—Direct-current service in the Packard Motor Company, Detroit, is supplied by this entirely automatic 1,500-kw. motor-generator set.

A complete list of Westinghouse automatic control equipments now on order as well as installed and running is given in the table. From this it may be observed that the Mississippi Valley is leading in the application of this new form of equipment. The Eastern States have shown a noticeable reluctance to take advantage of the better service at decreased cost which the elimination of manual operation seems to offer.

For large substations with several units automatic control should not be used. It is difficult, if not impossible, to show a tangible saving when the equipment to be controlled exceeds 5,000 kw. or 6,000 kw. concentrated in one station. On the other hand, using automatic control, there is no reasonable excuse for a station of such size. Since the operating cost does not rise excessively the units are scattered into numerous small stations; this division may be carried to any reasonable limit. As the units are reduced in size, the cost per kilowatt naturally rises, but a reduction of copper in the feeder system is effected. If the size of the units is made too small, however, this advantage is lost as it is necessary to keep a certain amount of copper for any given concentration of load so as to provide for load transfer in case a station is cut out for repairs. The rising cost of alternating-current feeders is another limiting factor in the subdivision of substation capacity.

It is thus very difficult to set up a hard and fast formula on which to base the best size and distribution of units, since there must necessarily be many assumptions. It is no easy matter to obtain accurately the average load in amperes per unit area, and even when obtained the local conditions are likely to be such as to prevent the theoretical solution of the case from proving practical.

It is well known that automatic control with its consequent distribution of small units close to the load will enable the central station to use plain converters with only a limited voltage control secured by shunt-field regulation with consequent operation at other than unity power factor. If a system can be laid out on this basis without the use of excessive copper or the sacrifice of too much in regulation on the customers' premises, then it will be an advantage indeed to eliminate the booster converter or the regulated motor generator. Care should be taken in the application of this idea, however, as central stations with Edison systems are very jealous of the quality of service rendered. The use of the boosterless converter requires that the alternating-current supply voltage be reasonably constant and that the regulation of the alternating-current feeder be very good indeed. With the booster converter or motor generator the direct-current voltage is independent of the alternating current within widely varying limits, this independence being gained by the regulation effected by the automatic control. The merits of these two systems should be carefully weighed by the central-station operator before either is adopted. There are cases suited to each of these methods of operation, and neither should be condemned because it does not happen to fit the particular case under investigation.

AUTOMATIC SUBSTATIONS BEING FURNISHED BY ONE MANUFACTURER FOR LIGHT AND POWER SERVICE

Name and Location	Apparatus	Kw.	A.-C. Line	D.-C. Voltage
St. Paul Gas Light Co.*, St. Paul, Minn	Syn. M.G. 3-wire	500	4,400	250 125
Packard Motor Car Co.†, Detroit, Mich	Syn. M.G.	1,500	4,400	230
Packard Motor Car Co., Detroit, Mich	Syn. M.G.	1,500	4,400	230
Lincoln Coal Co.,‡ Nanty Glo, Pa.	Syn. M.G.	200	2,200	275
Consolidated Coal Co., Mount Olive, Ill	Syn. M.G.	300	2,200	275
Consolidated Coal Co., Mount Olive, Ill	Syn. M.G.	150	2,200	275
Consolidated Coal Co., Mount Olive, Ill	Syn. M.G.	100	2,200	275
Consolidated Coal Co., Staunton, Ill	Syn. M.G.	300	2,200	275
Consolidated Coal Co., Mount Olive, Ill	Syn. M.G.	150	2,200	275
Consolidated Coal Co., Mount Olive, Ill	Syn. M.G.	150	2,200	275
Consolidated Coal Co., Mount Olive, Ill	Syn. M.G.	100	2,200	275
Consolidated Coal Co., Mount Olive, Ill	Syn. M.G.	150	2,200	275
Consolidated Coal Co., Staunton Ill	Syn. M.G.	300	2,200	275
Consolidated Coal Co., Mount Olive, Ill	Syn. M.G.	150	2,200	275
Consolidated Coal Co., Mount Olive, Ill	Syn. M.G.	100	2,200	275
Consolidated Coal Co., Mount Olive, Ill	Syn. M.G.	150	2,200	275
Milwaukee Elec. R. & L. Co., Milwaukee, Wis	Syn. Con. 3-wire	1,000	13,200	250–125
Morgan & Wright Tire Co., Detroit, Mich	Syn. M.G.	1,500	2,200	A.C. start only
Morgan & Wright Tire Co., Detroit, Mich	Syn. M.G.	1,500	2,200	A.C. start only
Crowe Coal Co., Henryetta, Okla.	Syn. M.G.	....	2,200	275

* In service Dec. 13, 1920. † Started Feb. 22, 1921. ‡ In service Jan. 12, 1921.

The best apparent way of arriving at the most economical solution of any particular system is to establish the load distribution as nearly as possible, after which two or more tentative layouts should be made, taking into account the cost of installing the alternating-current supply, the substations proper (including real estate and erection) and the direct-current feeder system, basing all figures on the same allowable voltage variation on the customers' premises. A curve can then be plotted with the cost per kilowatt against the size of units used, thus showing the tendency. From this a fairly accurate idea can be obtained as to the probable low point in the curve in cost per kilowatt of connected peak load. The cost per kilowatt of installed capacity is not a fair figure to use, since different distribution of converting units may require different total capacities of machines to handle the same connected load.

After the probable low point is estimated by inspection, two or more cases should be figured for points on the curve near the assumed low point. This will probably fix the low point with sufficient accuracy for practical purposes.

The price of copper will have a very decided effect on this calculation, the economical size of machine increasing quite rapidly as copper decreases. The cost of underground construction as affected by the character of the soil and the existing underground structures of other utilities will also have a noticeable effect on the curve.

AUTOMATIC STATION'S CARE OF GROWTH OF LOAD

In many cases of existing stations of large capacity the economy of automatic control would be very doubtful, but when the direct-current load increases such increase can almost invariably be handled at less expense by the installation of small automatic substations in the basements of large buildings at suitable points near the heaviest load centers. This type of installation should be used as an inducement to obtain the business of large office buildings, theaters, etc. With automatic sectionalizing equipment connected so as to give the building service first, the automatic system becomes attractive to the owners of the building.

A good example of the results to be obtained by this type of installation is given by a recent occurrence at St. Paul. There an automatic substation is installed in the basement of the Hamm Building, which contains many offices as well as the largest motion-picture theater in St. Paul. The power supply was interrupted in the middle of the afternoon by some high-tension line trouble.

All of the synchronous apparatus in the substations was dropped off, including the automatic. The entire direct-current load was thrown on the battery with consequent low-voltage conditions. The alternating-current power was almost immediately restored, and as the motor-generator was coasting at a fairly high speed, the automatic equipment was back on the line almost at once. The switches connecting the building to the street then opened, leaving the tie through the load-limiting resistance and thus helping out the battery to a limited extent; but the building immediately received normal voltage, while the rest of the system was low for about five minutes.

Such incidents, showing the speed and accuracy of automatic control, are occurring every day. An entire Edison system equipped with automatic control would resume normal service after an interruption with almost incredible speed. The possibilities of automatic control should be carefully investigated by the manager of any central station contemplating an increase in the direct-current system.

Value of Electric Drive Appreciated in the Textile Industry

A—In the plant of F. C. Huych & Sons, Albany, N. Y., where electric drive has given highly satisfactory results for five years, are 112 heavy-felt weaving looms like this driven by 2-hp. motors.

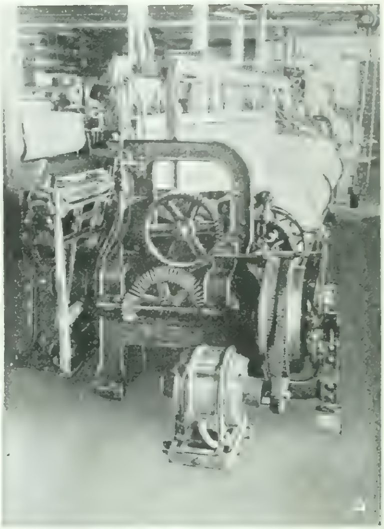
B—There is no belt slippage to give trouble on these woollen card machines. Individual motors with Link Belt chain drive are used in the Cleveland Worsted Mills plant.

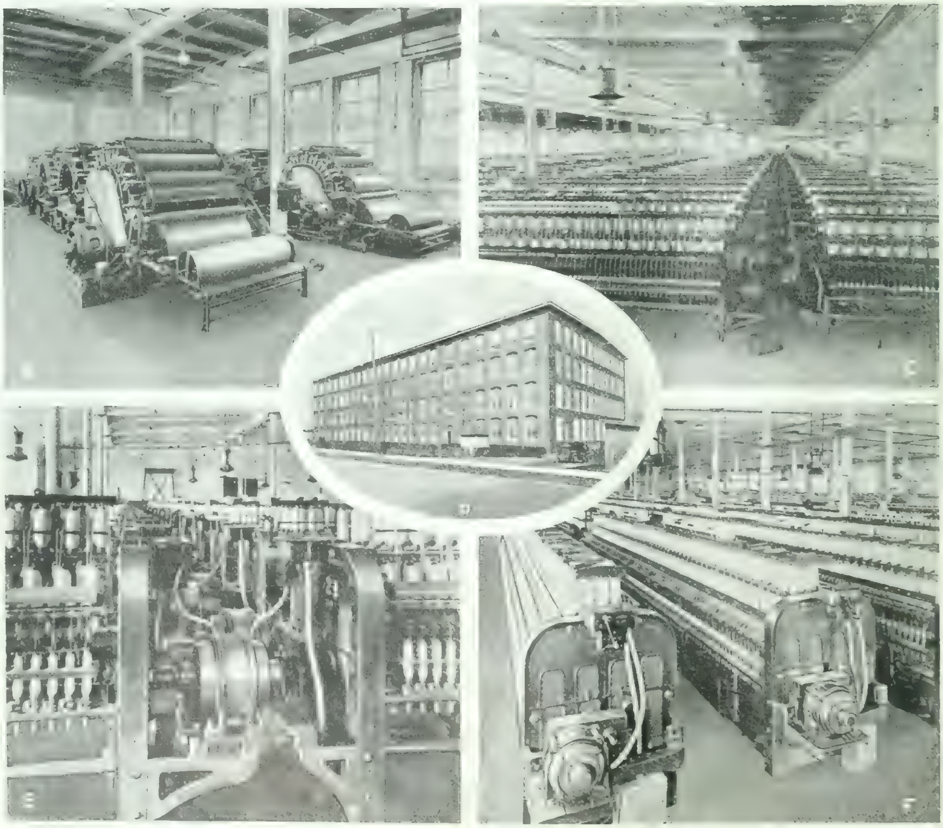
C—Production has been increased from 5 to 11 per cent by equipping the cotton spinning room as shown. In this spinning room of the Woodruff Cotton Mills, Woodruff, S. C., there are 172 5-hp. and 7½-hp. motors all using chain drive.

D—Modernized working conditions and a belief in the electric drive are rapidly raising the efficiency of the textile industry. A typical modern mill building of the Easley Cotton Mills.

E—Old mills once a maze of belts have been electrified, with a resulting improvement in working conditions.

F—Appreciation of the value of neat, safe electrical installations is shown.





Selection of Polyphase Motors

Comparison of Electrical and Physical Characteristics that Affect Service Requirements—Choice of Speed, Frequency, Weight and Rating Are Considered—Squirrel-Cage Compared with Wound-Rotor Motor

By BENJAMIN F. BAILEY
Chief Engineer Howell Electric Motors Company

IN THE intelligent selection of motor equipment there are a number of fundamental points that must be carefully considered if the best operating results are to be obtained. A comparison of speeds and the questions of weight and rating are typical features that should be studied in every application. While it is not possible to go into great detail regarding all of these characteristics, it is the intention in this article to discuss briefly some of the points that should be understood by both purchasers and salesmen of polyphase induction motors. Much of what is said will apply also to other types of motors.

HIGH-SPEED OR LOW-SPEED MOTORS

In general the higher the speed of the motor the better, for the power of the motor is dependent upon two factors—the size, which determines roughly the torque or turning effort that the motor can deliver, and the speed. The power is the product of these two factors.

In the first place high-speed motors are cheaper. Thus, if a 5-hp. motor at 1,800 r.p.m. is compared with a motor of the same horsepower at 1,200 r.p.m., it will be found that the latter costs about 40 per cent more. At 900 r.p.m. the cost is increased approximately 75 per cent above that of the 1,800-r.p.m. motor, and at 600 r.p.m. the cost is more than doubled. In addition to the fact that the low-speed motor costs much more than one of higher speed, it is in almost every respect a poorer motor. In the characteristic curves of two 10-hp., three-phase, 60-cycle, 220-volt motors designed for 1,800 and 600 r.p.m. respectively, it will be seen that the best efficiency of the high-speed motor is 88 per cent and of the low-speed motor 81 per cent. The difference is even more marked at one-quarter load, where the respective figures are 70 per cent and 65 per cent.

The power factor shows an even greater improvement in the high-speed motor, the respective figures at full load being 90 per cent for the 1,800-r.p.m. motor and 69 per cent for the 600-r.p.m. motor. The starting torques are respectively 290 per cent and 140 per cent, and again the high-speed motor is much the better.

The above remarks can hardly be extended to the case of two-pole motors giving a speed of 3,600 r.p.m. at 60 cycles. Two-pole motors are difficult to wind, which makes their cost little, if any, less than that of four-pole motors, and the electrical characteristics do not show much, if any, improvement over those of four-pole motors. Moreover, the speed is so high that it is difficult to connect motors to their loads except in certain special applications.

While it will be clear from the above that the high-speed motors possess distinct advantages, it is necessary in many applications to use motors of a lower speed. Thus, if a motor is to drive a countershaft, it may be impossible to mount a pulley on the countershaft large enough to insure that the standard diameter of motor pulleys may be used with high-speed motors and still get the proper speed ratio. For instance, the standard pulley for a 20-hp., 1,800-r.p.m. motor is 8 in. (20 cm.) in diameter and wide enough for a 6-in. (15.2-cm.) belt. The full-load speed of the motor will be about 1,720 r.p.m. If the countershaft is to run at 250 r.p.m., a pulley of 8(1,720/250) = 55 in. (140 cm.) diameter, would be required. In many cases there would not be sufficient clearance to get a pulley of this diameter upon the shaft. If it were possible to use a 6-in. motor pulley instead of an 8-in. pulley, the correct size of the countershaft pulley would be reduced to 41 in. (104 cm.), but the belt width would have to be increased in the same proportion, or to 8 in. The total belt pull would be increased 33⅓ per cent, and this would be exerted at a greater distance from the bearing. The pressure upon the bearing would be increased approximately 50 per cent. This would be very bad practice and almost sure to lead to trouble.

A 20-hp., 1,200-r.p.m. motor, however, is regularly furnished with a 9-in. (22.8-cm.) pulley. The full-load speed is about 1,150 r.p.m. and therefore requires a pulley of 9(1,150/250) = 41 in. In this case, then, it would be preferable to use a 1,200-r.p.m. motor. If, however, there is plenty of room for the larger countershaft pulley, an 1,800-r.p.m. motor is both better and cheaper.

In many cases it will pay to use a higher-speed motor with back gearing rather than to attempt to use a low-speed motor directly.

It should not be inferred, however, that a low-speed motor is never preferable. Many cases arise where a motor must be directly connected to its load in order to save space or to insure quiet running. In such cases a low-speed motor may be necessary. They should, however, be avoided, if possible.

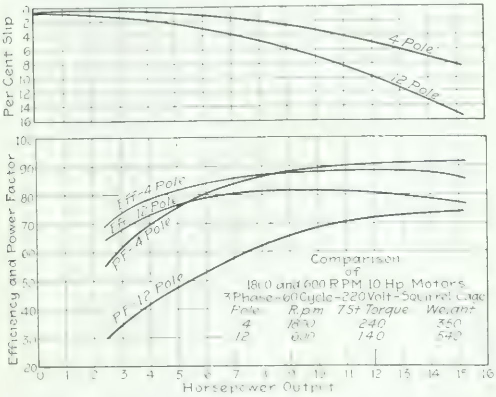
It has often been urged in favor of low-speed motors that they are more durable than high-speed motors. In the case of the squirrel-cage motor about the only parts which wear are the bearings. It is true that, other things being equal, high-speed bearings would tend to wear faster than low-speed bearings of the same type and would also tend to run hotter. Investigation has shown, however, that a ring-oiled bearing is capable of carrying much greater loads at high speed than at low speed. This is due to the fact that the high speed tends to carry the oil in between the shaft and the bearing so that the shaft actually floats upon a film of oil. If the speed is doubled, the load upon the bearing can be increased about 41 per cent without rupturing the oil film. This fact largely, if not entirely, offsets the more rapid wear which might be expected in a high-speed bearing, and since motor manufacturers usually use the same size bearing for a given weight, whether the speed is high or low, it is questionable whether the wear is any greater in a high-speed than in a low-speed bearing.

In the majority of cases a customer has no choice as to the frequency to be employed. If there is any choice, the 60-cycle motor is greatly to be preferred to the 25-cycle one in all cases where speeds of 1,800 r.p.m. or 1,200 r.p.m. can be employed. If the conditions should necessitate a low-speed motor, a four-pole, 25-cycle motor giving a speed of 750 r.p.m. would be better than would a ten-pole, 60-cycle motor at 720 r.p.m.

The three-phase motor is decidedly better than the two-phase. The efficiency and power factor of the three-phase motor are almost always 1 or 2 per cent higher and the starting torque about 50 per cent better. Consequently the three-phase motor, if built on the same size of frame, almost always runs several degrees cooler. In other words, it is inherently capable of carrying a larger load than the two-phase motor of the same rating for the same temperature rise.

Squirrel-Cage and Wound-Rotor Motors

If it is possible to use a squirrel-cage motor, it is much to be preferred to the wound-rotor motor. It is more rugged and occupies less space, is less liable to get out of order, and the efficiency and power factor will average several per cent better. The wound-rotor motor is a necessary evil. It must be used if it is necessary to run the motor at varying speeds. The wound-rotor motor can be made to operate for practical purposes at any speed from one-half to full by inserting resistance in the rotor circuit. This is done, however, only at the cost of low efficiency and poor speed regulation.



CHARACTERISTICS OF TWO 10-HP., THREE-PHASE, 60-CYCLE, 220-VOLT MOTORS AT 1,800 AND 600 R.P.M. RESPECTIVELY

It is also necessary to use wound-rotor motors if it be essential that the motor should exert great starting torque and at the same time operate under full load with small slip. Squirrel-cage motors can be constructed to give even better starting characteristics than wound-rotor motors, but such motors will have 15 to 20 per cent slip at full load; that is, the full-load speed will be 15 or 20 per cent lower than the no-load speed. Such motors will also heat up rapidly under full load.

Many purchasers consider that a heavy motor is better than a light motor, but, other things being equal, the reverse is more apt to be the case. If a light and a heavy motor run at the same external temperature under the same load, there will be spots in the heavier motor much hotter than the hottest spots in the light motor. This is shown by the fact that in building a light-weight motor it is necessary to subdivide the iron into comparatively small divisions. There is therefore no spot in a light, well-ventilated motor very far from an outside cooled surface. In heavy motors, on the other hand, there may be spots and long distances from any cooled surface, and such spots will necessarily be considerably hotter.

It is these hot spots rather than the external temperature which determine the liability of the insulation of a motor to break down, since it is impracticable to measure the actual temperature at the hottest spots. As motors are guaranteed on the basis of their external temperature, it will be evident that if two motors give the same external or measurable temperature, the actual danger points will be hotter in heavy than in light motors.

It is true that the heavy motor will have the advantage in taking care of temporary overloads. A heavy motor will carry such an overload for a greater length of time without becoming excessively hot, since it has a greater mass of metal to absorb the heat generated.

Inclosed motors are very difficult to cool because there is no opportunity for the motor to cool itself by throwing out the hot air by means of fans or otherwise. An inclosed motor for continuous service must be at least twice as large as a similar open motor for the same service. Such motors have good efficiency and power factor, but they are also exceedingly expensive.

If an inclosed motor is to be used to carry a load only for a short time, the question of heating hardly enters and there is no disadvantage in the inclosed motor.

Two-Speed and Four-Speed Motors

It is possible to build good induction motors to operate at two speeds in the ratio of two to one. Thus, by a change in the connections of the coils and by bringing out additional leads it is possible to produce a motor having, say, four and eight, or six and twelve, or eight and sixteen poles. The horsepower rating at the lower speed will be approximately half that at the higher, but the allowable torque or turning effort will be the same at either speed. Such motors have in general poor starting torque with the greater number of poles—*i.e.*, with the low-speed connection—and should be used with caution if great starting torque is necessary. Such a motor at its highest speed costs approximately 5 per cent more than a standard motor of the same rating.

A two-speed motor giving speeds not in the ratio of two to one (say 1,800 and 1,200 r.p.m.) can be built only by using two independent windings. Such motors are satisfactory, but are larger and more expensive than those just described.

By using two independent windings and bringing taps out from each of them it is possible to build a four-speed motor. With small 60-cycle motors the speeds are usually 1,800 and 900 r.p.m. on one winding and 1,200 and 600 r.p.m. on the other. The horsepower developed will be proportional to the speed. They are, of course, large, to accommodate the two windings, and will cost about 50 per cent more than a standard single-speed motor of the same rating as the four-speed motor at its highest speed.

RATING OF MOTORS

There are two methods of rating motors for continuous operation—the 40-deg. and the 50-deg. ratings. The load that a motor can carry is ordinarily limited by heating. If a motor is run too hot, the insulation in time becomes charred and fails and the motor must be rewound. The 40-deg. C. (72-deg. Fahr.) motor is guaranteed to carry its rated load continuously with a rise of temperature not in excess of 40 deg. C. (72 deg. Fahr.). It is also guaranteed to carry an overload of 25 per cent for two hours with a rise not in excess of 55 deg. C. (99 deg. Fahr.). A 50-deg. motor, on the other hand, is guaranteed to carry full load with a rise not in excess of 50 deg. C. (90 deg. Fahr.) and is not guaranteed to carry any overload.

The selection of the motor depends upon many circumstances. Thus suppose a customer desired a motor to operate a fan which required 11 hp. at full load. It is impossible to overload a fan beyond its full-load capacity (except by speeding it up), and therefore it would be impossible ever to exceed this load on the motor. Many times the horsepower demand will be less, owing to the full capacity of the fan not being needed. The temperature rise of a 10-hp., 40-deg. motor should not exceed at any time 50 deg. while carrying 11 hp. and should be entirely satisfactory for the work. A 50-deg., 10-hp. motor could not be used as its rise would be about 62 deg.

Another typical installation would be that of a motor used to drive a lineshaft in a factory. The lineshaft in turn drives miscellaneous machine tools, and it is entirely possible that the motor may be overloaded at times, perhaps 50 per cent. If the average power required is, say, 10 hp., a 40-deg., 10-hp. motor would easily take care of the load. With a 50-deg. motor it would be necessary to use the next larger size, presumably a 15-hp. motor.

STANDARD RATINGS MAY NOT SUIT CONDITIONS

Many cases occur in practice where a motor operating a little above one of the standard ratings but below the next standard rating is required. Thus it might be that a motor of 55 hp. was needed. The nearest standard ratings are 50 hp. and 75 hp. If the matter is discussed with the manufacturer of the motor under consideration, it may very likely appear that, although the 50-hp. motor is supposed to give a rise of 40 deg., the actual rise is only perhaps 30 deg. Every manufacturer has a number of motors in his line of which this is substantially true, since it is not practicable to pare down the size of each motor to the point where it will just "get by." In other words, some of his motors will run close to the limit, others may drop quite far below it. In the case of the latter it is practicable to operate them above their rated horsepower without any danger to the motor. In other words, the motor which is normally rated at 50 hp. may in reality be a 55-hp. motor, but the manufacturer does not so rate it since this is not one of the standard ratings. A very considerable saving in the cost of a motor installation may often be made by taking advantage of such conditions. The matter should, however, be taken up with the manufacturer, and particularly the matter of bearings should be carefully looked into to make sure they will stand the additional load.

It is also practicable to overload a motor to a considerable extent if its location is such that the surrounding temperature is always low. The insulating materials in a motor will be more or less injured if the temperature of the motor exceeds 90 deg. C. (194 deg. Fahr.). If the air surrounding the motor is cold, naturally a larger load can be carried without the motor becoming excessively hot. If the surrounding atmosphere is hot, the load that can be carried is smaller. Motors are guaranteed to operate safely with the temperature of the surrounding air not in excess of 40 deg. C. (104 deg. Fahr.). Advantage should be taken of this fact only with caution, and the customer should be sure that the surrounding temperature will not under some conditions become so high that the final temperature will be excessive.

OVERMOTORING SHOULD BE AVOIDED

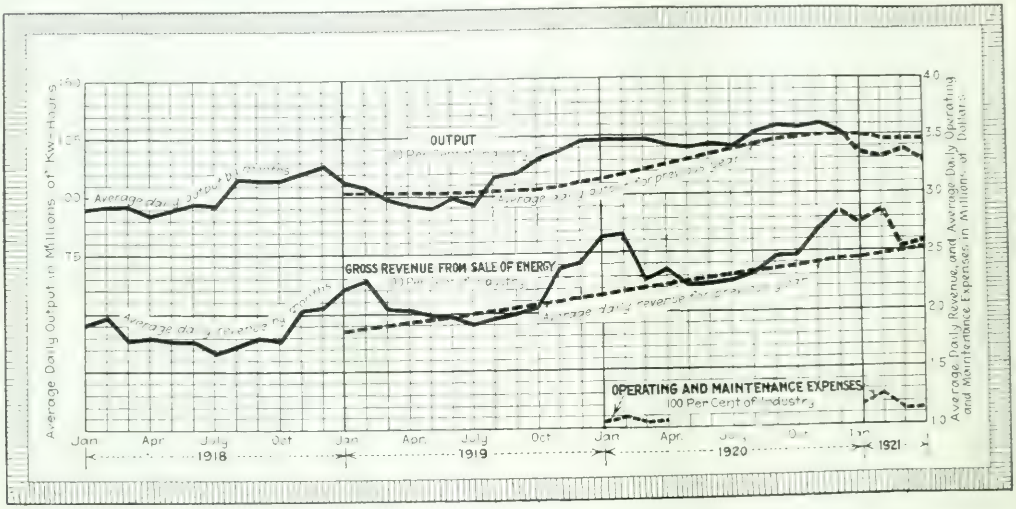
The use of motors that are larger than necessary should be avoided. Thus, if the 5-hp., 1,800-r.p.m. motor, with characteristics as shown in the diagram, is used to develop only 3 hp., the efficiency is reduced from 88 to 84 per cent and the power factor from 89 to 80 per cent. The lower efficiency means increased power bills, while the lower power factor causes poor voltage regulation, loads up the lines, transformers and generators with useless or "idle" current, and in many cases is penalized by an increased charge for power.

Before purchasing a motor the power requirements of the machine to be driven should be ascertained as accurately as possible. An occasional "power survey" of the motors in a factory with the proper electrical instruments will often disclose startling facts and will be a paying investment. Better yet, if one is operating a large number of motors, is the purchase of a recording wattmeter and its regular use. It will tell the complete history of a motor for twenty-four hours or longer. It is interesting to know, for example, whether a machine is producing all the time.

Suppose, for example, that by means of a test as above described or in other manner it has been found that the load is 15 hp. for one minute and 5 hp. for three minutes and that this cycle is constantly repeated. Probably a standard 10-hp. motor could be used provided it had sufficient starting torque to start the load and enough overload capacity to carry the 15 hp. without excessive slowing down. In many cases like the above a special motor would be preferable. This would probably be a standard 10-hp. motor, except for the winding, which would be adapted to give greater overload capacity and greater torque. In other cases it might be desirable to have a motor capable of giving great starting torque with comparatively small starting currents. Such motors can be built with squirrel-cage rotors, although they necessarily fall off in speed more under load than a standard motor and are consequently less efficient.

A wound-rotor induction motor must be used if excellent starting characteristics and also high running efficiency are desired. In all cases where special motors are necessary and any doubt exists as to the proper type of size, the manufacturer should be consulted.

Industrial Load Near Equilibrium During April



CENTRAL-STATION OUTPUT DECREASES WHILE GROSS REVENUE INCREASES

Returns received for the month of April by the ELECTRICAL WORLD from electric light and power companies representing 78 per cent of the installed generating capacity of the country indicate that a state approximating rest has been produced in the central-station industrial load by the counter-action of the primary industries. Definite reports indicate that while material curtailments were made in several of the primary industries using large quantities of electrical energy, yet these decreased power requirements were almost balanced by the increased power requirements of other important industries. The industrial sections of the country reported a decreased average daily energy output, but the decrease was probably not in excess of the drop in the lighting load of these sections. The agricultural sections of the country reported greater central-station operations, due in large part to the increased irrigation load. The aggregate daily output of the country was still slightly in excess of that reported in February of this year, but was 6.8 per cent below that of April, 1920. Both the gross revenue and the operating expenses increased during April. The total gross revenue was 12.8 per cent greater than that reported in April, 1920, while the operating and maintenance expenses were only 8.1 per cent greater.

During April about 285,000 more spindles were operating in the textile mills of New England than in March, leaving about 1,607,000 spindles still idle in this section. The boot and shoe industry showed a slight upward swing, but in the most active centers was operating only on a 55 per cent basis. In the aggregate the industrial load of the central generating stations of New England during April was probably about the same as that of March, and the small drop in output can reasonably be attributed almost entirely to the reduced lighting load.

Industrial conditions in the Middle Atlantic States showed little improvement during April. The automobile and allied industries reported slight improvement, but this was more than offset by the further reduction

TABLE I—CENTRAL-STATION RETURNS FOR TWELVE MONTHS

	Percentage of Installed Ratings Represented	Kw.-Hr. Output (Companies Reporting)			Percentage of Installed Ratings Represented	Revenue from the Sale of Energy (Companies Reporting)		
		1920 Thousands	1919 Thousands	Per Cent Increase		1920 Thousands	1919 Thousands	Per Cent Increase
May	70	2,631,560	2,179,916	21.2	65	$43,888	$35,512	23.4
June	71	2,630,831	2,175,645	20.2	66	44,434	35,528	24.5
July	71	2,677,131	2,234,215	20.0	66	46,608	36,265	28.5
Aug.	71	2,769,175	2,303,099	20.1	66	47,410	36,713	29.1
Sept.	71	2,734,179	2,327,460	17.4	66	49,224	38,209	28.5
Oct.	71	2,797,625	2,499,488	11.9	66	51,370	41,055	25.1
Nov.	71	2,741,705	2,503,402	9.6	66	54,620	44,711	22.0
Dec.	71	2,792,554	2,648,746	5.4	66	57,697	48,580	18.6
		1921	1920			1921	1920	
Jan	76	2,765,632	2,943,349	-6.0	70	58,855	50,861	15.8
Feb.	76*	2,453,671	2,711,800	-9.4	70*	55,540	48,633	14.3
Mar.	77†	2,806,609	2,989,581	-6.1	72†	55,513	49,071	13.3
April	78‡	2,691,661	2,888,727	-6.8	72‡	55,253	48,974	12.8

	Percentage of Installed Ratings Represented	Operating and Maintenance Expenses (Companies reporting)			OPERATING RATIO					
					Steam Plants		Hydro Plants		Combined Systems of Steam and Hydro	
		1921 Thousands of Dollars	1920 Thousands of Dollars	Per Cent Increase	1921	1920	1921	1920	1921	1920
Jan	40	14,562	13,085	11.3	56.1	55.3	26.8	27.0	38.1	45.6
Feb.	43	15,085	13,640	10.5	55.6	54.5	22.4	26.0	44.1	47.3
Mar.	53	18,757	17,248	8.7	56.1	57.7	23.4	19.6	40.3	44.8
Apr.	53	18,305	16,945	8.1	53.0	56.5	23.9	19.8	41.4	43.3

*Includes estimates for thirty-three companies, representing 3.3 per cent of the total installed rating of all central stations.

†Includes estimates for forty-one companies, representing 4.2 per cent of the total installed rating of all central stations.

‡Includes estimates for seventy-nine companies, representing 16.7 per cent of the total installed rating of all central stations.

TABLE II—CENTRAL-STATION RETURNS BY SECTIONS OVER A TWELVE-MONTH PERIOD

	Month	Percentage of Installed Ratings Represented	New England States			Percentage of Installed Ratings Represented	Atlantic States			Percentage of Installed Ratings Represented	North Central States			Percentage of Installed Ratings Represented	South Central States			Percentage of Installed Ratings Represented	Pacific and Mountain States		
			1920 Thousands	1919 Thousands	Per Cent Increase		1920 Thousands	1919 Thousands	Per Cent Increase		1920 Thousands	1919 Thousands	Per Cent Increase		1920 Thousands	1919 Thousands	Per Cent Increase		1920 Thousands	1919 Thousands	Per Cent Increase
KW.-HR. OUTPUT	May	82	188,566	148,186	27.5	65	854,631	711,276	20.0	74	862,127	700,095	23.5	56	137,779	98,815	39.2	79	588,457	521,544	12.6
	June	82	189,934	149,607	26.5	66	865,714	721,688	19.9	74	855,013	681,780	25.5	56	132,733	99,660	33.2	79	587,437	522,901	12.2
	July	82	190,668	159,000	20.0	66	881,241	714,485	23.5	74	841,351	702,302	19.7	56	138,937	106,460	30.1	79	614,934	551,959	13.4
	Aug.	82	194,028	171,002	13.5	66	905,170	728,097	24.2	74	891,712	750,787	18.6	56	147,082	111,573	32.0	79	631,183	541,640	16.5
	Sept.	82	194,730	170,593	14.1	66	905,872	758,737	19.5	74	878,237	758,017	15.9	56	147,524	113,649	30.0	79	607,816	526,464	15.5
	Oct.	82	196,310	191,132	2.7	66	964,739	841,694	14.5	74	896,241	817,757	9.5	56	157,267	126,769	24.1	79	583,068	522,136	11.7
	Nov.	82	193,231	183,624	5.4	66	953,436	825,011	15.5	74	895,229	861,352	10.5	56	144,889	125,438	15.0	79	554,920	507,977	9.2
	Dec.	82	210,494	227,403	-7.4	66	969,909	917,945	5.7	74	903,628	852,264	5.9	56	140,485	133,419	5.3	79	568,038	517,715	9.6
			1921	1920			1921	1920			1921	1920			1921	1920			1921	1920	
	Jan.	81	200,269	247,800	-19.2	77	1,003,223	1,043,650	-3.9	73	860,643	956,078	-10.0	62	144,936	145,336	-0.3	81	556,561	550,685	1.1
	Feb.	81	178,694	216,890	-17.6	77	902,030	970,539	-7.0	73	789,539	882,873	-10.6	63	131,654	132,537	-0.7	81	451,754	508,961	-11.2
	Mar.	81	205,348	230,309	-10.7	79	1,029,120	1,119,428	-8.1	73	894,500	941,893	-5.0	63	139,381	136,017	2.4	81	538,260	561,934	-4.2
	April	81	197,029	227,008	-13.2	79	967,877	1,053,496	-8.1	73	830,215	895,018	-7.2	63	132,774	135,324	-1.9	88	565,191	584,279	-3.3
REVENUE			1920	1919			1920	1919			1920	1919			1920	1919			1920	1919	
	May	82	$4,897	$3,741	30.1	64	$16,624	$13,631	21.9	57	$12,471	$9,853	26.8	54	$2,829	$2,140	32.0	79	$7,067	$6,147	15.1
	June	82	4,948	3,778	30.5	65	16,525	13,449	22.1	57	12,412	9,776	26.9	54	2,849	2,127	33.9	79	7,700	6,398	20.5
	July	82	5,009	3,802	28.5	65	16,899	13,438	25.5	57	12,822	9,793	30.9	54	2,747	2,194	35.0	79	9,131	6,948	31.5
	Aug.	82	5,075	4,093	24.0	65	17,210	13,731	25.9	57	13,497	10,151	32.9	54	3,168	2,281	38.1	79	8,460	6,457	31.1
	Sept.	82	5,409	4,296	25.9	65	18,081	14,456	24.5	57	13,834	10,522	31.5	54	3,262	2,386	36.5	79	8,638	6,549	32.0
	Oct.	82	5,675	4,623	22.7	65	19,201	15,722	22.0	57	14,458	11,667	23.9	54	3,504	2,551	37.3	79	8,532	6,492	31.5
	Nov.	82	5,898	5,017	17.5	65	20,938	17,119	22.2	57	15,158	12,561	20.8	54	3,853	2,910	32.4	79	8,775	7,104	23.5
	Dec.	82	6,548	5,744	14.0	65	22,332	19,149	16.7	57	16,004	13,142	21.8	54	3,722	3,113	19.8	79	9,091	7,432	22.3
			1921	1920			1921	1920			1921	1920			1921	1920			1921	1920	
	Jan.	81	6,379	6,170	3.5	74	22,180	19,225	15.3	59	16,818	14,436	17.3	62	4,155	3,484	19.3	81	9,323	7,546	23.6
	Feb.	81	5,925	5,728	3.4	74	21,492	18,327	17.4	59	15,971	14,070	13.6	62	3,915	3,329	17.6	81	8,237	7,179	14.7
	Mar.	81	5,784	5,566	3.8	76	21,822	18,934	15.3	59	15,853	14,103	12.4	63	3,747	3,246	15.5	81	8,307	7,222	15.0
	April	81	5,665	5,554	2.0	76	21,659	18,607	16.3	60	15,506	13,829	12.2	63	3,669	3,266	12.3	87	8,754	7,718	13.3
OPERATING EXPENSES:			1921	1920			1921	1920			1921	1920			1921	1920			1921	1920	
	Jan.	34	$1,098	$1,288	-14.7	48	$6,373	$5,411	17.8	28	$3,941	$3,451	14.2	37	$1,015	$905	12.2	54	$2,135	$2,030	5.2
	Feb.	35	1,069	1,242	-13.9	53	6,799	5,937	14.5	29	3,958	3,445	14.8	44	1,217	1,053	15.5	55	2,042	1,963	3.9
	Mar.	45	1,576	1,651	-4.5	59	7,969	7,241	10.0	35	4,570	4,228	8.2	51	1,776	1,514	17.2	79	2,866	2,614	9.7
	April	45	1,418	1,479	4.1	59	7,762	7,275	6.7	36	4,481	4,194	6.8	51	1,688	1,465	14.5	79	2,956	2,532	16.8

in the iron and steel operations. In the South Atlantic States, although only a little more than 216,000 spindles were idle, yet a great number of textile mills were operating on part time. The lumber industry of the South showed considerable curtailment, and the coal mines of West Virginia were operating at from 20 to 25 per cent capacity.

As a result of the decreased power demand in the Atlantic States, in conjunction with the seasonal drop in lighting load, the average daily output of the central stations of that section was about 1,200,000 kw.-hr. below that reported for March.

With the exception of the automobile and accessory industries, the industrial load of the central stations of the North Central States showed a drop very similar to that reported by other industrial sections of the country. The iron and steel industry showed a decrease of about 10 per cent in operations, and the mining districts were almost entirely closed down. The lighting requirements were also materially decreased. These adverse conditions resulted in a daily electrical output of about 2,555,000 kw.-hr. below that of the month of March.

Slight improvement in industrial activities was reported throughout the Mountain Section, excepting in the localities dependent upon mining, where no improvement was noted. The Pacific States also reported slight industrial improvement. The daily output of the central generating plants of California was about 21 per cent above that of March, this material increase being largely due to the extensive irrigation load. This increased irrigation load was sufficient to overcome the decreased operations of the central generating plants at the Mountain States, resulting in a daily output for the Mountain-Pacific section almost equal to that reported in March.

TABLE III—AGGREGATE OPERATING RATIO OF COMPANIES REPORTING DATA MONTHLY TO THE "ELECTRICAL WORLD"

Type of Generating Plant and Month	New England States				Atlantic States				North Central States				South Central States				Mountain and Pacific States			
			Average for Year				Average for Year				Average for Year				Average for Year				Average for Year	
	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920
Steam Plants																				
January	54.0	60.8	54.0	60.8	53.5	50.9	53.5	50.9	61.2	61.8	61.2	61.8	53.1	53.7	53.1	53.7	69.0	60.5	69.0	60.5
February	54.3	59.5	54.2	60.3	52.3	53.0	52.7	52.1	63.0	57.9	62.1	59.8	59.1	51.2	56.2	52.3	60.2	60.3	64.3	60.3
March	64.0	70.0	56.7	62.5	54.5	56.7	53.3	53.7	58.4	59.7	60.8	59.8	53.3	50.9	55.0	51.9	68.4	62.5	65.9	61.2
April	59.4	63.5	57.3	62.7	50.9	54.3	52.8	53.8	54.8	61.2	59.3	60.2	54.1	52.8	54.7	52.1	53.7	53.7	61.8	58.6
Hydro Plants:																				
January	26.5	35.2	26.5	35.2	21.2	21.2	21.2	21.2	25.0	20.8	25.0	20.8	26.4	20.1	26.4	20.1	27.5	27.3	27.5	27.3
February	30.1	46.5	26.8	35.6	20.1	20.6	20.7	20.9	24.1	20.6	24.6	20.6	28.6	21.4	27.4	20.5	23.9	27.9	26.0	27.6
March	29.9	30.0	26.9	35.3	21.0	20.6	20.8	20.8	23.0	20.6	23.5	20.6	30.4	23.2	28.4	21.3	24.9	19.0	25.8	25.6
April	24.6	34.7	26.5	35.2	18.2	18.8	20.2	20.3	24.8	20.8	24.2	20.7	22.4	25.0	26.8	21.2	27.3	19.2	26.0	24.2
Combined Systems of Steam and Hydro Plants:																				
January	45.3	53.5	45.3	53.5	43.5	45.8	43.5	45.8	39.5	38.6	39.5	38.6	38.6	46.6	38.6	46.6	35.2	45.6	35.2	45.5
February	44.3	60.0	44.7	58.8	41.8	41.9	42.6	43.8	42.4	49.8	41.9	48.2	41.7	39.6	40.5	42.0	39.6	43.8	37.4	44.7
March	49.7	53.8	47.3	56.0	39.7	47.3	42.0	45.3	41.5	46.0	41.8	47.3	38.6	39.2	40.2	41.2	36.4	39.7	36.9	43.0
April	46.6	48.5	47.1	53.5	42.9	43.9	41.9	44.8	45.0	48.3	42.7	47.5	43.6	48.6	40.7	42.8	37.0	36.8	37.0	41.0

Readers' Views and Comments

This is a readers' forum. Comments on questions before the electrical industry presenting economic, financial, engineering or commercial aspects and new or supplementary viewpoints on published articles are cordially invited

The Penalty for Carelessness in Operation

To the Editor of the ELECTRICAL WORLD:

SIR: In engineering practice, as elsewhere, serious trouble sometimes appears in quarters where it is least expected. An example of such trouble of a somewhat serious nature came within the experience of the writer some time ago. A short description of its nature and the circumstances under which it occurred, with some of the results observed and conclusions drawn, is given here in the hope that perhaps operating engineers may find in them something of value. Since the purpose for which this experience is here recorded would be in no way served by naming the companies involved fictitious names are used.

The Smelting & Refining Company received three-phase energy at 6,600 volts from the Master Power Company over a No. 4/0 line about a quarter of a mile long. The line wires were spaced 6 ft. apart and were carried on poles and cross-arms of usual construction. The line passed out from the Master Power Company's buses through an oil circuit breaker having a series coil which closed the shunt tripping coil circuit in heavy overloads. The latter circuit was operated from the station exciter buses. At the receiver end the line terminated in a 6,600-volt bus, from which power was distributed mainly to two loads, each taking about 400 amp. through suitable disconnecting switches and oil switches. At certain more or less regular intervals during the day it became necessary for the operator at the Smelting & Refining Company's plant to disconnect one of the 400-amp. loads from the feeder circuit. The operator on shift, instead of first throwing the oil switch, as he had done many times before, carelessly opened the disconnecting switches, the three blades of which were interlinked, and all pulled together.

Right there the fireworks started. A heavy arc hung across the switch blades for perhaps half a minute before the blades melted away. The arc soon burned itself clear of the switches, but not before it had set the building on fire. The line wires burned off outside the building, but as the arc broke at one place it formed at another. The entire line suddenly became animated. It snapped at a score of places, leaped to earth, writhed and was still. It was all over in much less time than it takes to tell it, and there was scarcely a span of feeder wire left in place on the poles anywhere on the line.

All of the conditions and circumstances connected with the disaster were subsequently carefully examined. As a result of this examination the following conclusions seem warranted:

1. The immediate cause of the disaster was carelessness on the part of the operator, again emphasizing the fallibility of human nature.
2. As a result of the intense heat developed, in many sections of the feeder wire the copper had apparently been vaporized and blown from its sheath, leaving the weatherproof covering in good condition. A large part of the wire was badly burned and of no value except as junk.
3. Even after the lines burned free from the disconnecting switches they did not burn clear at the load end, indicating that a 6,600-volt arc may persist and largely destroy a line in which the wires are spaced 6 ft. apart.
4. The circuit breaker at the power house had failed to open, although on all previous occasions it did open under accidental short circuits. In the present instance the switch was tripped by the operator.
5. Circuit breakers so connected as to depend upon the exciter voltage to operate the tripping mechanism are poor protection against a short circuit which comes on gradually or has an initial high resistance. The tripping mechanism will not operate below a certain exciter voltage. If the switch remains closed until the excited voltage goes below this critical value, it must fail to open.

E. A. L.

Seattle, Wash.

Meters Increased 37 per Cent in Price from 1916 to 1921

To the Editor of the ELECTRICAL WORLD:

SIR: A curve shown in the March 26 issue of the ELECTRICAL WORLD relative to the increased cost of central-station apparatus versus increased cost of commodities for a period from 1916 to 1921 shows an increase in the price of meters of 8 per cent. This figure appears incorrect when compared with the data available to our sales department.

For your information I would say that our price on a 5-amp., 110-volt, 60-cycle meter, which is the type generally taken as the standard by all manufacturers in discussing price, was $6.80 in the early part of 1916. At that time the prices of other manufacturers of meters, according to their published list prices and discounts, were somewhere between $6.80 and $6.90. Since last spring our price on the same meter to the same class of customers has been $9.35, and the published prices of other meter manufacturers run somewhere from $9.40 to $9.50. The increase in our price from 1916 to 1921 was, therefore, $2.55 on $6.80, or 37 per cent, and from the published prices of other manufacturers the increase made by them was approximately the same.

I think all the meter manufacturers take pride in the fact that prices did not go up on meters nearly so much as on other electrical apparatus during the war, but at that, there is no reason to publish data in the leading paper of the electrical business which gives such a misleading impression as that the increase in price of meters during the said period was only 8 per cent.

R. C. LANPHIER.
Vice-president and General Manager.
Sangamo Electric Company,
Springfield, Ill.

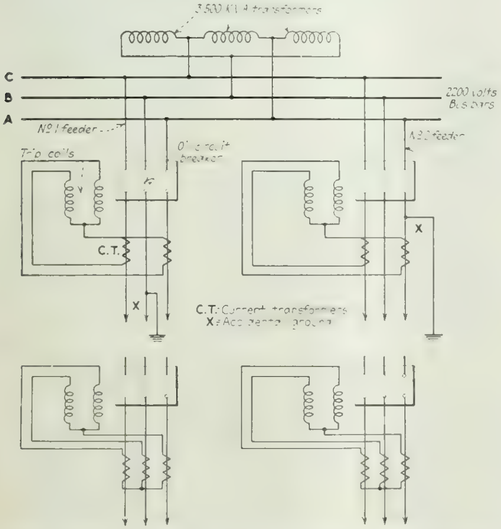
[Upon checking the data on which the curve of increase in meter prices was based, we regret to find that an error was made in the original computation of the percentage gain in meter prices since 1916, and that the figure of 37 per cent, as indicated by Mr. Lanphier, is very nearly correct.—EDITOR.]

Station and Operating Practice

A Department Devoted to Problems of Installation,
Operation and Maintenance of Equipment for Economical Generation and
Distribution of Electrical Energy

Advantage of Three Current Transformers for Relay Operation

A CASE of trouble resulting from accidental grounds on a three-phase, three-wire system recently led the writer to conclude that the use of three current transformers to operate relays would be more satisfactory than using two transformers, as is the general practice. In the case in mind there were two three-phase feeders fed through oil switches from a 2,200-volt bus. On the line side of each of these oil switches were installed two current transformers connected to two trip coils as indicated in the accompanying sketch. Since there were no ground detectors on the lines and the power transformers were ungrounded, a ground which developed on the middle phase of No. 1 feeder remained unnoticed. No trouble resulted until a second ground developed on the *A* phase of No. 2 feeder at a point indicated by *X* in the drawing. This caused a dead short circuit across the main busbars, but there were no current transformers in the circuit to operate the relays on the feeder switches. Consequently the short circuit resulted in considerable damage.



SHORT CIRCUIT CAUSED BY GROUNDS FAILED TO OPERATE RELAYS WITH ONLY TWO CURRENT TRANSFORMERS INSTALLED

At the bottom of the drawing are shown three current transformers connected so as to prevent this trouble.

To guard against such troubles three current transformers may be used as shown at the bottom of the drawing. With these three transformers installed at least one of the oil switches will be tripped out in a case like that described.

Of course, the installation of ground detectors would make it known when the first ground developed upon the system. However, the second ground might develop before the first one could be removed. This ground would show all over the system and each feeder might have to be opened before the ground could be located.

R. H. N. LOCKYER.

Bonnington Falls, B. C., Canada.

Large Systems Need Special Protection Against Short Circuits

WITH the ever-increasing amounts of power being generated and distributed by central stations more attention should be given to limiting the amount of energy that can feed into a short circuit. More study must be given to the design and installation of current-limiting reactances, circuit breakers, instrument transformers and protective devices. Ample clearances must be allowed between phases not only in new installations but also in older plants before interconnection with systems of large capacity is made. With the large units installed and the adding together of a number of stations by interconnecting transmission lines, it is often possible for an enormous amount of power to feed into a short circuit. There is also possibility of danger when plants of older design are tied by means of transformers and transmission lines to systems or plants of large rating.

In designing new stations and in remodeling old ones partitions, passageways and exits should also have consideration from the standpoint of fire and accident prevention. Outdoor substations are probably safer from this point of view.

All the safeguards and protective devices possible, however, will be of little use unless properly installed, maintained and operated. For the purpose of helping correct installation manufacturers of electrical apparatus should provide, where necessary, installation instructions and diagrams of connections. These instructions should be shipped with each piece of apparatus and where practicable pasted on or tied to the frame or case of the machine or equipment. Whenever blocking is used to prevent breakage or dislocation of parts during the shipment conspicuous signs to this effect should be securely fastened to the apparatus by the manufacturer. The signs should call attention of construction men to the fact that the blocking must be removed before the apparatus is placed in service.

Before installation all apparatus should be examined by some responsible person. Competent and well-qualified men only should take charge of the installation, maintenance and operation of high-tension lines and equipment, especially where extra high voltage and large volumes of energy are handled.

Immediately after the installation of a piece of apparatus and before current is applied employees and those in the vicinity should be told that the apparatus is about to be energized and be warned to stand at a safe distance. After closing the switch the operator should stand for a reasonable length of time ready to reopen the switch upon evidence of trouble. The switch, of course, should be safe to operate under the heaviest possible load. Under certain conditions it is safer to close the switch and let the automatic features take care of the opening should trouble occur.

Whenever possible the installation should be tested before hand. This will relieve the switch of the risk of having to open the heavy current. If at all practicable, after the installation of current and potential transformers and before such apparatus is placed in service the voltage should be built up gradually. The secondaries of current transformers must always be short-circuited. If they are found open during operation, they should be de-energized before an attempt is made to apply a jumper.

Operators should know that serious trouble is often preceded by a flash, a noise or the smell of burning insulation. Noise and static on adjacent telephone lines, discharging lightning arresters, or an unusual amount of static on or around lines, insulators or equipment indicates trouble, and when such an indication is present after energizing a new piece of equipment extreme caution should be taken and the equipment should be removed from service until the reason for the disturbance is found.

Unauthorized persons should not be allowed in a high-tension room nor in the vicinity of switches, regulators, transformers or other equipment which has a great store of energy behind it. Employees whose duties require that they occasionally go near such equipment should be instructed as to the precautions to be taken. They should not spend unnecesary time in dangerous places.

H. J. BURTON.

Consumers' Power Company,
Jackson, Mich.

Oil Circuit Breaker Has Double Tank and Resilient Support

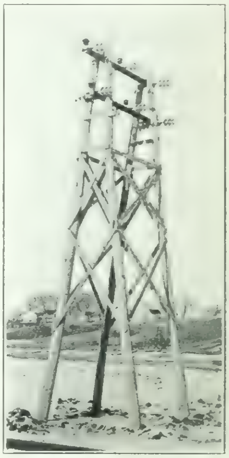
As SPACE is a very important factor in the design of power houses and substations, an oil circuit breaker of comparatively small over-all dimensions for its interrupting capacity is desirable. Such a breaker has been developed recently. To absorb the mechanical shock incident to rupturing a heavy short circuit and to reduce the expulsion of hot oil and gases double tanks are furnished, supported by a heavily ribbed cradle which is in turn hung by strong bolt construction with resilient features. An exceptionally heavy and rugged frame construction is used throughout.

The inner tank contains the oil in which the switch contacts are immersed and is heavily reinforced at the top by a deep web on the frame. The outer tank in connection with the resilient features is so arranged as to chill the gases and to prevent the hot oil from being discharged from the breaker. Owing to this the breakers are of particular interest in connection with automatic substations or where automatic reclosing of circuit breakers is necessary.

These breakers are built in single units for 500 amp. to 1,200 amp. rating at 15,000 volts and 500 amp. to 800 amp. rating at 25,000 volts, single-throw, and can be furnished for operation as a single unit or for multiple operation.

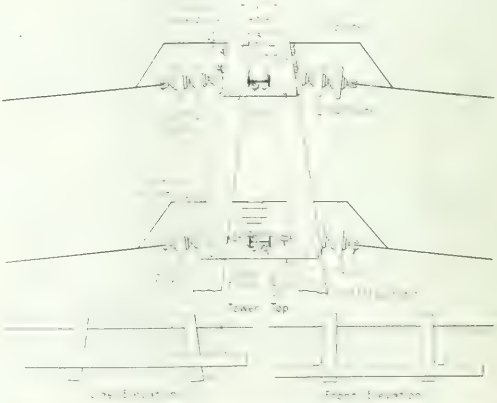
Wooden Towers for Marshy Ground

IN BUILDING a pair of 38-kv., three-phase transmission lines on a right-of-way in the Stroudwater River Valley, near Portland, Me., the Cumberland County Power & Light Company adopted the wooden-tower construction illustrated herewith, which furnishes rigid support in the face of loose and uncertain subsoil. The Stroudwater is a tidal stream, and in some cases earlier pole construction used in this district has been forced upward out of the ground by the pressure of the water and the ice in winter. To avoid this and to minimize the number of structures required, four spans requiring five wooden towers were put in. These spans ranged from 541 ft. to 695 ft., and No. 2 0 stranded copper conductor were used, the spans being designed for a minimum clearance of about 22 ft. above ground, with a ½-in. ice coating, a wind of 40 miles per hour and a temperature of about 20 deg. below zero Fahrenheit. The conductors are attached to Jeffrey-Dewitt suspension insulators at the span ends, and jumpers fastened to pin-type insulators are provided at each tower as illustrated.



LINE CONSTRUCTION WHICH PROVED SUCCESSFUL IN SOFT GROUND

The towers are built of 50-ft. chestnut poles with 8-in. tops. The butts are set 6 ft. into the ground and are keyed at the bottom to short sections of old poles resting on old ties as indicated. Four poles are used in each tower, forming an A-frame viewed from one side, and notched at their tops to fit snugly against a filler block, the structure being held together at this portion by 1-in. bolts. Cross arms of 8-in. I-beams carry the insulator clamps.



DETAILS OF FOUR-POLE TOWER USED WHERE SUBSOIL IS MARSHY

GEORGE E. HAGGAS,
Chief Engineer.

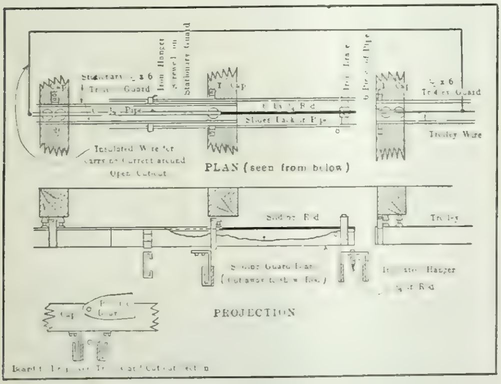
Cumberland County Power & Light Company,
Portland, Me.

Industrial Applications

The Economical Utilization of Electrical Energy
in Mills and Factories, Together with Practical Details of Installation, Control,
Testing and Repair of Equipment Required

Safety Cut-Out for Mine Trolley Wires at Loading Chutes

IT IS difficult to guard effectively trolley wires at loading chutes along the haulage ways in mines, and chute trappers may sometimes be shocked through loading bars accidentally touching the trolley line unless proper safeguards are installed. To overcome this danger the Calumet & Arizona Mining Company, Lowell, Ariz., uses a cut-out which is efficient, easily constructed and does not interfere with the operations at the chutes or with the motors operating on the same level. When the cut-out is closed it is guarded by two ½-in. x 6-in. boards as the trolley is elsewhere. When the cut-out is open a hinged board drops down over the ends of the trolley guard and prevents anything touching the live wires. The current is carried past the gap by an insulated wire on the opposite side of the drift.



SAFE MINE-TROLLEY CUT-OUT FOR LOADING FROM ORE CHUTES

The levels under the stopes are timbered with drift sets placed 5 ft. apart, and the loading chutes take up the space between two sets. All trolley wires are carried 6½ ft. above the rails and guarded by two ½-in. x 6-in. boards placed on either side of the wire. The cut-out consists essentially of a section of ¼-in. iron rod that may be slid back into a 6-ft. length of ½-in. pipe, both of which are a part of the trolley line. When closed one end of the rod remains in the long pipe at the set back of the chute and the other end fits into a 6-in. length of pipe on the set ahead. Both ends have enough bearing to make proper electrical contact. As the standard trolley-wire hangers will not fit the ½-in. pipe, a ¼-in. rod is welded on top for clamping it in place.

When the cut-out is closed it is guarded by the two ½-in. x 6-in. boards. The free end of the rod and guard boards are fastened together by an open rectangular piece of ½-in. x 3-in. iron. The trolley rod is hung from the top of the iron by an insulated hanger, and the guard boards are bolted to the sides. To open the cut-out the rod slides back into the long pipe, and at the same time the boards slide back in brackets outside of the regular guards. When the rod is all the way back a hinged board drops down over the end of the trolley-guard boards.

Occasionally, in wet places, enough current leaks through the insulators to the boards of the cut-out to shock a man, and to prevent this insulated knobs are placed on both guard boards for handling.

Bureau of Mines, E. D. GARDNER,
Washington, D. C. Mining Engineer.

Checking Condition of Motive-Power Storage Batteries

IN TESTING a motive-power battery for low cells experience is required, as there are many things external to the battery which bring about shortened capacity. For example, it may be noticed that the locomotive or truck, after being in operation for a considerable time, does not go so fast at the end of the day's work or cannot bring in so many loads in a day as formerly. It seems to be general experience thereupon to suspect the battery immediately, and very often no attempt is made to investigate other possible causes until after the battery has been thoroughly inspected and found to be delivering rated output. Or one battery may be compared with another on the basis of tons output and little consideration be given to the fact that the cars hauled by one are equipped with roller bearings, while those pulled by the other are of another kind.

A second battery is often blamed for failure where it is not the battery but the vehicle which causes the reduced output. The latter has grown older and less efficient and the second battery cannot make up for it. There was one case of this sort with a mining locomotive. It was found that the wheels had become grooved to a considerable extent, the resultant friction with the track calling upon the battery for energy. This it delivered, but, being waste energy, it had no effect on the mileage.

An ampere-hour meter is indispensable for use with a battery in motive-power service, but if it is not working properly, it is of no more use than a watch which cannot be trusted. There has been considerable trouble with ampere-hour meters, most of which can be traced to the use of the wrong type of meter or else to a meter with too high a rating. The meter of today has many improvements over that made several years ago; difficulties experienced in the past have been overcome. One mistake which is often made with ampere-hour meters is that they are looked upon as never requiring adjustment or cleaning, but they should be regularly cleaned and adjusted as often as conditions make it necessary. When an ampere-hour meter gets out of step with the battery the meter may indicate a partial discharge, whereas the battery may be entirely discharged. The meter may be very easily tested for correct registration, and if this is done and the meter then put in step with the battery, it may often be found to correct the trouble.

With these facts in mind, it is readily seen that often a test of the battery will be found unnecessary, as the trouble can be located by inquiring into methods of operation and past history. To test a battery takes several shifts. The battery should first have a long charge to insure its being fully charged, and there may be some electrolyte adjustment necessary which involves added charging.

Probably the first thing to do upon inspecting a battery is to take hydrometer readings of the electrolyte in several cells, so as to check in with the meter, and at the same time ascertain in about what state of charge the operator considers the battery. Suppose, for example, that with a 400-amp.-hr. acid battery the operator considers the battery half discharged, the meter reads 200 and the hydrometer readings average 1.175 specific gravity. A battery of this type operates with a full charge gravity of about 1.275, and the gravity drops about 125 points on a discharge. For half discharge it would drop 62 points, or to 1.213. Evidently this does not check with the obtained readings, so either the meter is out of step with the battery or else the full-charge gravity is low. If it is low, acid may have been spilled from the cells, or else the operator may have been running by the meter entirely, in which case a prolonged charge would be necessary to restore the gravity. If there is any doubt about the full-charge gravity, the only way of checking is to put the battery on charge, take gravity readings of every cell and continue charging until the gravity of every cell stops rising. Then charge for five more hours, taking care that the temperature of the electrolyte is not allowed to go above 110 deg. Fahr. during the charging. To reduce the number of gravity readings to a minimum, a good practical plan is to pick out the two or three cells showing lowest gravity and charge until their gravity ceases to rise. Then take a reading of all cells and repeat after five more hours of charge. Even this makes quite a number of readings, but there is no shorter way of being sure that *all* cells are fully charged.

When the battery is thus fully charged, it may be found that some of the cells are below 1.250 in specific gravity. These may be brought up above 1.250, preferably around 1.275, by withdrawing all the electrolyte possible with a syringe and adding 1.300 specific gravity electrolyte, then charging a half hour or so to mix the electrolyte, repeating the process if necessary. But never under any circumstances add electrolyte or acid to bring up the gravity without first having brought up the gravity as high as it will go by charging, as outlined above. A great many batteries have been injured by disregarding this rule.

The test for faulty cells is a simple matter, the most important point being first to make sure the cells are all fully charged and the gravity is between 1.250 and 1.300. Then the discharge is made at normal current and time. Any cell which runs abnormally hot on charge or discharge should be watched particularly. A variable resistance (a water-barrel rheostat will do) and an ammeter, together with a 3-volt voltmeter, are required. The ammeter should be checked as to its accuracy at the current rate to be used. For example, for a 400-amp.-hr. battery the discharge rate would be about 80 amp., and this should be maintained on discharge by regulating the resistance. The ammeter should preferably be connected to one of the battery terminals, breaking the connection between the battery and vehicle.

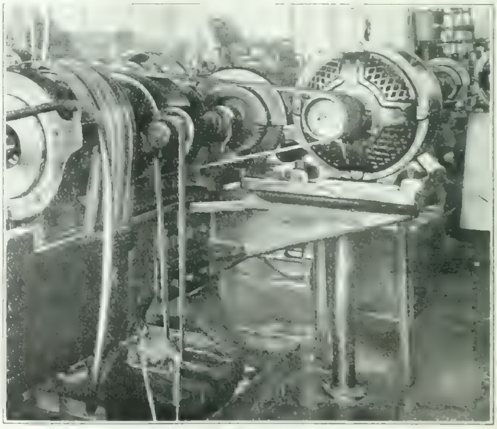
After the battery has been on discharge a few minutes a voltage reading of each cell should be taken and recorded. Any cell which shows an appreciable variation from the others should be watched. After about four hours' discharge at the constant rate another set of readings should be taken, and any cell which shows a voltage 0.1 volt less than the others should be marked. If this difference keeps increasing so that the voltage of the cell is less than 1.60 volts when the others are 1.75 volts, it should be opened up and examined.

The chief thing to remember in drawing conclusions from the test is that the difference between voltages of various cells on discharge is what gives the indication and not the absolute value of voltage. The absolute voltage is higher for high temperature, low rate, high gravity and a battery only a few months old.

Electric Storage Battery Co., RALPH W. RITTER,
Philadelphia, Pa. Engineer Operating Department.

Motor Mounted on Brackets on Heavy-Duty Lathe

IN CHANGING a heavy-duty lathe in the automotive factory of the Westinghouse Electric & Manufacturing Company at East Springfield, Mass., from group drive to individual motor drive the mounting chosen for supporting the motor consisted of a heavy bracket on one end of the machine, as shown in the accompanying illustration. The lathe was a No. 21 heavy-duty 18-in. LeBlond machine, which required a 7½-hp. motor. The weight of the motor was such that the bracket was required to be reinforced by a 3½-in. pipe pedestal resting on the floor. The motor is placed well toward the outside end of the bracket to give sufficient belt length. The control equipment of the contactor type is mounted in a box below the motor hung by 1¼-in. x ⅜-in. strap iron. Push-button control is provided near the operator's position at the front of the machine. The wiring from the control box is attached to the frame of the lathe by clips.



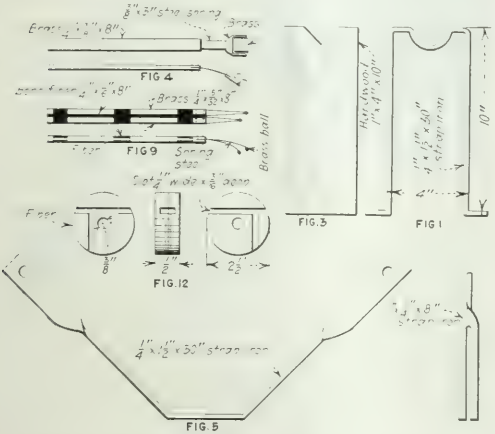
A 7½-HP. MOTOR MOUNTED ON A BRACKET ATTACHED TO A HEAVY-DUTY LATHE

Boston, Mass. FIELD EDITOR ELECTRICAL WORLD.

Bar-to-Bar Test of Small Armatures Made Rapidly

FOR quickly making a bar-to-bar test on armatures from ¼ hp. in size to 5 hp. a rack has been built in the shop of the Maintenance Company, New York City. This rack is adjustable for any motor within this range of size. In making the test the hands of the tester do not have to hold any lead wires or contacts on the commutator as spring arms accomplish this purpose. The tester has only to turn the motor and read the meter.

One end of the motor shaft is supported on a horse of strap iron (1 in the illustration), which is 10 in. high and 4 in. wide. This is made by bending a piece ¼-in. x 1½-in. strap 30 in. long. The horse may be screwed to the testing bench. The commutator end of the shaft rests in a notch cut in the top of an upright of hard wood 1 in. x 4 in. x 10 in. in size (3). This is screwed to the end of the hard-wood base, which is 2 in. x 2 in. x 14 in. in size. This base rests on the bench and extends through the legs of the horse. By sliding the base the supports are adjustable for different lengths of shaft.



DETAILS OF RACK FOR MAKING QUICK BAR-TO-BAR TEST

For feeding current into the armature two arms (4) are mounted upon a bracket (5). This bracket is made of ¼-in. x 1½-in. x 30-in. strap iron bent as shown. It is held on the base piece by a wing nut and a ½-in. bolt. To vary the position of the bracket the bolt may be slid in a slot ½ in. wide and 4 in. long cut in the base. In each end of the bracket a ⅜-in. hole is drilled for a belt to hold the fiber disk (12) which supports the arm (4).

The arms are made of two brass rods ¼ in. x ⅜ in. x 8 in. in dimensions. In the end of each rod is riveted a flat ⅜-in. x 3-in. steel spring with a U-shaped piece of brass riveted to its end. In the arms of the U a small block of brass is pivoted. The faces of this cube are hollowed to fit a commutator, and the corners are rounded so that it will slide over a commutator.

The brass rods are held on the bracket by means of fiber disks (12) which are 2½ in. in diameter and of two halves ½ in. thick. A ⅜-in. hole is drilled in the center of each disk, and just off this hole a slot is milled across the face of the disk 3/16 in. deep and ¼ in. wide. Another similar slot is milled at right angles, starting at the first slot and extending to the edge in one direction.

To make a pair of disks this last slot is milled on the right-hand side of the first disk and on the left-hand side of the second disk. Three such pairs are required in all. In the bottom of the slots a piece of brass 0.015 in. thick is fitted. This serves to make contact on the brass rod.

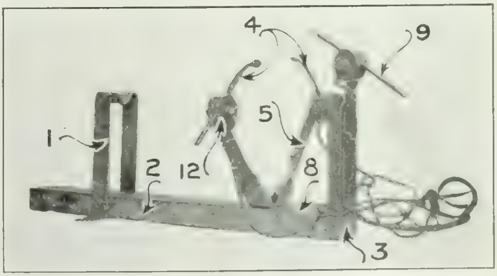
To make connection the brass in the short slot is drilled and tapped for a No. 6-32 thread and a brass screw is put in to hold the wire. A 6-ft. piece of No. 10 flexible wire is divided at the end and half the strands are fastened under the screw on one disk and half on the other disk. The disks are pressed together, the test arm is slid through the long slots, and the pair of disks are fastened to the bracket by means of a bolt and wing nut.

The arm will be quite rigid, but it may be slid in or out and tilted up or down by loosening the wing nut. The second disk is assembled in the same fashion and mounted on the other side of the bracket. The flexible wires are run to a direct-current line in series with a bank of lamps.

To make the test fingers for spanning from one bar to the next the third disk is employed. This is similar to the other disks. The rod in this case, however, consists of two brass pieces (¼ in. x 5/32 in. x 8 in.) fastened on opposite sides of a piece of bone fiber ¼ in. x 1/16 in. x 8 in. The brass pieces are placed in a vise with the fiber between them and a slot 1 in. wide and 1/16 in. deep is filed across the center of all three. A piece of 1/16-in. fiber is fitted in this slot after which the pieces are turned over and another piece of fiber is fitted into the opposite side. Then the pieces are riveted together with copper wire. Pieces of fiber may then be placed at each end of the pieces and riveted.

A slender finger of steel spring is riveted in the end of each brass rod. One finger is 2½ in. long and the other is ⅛ in. longer. The end of each finger is drilled to receive a small brass rivet which is rounded off like a half sphere. Use turpentine to drill the springs instead of oil.

One conductor of a lamp cord is connected to each half of the disk and the test arm is inserted. The disk is then fastened to the piece of 1-in. x ¼-in. x 8-in. strap iron by a bolt and wing nut. The strap iron in turn is mounted on the upright wood pieces (3) by a bolt and wing nut. A slot in the strap allows adjustment up and down.



ARMATURE IS RAPIDLY CONNECTED FOR BAR-TO-BAR TEST IN THIS RACK

When testing, the armature is placed on the horse, the bracket (5) is moved to the center of the commutator, and the test arms are adjusted with the wing nuts to bear at points 90 deg. apart (on a four-pole motor).

Lower the test finger to cover two adjacent bars midway between the arms, connect the No. 10 flexible leads to a direct-current supply with a rheostat to limit the current, and connect the lamp cord to a millivoltmeter. The armature is then turned a bar at a time, pausing a few seconds to take each reading.

The Maintenance Company, New York, N. Y. — H. I. Mickle, Foreman of Repair Shop.

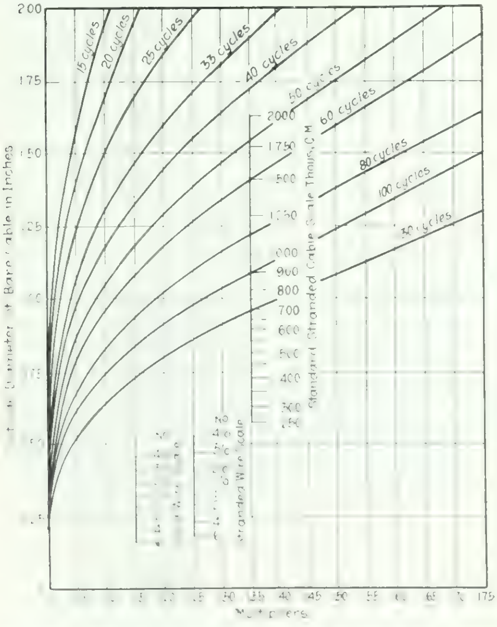
Chart Shows Apparent Resistance of Large Cables

IN THE calculation of heavy feeder cables, which are frequently required for low-voltage power circuits of industrial plants, the skin effect is often of considerable importance. While a number of tables have been published giving these factors they are usually calculated for the cable diameter given in even fractions of an inch and do not offer a ready comparison when only the size of the cables in circular mils is known.

The writer has devised a chart for his own use which allows a rapid comparison to be made without looking up the diameters of the cables corresponding to certain circular-mil sizes. The curves are simply the plotted results given in tables for the various frequencies. One scale is graded in circular mils and the other scale in multiplying factors. To determine the multiplier for any size of wire at any of the frequencies given, lay a straight edge in a horizontal direction from the wire size selected to intersect with the desired frequency curve, project vertically down to the bottom scale from the intersection and read the multiplier. The product of the multiplier and the ohmic resistance of the wire will give the apparent resistance of the wire at the frequency selected.

T. H. Arnold.

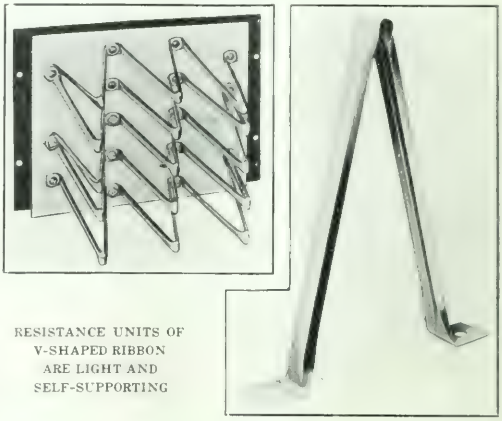
El Paso, Tex.



APPARENT RESISTANCE OF CABLES FOUND FROM THIS CHART

Rheostat Which Occupies Very Small Space

A COMPACT and light rheostat has been developed for use in connection with motion-picture machines which may be suitable for similar service elsewhere. The metallic ribbon, which constitutes the resistor element, is formed into a trough or channel-shaped section which is flattened at both ends and in the middle. The ribbon is bent about the middle to form a "V," as shown in the accompanying illustration, and both ends are turned up to form supporting feet which permit the attachment of the unit to a panel board.



RESISTANCE UNITS OF V-SHAPED RIBBON ARE LIGHT AND SELF-SUPPORTING

The particular rheostat referred to here is made up of two sections—a heavy-current section of "ribohn" construction which forms the fixed resistance of the combination, and the fine-adjustment section of lower current capacity which is connected in parallel with the first section. There are seven steps in parallel with the fixed step, and the adjustments are made by a radial switch. The adjustable steps consist of "vitrohm" tubes. The rheostat, according to the manufacturers, is virtually unbreakable, no part of the circuit can rust or corrode and the rheostat will return to room temperature within two minutes after the current has been cut off.

A resistor unit of this kind designed for 3 kw. continuous duty occupies a space of 10 in. x 10 in. x 12 in. and weighs 8 lb. A complete rheostat with twelve steps designed for 9 kw. continuous duty occupies a space of 18 in. x 18 in. x 21 in. and weighs 80 lb.

Armatures Must Not Be Rolled on Rough Floor

ONE of the worst crimes in many electrical shops is the careless handling of armatures. Rolling across the floor or other rough handling may jam the laminations together and thus permit high eddy currents in the iron and cause heating which will destroy the insulation of the coils. The only sure remedy is to dismount the armature, take off all the laminations, file off the burred edges and reassemble the core. This is a tedious job which a little care can prevent.

A speaker voiced this thought at a recent meeting of the Iron and Steel Electrical Engineers.

Central Station Service

A Department Devoted to Commercial Policy
and Management Topics, Including Methods of Increasing the Use
of Electric Light, Power and Heat

Cheaper Financing by Security Sales to Customers

PUBLIC utilities financed through the local sale of securities are on a more stable basis, asserted R. J. Long of Abilene, Kan., in discussing the sale of securities to customers before the meeting of the Kansas Public Utilities Association at Kansas City recently. Mr. Long discussed the subject from the experience of the Associated Companies, which, through subsidiaries, serves a number of Kansas communities. Mr. Long said in part:

"I do not desire to discuss methods of selling these securities so much as to point out the reasons for selling them and the reason why selling the securities of the public utility to its patrons is sound from a financial as well as from a public relations standpoint. We have for the last twelve years promoted and financed the extensions of all our companies—serving sixty-eight cities with light and power and fifty-five cities with telephones—by the sale of 7 per cent non-taxable, non-assessable preferred stock among our employees and patrons. As we are prevented by law from selling our stock at less than par and public utilities commissions do not countenance large commissions for the sale of utility securities, we have been dependent largely upon the loyalty of our employees, together with a moderate use of advertising in the sale of our securities.

"Previous to the adoption of this plan of financing utilities depended upon outside capital for new finances and, generally speaking, every few years the companies seemed to get tied up in their finances. Every financial flurry in the money market affected the utilities of the country. The growth of this condition meant the restriction of development. We needed more elasticity in our financing methods if we were to develop to meet the requirements of our territory, and we decided at the outset that the only way we could obtain this elasticity was by the sale of our securities in our own territory. Since the inauguration of this policy we have never floated a single bond or security issue outside of the territory. The most of our preferred stockholders own a small amount of stock and hence they are very little worried at times of unsettled financial conditions. Consequently we have not only secured elasticity in our financing by this method but we have secured a high degree of stability.

"Then there is an educational reason for the adoption of this policy. The sale of our securities has opened another avenue to our employees to participate in the development of the business which is their bread and butter. Naturally, their interest in the sale of securities has the added effect of increasing their loyalty to the company. From the public standpoint, this practice of selling public utility stock to customers has had a most salutary effect. Abusing or condemning public service corporations justly or unjustly was at one time a sure way of getting public applause. The first great effect of securing customer stockholders by this company was the noticeable change in the attitude of the public, and particularly of politicians and certain newspapers. An advertisement in a local newspaper telling how many people in that community own stock in that company has a most beneficial effect from a public relations standpoint, and the radical semi-socialistic agitator becomes very docile once he is induced to purchase even one share of stock.

"The economic aspect of this policy is also worth considering. By a campaign of advertising and education the public service corporations should be able to finance all their extensions and improvements with local capital, and when they are able to do this they will not only be reaping the benefit of a more stable financing plan but they will be contributing to the prosperity of the community which they serve in a greater measure than has been their privilege in the past.

"Whether selling stock to customers should be handled through a financial department or by the employees of the company is a matter to be decided by each institution. We have found the sale by employees of double advantage to us. It minimizes the expense of selling and has the effect of impressing the public with the importance of the proper treatment of utilities, if communities are to grow and people are to prosper.

"It is our firm belief that if the utilities can be financed at least in their extensions and improvements by their customers, a large measure of the financial worries will have been obviated and nine-tenths of our public relations problems solved."

Public Ownership of Public Service Companies

MANY sweeping assertions are made and countless half-truths are uttered in behalf of public ownership of the public service industry, says W. R. Creed, president of the Pacific Gas & Electric Company, in an article discussing and calling attention to some of the fallacious arguments of proponents of municipal or government ownership of utilities.

"Seldom if ever," continued Mr. Creed, "do its advocates discuss calmly and without emotion those aspects of public ownership and operation disclosed by (a) the government's failure with the steam railroads, or the numerous other conspicuous failures, of which the Seattle street railways are the most recent example; (b) the invariable increase in number of employees; (c) the drop in the morale and efficiency of organization to about the level of government organization, for which the public pays; (d) the camouflaged accounting which conceals the facts about costs and relies upon the borrowing ability of government to meet emergencies and pay the piper; (e) the amount of public service cost covertly imposed on the taxpayer to secure popular support through the expedient of low rates, or (f) the serious burden added to the taxpayers' staggering load by the withdrawal of public service properties from taxation and the substitution of new taxes upon all other property to meet the loss of the public service taxes.

"Here is ample material calling for sound thinking and the employment of the scientific attitude, but your public ownership man will have neither. He cries for the moon but never considers whether he can reach up and get it. Even if the argument for government ownership were convincing, there is still the question of its present possibility. As a matter of fact, it is utterly impossible at this time to bring about public ownership and operation of the public service properties with the exception of the comparatively few remaining privately owned water companies.

"The only possibility of public ownership would be through the agency of the state itself, as these great plants cover so large a territory and serve so vast a number of consumers that no one municipality or group of municipalities or counties could possibly undertake the task they now perform and must continue to perform. To state the financial side of the matter alone is to convince any reasonable person that private ownership and operation must continue for a considerable time at least. If the state sought to purchase the properties now giving these services, it would require a huge sum of money in payment. While it is impossible definitely to state the sum required, it safely may be said that it would be more than a billion dollars. The only way the state could obtain such a sum would be to issue bonds, and if California attempted to issue and sell a billion dollars of bonds, it would be utterly impossible to market these securities. The federal government itself could not at this time issue a billion dollars of bonds and advantageously market them, and if the federal government with its huge taxing possibilities could not, certainly no one state could.

"With our state government demanding additional money for state expenditures, with the necessity recently of increasing the interest rate on state bonds for highway building to 6 per cent, with difficulty encountered in promptly marketing $40,000,000 or $50,000,000 of these bonds even at this high rate of interest, the contemplation of a billion dollars of bonds to be sold is foolish.

"But aside from the enormous purchase price of these properties, if the state did acquire them, it would then be under the necessity of raising for power development alone between $500,000,000 and $800,000,000 in the next ten years. This also would have to be done through the issuance of bonds and the market would be overwhelmed with state securities. At least some variety is demanded by the investment market.

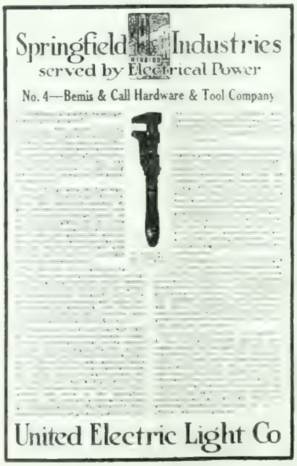
"If these difficulties could be surmounted, there would still be the necessity of properly conducting this business after its acquisition by the state, and there is no governmental machinery provided for this purpose. It is not unfair to suggest that the state successfully accomplish its present business of running state government with reasonable efficiency and economy before it undertake the enormously more complicated task of conducting these huge enterprises with all their complicated technical requirements plus the absolute necessity of complete and adequate organization.

"From an economic point of view, California needs right now, more than anything else, the unrestricted development of its railroads and power companies. The existing agencies for this development are the public service companies. They are organized and equipped for the work; they are proceeding with it and will continue, provided they receive the public co-operation, support and encouragement which will sustain them. The process of development must not be delayed unless California wishes to delay the accomplishment of its destiny. Under these circumstances, to 'swap horses in midstream' is the peak of folly.

"It would be safe to say, if the public plunged into the business of owning and operating the public utility services of this state, that before it finally worked out the problem of efficient and economical operation there would be enormous loss and tremendous suffering, undoubtedly involving a serious setback to the state as a whole through the failure properly to develop the services adequately to meet the demands, plus the discredit of muddling and injuring the vital business of producing and distributing public utility service and the blunder of discouraging the flow of capital to California.

"While the public service companies are in charge of this industry it is folly on the part of the public to fail to sustain them and to give them every reasonable opportunity to conduct the business in the public interest. These companies should be looked upon as agents for the public, and surely an agent should be strong and virile properly to give service and attain the objects of the agency."

Springfield (Mass.) Company Features Local Industries



Springfield Industries served by Electrical Power

No. 4—Bemis & Call Hardware & Tool Company

United Electric Light Co

HOW UTILITY "TIES IN" WITH INDUSTRIAL ACTIVITY

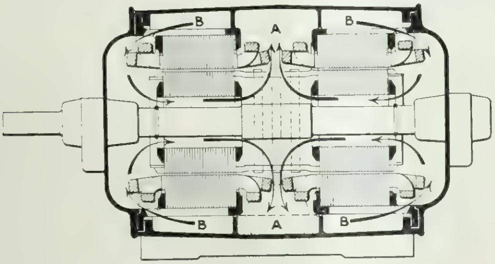
FORCEFUL advertising of local industries using electric power has been inaugurated by the United Electric Light Company, Springfield, Mass., in leading dailies of its headquarters city. In a signed "spread" the central-station company presents in each insertion an interesting sketch of one establishment, telling the public something of the customer's history, the scope of the market reached by the concern, its war service, recent development, and the benefits derived from the installation of electrical equipment. In this way the company "ties in" with the progressive concerns of its city and shows that it is interested and active in the industrial advancement of the community.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
of the World

Generators, Motors and Transformers

Induction Motor with Double-Cage Rotor.—A manufacturing company in Cologne has placed on the market a double motor with two distinct stators and two cage armatures with copper rods going through both rotors, connected in the middle by two high-resistance alloy strips. The two motors are incased in a single-shell casting, which contains an entrance and an exit flange for cooling air, the rods between the two armatures acting as an excellent air impeller. On top of the motor is mounted a controller switch with seven points, permitting as many economical speeds and torques, without the use of any resistance, by simple combinations of the two stators in delta-star series and parallel. Torque, efficiency and speed curves of this interesting motor are given.—*Elektrotechnische Zeitschrift,* April 21, 1921.



INDUCTION MOTOR WITH TWO STATORS AND TWO ROTORS PERMITS ECONOMICAL SPEED CONTROL

Lamps and Lighting

Artificial Illumination for Kinematography.—J. C. Elvy.—The use and abuse of light in studios for "kinema" film production are discussed in this article. —*Illuminating Engineer* (London), Vol. XIV, No. 2, page 32.

Plant Economies Resulting from Better Lighting.—C. H. Reeder.—The author gives suggestions and data which may be presented to managers of industrial plants relative to improving lighting conditions in all factories and planning satisfactory equipment in new ones. —*Electrical Review,* June 11, 1921.

Traction

Running Resistance and Mass Action of Rotating Parts on an Austrian Alternating-Current Locomotive. —G. Markt.—On the lines of the Arlberg and Salzkammergut railway there are at present sixteen alternating-current locomotives of the C+C type in operation, narrow-gage (760 mm.), driven by two single-phase motors of 300 hp. each, actuating with a gear ratio of 1:3.448 a jack shaft, which in turn is rod-coupled to three front and three rear axles. A periodicity of 16⅔ cycles is used. One of these locomotives was used for a number of tests to determine the exact running resistance and the action of the rotating masses. All test results are given in tabulations and curves and are compared with results calculated from known formulas. In many instances it has been found that the theoretical values do not agree with the actually observed facts. A striking instance of this is that the apparent increase in weight of the locomotive due to the rotating masses of the engine, which is given in the literature at about 10 to 15 per cent, has been actually found to be almost 45 per cent.—*Elektrotechnik und Maschinenbau,* May 1, 1921.

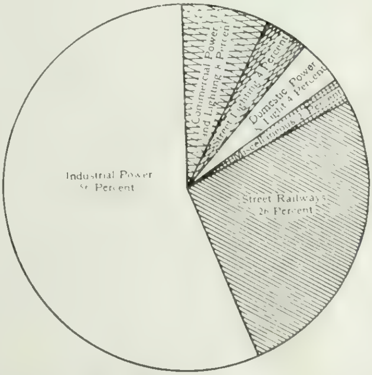
Characteristics of the Electric Locomotive.—N. W. Storer.—A discussion of inherent advantages which clearly show to what extent the steam locomotive is surpassed by the electric locomotive.—*Railway Electrical Engineer,* May, 1921.

Generation, Transmission and Distribution

Use of Central-Station Power in Mines and Steel Plants.—K. A. Pauly.—A discussion of the basis upon which central stations have obtained power load by concentrated study of their requirements, giving tabular data on the energy sold to coal and metal-mining industries last year by thirty-four power substations.—*General Electric Review,* June, 1921.

Operation for Maximum Output and Operating Records.—George H. Bragg.—The writer deals with the problem of making full use of hydraulic energy available and reserving steam-plant operation for periods of actual necessity.—*Journal of Electricity and Western Industry,* May 15, 1921.

Power Requirements in the Pittsburgh District.—Joseph McKinley.—An analysis of the loads carried by the Duquesne Light Company showing the portions due to each of several groups of industries, with data showing the amount of energy furnished from other sources, such as that generated in the steel mills themselves.—*Electric Journal,* May, 1921.



PERCENTAGE OF OUTPUT OF DUQUESNE LIGHT COMPANY DEVOTED TO DIFFERENT CLASSES OF SERVICE

Installations, Systems and Appliances

Chains of Disk-Type Insulators.—F. BUSKE.—It is a well-known fact that the voltage along a chain of disk-type insulators is by no means divided equally between the individual disks. As a matter of fact the first unit of the chain next to a line of, for example, seven Hewlett insulators has to stand more than three-sevenths of the line voltage. Several attempts have been made to distribute the voltage more uniformly along the chain by varying the capacity of the individual units. This was possible on the cap-type-unit chains by using smaller and larger bolts and on the Hewlett-type chains by means of metallic coating upon the porcelain. But neither of these methods proved satisfactory, because a large number of different parts had to be kept in store and because it was difficult to make sure that a damaged unit would be exchanged for the same kind of unit. The author has found that if chains are built up with two, three or more cap-type insulators next to the line and the remainder of the Hewlett-type disks a far more uniform voltage distribution results. On such a chain, built up of three cap disks and four Hewlett disks, the first disk next to the line has to stand only about one and four-fifths times one-seventh of the line voltage.—*Elektrotechnische Zeitschrift,* May 12, 1921.

Investigation of the Rupturing Capacity of Oil Switches.—P. CHARPENTIER.—It is very essential that an oil switch be designed with sufficient rupturing capacity to meet the requirements of its particular service. Among other important details the minimum amount of oil should be determined exactly. Based upon some empiric assumptions, as, for example, the amount of gases developed in the oil for each ruptured kilowatt-second (50 cu.cm.), the author developed formulas for the accurate calculation of the necessary volume of oil for single and double break-per-pole switches. Similar formulas and calculations are given to determine the safe rupturing capacity of any existing breaker. —*Revue Genérale de l'Electricité,* May 14, 1921.

Substation Capacity for Heavy-Duty Material-Handling Cranes.—W. C. RAUBE.—The following empirical rules are offered for use in estimating the proper substation capacity: (1) For two cranes, use the root-mean-square value of input to one crane, plus the arithmetic average value of input to one crane. (2) For three cranes, use the root-mean-square value of input to one crane plus twice the average value of input to one crane. It is also necessary to supply apparatus which will stand a large number of repeated operations where all of the cranes are consuming power in the worst possible combination.—*General Electric Review,* June, 1921.

Telegraphy, Telephony and Signals

Nauen and Togoland: A Tragedy of Radio Telegraphic Development.—R. ROSCHER.—The article deals largely with the brief but striking history of the Togoland station at Kamina and the German plans for the development of an imperial chain of wireless stations. —*Radio Review,* May, 1921.

Effect of the Heaviside Layer on the Apparent Direction of Electromagnetic Waves.—T. L. ECKERSLEY.—The errors in obtaining bearings taken by night and the systematic swinging of bearings at sunset are ascribed to the reflecting power of the upper conducting layer of atmosphere.—*Radio Review,* May, 1921.

Recent Progress in Radio Communication in Germany and Austria.—Dr. EUGEN NESPER.—After describing the general trend of radio development in Central Europe during and immediately after the war, the author deals with a number of pieces of apparatus in detail. — *Proceedings Institute of Radio Engineers,* June, 1921.

Electrophysics and Magnetism

Nickel.—This circular deals primarily with the physical properties of nickel and its common alloys, including thermal conductivity, electrical resistivity, thermo-electromotive force and magnetic properties. It is a collection of information available to date and has a complete bibliography appended.—*Circular No. 100, U. S. Bureau of Standards.*

Electrochemistry and Batteries

Electrodeposition of Iron.—W. E. HUGHES.—The writer enumerates some of the practical uses of electrolytic iron and then discusses processes and apparatus by which the metal is deposited.—*Beama* (British Electrical and Allied Manufacturers' Association), May, 1921.

Units, Measurements and Instruments

A System for Measuring the Amount of Static.—AUSTIN M. CURTIS.—Amplified and rectified energy from static is stored in a large condenser in the output circuit of a vacuum tube. The condenser discharge current through a high resistor and sensitive galvanometer will, under given conditions, be a measure of the average static.—*Proceedings Institute of Radio Engineers,* June, 1921.

Miscellaneous

Thermal Expansion of Copper and Its Important Industrial Alloys.—PETER HIDNERT.—Data on the thermal expansion of 128 samples of copper alloys of various compositions (56 to 100 per cent copper), heat treatments, mechanical treatments, etc., are presented. In general the coefficients of expansion increase with a decrease in the copper content. The addition of lead or tin has a decided effect on the coefficient. The former element generally decreases and the latter increases the coefficient.—*Scientific Paper No. 410, U. S. Bureau of Standards.*

Some Properties of White-Metal Bearing Alloys at Elevated Temperatures.—JOHN R. FREEMAN, JR., and R. W. WOODWARD.—Results of tests indicate that up to 5 per cent of lead in a high-grade babbitt does not effect the yield point or ultimate strength at 25 or 75 deg. C. The yield point of tin-base alloys is not affected by heating for six weeks at about 100 deg. C., but the yield point is lowered in the lead-base alloy by heating for two weeks at about 100 deg. C.—*Technologic Paper No. 188, U. S. Bureau of Standards.*

Relation of Water Power to the Fuel Problem.—It is shown that the per capita coal consumption in Canada is 50 per cent less than in the United States and that per capita water-power development is 194 per cent greater. Thus it is estimated that the Canadian water-power developments reduce the annual coal bill by $146,500,000.—*Canadian Engineer,* Toronto, May 26, 1921.

Aluminum and Its Alloys in Engineering.—I.—JOHN G. A. RHODIN.—The physical and electrical properties of aluminum are summarized and discussed in this article.—London *Engineer,* May 13, 1921.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

British and American Engineers Fraternize

ENGINEERS representing the four large national engineering societies are in England this week fraternizing with their English confreres. On Wednesday the delegation presented the John Fritz gold medal to Sir Robert Hadfield for his achievements in the development of manganese steel. Thursday evening they were the guests of the British Institution of Electrical Engineers. Other British engineering associations entertained the American engineers as well.

The delegation consists of Charles T. Main, representing the American Society of Civil Engineers; Ambrose Swasey, representing the John Fritz medal board of award and the American Society of Mechanical Engineers; Col. Arthur S. Dwight, representing the American Institute of Mining and Metallurgical Engineers, and Dr. F. B. Jewett, representing the American Institute of Electrical Engineers. Dr. Ira N. Hollis, president of Worcester Polytechnic Institute and past-president of the A. S. M. E., accompanied the delegation and carried a message from the American engineers.

Eastern Governors to Confer on Water Power

AT THE proposal of Governor Sproule of Pennsylvania the Governors of that state, New York and New Jersey will meet soon to discuss flood control and the general economic importance of the rivers of the three states.

New York has a newly appointed water-power board, and a movement in this direction is being organized in Pennsylvania by Gifford Pinchot, state forester.

Can Now Develop Niagara Falls Without Marring Their Beauty

UNDER the new regulation of the Federal Power Commission further developments at Niagara Falls without marring the beauty of the falls are now possible, J. A. Johnson, electrical engineer of the Niagara Falls Power Company, stated last week before the Salt Lake City Convention of the American Institute of Electrical Engineers, through a division of the flow of Niagara River on the Canadian and American sides. Up to this time Mr. Johnson said only the first stage (220-ft. head) has been utilized. Developments of the future will utilize the second stage of 94 ft., thus using the gross total head of 314 ft.

The units proposed in the Niagara Falls extension, to be placed in operation about 1923, it was said, will probably be three in number and rated at 70,000 hp. each. Mr. Johnson also pointed out that future power generation at Niagara Falls will take into consideration not only the service requirements of primary industries at that point but the transmission of power at high voltage for distribution as needed by utilities in other parts of the state.

Senators Criticise Working of Water-Power Law

AN ATTEMPT to obtain through an act of Congress permission for the Trumbull Steel Company to construct a dam across the Mahoning River at a point near Warren, Ohio, precipitated a discussion in the United States Senate on June 24 as to the advisability of requiring such applications to go through the Federal Power Commission. The bill provided that the dam is not to be built until the plans have been approved by the Chief of Engineers and that the dam is not to be used for power purposes. The presentation of the bill led Senator Underwood of Alabama to say, among other things:

"I regret that the committee now is proposing to make a precedent to ride over the water-power act. While this amendment prevents the use of the dam for power purposes, you take away from other people the right to develop it for power purposes in the future. No man on this floor regrets more than I the delays in Congress which have held up the development of water powers in this country. There have been great waste and great injury to the American people. I have suffered from it. Outside the Rocky Mountain States, Alabama has more undeveloped water power than any other state. Our hands have been tied for fifteen or twenty years in the development of the state's natural resources because Congress would not do for us what the Senator from Ohio is asking Congress to do for a great corporation in his state."

This led Senator Jones of Washington, the chairman of the committee on commerce, to say:

"There is much force in what the Senator has said. I will state frankly that that phase of the matter was not considered by the committee. The committee does not intend to over-ride the water-power act or to do anything that will interfere with the operation of that act." Senator Jones then asked that the bill be recommitted so that the committee could consider it further.

Incidentally Senator Jones expressed the following opinion with regard to the Federal Power Commission:

"The commission has not acted as I had hoped it would act. It has acted as I feared it might. I felt all the time that it was a great mistake to create a commission composed of Cabinet officers to deal with this great work. The time of Cabinet officers is so fully taken up with other things that they do not have the time to give the attention to this matter that it should have. I am satisfied that that is the real reason for delay in the committee's procedure."

Senator Nelson of Minnesota, a former chairman of the committee on commerce, which has jurisdiction over water-power matters, contributed the following to the discussion:

"What the Senator from Alabama says is too true. For years water-power companies have been struggling for a chance to begin development. We finally succeeded in passing what I consider a most cumbersome and complicated water-power measure. I doubt whether the law will work satisfactorily or lead to that development of water power we ought to have in this country.

Important Standards Proposed by Testing Society

THREE committee reports were presented at the annual meeting of the American Society for Testing Materials last week that should be of utmost interest to every one in the electrical industry. The subjects were electrical insulating materials, rubber products and copper wire. In each case the action of the committee has been not to advance any radically new standards but rather to study existing practices and propose the best as standard for the country.

The most important work reported was a thorough investigation of the methods of testing transformer oils, including more than 2,100 separate tests, to determine the best electrode arrangement and factors to be employed in comparing results obtained with different electrode arrangements. As a result of these experiments tentative standard specifications for testing such oils were proposed by the committee.

Specifications for insulated wire and cable constituted another very important tentative standard proposed. This standard has been very materially improved, although no extensive revision has been made. The principal changes include the addition of tables of recommended insulation thickness, methods of measuring the thickness, variation limits, rejection conditions and subdivisions on tape and braid.

The specifications for tinned soft or annealed copper wire which were accepted as standard have been in practical use for about two years without any indications that modifications were necessary. The specifications for bare "concentric-lay" copper cable, however, were revised slightly and accepted as amended by the society as a standard.

Among other features of the committee reports were a study of methods of testing sheet insulation; tentative standards for testing insulating varnishes, molded materials, and porcelain insulation, and tentative specifications for adhesive insulating tape and rubber gloves. Work of the insulating materials committee which is under way but not yet in shape to be reported upon includes (1) a procedure for dielectric strength tests of sheet insulating materials, (2) procedure for a sludging test of transformer and switch oils, and (3) preparation of tests of molded insulation for high-frequency applications. The committee also expects to give its attention to (1) pothead and splicing compounds for underground cables, (2) dielectric losses in insulating materials.

Rates on Copper and Aluminum Carried by New Tariff Bill

INFORMATION received by telephone from the Washington correspondent of the ELECTRICAL WORLD as it goes to press gives the following rates as included in the new tariff bill just introduced by the ways and means committee into the House of Representatives:

Copper wire, not coated or covered, 1½ cents a pound.

Crude aluminum, 5 cents a pound.

Aluminum sheets and bars, 9 cents a pound.

June Electrical Financing Only One-third that of May

DURING the month of June the total amount of stocks and bonds offered the investing public by electric light and power utilities was only $19,939,263. This figure is amazingly small in comparison with the unprecedented total of last month, which was almost three times as great. The total amount of the monthly flotations, which had been increasing regularly for the past six months, has evidently taken a decided turn in the downward direction. The striking decrease of $35,436,212 under May's total issue is not, however, inconsistent with the public utility financing of a year ago. June, 1920, also showed a correspondingly large drop from the total of the preceding month.

Although the tendency toward long-term securities is still evident, there are two noticeable differences in the June offerings as tabulated below. The one is that the single issues are without exception unusually small, the largest amounting to only $3,500,000. The other is that the offerings are yielding lower returns to investors, the average yield having gone down to 7.54, a decided drop from last month's yield.

Name of Company	Amount of Issue	Period	Class of Security	Purpose of Issue	Rate of Interest	Per Cent Yield	Offered at
Columbus (Ohio) Railway, Power & Light Co.	$3,000,000	3-year	Sinking fund mortgage bonds	Refunding	8	8.75	98
Alabama Power Co.	2,500,000	30-year	First mortgage lien and refunding gold bonds		6	7.25	84.75
Northern New York Utilities, Inc.	1,200,000	25-year	First lien and refunding bonds, series "A"	New construction	7	7	Par
New England Power Co.	1,000,000	40-year (Due 1951)	First mortgage sinking fund gold bonds		5	6.20	83.75
Southwestern Power & Light Co.	750,000	20-year	Bond-secured gold notes, series "B"	Extensions and improvements	8	8.10	99.02
Niagara & Erie Power Co.	699,000	30-year (Due 1941)	First mortgage gold bonds	Acquisition of new property	5	7.50	74
Worcester (Mass.) Electric Light Co.	620,000		Capital stock	Payment of outstanding obligations			155
Plymouth Electric Light Co.	100,000		Capital stock	Retirement of outstanding notes			Par
Interstate Public Service Corp.	250,000	10-year	Secured convertible gold notes		8	8	Par
Milwaukee Electric Railway & Light Co.	3,000,000		Preferred stock	Funded debt	8	8	Par
New Bedford Gas & Edison Light Co.	572,000		Stock	Extensions			120
New England Power Co.	1,200,000		Preferred stock		6	6	Par
Penn Central Light & Power Co.	547,863		Preferred stock	Floating debt and general corporate purposes		(No par)	43
Laurentian Power Co., Ltd. (Canada)	1,000,000	20-year (Due 1941)	First and refunding mortgage sinking fund bonds		6	7.25	88.5
Los Angeles Gas & Electric Corp'n	3,500,000	10-year	General and refunding mortgage gold bonds, series "B"	Additions to plant	7	7.35	97.5
Total	$19,939,263						

Bill for Equitable Division of Colorado River Water Among States

CONGRESS is asked in a bill introduced by Majority Leader Mondell to allow Arizona, California, Colorado, Nevada, New Mexico, Utah and Wyoming to negotiate and enter into a compact providing for an equitable division and apportionment among those states of the water supply of the Colorado River and of its tributaries. A condition of the bill is that the President of the United States is to participate through a representative who would look after the protection of the interests of the United States in the transaction. The bill passed the House last week.

New England Information Bureau Executive Committee

AT THE meeting of public utility representatives in Boston on June 21 the following utility men were elected members of the executive committee to supervise the work of the New England Bureau of Public Utility Information: H. T. Sands, Charles H. Tenney & Company, chairman; C. L. Edgar, president Edison Electric Illuminating Company; A. E. Childs, president Massachusetts Lighting Companies; A. M. Barnes, president Cambridge Gas Light Company; E. W. Longley, vice-president New England Telephone & Telegraph Company; C. S. Pierce, general counsel New England Telephone & Telegraph Company; H. G. Bradlee, Stone & Webster Corporation; Edwin A. Barrows, president Narragansett Electric Lighting Company, and C. V. Wood, president Springfield Street Railway Company. A representative of the Consolidated Gas Company also will be appointed to the executive committee.

Customer Ownership to Be Featured in Western Association Work

DEVELOPMENT of customer ownership of electric light and power utilities among all companies will be the big feature of association work in the Far West this year, in both California and the Northwest, according to M. H. Aylesworth, executive manager of the National Electric Light Association, who has just returned to New York from the Pacific Coast. Mr. Aylesworth left for the West immediately after the Chicago N. E. L. A. convention to attend the conventions of the Pacific Coast and Northwest divisions of the association and to obtain first-hand information on the plans of the executives of that section of the country for developing and strengthening the industry.

"All branches of the electrical industry in the Far West," Mr. Aylesworth said, "are uniting back of the electric light and power companies in the sales of their securities so that additions to plant and lines may be made in order to keep abreast of all other developments. As an instance, there are 37,000 holders of Pacific Gas & Electric Company securities, of whom 3,000 are employees. That company is organizing educational or "get-acquainted" talks for its stockholders in the different communities in the vast territory it serves.

"The companies on the Pacific Coast and in the Northwest are bringing it home to the industries of that section that electricity reveals the means of placing that great empire on a parity with the East. As a result the local industries are awakening to a realization of the fact that without electricity there can be no Pacific Coast commercial development of any consequence. The West therefore takes pride in its record achievement of the largest per capita use of electricity anywhere."

Another major part of the year's program in the Far West is the organization in each state of committees on public utility information, Mr. Aylesworth said.

Edison Inspects New York's Latest Power Development

ON WEDNESDAY of last week, forty years after he was engaged in the construction of New York's first electric lighting plant, the old Pearl Street station, Thomas A. Edison visited the latest addition to the city's electric service stations, the new Hell Gate plant of the United Electric Light & Power Company now in the process of construction.

MESSRS. MURRAY, EDISON AND LIEB STUDYING PLANS FOR NEW HELL GATE STATION

Mr. Edison, who was the guest of the city's various electric light and power companies, made a thorough inspection of the new station and was particularly interested in the progress of the concrete work, the plans for the intake tunnels and the arrangements for the large steam turbines and generators. The trip was concluded with a visit to the ventilating show then in progress in the big showroom of the New York Edison Company.

Alabama Power Finally Obtains Coosa River Permit

AFTER long years of effort the Alabama Power Company finally has in its possession a license which will permit the development of its project at Duncan's Riffle on the Coosa River. The license was issued June 28. The Federal Power Commission's meeting on May 20 authorized the issuance of this license. After the authority had been given a very vigorous protest was received from the Wisconsin-Alabama Lumber Company asking that the commission reconsider its action. A hearing was granted the lumber company on June 27, but the commission was in no way influenced to depart from its original ruling.

Michigan Electric Light Association

THE Michigan Electric Light Association will hold its annual convention at the Hotel Ottawa, Ottawa Beach, Mich., on Aug. 24 and 25. The program committee announces that there will be morning sessions on the two days with a banquet on Aug. 24. It is the committee's aim to make the program one of general interest in which matters of policy may be discussed, technical matters being handled by the Great Lakes Division, N. E. L. A. The afternoons will be given over to recreation. Herbert Silvester, Ann Arbor, Mich., is chairman of the association.

Coal Storage, Rural Service and Radiation Loss Discussed at Duluth

WITH coal moving into the tributary country very slowly, the total shipments of this fuel to the Duluth-Superior docks for April, May and June of this year were given before the North Central Geographic Division of the N. E. L. A. by Secretary Price of the Duluth Chamber of Commerce on Thursday of last week as approximately 4,100,000 tons, of which 3,700,000 tons is bituminous and 400,000 tons anthracite. The shipments for the entire season last week were slightly in excess of 9,000,000 tons. Since coal can be handled into Duluth until Dec. 1, Mr. Price said, it is apparent that the shipment of about 5,000,000 tons to bring the total up to the figure of last year will not tax the lake transportation facilities very seriously during the next four or five months. Coal and grain shipments to and from the docks at the head of the lakes are much above normal, while ore shipments were asserted to be 25 per cent to 30 per cent below normal.

T. D. Crocker, president of the association, in discussing the question, advised the utility operators to keep fair storage stocks ahead to provide against emergencies, but warned against panicky buying of coal to forestall a fancied shortage, asserting that he could see no shortage or reasonable possibility of one under any conditions likely to exist during the coming fall and winter season.

A lively discussion was started when F. R. Winders, an engineer with the Wisconsin Railroad Commission, outlined the results of experience with the Wisconsin rural-service rules and made a strong plea for a more careful analysis of the costs of giving such service. He pointed out that many of the complaints coming before the Wisconsin commission had been the result of improperly presenting the situation in advance of doing the work. Contracts should provide a definite statement of the cost of general and local (consumers') equipment and also of the rural or service charge. The schedule rate for energy should be definitely stated to avoid misunderstandings. Mr. Winders said that the commission had never been called on to settle a case where the contract definitely settled these items and was properly signed before work on the extension was begun. A committee was appointed to study the subject in cooperation with the committee of the Wisconsin Electrical Association.

Loss of efficiency by radiation and the escape of hot water was characterized as inexcusable by J. J. Brennan of Minneapolis in discussing "Coal Economy in Small Steam Plants." Loss in the ashes was said to be the easiest loss to detect and can only be reduced to a minimum by careful selection of the fuel and proper grates. Excess air was given as a great cause of inefficiency, and the use of proper apparatus for its detection was advocated. The proper education of engineers and firemen was urged as an important item in small-plant operation. Accurate records of operations and performance were also advocated.

T. D. Crocker of Minneapolis was re-elected president of the division, Lee Boyer of Deadwood, S. D., was elected as vice-president and F. C. Hoffman as treasurer.

W. D'A. Ryan Selected to Design Ideal Lighting for Lincoln Highway

PROPER lighting of the Lincoln Highway is to receive special attention. According to plans which have just been announced the Lincoln Highway Association has made arrangements whereby the illumination of the ideal section of this national road will be designed under the supervision of W. D'Arcey Ryan, chief illuminating engineer of the General Electric Company. It is the thought of the Lincoln Highway Association that an ideal system, economical as well as practical, may thus be developed which can be used by the several communities along the highway.

Delegates to A. I. E. E. Convention Visit World's Largest Surface

Educators Advocate Broad Training for Engineers

RECOGNITION of the growing importance of the engineer in public and private life and of the need of broad training for students qualifying for professional service in science and commerce featured the twenty-ninth annual meeting of the Society for the Promotion of Engineering Education, held from Tuesday to Friday of this week at Yale University, New Haven, Conn. About 200 educators from all parts of the country were registered. The program included five working sessions and many most enjoyable entertainment features, the climax of the latter being a trip to the United States naval submarine base at New London aboard the destroyers Pruitt, Biddle and Breckenridge.

Dr. R. H. Chittendon, director Sheffield Scientific School, Yale University, welcomed the delegates at the opening session Tuesday, and to his welcome a response was made by President M. E. Cooley of the society. Francis C. Pratt, vice-president General Electric Company and president Yale Engineering Association, addressed the convention upon "Alumni Engineering Associations," and J. E. Otteson, president Winchester Repeating Arms Company, New Haven, spoke upon "College Education as Related to Industry." The latter advocated a better guidance of undergraduates toward work for which they as individuals are qualified, classifying the types of service as engineering and executive. Other papers and addresses listed for presentation in addition to committee reports on intelligence tests, business training, admission, mathematics, electrical engineering, drawing and the standardization of technical nomenclature were: "Engineering at Yale," John C. Tracy, chairman division of engineering, Sheffield Scientific School; "General Studies in the Engineering Curriculum," W. H. Burr, emeritus professor of civil engineering, Columbia University, New York; "The Problems of Training an Engineer in the Public Service," W. A. Bassett, staff engineer, New York Bureau of Municipal Research; "Engineering Teaching and Practice," W. F. M. Goss, president Railway Car Manufacturers' Association, New York City; "Mental Discipline Versus Culture in College, "George F. Swain, professor of civil engineering, Harvard Engineering School; "Student Government," P. H. Daggett, professor of electrical engineering, University of North Carolina; "Some Results of the Co-operative System," J. W. Hallock, director of co-operative work, University of Pittsburgh. At the annual dinner addresses were scheduled by President Cooley and Calvert Townley, assistant to the president Westinghouse Electric & Manufacturing Company, New York.

Ohio Electric Light Association Program

AT THE twenty-seventh annual convention of the Ohio Electric Light Association, which will be held at the Breakers Hotel, Cedar Point, Ohio, from July 12 to July 15, special emphasis will be placed on the discussion of the papers and reports presented, according to the announcement of President Hard, who has undertaken the duty of selecting men to lead the discussion on various papers.

The program as tentatively arranged is as follows:

TUESDAY, JULY 12

Afternoon — President's address, secretary-treasurer's report, appointment of nominating committee, report of illuminating committee, by W. S. Merrill, Nela Park, Cleveland; symposium on street lighting.

WEDNESDAY, JULY 13

Morning—Report of meter committee, by S. C. Henton, Akron; address, "Rate Making."

Afternoon—Report of transmission and distribution committee, by Prof. A. M. Wilson, University of Cincinnati; report of farm-service committee, by J. C. Matthieu, Dayton Power & Light Company.

THURSDAY, JULY 14

Morning—Report of new-business co-operations commitmittee, industrial power and heating, by M. W. Arthur, Akron; report of new-business co-operations committee, lighting and merchandising, by J. L. Gaston, Union Light, Heat & Power Company, Covington, Ky.

Afternoon—Address by a banker; address by G. C. Maxwell.

FRIDAY, JULY 15

Morning—Station operating committee report, by Prof. H. B. Dates, Case School of Applied Science, Cleveland; election of officers.

Forty-two spaces will be prepared in the convention hall for the use of exhibitors. The exhibits will be on each side of the room and the meetings will be held in the center.

Copper Mine, the Bingham Mine of the Utah Copper Company

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Beverly Central Station Reduces Rates.—The Beverly (Mass.) Gas & Electric Company has reduced the maximum price of electricity from 14 to 13 cents per kilowatt-hour, effective July 1.

Oklahoma's Water Powers.—Surveyors have been at work on a project to develop three sources of water power situated respectively 54, 30 and 20 miles from Hugo, Okla. The first of these, at Mountain Fork Unit, would, it is reported, have an ultimate output of 150,000 hp.; the second, at Little River, 100,000 hp., and the third, at Kiamichi River, 50,000 hp.

Electricity in Industry.—Under the title "Electricity in Industry" Bonbright & Company, Inc., have issued a booklet giving a partial list of industries which show the great diversity of uses to which electric motors may be applied. These uses are put at three thousand, and special reference is made, among other things, to freight handling, heating, smelting, electrochemical processes, railroad electrification, electric locomotives and superpower zone development.

Japan's New Radio Tower.—The reinforced-concrete wireless tower built at Tokyo for the Japanese government is said to be the highest monolithic structure in the world. It reaches 660 ft. above ground and tapers from 55 ft. in diameter at the bottom to 4 ft. at the top. The corresponding thicknesses of the shell are 33 in. and 6 in. The footings extend to a depth of 12 ft. and have an area of about 6,000 sq.ft., resting on gravel and clay. The work required about 6,000 cu.yd. of concrete and 425 tons of steel.

Low-Power Lamps as Burglar Insurance.—A San Francisco news letter recently published tells of an instance where burglars robbed two of a row of three houses, leaving the middle house unmolested. The dweller in the unrobbed house carried burglary insurance in the form of a 10-watt electric lamp burning all night. His neighbors didn't. A 10-watt lamp burning all night at 10 cents a kilowatt-hour costs, it is pointed out, a cent a night, or 30 cents per month. If left burning twenty-four hours a day while the family is away on a two-weeks vacation, the cost is only 34 cents.

Water-Power Development in Vermont.—The New England Power Company, Worcester, Mass., plans to start work this summer on the development of a 245-ft. fall near the headwaters of the Deerfield River at Searsburg, Vt. It is planned to develop from 5,500 hp. to 6,000 hp., conveying the water several miles through a large wooden conduit. This, it is said, will be the highest-head development in the East, exceeding by a few feet that at Monroe Bridge, in Franklin County, Mass. Between the Somerset reservoir, in Somerset, Vt., and the proposed development at Searsburg, Vt., the Deerfield River falls about 1,800 ft., and the company has approximately 1,050 ft. available for development purposes. It now has on the Deerfield River five generating stations of about 48,000 hp. generating capacity, and a total of more than 100,000 hp. is contemplated.

Narragansett Stockholders Are Six Times as Many as in 1906.—There are now 6,101 stockholders in the Narragansett Electric Lighting Company of Providence, R. I., as against 1,095 in 1906, according to a report recently made public. Of these, 332, or 6 per cent of the total, are employees and they own 2,852 shares. Ninety per cent of the shareholders, owning 87 per cent of the stock, live in Rhode Island. Sixty-one per cent, owning 71 per cent of the shares, are residents of Providence. Stockholders to the number of 2,967, or 49 per cent of the total, own from one to five shares each.

Puget Sound Power & Light Company Increases Dividends.—The directors of the Puget Sound Power & Light Company have raised its annual preferred-stock dividend rate from 3 per cent to 6 per cent, effective July 15. This increase, which will be paid to the 4,300 preferred stockholders of the company, is, the management holds, convincing evidence of the strength of public utility securities for conservative long-term investment. In the case of the Puget Sound company this basic soundness of public utilities in general has been reinforced by a far-sighted policy of developing the hydro-electric power resources of the Cascade Mountains. The properties of the Puget Sound Power & Light Company, which now serve a population of about 600,000, have been under Stone & Webster management for twenty-three years.

Restoration of Ampère's Tomb.—The observance last year of the centenary of electromagnetism drew the attention of French scientists to the fact that the modest monument erected to the memory of Ampère over his grave in the Montmartre Cemetery had been allowed to fall into decay. No descendant of the great electrophysicist being now alive, the French electrical engineering society—the Syndicat professionnel des Ingénieurs électriciens français—undertook the task of restoring it. This work was successfully carried through, and a few weeks ago, in the presence of representatives of this and other electrical associations, the monument was rededicated, the president of the Syndicat des Ingénieurs électriciens, Mr. Boucherot, making a fitting address in which he briefly outlined the great results that have sprung from the electrical beginnings of a century ago.

Utica Company Restores January Domestic Rates.—By agreement with the city's counsel, the Utica (N. Y.) Gas & Electric Company has met the complaint against it by applying to the Public Service Commission for permission to put into effect in that city and neighboring places the domestic electric rates that obtained before an increase was made on Jan. 20 of this year. This schedule begins, for Utica consumers, with a monthly charge of 10½ cents per kilowatt-hour for the first 60 kw.-hr., with a minimum charge of $1. Power rates are to remain unchanged.

Telephones per Capita in Great Britain and the United States.—The Assistant Postmaster-General of the United Kingdom, answering a parliamentary inquiry recently, said that the total number of telephones in service in the British Isles on Dec. 31, 1920, was 988,500 and in the United States approximately 13,500,000. The ratio of telephones to population was one telephone to every forty-seven inhabitants in the United Kingdom and one to every eight inhabitants in the United States. Under the British plan of government ownership, an English telephone engineer adds, the Post Office Department telephone system can barely make ends meet and can promise to do that for the next few years only by almost doubling the rates.

Associations and Societies

Providence Engineering Society.—The nominating committee of this society selected the following as officers for the coming fiscal year: For president, Frank E. Winsor; vice-presidents, James A. Hall, Walter C. Slade and Chester T. Morey; secretary, John T. Barnicoat; treasurer, Albert E. Thornley; librarian, Lloyd E. Baker.

St. Louis Electrical Board of Trade.—H. N. Goodell, St. Louis manager of the Western Electric Company, has been elected president of the St. Louis Electrical Board of Trade for the next fiscal year; A. T. Perkins, manager for the receiver of the United Railways Company, has been elected vice-president, and Fred B. Adam of the Frank Adam Electric Company has been elected treasurer.

Coming Meetings of Electrical and Other Technical Societies

Ohio Electric Light Association—Cedar Point, Ohio, July 12-15.

National Association of Electrical Contractors and Dealers—Buffalo, July 18-22 (For program see issue of April 30, page 1010.)

American Physical Society, Pacific Coast Section—Berkeley, Cal., Aug. 4 and 5.

Michigan Electric Light Association—Ottawa Beach, Mich., Aug. 24-25.

N. E. L. A., New England Division—New London, Conn., Sept. 6-9.

N. E. L. A., Great Lakes Division—French Lick Springs, Ind., Sept. 14-16.

Association of Iron and Steel Electrical Engineers—Chicago, Sept. 19-24.

Illuminating Engineering Society—Rochester, N. Y., Sept. 26-30.

American Electrochemical Society — Lake Placid Club, N. Y., Sept. 29-Oct. 1.

American Electric Railway Association—Atlantic City, N. J., Oct. 3-7.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies

Right of Commission to Intervene in Rate Suit Denied Because of Previous Federal Action.—In Duitz vs. Kings County [Gas] Lighting Company, a suit to enjoin the company from increasing its rates, the Supreme Court of New York held that the Public Service Commission was not entitled to intervene in view of a decree in a previous federal action expressly enjoining such intervention. (188 N. Y. S. 67.)*

Damages Caused to Farm Because of Right-of-Way of Electric Power Company.—The Supreme Court of Iowa, in Draker vs. Iowa Electric Company, in which an appeal was taken because of dissatisfaction with a verdict of $200 as compensation and damages for the condemnation of a 25-ft. strip of land across a farm, it being the intention of the company to erect transmission lines on the said strip, found that private property was not taken without compensation because the award did not include payment for damages to crops not yet inflicted but postponed such payment until the damage should have actually taken place. (182 N. W. 896.)

Massachusetts Supreme Judicial Court Upholds Constitutionality of Water-Power Development Bill.—By order of the Massachusetts State Senate four questions concerning the constitutionality of the bill entitled "An act to promote the conservation, development and utilization of the water resources within the commonwealth" were submitted to the Supreme Judicial Court of the state as follows: (1) Are the uses for which property may be taken by eminent domain under the provisions of said bill public uses within the meaning of the constitution of the commonwealth? (2) Having authorized the taking of property by eminent domain, as provided in said bill, is it constitutionally competent for the General Court to restrict the participation in the benefits to be derived from such taking to particular persons or corporations? (3) Is it constitutionally essential that where property is taken for a public use by eminent-domain proceedings the public generally, without discrimination, shall be entitled to participate in the benefits to be derived from such taking? (4) If enacted into law, would said bill be in any respect unconstitutional? The court unanimously answered the first and second questions in the affirmative and the third and fourth question in the negative. (131 N. E. 25.)

Instruction to Jury Making Electric Company an Insurer Erroneous.—Although the Kansas City Court of Appeals found, in Weddle vs. Tarkio Electric & Water Company, that the question of contributory negligence in a case where a telephone lineman sued an electric generating company because of injuries received from a transmission wire alleged to have been brought by the wind into contact with a telephone wire on which he was working was for the jury to decide, it nevertheless reversed the verdict for the plaintiff because of the lower court's instruction to the jury that if the generating company failed to keep its high-tension wires insulated and from coming into contact with telephone wires and the plaintiff had for this reason been injured, the verdict should be for him. This instruction, the reviewing court held, illegally made the defendant company an insurer. (230 S. W. 386.)

Contracts and Confiscation.—In reversing the decision rendered by the United States District Court for the Southern District of Iowa in favor of the city of Chariton and other municipalities and against the Southern Iowa Electric Company and other light and power companies (see ELECTRICAL WORLD for April 16, page 895), the United States Supreme Court, which found that the cities had exceeded their authority under the Iowa statutes when they entered into the contracts in question, declared: "The total want of power of the municipalities here in question to contract for rates which is established and the state public policy upon which the prohibition against the existence of such authority rests absolutely exclude the existence of the right to enforce, as the result of the obligation of a contract, the concededly confiscatory rates which are involved, and therefore conclusively demonstrate the error committed below in enforcing such rates upon the theory of the existence of contract." (41 S. C. R. 400.)

Texas Utility Held Subject to Workmen's Compensation Act.—In Woods vs. Eastern Texas Electric Company damages were awarded in the lower court for injuries received by the plaintiff from severed wires which were in contact with high-voltage wires while he was working on a pole belonging to the electric light and power utility operated by the defendant. The company claimed that as part of its business was that of operating street railways, which are exempt from the provisions of the workmen's compensation act of Texas, the verdict found under that act, to the provisions of which it had not subscribed, was illegal. It also alleged contributory negligence. The Court of Civil Appeals of Texas, sustaining the lower court, declared that an interpretation of a statute which must lead to consequences which are mischievous and absurd is inadmissible if the statute is susceptible of another interpretation, and that the evidence justified the jury's finding that the company's negligence was the proximate cause of the injury. (230 S. W. 498.)

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*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities

Jurisdiction of Kansas Public Utilities Commission.—Asserting that it had jurisdiction over the electric rates of the Interstate Electric Company, the Great Bend Water & Electric Company and the Hoisington Electric & Ice Company, despite the fact that the Great Bend and Hoisington companies are one-city utilities, inasmuch as their electric franchises were granted subsequently to the enactment of the public utilities act and were therefore not binding on the commission, the regulating body denied these companies' applications for increased rates for power, except in the case of municipal street-lighting rates and certain power rates of the Great Bend company, increases of these last-named rates being allowed. The commission's decision was based largely on the appreciating value of the dollar.

Wisconsin Commission's Attitude on the Joint Use of Poles.—In a contest between the Bangor Telephone Company and the Holmen Service Company it appeared that the Holmen Service Company had placed its poles between the wires of the Bangor Telephone Company in such a manner that the poles of the electric line were in contact with the wires of the telephone line, in violation of the commission's order on standards for safe construction and operation of electric systems. The commission found the overbuilding of the lines not to have been necessary and that the telephone company should not be forced into a joint agreement. The commission stated that it was not prepared to recommend without qualification joint construction between electric and telephone lines in rural districts where it is not certain that maintenance will be properly taken care of, yet the line in question was of such construction and would, on account of proximity to the village, be so maintained as to make joint construction entirely satisfactory, the poles being of sufficient height to permit the use of a lower cross-arm carrying telephone wires and the electric wires being stranded. The poles of the telephone company were thirteen years old and to move the lines would necessitate considerable reconstruction. Therefore the commission held the right granted the telephone company to place a cross-arm without charge on the poles of the service company to be sufficient compensation for the line overbuilt, and that the cost of cross-arms and moving expense should be borne by the telephone company, as well as the cost of making the telephone lines metallic if found necessary.

Men of the Industry

Changes in Personnel—Responsibilities and Association Appointments of Men Engaged in Professional, Executive, Operating and Commercial Branches of the Industry

Stephen I. Miller, dean of the College of Business Administration of the University of Washington, has been appointed secretary and manager of the Northwest Electrical Service League.

Allan D. Colvin, assistant general manager of the Hartford Electric Light Company, has been appointed graduate lecturer in electrical engineering for the Graduate School of Yale University.

Miss Sarah M. Sheridan, who as sales manager has been for many years in active charge of the commercial department of the Detroit Edison Company, was elected a vice-president of the company at a meeting of the board of directors held Tuesday.

Abbott R. Heywood, formerly Mayor of Ogden and recently appointed a member of the Public Utilities Commission of Utah, to succeed H. H. Blood, has been elected president of the commission. Mr. Heywood went to Utah in 1876 and practiced law until a few years ago. Since that time he has been engaged in banking and public service.

C. B. McKarrahan has purchased the interests of C. D. Boyd, former president of the Southern Electrical Supply Company, Atlanta, Ga. Mr. McKarrahan has assumed the duties of president and will be in personal charge of the company's activities in the future. He was formerly connected with the Central Electric Company, Chicago, for a long time as sales manager. Associated with him will be Fred A. Warner, formerly city sales manager of the Central Electric Company.

R. J. Russell, recently elected president of the Power Club, is vice-president and secretary of the Century Electric Company of St. Louis. He was born in Detroit in 1872. After a course at the University of Michigan he joined the forces of the old Detroit Electric Works and later of the Walker Electric Company. In the shops of these companies he gained his knowledge of electromotive equipment and contributed to the development of modern electrical apparatus, particularly in the street-railway and lighting fields. Here, as later, his engineering work was along practical rather than theoretical lines. He later joined the Wagner Electric Company of St. Louis in a sales capacity and became connected with the Century Electric Company on its formation about seventeen years ago. In his present position Mr. Russell directs the sales and general activities of the Century Company, which specializes in motor manufacture.

Walter Robbins on Thursday of this week severed his connection with the Wagner Electric Manufacturing Company of St. Louis, of which he was vice-president, and is now entering on an extended vacation. Mr. Robbins joined the Wagner organization in 1906 as assistant general manager and was elected vice-president in 1914. During the war as chief of the electric power and equipment section of the War Industries Board Mr. Robbins came into national prominence. His intimate knowledge of electrical conditions as regarded both manufacturing and power supply made it possible for him to get from the electrical industry what was probably the greatest degree of co-operation with the government displayed by any industry in the country. Mr. Robbins was born in 1875 and was graduated in engineering from the University of Michigan in 1896. From then until joining the Wagner organization, except for a year and a half with Pierce, Richards & Neiler, consulting engineers, he was employed by the Western Electric Company of Chicago.

WALTER ROBBINS

James M. Gilchrist has been elected vice-president and general manager of the Federal Electric Company and the Federal Sign System (Electric), Chicago, succeeding Herbert I. Markham, who has recently resigned as general manager. J. S. Macpherson and P. D. Rensenhouse, who have been with the two companies for a number of years, were elected treasurer and secretary respectively.

R. L. Watts, formerly mechanical superintendent of the St. Paul & Tacoma Lumber Company, Tacoma, Wash., has become associated with H. H. Lewis in the firm of Lewis & Watts, engineers, of Seattle, Vancouver, B. C., and Portland, Ore., in an engineering firm which conducts general power-plant engineering and sales business. For seven years Mr. Watts was with Armour & Company of Kansas City as steam, electrical and refrigeration engineer, after which for ten years he was electrical and mechanical engineer for the Sante Fé Railway system on its Pacific Coast lines.

Obituary

George Frederick Blessing, dean of the engineering department, Swarthmore College, died on June 25 at his summer home at Bay View, Mich. He had been in charge of the engineering department at Swarthmore since 1908. Professor Blessing did work in steam turbine design, first with the Platt Iron Works in turbine pumps and later with the General Electric Company at Lynn, Mass. Prior to going to Swarthmore he taught machine design for two years at Cornell University.

Will H. Bloss, manager of steam-railroad sales of the Ohio Brass Company, died at his home at Mansfield, Ohio, June 22 from heart failure. Mr. Bloss was born April 4, 1869. He received his engineering training at the Indiana University and began railroading, working up to be division engineer on the Santa Fé. Later he became chief engineer of the Indiana Union Traction Company. He went to the Ohio Brass Company in the fall of 1906 from the Buda Company of Chicago and was district sales manager in some of the Central States until about a year ago. From that time he had devoted his effort to electrification development and other steam-railroad problems.

Crawford R. Brown, formerly in charge of the standardizing and testing department of the Edison Electric Illuminating Company of Boston, died recently at Dedham, Mass. Mr. Brown was born at Providence, R. I., in 1861 and was educated at Harvard College, being graduated in 1886. He soon entered the service of the Boston Edison company and from 1890 to 1897 was in charge of the meter department. For twenty-three years, beginning with 1897, Mr. Brown was at the head of the company's laboratory organization, which later became known as the standardizing and testing department, and he was actively concerned with the development of this work, including the provision of quarters at Head Place, and later at the company's service buildings, where a finely equipped structure is devoted to the company's most advanced scientific pursuits. Mr. Brown retired from his post about a year ago on account of ill health. He was very highly regarded throughout the New England central-station field.

Trade and Market Conditions

Business Reviews, Together with Market Letters from Important Trade Centers, on the Supply, Demand and Prevailing Prices of Electrical Apparatus and Supplies

Fairly Good Central-Station Buying of Lightning Arresters

CENTRAL-STATION buying of lightning arresters is reported to be fairly good this year, far better in fact than demand from industrials or from electric railways for the types that they use. Central-station demand largely follows the use of transformers, but this is not necessarily true with industrials, it is stated, because slack business conditions as well as the need of education in the matter of lightning protection have operated against buying there. Demand for pole-top arresters and for the large types used in central-station protection is about on a par, according to one of the larger producers. Total business in this field is not up to the standard of last year, which also was below normal, but it shapes up well under present conditions.

On large central-station types deliveries can be made in from two to eight weeks, the lower range being for arresters generally used and the longer delivery for highly special products. Stocks of the finished product on this type are not carried, but a good supply of parts is reported on hand ready to assemble. Low-voltage lightning arresters can be shipped from stock. Prices are down 10 per cent, this drop being made earlier in the year.

May Electrical Exports Show Further Falling Off

ELECTRICAL exports for the month of May amounted to $8,670,124, the lowest month so far this year. There has been a steady decline each succeeding month from a record of more than $15,000,000 set in January, but also there has been a steady decline in prices of electrical materials since the first of this year. The decline of April was only 8.1 per cent below March's figures, and May is only 4.5 per cent below April's figures. This figure of $8,670,124 is still much higher than any month of 1918, was surpassed only once in 1919 and was surpassed six times in 1920, when prices were so high and buying so heavy. The export market is lower than it has been, but it would seem to be still in a pretty healthy state compared with the market for other commodities in foreign fields.

	May		Five Months Ended May	
	1920	1921	1920	1921
Batteries	$676,624	$430,432	$2,756,664	$2,380,154
Carbons	129,546	27,464	559,270	224,266
Dynamos and generators	564,251	610,922	2,426,424	3,135,493
Fans	152,100	77,480	526,264	1,045,597
Heating and cooking apparatus	227,227	101,745	757,231	1,121,688
Insulated wire and cable	791,303	860,491	3,090,283	5,960,883
Interior wiring and supplies	341,302	114,564	1,244,111	1,284,253
Arc lamps	3,817	878	5,866	8,347
Carbon filament lamps	5,566	15,194	53,945	82,110
Metal-filament lamps	334,843	353,339	1,689,948	2,252,091
Magnetos, spark plugs, etc.	360,317	92,595	1,628,719	800,016
Meters and measuring instruments	288,021	276,001	1,084,926	1,555,526
Motors	1,132,811	1,641,827	4,863,262	9,415,905
Rheostats and controllers	43,365	101,663	287,690	629,545
Switches and accessories	269,794	459,609	1,574,344	2,782,026
Telegraph apparatus	41,752	190,343	347,830	741,389
Telephones	414,838	480,830	1,639,429	2,906,607
Transformers	319,992	701,965	1,482,712	4,497,288
All others	2,893,316	2,132,782	11,693,259	15,680,016
Total	$8,990,785	$8,670,124	$37,712,177	$56,503,200

The total value of exports for the five months to date amounts to $56,503,200; in the twelve months of 1917 the exports amounted to $55,478,079, and in 1918 they amounted to $59,982,526. So much for present total to date and past totals for twelve-month periods.

Special low records for the year were made in exports of fans, heating and cooking apparatus, interior wiring supplies, arc lamps, magnetos and spark plugs, transformers and miscellaneous appliances. Batteries, carbons, dynamos and generators, insulated wire and cable, meters and measuring instruments, switches and accessories, telegraph and telephone materials held up better than in the month of April.

Figures in the accompanying table were compiled by the Bureau of Foreign and Domestic Commerce.

Washing-Machine Production Steady

THE number of washing machines produced by the members of the American Washing Machine Manufacturers' Association during the month of May has kept pace with the output for April, which had been the record month of the present year, according to the figures compiled by that organization. This is very encouraging inasmuch as these manufacturers have had to continue selling their product at prices almost as high as those of last year. In addition to this May proved a slow month for most other electrical lines, and the fact that washing-machine production did not slump indicates that this appliance is fast becoming a necessity. May production averaged between 55 per cent and 60 per cent of normal.

The head of the educational bureau of the association, who recently returned from a trip through the South, reported that her survey shows the Southern States to be an impressively large potential market. At the present time the inability to dispose of last year's cotton crop has reduced buying power considerably, but the sentiment all through the territory is very strongly in favor of labor-saving devices.

In a number of the Southern States campaigns have been or will be carried on to introduce appliances. State boards of health and education, state universities, county boards and many business organizations are co-operating to make these campaigns successful. With these powerful influences working it appears to be only a matter of waiting for business to recover until the Southern States will become an important market for washing machines.

Germany Ready to Undersell the World, Says President Du Bois

"GERMANY today is in a position to undersell the world on most manufactured articles," said Charles G. Du Bois, president of the Western Electric Company, on his return from six weeks of intensive data gathering in France, Switzerland, Austria, Hungary, Germany, Belgium and England.

"Industrially Germany seems to be as efficient as ever. With wages low, as measured in the currency of other countries, with highly competent workers eager to produce and with the reparation question in a more settled state, Germany is in a position to go ahead in building up her industries to handle export business. At present she can turn out many lines of manufactured articles to sell profitably for less money than any other country.

"As nearly as I can calculate it, the cost of German labor in the metal working trades is about one-sixth of the cost of equivalent labor here. While in all probability this will lead to protective measures on the part of competing countries, such as taxes on German exports and other measures for the encouragement of home industries, yet wages in such countries are now decreasing and this tendency is likely to continue if they effectively meet German competition in foreign trade.

"Looking at the other side of the picture, however, we see not exactly unrest, but a grave question arising as to whether the working population can or will continue to accept its present low standard of living. The danger in Germany, therefore, is of a social overturn more than anything else. Politically the various Socialist parties seem to be in the majority, but the anti-Socialists are in control of the government, largely because the Socialists do not care to assume control at a time when they cannot hope to make good all their promises.

"In Austria the situation is serious but not immediately critical. The people are not getting enough to eat, but every one is getting something. Conditions in Hungary are quite different. This country, largely agricultural, is able to support herself. She has passed through two terrible experiences—Communism and Rumanian occupation. She is done with Communism. She is breaking away from German influence and seeking favor with England. For the first time Hungary claims she has balanced her budget and does not want outside loans. She is preparing to build up from within.

"Czechosolvakia among the central powers and Belgium among the Allies seem to be in the best condition. From the beginning of peace Belgium has been a bright spot in Europe, industrially. She is continuing to improve steadily. Uneasiness on questions of foreign relations is apparent in France. The motive which dominates all French policies is fear of Germany as well as lack of certainty in her alliances with other countries and a certain doubt about the efficacy of the League of Nations. Her people are disillusionized. They have finally accepted the principle that France must work out her own economic salvation, and having accepted this principle the natural thrift and industry of her people are bound to produce results.

"Looking below the surface, the immediate situation in England is serious," Mr. Du Bois continued. "Hundreds of thousands of people are out of employment. Rail transportation is seriously impaired. The labor unions as well as the employers are agreed that there must be lower wages, but the bone of contention is the amount by which wages must be reduced. In due course the British always appreciate the logic of circumstances, and it seems certain that an agreement will soon be reached. England in the meantime is losing heavily in trade balance.

"There is one thing, however, common to all European countries: The people everywhere are thinking and talking about earning a living. This is a change from my visit in 1919, when world movements, world politics and world improvement seemed to engross their thoughts. Now there is a much clearer realization of the long-continued hard work necessary before normal conditions can be restored."

Body Formed to Boost American Valuation in Tariffs

THE American Valuation Association has been recently organized by a group of Eastern manufacturers to boost the Fordney tariff measure now before the ways and means committee at Washington. This bill has great interest to manufacturers of electrical goods. The headquarters are at 304 Madison Avenue, New York City, and the association is inviting manufacturers of the United States to become members and lend their influence and co-operation in a general movement to bring about the adoption of the American valuation plan in the permanent tariff bill.

The president of the association is Walter Camp, president of the New Haven Clock Company; D. W. Jayne of the Barrett Company is vice-president; Stanley Williamson of the Linde Air Products Company is secretary, and F. D. Dodge of the Toy Manufacturers of the U. S. A. is treasurer. William Burgess, who has just been appointed to the Tariff Commission by the President, and J. F. Zoller of the General Electric Company are on the executive committee.

The Associated Manufacturers of Electrical Supplies at its March 15, 1921, meeting by resolution favored the American valuation plan, and among the companies which are members of the new association to date are the American Ever Ready Company, Black & Boyd Manufacturing Company, E. F. Caldwell & Company, Inc., Robert Findlay Manufacturing Company, Inc., J. P. Frink, Lightolier Company, Mitchell Nance Company, Inc., Pass & Seymour, Inc., L. Plaut & Company, General Electric Company, John A. Roebling's Sons Company, Shapiro & Aronson, Inc., Stanley & Patterson, Barrett Company, and Safety Insulated Wire & Cable Company.

It is the purpose of the new association, as announced by the executive committee, to take up every phase of both plans—the plan favoring the basing of import duties on American values of imported merchandise and the plan basing them on foreign valuation—and to submit to manufacturers a statement regarding the advantages to be derived by American industry through adopting the American rather than the foreign valuation plan.

It is interesting to note that William Burgess, adviser on tariff matters to the A. M. E. S., was responsible for the suggestions made to Representative Fordney in June, 1919, out of which this bill has come.

Slight Drop in Pole-Line Hardware Prices Is Not General

ALTHOUGH one producer of pole-line hardware has made a 5 per cent price reduction effective June 16 and a large manufacturer's distributer reduced the price 5 per cent about two weeks ago, there has been no general recent decrease so far as can be learned. Manufacturers in this line have apparently reached the conclusion that price cuts will provide absolutely no stimulus to buying, consequently reductions represent lower costs and nothing more. Three general price cuts have been made since the first of the year and buying has shown little or no reaction. The first cut of 5 to 15 per cent was made in late December and early January, the second of 5 to 7½ per cent on Feb. 15, and the third from 7½ to 10 per cent occurred on April 11.

At the present time there are a few orders and inquiries coming in from central stations.

The Metal Market Situation

LITTLE improvement is seen in the copper market this week. Large producers are not pressing to sell, but neither do consumers seem anxious to buy. The latter are covered for their immediate needs, and with demand for finished brass and copper products as light as ever manufacturers apparently see no necessity for stocking copper. There are offerings of prompt-shipment copper from second hands and some of the small producers at 12½ cents per pound f.o.b. refinery, which figures about ¼ cent more delivered. The majority of the producing interests, however, are not anxious to sell under 13 cents per pound.

NEW YORK METAL MARKET PRICE

	June 21, 1921	June 28, 1921
Copper	£ s d	£ s d
London, standard spot	70 7 6	70 5 0
	Cents per Pound	Cents per Pound
Prime Lake	12.75—13.00	13.00
Electrolytic	12.62½—13.00	12.87½—13.00
Casting	11.75—12.00	11.87½
Wire base	15.00—15.25	15.00—15.25
Lead, trust price	4.50	4.40
Antimony	5.12½	4.75
Nickel, Ingot	41.00	41.00
Sheet zinc, f.o.b. smelter	10.00	10.00
Zinc, spot	4.95	4.75
Tin	29.00	29.12½
Aluminum, 98 to 99 per cent	28.00	28.00

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	10.00—10.25	9.50—10.00
Brass, heavy	4.75—5.00	4.75—5.00
Brass, light	4.00—4.50	4.00—4.25
Lead, heavy	3.50—3.75	3.50—3.62½
Zinc, old scrap	2.50—2.62½	2.50—2.62½

THE WEEK
IN TRADE

Prices When Quoted Are Those Prevailing at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

INACTIVITY in the electrical trade continues general throughout the country. Fans are the only real active item at present. In these hot weather has started a brisk movement except in the Southeast, where a slump is noted. A favorable volume of construction work is reported from New England, from the South, the New York district and the Northwest, but labor troubles and the high level of wages and of material are retarding actual work in the Middle West, on the Pacific Coast and in St. Louis territory. Atlanta reports better conditions in the rural districts, and there is considerable activity on the part of municipalities and electric light and power companies. Industrials are going ahead with deferred plans, too, though this outlet for goods is less active in the St. Louis section. The New England textile market shows some improvement, while on the Pacific Coast the fruit crop shows up well, as does the live-stock and agricultural situation in the Intermountain section.

NEW YORK

Trade is drifting along on the even plane of summer dullness, but at least business is becoming no worse and some in the electrical trade report a more active market within the past two weeks. For one thing, recent price reductions on many lines of goods have had the effect of stimulating demand. This, however, may be but the natural replenishment of stock after a price drop, as is thought to be the case with schedule material. Fans have recently shown the first honest-to-goodness sign of an active movement this year, the buying starting much later than is usual.

The building construction schedule for New York State and northern New Jersey during the week of June 4 to 10 includes plans started by engineers and architects for 852 projects totaling $21,742,400, of which 590 were for residential work. Contracts were actually awarded in that time for 439 operations involving about $15,400,000, of which total more than half is for housing facilities. The above figures are from the weekly Dodge reports and carry out the favorable figures recorded during May.

Motors.—The Advance Electric Company, St. Louis, Mo., announces a reduction of 10 per cent in the prices of motors.

Conduit.—In 2,500-ft. lots ½-in. black is quoted at $58.92 to $62, ¾-in. at $76.60 to $81, and 1-in. from $110.16 to $117 per 1,000 ft. Here and there sales show an increase, but general demand is quiet with good stocks held.

Lock Nuts and Bushings.—A fair quantity is moving, but there is no life to demand. On ½-in. sizes the general quoted discount is 55 to 60 per cent. Stocks are well filled.

Outlet Boxes.—In lots of 100 the quoted discount on black boxes ranges from 40 to 50 per cent and on galvanized from 35 to 45 per cent. Sales are only fair.

Flexible Armored Conductor.—Though No. 14, two-wire, double-strip can be bought for $53.15 per 1,000 ft. in that quantity, there is not much movement to the comfortable supply.

Rubber-Covered Wire.—No. 14 single-braid in 10,000-ft. quantities is down to $6.50 per 1,000 ft. and ranges up to $7, but not much activity is evident and stocks continue fairly large.

Fans.—A week of warm weather has started things moving in good shape, with 12-in. and 16-in. oscillators well ahead in the call. In lots of a dozen two well-known makes are sold to dealers on a contract basis at $30.37 and $29.20 each for 16-in. oscillators and $26.32 and $25.20 for 12-in.

Heating Appliances.—The market is lifeless, even the usual "gift buying" during June having been small. The trade is generally sitting back awaiting the result of expected price drops, though the benefit of these is already being extended in some instances.

Porcelain.—"Nail-it" knobs in barrel lots sell for $22.40 to $30 per 1,000, 3-in. x $\frac{5}{16}$-in. tubes for $9.20 to $10, and two-wire unglazed cleats for $20 to $25. There is not much demand at present.

CHICAGO

The week in Chicago has been generally unproductive of news. The building labor arbitration by Judge K. M. Landis still hangs fire, the arbitrator's decision having been delayed to permit him to study the various existing agreements in regard to working conditions and union jurisdiction. It is thought that the decision, when rendered, will not only settle the wage question but will also go far to eliminate jurisdictional disputes which have hitherto been such a disturbing factor.

Construction under way is proceeding at a steady pace, but no jobs are being initiated and apparently none will be until the wage question is settled. General industrial conditions remain quiet. The rank and file of business men seem convinced of the fact that there will be no revival worthy of note before fall and are content to mark time during the hot season. One local concern, normally operating with 3,600 men but closed for some weeks, put 1,600 men to work Monday. Certain of the tire and accessory people are reported as increasing forces, so that what few signs can be seen may be said to be favorable.

Midsummer weather has prevailed over this entire region for more than two weeks, and the movement of fans and household appliances has been stimulated thereby.

Conduit.—With no published change in the list, 5 per cent shading is being given by some interests. Business is light. Prevailing quotation for ½-in. black, in 5,000-lb. lots, is $59 per 1,000 ft.

Bare Copper Wire.—The volume of replacement work necessary at this time of year is keeping trade fairly active, most purchases being for small lots. No. 8, in 1,000-lb. lots, is priced at 16½ cents per pound, with figures subject to negotiation on larger quantities.

Insulated Wire.—Pending establishment of a wage schedule in the construction industry, the market on inside wire remains quiet as the quantity of material being used on construction under way is not sufficient to boom trade. Demand for rubber-covered for use in temporary outside illumination is fairly active, No. 14 rubber-covered in 10,000-ft. lots selling for $7 per 1,000 ft. No. 6 triple-braided weatherproof is held at 18½ cents per pound in 1,000-ft. lots, with sales light.

Flexible Armored Conductor.—Quiet conditions in the building trade keep this material out of active demand. The expected stocking on the part of jobbers and contractors is not taking place, a thirty-day supply at the present consumption rate being considered ample. Price remains unchanged at $57.50 per 1,000 ft., which is considered high by most buyers.

Bells and Buzzers.—Prices are in a rather unsettled state. Certain makes have registered a drop, but their sales have not been increased to any material extent and other makes are holding firm to old quotations. Call for this material continues light, with ample stocks in hands of both dealers and jobbers.

Lamp Cord.—Stocks are as heavy as can safely be carried, while prices are uncertain and demand is poor. Activity in the heating appliance field has failed to cause a livening up of demand for cord, No. 18 twisted, cotton-covered, is priced at from $16 to $17 per 1,000 ft., in 5,000-ft. lots, with silk and cotton-covered about $7 higher.

BOSTON

Business continues moderate in volume, with slow liquidation of stocks and labor. Most prices underwent no material change last week, but some weakness was noted in retail circles, where efforts were being made to realize cash on accumulated appliances. Collections are about the same and all accounts are being closely followed. A decided improvement in building construction is apparent, comparing May with April. In twenty-eight Massachusetts cities the May aggregate was $5,841,666, against $4,259,055 for April, a gain of 37 per cent, and the 1921 May total is 84.7 per cent of the 1920 May figure. Business building is relatively more active than other construction. Central-station output is running below recent totals in some companies as regards industrial power service, but substantial gains in residential use of energy are being registered even in cities suffering from industrial depression. Conditions in the textile branches are showing improvement. In the metal-working field further liquidation of labor must occur before increased activity will amount to much, it is believed.

Fans.—A brief spurt in sales took place during the torrid weather of last week. Stocks are still overlarge, and current fan prices are being shaded in retail circles here and there to move this equipment. Jobbers sold last week a representative 12-in. fan of the fixed type for $22 to $24 net.

Appliances.—Curling irons and toasters are moving well, especially in the lower-priced assortments. Flatirons are dull this week, and washers and cleaners are quiet. Intensive sales efforts, however, are accomplishing much good and laying the foundation for a vigorous trade. A little life is apparent in electric ironers.

Lamps.—Although this is the quietest season of the year for lamps, portables are moving here and there for summer home service. A fair staple demand is apparent for "bread-and-butter" sizes of lamps for ordinary house and mercantile service.

Flexible Armored Conductor.—Fair sales are reported, with uneven demand. Local stocks are satisfactory and prices changed little last week. No. 14 double-strip is now selling for $55 per 1,000 ft. in 1,000-ft. lots.

Knobs and Tubes.—Industrial building developments are helping the demand for this class of material, though orders are far from large. In barrel lots, "Nail-it" knobs are selling for $21 per 1,000 and 3-in. x 5/16-in. tubes are moving in this quantity for $9.50 per 1,000. On lots of 500 the tubes sell at $25 per 1,000.

Bells and Buzzers.—Prices dropped sharply last week, some falling between 15 and 20 per cent. On Class B iron-box bells, for instance, the 2½-in. iron box sells for 46 cents in lots of 100 or over against a former price of 56 cents. Class B buzzers now sell for 45 cents, lots of 100, iron box. The demand is small at present.

Dry Cells.—Some vacation business is being handled, and replacement orders are keeping stocks moving slowly.

Annunciator Wire.—Moderate sales rule. In 25-lb. to 100-lb. lots No. 18 wire on 1-lb. spools sells at $42 per 100 lb. with a 2-cent addition for duplex or twisted pair.

ATLANTA

A steady and more optimistic tone is to be noted in nearly all lines of business, brought about by the gradual increase in the tendency of consumers to repurchase in anticipation of early fall activities. The electrical jobbing trade expresses more confidence in the outlook than has been the case for some time past, and June business generally shows quite a marked improvement over May. There is quite a bit of activity in the municipal and central station line, especially in the smaller centers, in the line of installing waterworks and electric distribution systems. A number of industrial plants have undertaken the completion of long-postponed plans and quite a few inquiries from parties interested in the establishment of new industries are to be noted.

Building activities, particularly in the larger centers, show a slow but steady increase and are causing a healthy demand for house-wiring material and specialties. The Atlantic Steel Company, one of the largest mills in this section, reopened for business at 60 per cent operation last week after a shutdown of six months. Conditions in the rural district while still very slow, show some improvement, buying still being on the hand-to-mouth basis. Collections are reported as showing considerable improvement when compared with those of sixty days ago.

Fans.—The fan business this season has had an unusual number of ups and downs, the brisk movement of two weeks ago being replaced by a very sluggish market at the present time, despite the continued hot weather. It seems that high prices are acting as a heavy drawback to sales. and prospects are that there will be a considerable carry-over this season.

Schedule Material.—The recent price cut in this line has stimulated buying, and jobbers report considerable improvement in the movement of all articles. Stocks are still very heavy.

Dry Batteries.—A price reduction of approximately 7 cents per battery became effective the first of this week. Rural telephone lines and country trade generally are purchasing quite satisfactorily, the demand from all sections being exceptionally good. Stocks are in excellent shape, with a current quotation of $33.15 per 100.

Conduit.—A further general price reduction of approximately 5 per cent is not serving to create an active market. Stocks in general are slow, though popular sizes are moving fairly well.

Lightning Arresters.—Jobbers as a whole are disappointed in the demand, orders to date being far below expectations. This line, however, should show improvement as soon as summer thunderstorms become prevalent. Stocks are rather low.

Poles.—This week has witnessed a brisk movement, the demand being for chestnut, cedar and cypress. Florida is placing a good percentage of the orders, though southern Alabama and sections of Georgia show much improvement.

Farm-Lighting Equipment.—Sales are very spotty, for, though there is a great deal of interest being displayed, the movement is handicapped by shortage of funds. Fall should usher in a brisk period in this line.

ST. LOUIS

Fans constituted one of the most active sellers during the past week. Except for the good showing in that line, there was noticed very little actual change in demand. In some lines, however, there is perceptible a tendency toward reduced buying. Purchasing by the industrials seems to be declining, whereas up to about two weeks ago it showed slight increases each week. Sales of appliances are apparently maintaining a good rate.

A number of the industrials have worked up the greater portion of their raw materials they had on hand and now with their finished products in stock are beginning to close down their plants until further operation is warranted. Other concerns, because of the lack of demand, are operating only to the extent of meeting current demands, so as to be able to take advantage of the falling prices in raw materials.

It is reported that construction work is not developing so rapidly as was expected. A number of contractors state that jobs on which they have figured have been held in abeyance indefinitely because of the slow decrease in costs of building materials and labor. There is a possibility that there will be some decrease in the latter item after July 1. Outside of a slight amount of residential construction there is very little building at the present time.

Wire.—Prices on the various types remain about the same. No. 14 rubber-covered, for which a reasonably good demand continues, is quoted at $6.75 per 1,000 ft. in 5,000-ft. lots and $6.65 in 10,000-ft. lots. A slightly increased demand for the week was reported by one jobber for No. 6 and No. 8 weatherproof at a base price of 16½ cents per pound.

Stocks of No. 14 rubber-covered are generally low, but in spite of the prevailing low prices there is no tendency to stock more than is necessary to meet the demand satisfactorily.

Conduit.—Half-inch black is quoted at $6.61 per 100 ft. and ½-in. galvanized at $7.12 per 100 ft. There is a good demand for the smaller sizes in the black, but practically none for the galvanized.

Flexible Armored Conductor.—Demand continues fairly steady with prices supposedly firm. No. 14, two-conductor, sells at $60 per 1,000 ft. Stocks are about in line.

Bells and Buzzers.—The prevailing net prices to contractors for bells in standard-package lots are 50 cents for the 2½-in. size and 58 cents for the 3-in. The price for buzzers is 50 cents each.

Fuses.—Prevailing prices on N. E. C. non-renewables, in standard-package lots, are as follows: 3-amp. to 30-amp., 13½ cents net; 31-amp. to 60-amp., 18 cents net; 3-amp. to 30-amp., renewables, 29 cents, and 31-amp. to 60-amp., renewables, 58 cents. A steady demand for all kinds and sizes is found, and stocks have been reasonably maintained.

Fans.—Both retailers and jobbers report continued activity, though it is felt by some that prevailing high prices are keeping demand below what it would otherwise be.

Safety Switches.—Announcements are being made on the part of some firms of 10 per cent reductions effective July 1. The Lewis Electric Company announces that the new price to dealer on two-wire, two-circuit, safety-entrance boxes, in standard packages of twenty, will be $4.95 each. Increased demand for safety switches of all kinds is reported by jobbers.

SAN FRANCISCO

The electrical contracting business in San Francisco and the bay cities is in a very chaotic state, because some contractors are working crews and state that they have plenty of work at the American or open-shop plan of $9.25 per day wages, whereas other contractors have been unable to assemble men to care for jobs in urgent need of completion. Furthermore, most of the construction under way is for private dwellings and alterations with practically no big jobs under way. The situation is still hopelessly deadlocked, for the statement made by some unions that their men would work alongside non-union men has been followed by an order that all union journeymen should quit such work. Needless to state this deplorable situation has not only caused a serious loss to owners and contractors but also to the men themselves and the shops and stores which sell to them.

San Francisco jobbers report very poor sales not only on roughing in material and electrical staples but also on household appliances. Dealers are willing to purchase, but their repeat orders are slow because of the buying lassitude of many of their customers in this territory. The electrical business is fast approaching normal in southern California; in fact, it is almost doubling even last year's tremendous volume.

The fruit and agricultural districts report excellent crops, very slightly touched by frost and unseasonable rain. There is no doubt that the lessons of last year have had their effect and that satisfactory selling prices between growers and packers can be arranged.

Household Appliances.—Business is much less than last year. Lower prices have not yet influenced the buying public, which seems to be holding out confidently for further drops. Dealers themselves expect lower prices about the middle of next month and are buying in the smallest possible quantities and are exchanging lists of their stock among themselves.

Ranges.—The range order to be placed by the Great Western Power Company is still in abeyance. It is reported that the original estimate of 1,000 ranges covered by this order has considerably diminished. The trade has been circularized regarding the new transferable-unit Edison-Hotpoint-Hughes range, and it is endeavoring to market its considerable stocks of the present types.

SALT LAKE CITY—DENVER

An event of outstanding interest was the convention in Salt Lake City last week of the American Institute of Electrical Engineers, the convention bringing to the West many of the world's most eminent engineers.

Though business shows little or no improvement from the point of view of distribution through retail channels, yet there is a better general tone in banking circles and a slight easing of the money market. The payment of taxes and the gradual liquidation of crops are largely responsible for the improved conditon. There is a better morale among farmers, especially the dry farmers, whose crops are far enough along to be practically free from the damaging effects of drought. Forecasts of the general staple crop yields are highly encouraging. Sheepmen report a good lamb crop and a satisfactory market. In view of the unusually low cost of production during the last year they are securing fair profits and getting in a better condition generally. Improvement in the agricultural and the live-stock markets is a boon to the Intermountain West.

Heating Appliances.—A blanket reduction of about 10 per cent has been announced to take effect July 15. Manufacturers have decided in this case to advertise the fact in advance for its psychological effect on the public mind.

Flat Irons.—Movement is still very unsatisfactory. The eight-dollar type has been reduced to $6.95. It is believed that better sales will follow.

Meters.—Demand is steady with stocks in good shape. No recent price change is noted.

Rubber-Covered Wire.—It is believed by jobbers that the price has hit bottom. The present quotation on No. 14 is $7.20 per 1,000 ft., the lowest mark recorded in years. Stocks are heavy with demand extremely small.

SEATTLE—PORTLAND

Seattle retailers as a whole report business on the increase, and jobbers, too, state that there is slight improvement on certain lines, principally washing machines and other domestic appliances and schedule materials. Industrial business is dead and sales to industrials are negligible. The lumber industry is pretty badly shot, and no particular improvement is looked for until fall and perhaps later. Stocks are in fine shape and shipments are coming through satisfactorily.

A good volume of construction is under way in Seattle. Permits for May number 1,044, with a valuation of $1,566,000, and from present indications June will exceed this mark.

Electrical jobbers in the Portland field report that conditions are somewhat improved and that there is greater activity in line construction material than in other classes of electrical merchandise, although a noticeable improvement is seen in the movement of home appliances. Collections in this district remain unchanged, though they are expected to improve materially within the next sixty to ninety days. Portland contractor-dealers report very little if any change in business, although it seems to be on a more stable basis than for some time past. Residence construction is holding up well; if anything, it is on the increase. Retailers report some increased activity in the sale of appliances, but aside from this there is very little change noted.

Fixtures—Because of the increasing volume of residence construction, not only in Seattle but throughout the larger cities of the Puget Sound district, both jobbers and retailers report an increasingly healthy movement. The higher-class merchandise is moving well. Stocks are in excellent shape, replacements easy to obtain and prices show but little fluctuation.

Ironers.—Movement is more or less slow because of initial cost and installation charges. Many inquiries are being made, however, and it is believed that when prices are reduced and conditions become more stabilized this merchandise will be in popular favor.

Schedule Material.—On June 27 one Seattle jobber reported decreases in prices on thirty-seven lines included under schedule material, these reductions ranging from 10 to 40 per cent. Movement in this line is showing increases which are expected to keep up until fall.

Manufacturers' Activities

Devoted to the Business Side of Manufacturing, Distribution and Sales, News from Jobbers and Foreign Fields and a Record of New Devices and Trade Literature

Officers of Safety Car Heating & Lighting Company

At the meeting of the board of directors held June 15 the following officers of the Safety Car Heating & Lighting Company, New York City, were elected: W. L. Conwell, president; J. A. Dixon, R. Parmly and James P. Soper, vice-presidents; C. W. Walton, secretary and treasurer; William Stewart, assistant secretary and assistant treasurer.

Pittsburgh Electric Furnace Opens New York Office

While the Pittsburgh Electric Furnace Corporation, Pittsburgh, has offices in about thirty-five other cities in this country and abroad. it has recently established offices at 149 Broadway, New York City, in charge of Presley Hamilton. The territory covers part of New Jersey, the metropolitan district and the eastern half of New York State in general and embraces considerable export work.

Joseph E. Greene Company

Joheph E. Greene, Inc., 111-115 Federal Street, Boston, Mass., has purchased the assets of the Joseph E. Greene Company, Inc. The new company manufactures electrical supplies, auto specialties and lighting fixtures. Joseph E. Greene is president and treasurer and L. A. Greene is secretary

New Building for John A. Roebling's Sons

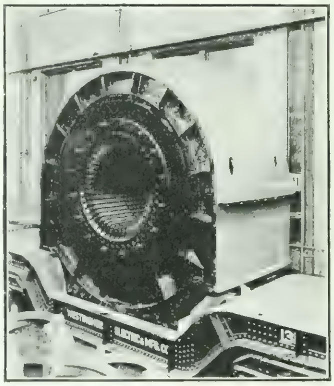
The construction of a new building for the copper wire and electrical galvanizing department of John A. Roebling's Sons Company, Trenton, N. J., is under consideration. Plans at present are in a preliminary stage and no definite time is set for the completion of the work, the company announces.

Lighting Fixture Manufacturers' Summer Meeting Canceled

The National Council of Lighting Fixture Manufacturers announces that after careful consideration of the matter from all angles it has been deemed advisable to call off the midsummer convention which was to have been held at West Baden, Ind., July 6 to 8. It has been decided to place still more effort on the winter convention and annual fixture market in order to set a new record in enthusiasm and beneficial results. The committee stated that plans for this affair are progressing well and that a definite announcement, which it was hoped could be made at the midsummer meeting, will be made in the near future.

Westinghouse Makes Record Shipment

The largest single shipment ever made from the East Pittsburgh works of the Westinghouse Electric & Manufacturing Company is the stator of a 25,000-kw. turbine-generator for the Gold Street station of the Brooklyn (N. Y.) Edison Company. This generator when loaded on a special 95-ton car weighed 201,000 lb., and because of its dimensions, 16 ft. 6 in. in height and 8 ft. 4 in. in width, had to be taken over a special route in order to avoid railroad tunnels.



GENERATOR WEIGHS 100 TONS

New York Edison's Ventilating Show Decided Success

The New York Edison Company has again found it necessary to extend the duration of the electrical show which it has been putting on in its showrooms at Fifteenth Street and Irving Place, New York City. The ventilating show was scheduled to be open from June 20 through June 25, from 9 a.m. to 6 p.m., but so great was the interest it aroused its time was extended to include June 29. A special appeal was made to the engineer, the architect and the contractor as the main factors in sales of ventilating equipment.

Twenty-five of the leading manufacturers of ventilating equipment took space in the rooms, and all kinds and types of fans and blowers from 6-in. desk fans to 12-ft. ventilating fans were in operation. Blower systems for industrial and domestic use and air-conditioning systems for industrial use and for power-plant ventilating and conditioning were much in evidence. A good deal of interest was shown in small direct-connected exhaust fans and blowers for home use.

Reports from the exhibitors were very favorable in showing the success of the show. The 12-ft. fan was reported sold on the floor, and several sales of smaller equipment were made, including ordinary desk fans. In particular, the number of inquiries and leads obtained was very gratifying. One exhibitor aptly remarked that the leads he had been getting were from entirely unexpected quarters. It so happened that on the dates of the show the weather was extremely hot.

Belden Commences Issue of Monthly Bulletin

Starting with the June 1 issue, the Belden Manufacturing Company, Chicago, has inaugurated the publication of a monthly bulletin as a help in setting prices and estimating jobs. Net prices only are listed, and Bulletin No. 1 covers rubber-covered wires and lamp cords.

Price Basis Warrants Resuming Trade, Says Boston Jobber

In a general letter to the trade, dated June 15, the Pettingell-Andrews Company, Boston, points out that an analysis of current jobbers' prices as tabulated by this house will show that there has been virtually an entire and complete readjustment in the prices of electrical material. J. E. Livor, secretary and sales manager, states in this circular that it is now possible to go to prospective customers on wiring jobs and illustrate clearly to them that the electrical industry is now on a sufficiently sound price basis. It is advised that anybody desiring work done of this character should start immediately without waiting for an additional readjustment, the circular stating that the loss in time would be far more costly than any possible slight future saving through further readjustment in the cost of materials. The company states that in event of further reduction of prices goods will be invoiced at the prices which are in effect on date of shipment from this organization's supply.

Allis-Chalmers Sales Over First Quarter 1921

During the first three months of this year sales billed by the Allis-Chalmers Manufacturing Comapany, Milwaukee, amounted to $7,656,218, as against $6,320,597 for the same period of 1920. The net profit after provision for federal taxes came to $774,189. Unfilled orders on hand as of March 31, 1921, aggregated $12,943,633, as against $19,442,791 for the first quarter of 1920.

Federal Trade Commission Cites Two Electric Companies

During the month of May the Federal Trade Commission, Washington, D. C., issued "orders to cease and desist" to the Vacuum Cleaner Specialty Company, Inc., West Forty-second Street, New York City, and to the Universal Motor Company et al., Oshkosh, Wis.

Typhoon Fan Finds Plenty of Ventilation Business

When the Typhoon Fan Company moved into its newly acquired property at 345 West Thirty-ninth Street, New York, in April, 1920, it found plenty of business to occupy its full plant. Since then, too, the company has been continuing on a full-time basis, and at times running on overtime, not only building Typhoon cooling systems to order but also making stock. The plant is now running to full capacity. A price revision of 10 per cent was made this spring.

A Buffalo office was opened the latter part of May at 256 Main Street, in charge of James M. Hawkins. Stocks will not be carried there but are carried in New York, New Orleans, Chicago and Los Angeles.

New Building for Empire Engineering & Supply

When the Empire Engineering & Supply Company moved into its new factory at Twentieth Street and Fourth Avenue, Brooklyn, N. Y., early in May, it about trebled its capacity for making switchboards and panelboards. The new building was designed especially for the purposes of the company, is 100 ft. x 160 ft., and although only one story in height now, it is so constructed that two or three stories may be added as needed. The company reports a satisfactory volume of business in these types of boards with the shops running almost full time.

Link-Belt Acquires Holdings of H. W. Caldwell & Son

Announcement has been made by Charles Piez, president of the Link-Belt Company, 910 South Michigan Avenue, Chicago, that it has acquired all of the capital stock of the H. W. Caldwell & Son Company and that Frank C. Caldwell has been elected director of the Link-Belt Company. Thus two experienced companies in the conveyor field have joined forces, with the result that the Link-Belt Company has added two lines, "Hellicord" conveyors and power-transmission machinery, to its line of manufactures. While the plant of the H. W. Caldwell & Son Company will continue to operate under separate corporate existence and under its present name, the joint facilities of the two companies and the broader avenues of distribution possessed by the Link-Belt Company should prove of distinct advantage to the customers of both, says Mr. Piez. There will be no modification of the policies of the Caldwell plant, no impairment of its service and no change in its product. The plant management will remain substantially the same.

Lombard in Production on Diesel Engines

The Lombard Governor Company, Ashland, Mass., is now getting production of its full Diesel four-stroke-cycle, multicylinder, vertical engines well under way. In the assembly of these engines only two sizes of cylinders and parts are used to form a number of sizes of engine ranging from 60 b.hp. to 500 b.hp. Norman McCarty, formerly with the Midwest Engine Company, has taken up the design of these Lombard engines since Midwest ceased production of this type of engine last fall.

Gibbons & Brown Establish Offices in Newark, N. J.

J. O. G. Gibbons has joined with C. E. Brown in forming a partnership under the name of Gibbons & Brown, consulting engineers, specializing on power plants and industrial problems, with offices in the Ordway Building, Newark, N. J. Mr. Gibbons was formerly with the Westinghouse, Church, Kerr & Company and is now engaged in private practice. For the past four years Mr. Brown has been a United States ordnance engineer.

Hoosier Farm Light Takes Over Property of Drury Company

The Hoosier Farm Light Company, Inc., 1713 First Avenue, Evansville, Ind., manufacturer of "Hoosierlite" generating units, has purchased the entire assets, including building, machinery, etc., of the Drury Engineering Company. The present capacity of the plant is between thirty-five and forty plants per month, but with machinery to be installed later the output will be increased to about fifty plants per month. The Hoosier company will manufacture a farm-lighting plant, to be known as the "Hoosierlite Slow Speed," which, though there will be some changes, will be practically the same as the plant made by the Drury company.

Developments Going Through Sepco Heating Line

While the plant of the Automatic Electric Heater Company, Warren, Pa., is not working up to full capacity, the amount of business being taken is reported to be very satisfactory in the light of current times. This is especially true of the company's "Sepco" line of domestic electric water heaters, additions to which have recently been made. Industrial business is poor. A new G 2 glue pot of 600 watts is ready for the market, and other developments are now in process of completion.

Elliott Company Enlarges Sales Organization

The Elliott Company, Jeannette, Pa., announces additions to its sales organization as follows: R. H. Schmidt has been assigned to the St. Louis district office, W. E. Widau to the Cleveland office and R. S. Bellman to the Philadelphia district office. All of these men have completed a year's course of intensive study and experience with the Elliott company's products following their graduation from engineering colleges.

In addition to the Elliott company's products they will also handle those of the Lagonda Manufacturing Company, Springfield, Ohio, and also the Liberty Manufacturing Company, Pittsburgh, Pa.

Arrow Tool Company Changes Name

The Arrow Tool & Manufacturing Company is the new name for the Arrow Tool Company, 200 Cannon Street, Bridgeport, Conn., manufacturer of tools of all descriptions. The company has a press department equipped for light and medium-sized sheet metal stampings, with a capacity of 300,000 stampings per day. It also manufactures a newly patented sheet metal hickey to take the place of the old hickey made from cast iron. Within the next few weeks the company expects to place on the market a new expansion electric plug to be used on electrical devices, such as vacuum cleaners, flatirons, washing machines, etc. The company will continue as in the past to manufacture tools, dies and special machinery. H. S. Forsberg continues as president, there being no change in the management of the concern.

The Electric Heating Apparatus Company, Newark, N. J., announces the removal of its general offices and factory from 123-125 Sussex Avenue to 18-34 Nesbitt Street.

The American Insulated Wire & Cable Company, Twenty-first, Sangamon and Morgan Streets, Chicago, manufacturer of "American Brand" weatherproof and bare copper wire and cables, contemplates building a rod mill when building conditions are more settled.

The Branford Electric Company in removing its New York office from 9 Church Street to 39 Cortlandt Street has given up its laboratory space and now maintains only an office in New York City. It has, however, a shop on Staten Island which is used for experimental work.

The Ahlbell Battery Container Corporation, Chicago, recently incorporated with a capital stock of $20,000, has acquired an option on a plant at 315 East Thirty-third Street, where it contemplates establishing works for the manufacture of battery containers. For the present work is being sublet to another company.

New Apparatus and Publications

AIR-CONDITIONING EQUIPMENT.—The Lynn Air Conditioning Company, 103 Park Avenue, New York City, has distributed a sheet on its air-conditioning equipment for generators, etc.

ELECTRICAL PORCELAIN.—"Standard Electrical Porcelain" is the title of a new catalog recently issued by the R. Thomas & Sons Company, East Liverpool, Ohio, covering its porcelain products.

WOOD-STAVE PIPE.—The Redwood Manufacturers' Company, Hobart Building, San Francisco, has issued Catalog X, June, 1921, "A Handbook of Information for Hydraulic Engineers, Relating to Remco Redwood Pipe."

BUFFERS AND GRINDERS.—The Valley Electric Company, 3157 South Kingshighway, St. Louis, has just completed development on a complete line of portable electric buffers and grinders. A circular describing these gives net trade prices.

DIESEL ENGINES.—Bulletin 10-D describes the "Diesel System High-Economy Oil Engines" of the Lombard Governor Company, Ashland, Mass.

MARINE GENERATOR SET.—The Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa., has placed on the market a Westinghouse - Sturtevant marine lighting set.

TESTING SET.—The Thompson-Levering Company, Philadelphia, is distributing a circular covering the new T-2002 "Peerless" switch-dial decade test set which it has recently placed on the market.

WIRING DEVICES.—Pass & Seymour, Inc., Solvay Station, Syracuse, N. Y., has issued catalog No. 26, 1921, covering its electric wiring devices. The book contains 160 pages and gives illustrations, list prices, schedule classifications, etc., of its products.

DAYLIGHT UNIT.—The Benjamin Electric Manufacturing Company, Chicago, has recently developed a "Dalite" unit for industrial lighting purposes.

THREADED FIXTURES.—The Benjamin Electric Manufacturing Company, Chicago, has recently placed on the market its type RR threaded fixtures for heavy-duty service. The units are particularly adapted for use in railroad shops and yards and large industrial plants.

New Incorporations

THE JOHN JERGENSEN COMPANY, New York, N. Y., has been incorporated by John Jergensen, M. F. Sticht and H. A. Kapit. The company is capitalized at $50,000 and proposes to manufacture electrical appliances and equipment. Sapinsky & Amster, 276 Fifth Avenue, represent the company.

THE AQUA ELECTRIC HEATER COMPANY, New York, N. Y., has filed notice of organization under the laws of Connecticut with a capital stock of $200,000 to manufacture electric heaters, etc. The company is represented by H. Bobker, 250 West Fifty-fourth Street, New York City.

THE THOMAS BROWN COMPANY, Hoboken, N. J., has been incorporated by E. Lambert, Byron Abrahams and Thomas Brown, 1618 Willow Avenue. The company is capitalized at $45,000 and proposes to manufacture electrical appliances and equipment.

THE DAWN MANUFACTURING COMPANY, Bridgeport, Conn., has been incorporated by J. A. Dickerman, G. Leckie and H. V. Leckis, 93 Oakland Street, Stratford, Conn. The company is capitalized at $50,000 and proposes to manufacture electrical appliances and equipment.

THE DETROIT (MICH.) WASHING MACHINE CORPORATION has been incorporated with a capital of $500,000 to manufacture electrically operated dishwashing machines, parts, etc. The incorporators are Anthony B. Eggert, A. and Roy J. Corrigan, 58 Glendale Avenue, Detroit.

THE LAMPSON LAMP COMPANY, 705 Bloomfield Street, Hoboken, N. J., has been incorporated by Robert Moore, E. A. Barnhart, Mount Tabor, N. J., and John Leon, 271 Stratford Road, Brooklyn, N. Y. They propose to manufacture and deal in electrical supplies.

Record of Electrical Patents

Notes on United States Patents

(Issued June 7, 1921)

1,381,073. Conduit-End Protector; Frederick I. Johnson, Warren, R. I. App. filed Oct. 16, 1917. Weather cap.

1,381,077. Automatic Starting Apparatus for Metal-Vapor Rectifiers; Bela Beno Schafer, Baden, Switzerland. App. filed July 14, 1920. Large output.

1,381,081. Device for Use in Disinfecting Telephone Instruments; Robert Cooper, London, England. App. filed Nov. 16, 1920.

1,381,086. Apparatus for Protecting the Field Structure and Windings of Dynamo-Electric Machines; William F. Dawson, Lynn, Mass. App. filed June 16, 1919. Against surges, etc.

1,381,089. Radio Receiving System; Harold H. Beverage, Schenectady, N. Y. App. filed April 10, 1920. Improved arrangement of antenna.

1,381,093. Rheostat; Chester H. Teegarden, Washington, D. C. App. filed Oct. 18, 1918. Potentionmeter for use in telegraphy.

(Issued June 14, 1921)

15,125 (reissue). Elevator; David L. Linquist, Yonkers, N. Y. App. filed Oct. 30, 1920. Electrically controlled.

1,381,138. Electric Motor for Talking Machines; James T. Sibley, Newark, N. J. App. filed June 19, 1917. Low speed.

1,381,163. Motor-Control System; Addison E. Boggs, Pittsburgh, Pa. App. filed May 6, 1915. For cranes, hoists and similar machines.

1,381,189. Electric Insulator; Emil Haefely, Basel, Switzerland. App. filed Dec. 22, 1919.

1,381,194. Dilator; John G. Homan, Steubenville, Ohio. App. filed Jan. 17, 1920. Electrically heated.

1,381,195. Telephone System; Harry H. Ide, La Grange, Ill. App. filed May 15, 1919. Automatic.

1,381,243. Electric Coffee and Peanut Roaster; Mark T. Seymour, Stowe, N. Y. App. filed June 5, 1920.

1,381,277. Control System; Andrew H. Candee, Pittsburgh, Pa. App. filed Aug. 7, 1916. For electric vehicles.

1,381,282. Heating Apparatus; Warren F. Clark, Cleveland, Ohio. App. filed April 24, 1919. Water heater.

1,381,283. Electrical Regulating System; Almon W. Copley, Wilkinsburg, Pa. App. filed Jan. 14, 1918. Synchronous condenser in power house.

1,381,289. Spring-Tension Means for Brush Holders; John S. Dean, Edgewood Park, Pa. App. filed Sept. 17, 1920.

1,381,298. Electric Battery; Edwin R. Gill, Yonkers, N. Y. App. filed Nov. 26, 1919. Has filling and overflow openings.

1,381,302. Electrical System; Albert L. Harvey and George W. Huey, Wilkinsburg, Pa. App. filed March 8, 1917. Motor control.

1,381,303. Phase-Converting System; Rudolf E. Hellmund, Swissvale, Pa. App. filed July 5, 1917. Single-phase alternating-current transformed into polyphase.

1,381,324. Inverted Rectifier; Friedrich W. Meyer, Pittsburgh, Pa. App. filed June 20, 1914. For transforming direct into alternating current.

1,381,3[illegible]6. Terminal for Electrolytic Condensers; Joseph Slepian, Pittsburgh, Pa. App. filed Jan. 8, 1919. No corrosion.

1,381,367. Synchro[illegible]tor; Edward G. Thomas, Springfield, Ill. App. filed June 12, 1918. Shaft made synchronous with movements of another device.

1,381,368. Busy-Back Circuits; John F. Toomey, New York, N. Y. App. filed April 1, 1919. Telephone.

1,381,357. Process of Manufacturing Battery Plates; Kenneth Wright, Flint, Mich. App. filed July 10, 1920.

1,381,396. Pilot-Directing Instrument and Bomb-Dropping Sight for Aircraft; Arthur H. Boettcher, Chicago, Ill. App. filed Nov. 18, 1918.

1,381,431. Machine-Switching Telephone System; Lipa Polinkowsky, Hyde Park, London, England. App. filed Aug. 27, 1918. Toll service.

1,381,443. Connector for Batteries; William Woessner, St. Louis, Mo. App. filed Jan. 26, 1920. For various sizes of terminal tips.

1,381,451. Switching System; Leslie E. Coon, Chatham, N. J. App. filed June 24, 1910. Selective signaling device.

1,381,456. Automatic Telephone-Exchange System; Gerald Deakin, London, England. App. filed April 11, 1919. Full-automatic and semi-automatic.

1,381,460. Magnet Core; Jonathan W. Harris, Montclair, N. J. App. filed Dec. 31, 1919. Finely divided magnetic material.

1,381,470. Telephone Muffler; Mary E. Kelleher, Rutland, Vt. App. filed Oct. 26, 1920. Megaphone mouthpiece.

1,381,474. Photo-Electric Cell Method of and Means for Making the Same; Jakob Kunz, Urbana, Ill. App. filed Aug. 24, 1918. Alkali metal as sensitive element.

1,381,480. Telephone System; Alben E. Lundell, New York, N. Y. App. filed Feb. 17, 1917. Devices indicating class of service.

1,381,483. Telephone-Exchange System; Harry W. McDougall, East Orange, N. J. App. filed Sept. 25, 1917. Ringing current automatically applied.

1,381,500. Electric Wax Heater; Russell F. Reader, East St. Louis, Ill. App. filed Sept. 15, 1919. For sealing packages.

1,381,505. Dynamo-Electric Machine; Henry K. Sandell, Chicago, Ill. App. filed Aug. 8, 1917. Poles not symmetrically spaced.

1,381,514. Electromagnetic Step-by-Step Mechanism; Charles P. Soper, Maplewood, N. J. App. filed Sept. 29, 1919.

1,381,521. Cell Diaphragm for X-Ray Apparatus; Sinclair Tousey, Westhampton Beach, N. Y. App. filed April 23, 1919. Means for excluding diffused rays from photographic plate.

1,381,529. Overshot Fishing Tool; George Whitmer, Brea, Cal. App. filed Jan. 2, 1920. For removal of parts of well apparatus.

1,381,530. Telephone-Exchange System; Samuel B. Williams, Jr., Brooklyn, N. Y. App. filed May 16, 1919. Automatic.

1,381,545. Repeater-Controlling System for Four-Wire Telephone Circuits; Charles S. Demarest, Brooklyn, N. Y. App. filed Sept. 16, 1919.

1,381,567. Method of Manufacturing Electric Coils; Ernst W. Kuttner, Berlin, Germany. App. filed June 30, 1917. Insulating method.

1,381,579. Electric Air Heater; Raymond H. Minns, Bedford Hills, N. Y. App. filed Aug. 23, 1918. Portable type.

1,381,580. Electric Control System; Benjamin M. Mooers, San Francisco, Cal. App. filed June 9, 1917. Opens circuit on high temperatures.

1,381,581. Electric Circuit-Protecting Apparatus; Benjamin M. Mooers, San Francisco, Cal. App. filed March 1, 1918. Overload and low-voltage protection.

1,381,608. Battery Jar; Oscar Wittmann, Lincoln, Neb. App. filed April 15, 1920. Elastic rubber with cloth embedded.

1,381,626. Process of and Apparatus for Producing Radio-Frequency Current; Leonard F. Fuller, San Francisco, Cal. App filed Jan. 19, 1918. Obviates use of spark.

1,381,647. Process of and Apparatus for Electric Arc Welding; Ross C. Knoll, Milwaukee, Wis. App. filed April 17, 1920. Continuous welding.

1,381,6[illegible]. Device for Receiving Radio-Telegraphic and Radio-Telephonic Signals; Cesare [illegible], Rome, Italy. App. filed April 1[illegible], 1919. Ionized-gas receivers.

1,381,695. Porcelain-Tube Heading Machine; Thomas W. Beatty, Carey, Ohio. App. filed Dec. 20, 19[illegible]. For forming heads or shoulders.

1,381,703. Telephone System; Bertram S. Cohen, Twickenham, England. App. filed Dec. 31, 1919. Communication maintained when one lead is broken.

1,381,770. Terminal Ground Clamp; Wheeler H. Vibber, New London, Conn. App. filed Aug. 9, 1920.

Construction News

Projects, Plans, Bids and Contracts,
Contemplated or Under Way

New England States

LEWISTON, ME.—A. R. Gould and associates have plans under way for the construction of an electric railway line extending through the northern part of Maine from a point connecting with the line of the Aroostook Valley Railway, Washburn, to Frontier Lake, Quebec, a distance of about 110 miles.

Middle Atlantic States

BROOKLYN, N. Y.—Bids will be received by Edward Riegelmann, president of the Borough of Brooklyn, Room 21, Borough Hall, until July 6, for furnishing all labor and material required for equipping the exterior of Brooklyn Borough Hall tower with flood-lighting. Blanks and further information may be obtained at the Bureau of Public Buildings and Offices, Room 1103, 50 Court Street.

MOUNT VERNON, N. Y.—The Willow Brook Dairy Company, 5 South Fulton Avenue, it is reported, is receiving bids for the construction of a one- and two-story dairy plant including a power plant, stable and garage. The cost is estimated at $250,000. The McCormick Company, Century Building, Pittsburgh, Pa., is architect and engineer.

NEW YORK, N. Y.—Bids will be received by the Bureau of Yards and Docks, Navy Department, Washington, D. C., until July 6 for the provision and installation of a fire alarm and watchman's signal system for building No. 5, Navy Yard, New York City. Drawing and specification 4470 may be obtained on application to the Bureau, or the commandant, Navy Yard, New York City, upon a deposit of a check or postal money order for $10, payable to C. W. Parks, chief of bureau.

NEW YORK, N. Y.—Plans have been filed by the New York Edison Company for the construction of a one-story power house, 24 ft. x 60 ft., at 38 Bowery, to cost, including machinery, about $130,000.

ROXBURY, N. Y.—Application has been made by the Roxbury Light & Power Company to the Public Service Commission for authority to erect an electric transmission line in the vicinity of Grand Gorge station with connecting distributing system at Roxbury. Arthur F. Bouton is president.

SOLVAY, N. Y.—The New York Central Railroad Company, Grand Central Terminal, New York City, is considering the erection of a new power house in connection with other work at its locomotive repair plant in Solvay. George W. Kittredge, company address, is engineer.

READING, PA.—Bids will be received by the City Council, in care of Charles Marks, city clerk, Reading, until July 13, for furnishing three 250-hp. water-tube boilers, two 160-hp. water-tube boilers and reconstructing four existing boilers; three 250-hp. automatic chain-grate stokers, six 160-hp. automatic chain-grate stokers, one 750-hp. feed-water heater, one 800-g.p.h. water purifier with alternate proposition on one 2,400-g.p.h. unit, two 11,200-cmf. fans and engines with alternate proposition on three 5,625-cfm. units, one radial brick chimney, coal and ash-handling equipment and one 15-m.g. turbo-centrifugal pump, condenser and auxiliaries. Plans, specifications and bidding blanks may be obtained at the office of Louis T. Klauder, consulting engineer, Pennsylvania Building, Philadelphia, or at the office of the chief engineer, Bureau of Water, Reading, upon a deposit of $5.

SHIPPENSBURG, PA.—The Chambersburg & Shippensburg Electric Railway Company plans to extend its system to the line of the Western Maryland Railway Company.

UNION BRIDGE, MD.—Application has been made by the Union Bridge Electric Company to the Public Service Commission to issue $10,000 in bonds for improvements, etc.

IAEGER, W. VA.—T. P. Lamp is considering the installation of an electric lighting system in Iaeger.

UNION, W. VA.—The Union-Fort Spring Power Company, recently incorporated with a capital of $30,000, plans to erect an electric transmission line to Fort Spring, a distance of 11 miles.

FRANKLIN, VA.—Improvements to the municipal light and water system to cost about $116,000 are under consideration.

NORFOLK, VA.—The United States Shipping Board, Washington, D. C., is considering the construction of an electric power plant to be used in connection with a new fuel-oil storage plant. The plans provide for an electrically operated pumping plant.

North Central States

BATTLE CREEK, MICH.—The Board of Education is considering the construction of a vocational and manual training school, including a machine shop, forge shop, metal-working and other mechanical departments to cost about $400,000. The plans also provide for a power plant. John D. Chubb, 106 North Dearborn Street, Chicago, Ill., is architect. L. H. Sabin is president of the board.

WELLS, MICH.—The Delta Chemical Company plans to rebuild its power house recently damaged by fire with a loss of about $40,000.

CLEVELAND, OHIO.—Bids will be received at the office of the Commissioner of Purchases and Supplies, Room 219, City Hall, Cleveland, until July 8, for providing and installing power house, kitchen and miscellaneous equipment in the city hospital on Scranton Road.

CLEVELAND, OHIO.—The City Council has adopted a resolution requesting the director of public utilities to submit estimate of the cost of the installation of an ornamental lighting system on St. Clair Avenue from East Boulevard to East 125th St.

CLEVELAND, OHIO.—The City Council has passed an emergency measure, an ordinance authorizing the director of public utilities to expend a sum not to exceed $17,500 for the purpose of furnishing necessary converters, transformers and other equipment for supplying the Euclid and East 105th Properties Company with electrical energy.

DAYTON, OHIO.—The erection of a power and heating plant for the Bonebrake Theological Seminary of the United Brethern Church is under consideration. The cost is estimated at about $60,000. A. A. Maysilles, county superintendent of schools, is secretary of the board of directors.

LOUISVILLE, KY.—Arrangements have been made whereby the Kentucky Utilities Company, under a ten-year contract, will take over the power plants of the St. Bernard Coal Company, Earlington, and the W. G. Duncan Coal Company, Greenville. The utilities company proposes to erect about 150 miles of transmission line to furnish electricity to a large number of towns. The cost is estimated at about $500,00. L. B. Herrington is vice-president.

ROSEDALE, IND.—The Carbon Hill Coal Company, Terre Haute, is considering additions to its properties at Rosedale, including the construction of a new machine shop, forge works, steel tipple and power plant for general operations.

CAIRO, ILL.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until July 7 for conduit and wiring changes, lighting fixtures, etc., in the United States Post Office and custom house at Cairo, Ill.

DANVILLE, ILL.—Plans for the installation of an ornamental lighting system in the business district are under consideration. The cost is estimated at about $34,023.

ROSCOE, ILL.—The Roscoe Electric Company, it is reported, is considering extensions to its system to serve Harlem and vicinity. Stuart Ralston is general manager.

KANSAS CITY, MO.—The City Council has approved a contract with the Kansas City Power & Light Company providing for lighting the streets exclusively by electricity. The larger portion of the lamps will be erected on ornamental poles.

SNYDER, NEB.—Bonds to the amount of $18,300 have been voted for an electric transmission line and distribution system. Electrical energy will be transmitted from Scribner.

Southern States

WILLISTON, S. C.—Bonds to the amount of $30,000 have been voted for electri clight and water systems in Williston. W. E. Protho is commissioner of public works.

AMERICUS, GA.—The Americus Lighting Company plans to build an electric plant, 117 ft. x 43 ft. x 33 ft., to cost about $33,000. The plans also provide for the installation of turbines, a 400-hp. boiler, etc. The total cost is estimated at $185,000. R. P. Ewing is superintendent.

ST. PETERSBURG, FLA.—The installation of a 4,000-kw. steam turbine at the local lighting plant to increase the capacity to 7,000 kw. is under consideration. Improvements to the distribution system are also planned.

FAIRFIELD, TEX.—Steps have been taken by the Fairfield Business League to secure the installation of electric lamps in Fairfield.

Pacific and Mountain States

CENTRALIA, WASH.—The City Commission has authorized the erection of a plant and office building at Pearl and Maple Streets to cost about $75,000 for the Municipal Light Department.

EVERETT, WASH.—The City Commission has authorized Louis Lesh, city clerk, to file with the state an application for permission to flood the shore land of Lake Champlain in connection with plans for a hydro-electric plant. The plans provide for Lake Champlain as a storage reservoir for the proposed power plant and the city water supply.

PUGET SOUND, WASH.—Bids will be received by the Bureau of Yards and Docks, Navy Department, Washington, D. C., until July 6 for construction of addition to fire-alarm system at Puget Sound Navy Yard. Plans may be obtained upon a deposit of $10. Specification 4440.

FILLMORE, CAL.—The Sespe Light & Power Company has started work on the construction of a power house, 6 miles from Fillmore, which is to be the first of a series of six dams and power houses planned for the first unit of its power and irrigation project. The second unit will consist of five dams and power plants. John S. Eastwood is consulting engineer and E. W. Case is chief enginee

LOS ANGELES, CAL.—A movement has been started by property owners on Washington Street for the installation of electroliers from Main to Vermont Avenues.

WILLIAMS, CAL.—The Pacific Gas & Electric Company plans to expend approximately $30,000 for rebuilding its transmission lines and installing new poles in Williams.

IDAHO FALLS, IDAHO.—The Shelley Light & Power Company has been granted a franchise to erect and maintain electric transmission lines in Bonneville County.

DENVER, COL.—Negotiations are under way between the city and county of Denver and the Jefferson County Power & Light Company, Golden, for lighting the Williams Highway from the city limits of Golden to the summit of Lookout Mountain, covering a distance of about 5 miles. The proposed system would require 150 series lamps of 600 cp. mounted on 20-ft. posts.

Canada

CAMROSE, ALTA.—Improvements to the municipal power plant to cost about $20,000 are under consideration. New equipment will be installed.

GALT, ONT.—The Ontario Hydro-Electric Power Commission has authorized the erection of a hydro-electric line to Port Dover.

KINGSTON, ONT.—Work will be started at once, it is understood, on the construction of a heating plant to be used in connection with the Queen's University. The power house will be connected with the hospital and university by means of a large tunnel.

LONDON, ONT.—The Hydro-Electric Power Commission plans to erect an electric line from the Queenston plant to transmit 60,000 hp. to the border and vicinity.

WINDSOR, ONT.—The City Council has authorized the expenditure of $900,000 for improvements to the street-railway system in Windsor which is operated by the Hydro-Electric Power Commission of Ontario.

Directory of Electrical Associations

Printed in the First Issue of Each Month

Alabama Light and Traction Association. Secretary-treasurer, J. P. Ross, Birmingham Railway, Light & Power Co.

American Association of Engineers. Secretary, C. E. Drayer, 63 East Adams St., Chicago, Ill.

American Electric Railway Association. Secretary, E. B. Burritt, 8 West 40th St., New York City. Annual convention, Atlantic City, N. J., Oct. 3.

American Electrochemical Society. Secretary, Prof. J. W. Richards, Lehigh University of Bethlehem, Pa. Annual meeting, Lake Placid, N. Y., Sept. 29-Oct. 1.

American Engineering Standards Committee. Secretary, P. G. Agnew, 29 W. 39th St., New York City.

American Institute of Consulting Engineers, Inc. Secretary, F. A. Molitor, 35 Nassau St., New York City.

American Institute of Electrical Engineers. Secretary, F. L. Hutchinson, 33 West 39th St., New York City. Board of directors meets monthly. Sections and branches in the principal electrical centers throughout the country.

American Physical Society. Secretary, Dayton C. Miller, Case School of Applied Science, Cleveland, Ohio.

American Society for Testing Materials. Secretary-treasurer, C. L. Warwick, 1315 Spruce St., Philadelphia, Pa.

American Welding Society. Secretary, H. C. Forbes, 29 W. 39th St., New York City.

Arkansas Utilities Association. Secretary, S. E. Dillon, Hot Springs, Ark.

Associated Manufacturers of Electrical Supplies. General secretary, C. E. Dustin, 30 East 42d St., New York City.

Association of Edison Illuminating Companies. Secretary, Preston S. Millar, Electrical Testing Laboratories, New York.

Association of Iron and Steel Electrical Engineers. Secretary, John F. Kelly, Empire Building, Pittsburgh, Pa. Annual convention, Chicago, Ill., Sept. 19-24.

Association of Municipal Electrical Utilities of Ontario. Secretary, S. R. A. Clement 190 University Ave., Toronto.

Association of Railway Electrical Engineers. Secretary-treasurer, Joseph A. Andreucetti, Chicago & Northwestern Railway, Chicago, Ill.

British Columbia Association of Electrical Contractors and Dealers. Secretary-treasurer, Capt. W. J. Conway, 406 Yorkshire Building, Vancouver, B. C.

Canadian Electrical Association, affiliated with N. E. L. A. Secretary-treasurer, Eugene Vinet, Shawinigan Water & Power Co., Montreal, Canada.

Colorado Electric Light, Power and Railway Association. Secretary-treasurer, M. B. W. Baker, Denver, Col.

Conference Club. Secretary, Sullivan W. Jones, 19 West 44th St., New York City.

Commercial Section, N. E. L. A. Secretary, R. H. Tillman, Baltimore, Md.

Eastern New York Section, N. E. L. A. Secretary, J. L. Hemphill, General Electric Co., Schenectady, N. Y.

Electric Hoist Manufacturers' Association. Secretary-treasurer, E. Donald Tolles, 52 Broadway, New York City.

Electric Furnace Association. Secretary, Dr. C. G. Schluederberg, Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.

Electrical Manufacturers' Club. Secretary, F. L. Bishop, Hartford Faience Co., Hartford, Conn.

Electrical Manufacturers' Council. Executive secretary, Frederic Nicholas, 522 5th Ave., New York City.

Electrical Safety Council. Secretary, Dana Pierce, 25 City Hall Place, New York City.

Electrical Supply Jobbers' Association. General secretary, Franklin Overbaugh, 411 South Clinton St., Chicago, Ill.

Electrical Supply Jobbers' Association, Atlantic Division. Secretary, E. Donald Tolles, 52 Broadway, New York City.

Electrical Supply Jobbers' Association, Pacific Coast Division. Secretary, Albert H. Elliot, 502 Flatiron Building, San Francisco, Cal.

Electrical Trade Association of Canada. Secretary, William R. Stavely, Royal Insurance Building, Montreal, Can.

Electric Power Club. Secretary, C. H. Roth, 1410 West Adams St., Chicago, Ill.

Empire State Gas and Electrical Association. Secretary, Charles H. B. Chapin, Grand Central Terminal Building, New York City.

Florida Engineering Society. Secretary, J. R. Benton, Gainesville, Fla.

Illinois State Electric Association. Secretary-treasurer, R. V. Prather, Springfield, Ill.

Illuminating Engineering Society. General secretary, Clarence L. Law. Sections in New York, Philadelphia, Pittsburgh, Cleveland, Chicago and Boston. Annual convention, Rochester, N. Y., Sept. 26-29.

Indiana Electric Light Association. Secretary, Thomas Donohue, Lafayette, Ind.

Industrial Electric Heating Association. Secretary, Homer Kunz, Toledo Railways & Light Co., Toledo, Ohio.

Institute of Radio Engineers. Secretary, Alfred N. Goldsmith, College City of New York, New York.

International Association of Municipal Electricians. Secretary, C. R. George, Houston, Tex.

International Electrotechnical Commission (international body representing various national electrical engineering societies contributing to its support). General secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England.

Iowa Section, N. E. L. A. Secretary-treasurer, M. G. Linn, Des Moines, Iowa.

Jovian Order. Jupiter (president), Arthur J. Binz, Houston, Tex.

Kansas Public Service Association. Secretary-treasurer, W. W. Austin, Cottonwood Falls, Kan.

Michigan Section, N. E. L. A. Secretary, Herbert Silvester, Ann Arbor, Mich.

Mississippi Electric Association, affiliated with the N. E. L. A. Secretary, E. S. Myers, Vicksburg, Miss.

Missouri Association of Public Utilities. Secretary-treasurer, F. D. Beardslee, 315 N. 12th St., St. Louis, Mo.

National Association of Electrical Contractors and Dealers. Secretary, W. H. Morton, 110 West 40th St., New York City, N. Y. State associations in Alabama, Arkansas, Connecticut, Georgia, Kansas, Illinois, Indiana, Iowa, Louisiana, Maryland, Massachusetts, Michigan, Minnesota, Missouri, New Jersey, New York, Ohio, Oregon, Pennsylvania, Tennessee and Wisconsin. Annual convention, Buffalo, N. Y., July 18-23.

National Council of Lighting Fixture Manufacturers. Secretary, C. W. Hoffrichter, 8410 Lake Ave., Cleveland, Ohio.

National Association of Electrical Inspectors. Secretary-treasurer, William L. Smith, Northeastern College, Boston, Mass.

National Association of Railway and Utility Commissioners. Secretary, James B. Walker, Public Service Commission of the State of New York.

National Electric Light Association. Executive manager, M. H. Aylesworth, 29 West 39th St., New York City.

National Electrical Credit Association. Secretary, Frederic P. Vose, 1350 Marquette Building, Chicago, Ill.

National Fire Protection Association Secretary of electrical committee, Ralph Sweetland, 141 Milk St., Boston, Mass.

Nebraska Section, N. E. L. A. Secretary-treasurer, B. H. Conlee, Nebraska Gas & Electric Co., Beatrice, Neb.

New England Electrical Credit Association. Secretary, Alton F. Tupper, 15 State St., Boston, Mass.

New England Geographic Division, N. E. L. A. Secretary, Miss O. A. Bursiel, 149 Tremont St., Boston, Mass. Annual meeting, New London, Conn., Sept. 6-9.

New Mexico Electrical Association Secretary-treasurer, Charles E. Twogood, Albuquerque, N. M.

New York Electrical Credit Association. Secretary, W. J. Kreger, 47 W. 34th St., New York City.

New York Electrical Society. Secretary, George H. Guy, 29 West 39th St., New York City.

North Central Geographic Division, N. E. L. A. Secretary, H. E. Young, Minneapolis General Electric Co., Minneapolis.

Northwest Geographic Division, N. E. L. A. Secretary, L. A. Lewis, Washington Water Power Co., Spokane, Wash.

Ohio Electric Light Association. Secretary, D. L. Gaskill, Greenville, Ohio. Annual convention, Cedar Point, Ohio, July 12-15.

Ohio Society of Mechanical, Electrical and Steam Engineers. Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus.

Oklahoma Utilities Association. Secretary, H. A. Lane, 611 State National Bank Building, Oklahoma City.

Pacific Coast Geographic Division, N. E. L. A. Secretary, S. H. Taylor, Electric Railway & Manufacturers' Supply Co., San Francisco, Cal.

Pennsylvania Electric Association, State Section N. E. L. A. Secretary, H. M. Stine, 211 Locust St., Harrisburg, Pa.

Public Relations Section, N. E. L. A. Chairman, J. E. Davidson, Omaha, Neb.

Public Service Association of Virginia. Secretary, W. J. Kehl, Virginia Railway & Power Co., Richmond, Va.

Public Utilities Association of West Virginia. Secretary, W. C. Davisson, West Virginia Water & Electric Co., Charleston, W. Va.

Radio Club of America. Secretary, T. J. Styles, 1112 S. Curtis Ave., Richmond Hill, Queens Borough, N. Y.

Rocky Mountain Geographic Division, N. E. L. A. Secretary, A. C. Cornell, Denver, Col.

Society for Electrical Development, Inc. General manager, J. M. Wakeman, Guaranty Building, 522 5th Ave., New York City.

Society for the Promotion of Engineering Education. Secretary, Dean F. L. Bishop, University of Pittsburgh, Pittsburgh, Pa.

Southeastern Geographic Division N. E. L. A. Secretary-treasurer, Charles A. Collier, Georgia Railway & Power Co., Atlanta, Ga.

Southwestern Geographic Division N. E. L. A. Secretary, H. A. Lane, Oklahoma Utilities Association, Oklahoma City, Okla.

Southern California Electrical Contractors and Dealers' Association. Secretary-treasurer, J. E. Wilson, 425 Consolidated Realty Building, Los Angeles, Cal.

Southwestern Electrical and Gas Association. Secretary, H. S. Cooper, 403-4 Slaughter Building, Dallas, Tex.

Southwestern Society of Engineers. Secretary, C. E. Barglebaugh, 721 First National Bank Building, El Paso, Tex.

Technical Section, N. E. L. A. Secretary, W. C. Anderson, 29 West 39th St., New York City.

Toronto Electrical Contractors' Association. Secretary, E. F. W. Salisbury, 615 Yonge St., Toronto, Ont.

Tri-State Water and Light Association. Secretary-treasurer, W. F. Steiglitz, Columbia, S. C.

Vermont Electrical Association. Secretary-treasurer, A. B. Marsden, Rutland, Vermont.

Western Association of Electrical Inspectors. Secretary, W. S. Boyd, 175 West Jackson Blvd., Chicago, Ill.

Western Society of Engineers, Electrical Section. Secretary, E. S. Nethercut, 1735 Monadnock Block, Chicago, Ill.

Wisconsin Electrical Association. Secretary, J. P. Pulliam, 1408 First National Bank Building, Milwaukee, Wis.

Electrical World

New York, Saturday, July 9, 1921

The Confusing Variety of Electrical Men

WE ARE making progress in this world of ours. We are doing better in our industry. We are gradually, collectively developing more common sense and using it.

The other day the Electrical Supply Jobbers' Association elected a representative to sit hereafter on the executive committee of the National Electric Light Association. There are already members representing the electrical manufacturers. Some day we shall probably see a member representing contractor-dealers. The result will be that problems of the electric light and power company coming before this body can have the consideration, the advice and the support of all the other major branches of the industry. They can be treated as matters primarily concerning the electrical business in its fullness. For, after all, it is the electrical business that we are all working in and for—not power plants or factories.

There have been too many kinds of electrical men. The manufacturer, the jobber, the central-station man and the contractor-dealer have all maintained their independent contact with the public. Each has endeavored to sell himself and his own service, working from his own little corner and expressing his own class point of view. But it has not meant much to William Jones.

William Jones and all the other people look upon us as just "electrical men" in the "electrical business." They know that it is a fine business, a big business, a growing business. But they think and care about as much concerning the inner workings of our industry as the average electrical man thinks and cares about the inside politics of the hardware world. People do not want to be confused with our cross-talk. They are interested simply in what the electrical business has to sell to them and in being well served.

Anything and everything that we among ourselves can do, therefore, to standardize our product and to harmonize our purposes and policies is a big help to the electrical business. It makes it easier for the rest of the world to understand us, to believe us, to take our advice and buy our goods. And that's the vital thing. All the doings within our industry are just our family affairs.

Every man of us should be continually conscious of this personal responsibility to the family. He should read not one but every section in the ELECTRICAL WORLD and know the electrical business broadly as Jones thinks he does. And when he makes decisions, he should reason, not just as a jobber or a contractor, but for his industry as an "electrical man."

Louis Aloysius Ferguson

One of the small group of engineers who have consistently contributed to the progress of the central-station industry since its very beginning

AS A LEADER in the engineering development and administration of the largest electric light and power company in the world Louis A. Ferguson has made for himself a prominent place in the central-station industry. His entire business and professional life has been spent in the service of the Commonwealth Edison Company and its predecessors. Early in his career he perceived the wider significance and possibilities of the ecntral-station business, and he had the capacity to grow with it. A military training in the Dorchester (Mass.) High School gave him a boyish ambition to go to West Point, but he was dissuaded from this idea and took instead the course in electrical engineering at the Massachusetts Institute of Technology, from which he was graduated in 1888. While a student there young Ferguson prepared a thesis on the "Relation of Candlepower to Current, Voltage and Energy Consumed in the Incandescent Lamp." It was the first research and analysis of its kind and the thesis was abstracted and presented before the Society of Arts at Boston by Prof. Charles R. Cross, attracting a great deal of favorable comment.

Joining the staff of the Chicago Edison Company in August, 1888, as an engineer in the underground department, Mr. Ferguson has come up to his present position of vice-president in charge of contract, operating, construction and electrical departments through the engineering side of the company.

Mr. Ferguson, who is not yet fifty-four years old, having been born Aug. 19, 1867, has received many honors from his professional associates in recognition of his ability and his contribution to the art. He is one of the few men who have been president of three national electrical organizations, namely, the National Electric Light Association, the Association of Edison Illuminating Companies and the American Institute of Electrical Engineers. He is also credited with being the first to utilize three-phase generation and transmission in conjunction with converter substations to supply a direct-current network. He has also prepared numerous engineering papers for various national associations. In 1897 a paper presented by him before the Association of Edison Illuminating Companies on "Economy in Distribution of Electrical Energy" advocated the centralization of production, a theory that the industry has so generally adopted.

Mr. Ferguson has made a number of trips to Europe to study engineering development, the first of which, in 1896, resulted in recommendations to the Chicago Edison Company that it adopt the differential rate system now so largely employed. Following his belief that an engineer is something more than a technical expert, he has always been active in Chicago affairs.

Mr. Ferguson is a man of action, strong character and pleasing but aggressive personality. In the play of these qualities he has the deliberation which avoids mistakes and the tact which makes friends.

Electrical World

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Opportunities in the Copper Wire Market

THE present plight of some of the wire manufacturers arouses in our mind the suspicion that users of copper wire are not always keenly alive to their opportunities. Movements in copper are still sluggish, yet low-priced copper will soon be a thing of the past. Production is far from normal, and constant drains are being made on reserve stocks. Cotton and rubber, the other chief ingredients of insulated wire, are also low in price at present, but the world's visible supply of cotton is less than it was a year ago and exports of rubber from Brazil are only about one-third of what they were at that time. There is, of course, still a possibility of lower labor costs, but when all of the facts are taken into consideration, the trend is obvious once things begin to move. For those who can use copper wire at all we suggest a careful study of the market. While general trade in this country is at present dull, it is questionable whether such a splendid opportunity for making investments in wire will present itself again for a long time.

The Tariff on Oil Is a Tax on Industry

WE VERY much regret to note in the tariff bill laid before the House of Representatives a few days ago that it is proposed to levy a tax on crude and fuel oil. Now, on general principles of a sound national policy we believe in protecting American industries, but we do not believe that protection ought to be solely for the purpose of raising the price to the consumer. The proposed tax on oil would be a straight tax on American industry from which none would gain benefit save those who might be thereby enabled to start a corner in oil and still further burden the plants requiring it for fuel. It is not as if the United States produced, all told, enough oil to satisfy the actual requirements of its citizens. On the contrary, there is a serious shortage, and for several years past the country has been obliged to import oil, not in competition with the native oil producers, but to make up for the shortage which he cannot, or at least does not, meet. The only effect of imposing a duty upon the oil, then, will be artificially to create a shortage to enhance the profits of the producers at the expense of all industries that use oil fuel, and to the serious punishment of enterprising Americans who, realizing that the production of the country is insufficient to meet its needs, have taken stiff risks in the development of foreign fields.

Electric light and power companies and all other fuel-using industries have been hard pushed in the matter of coal supply by devious practices which the government seems impotent to check. The present proposition to punish those who attempt to escape from the clutches of the coal profiteers by the use of oil is foolish to the verge of criminality. Protecting American industry against the dumping of foreign goods is a wise and proper step, but it is difficult to find words of condemnation strong enough to fit the requirements of a proposition to levy taxes upon articles of necessity which this country supplies in amounts actually insufficient to meet the normal demands of the people. Grave injustice is done to the consumer by thus creating artificially a shortage in a necessary commodity.

Central-Station-Company Advertising Often Too Dignified—The Reason

IT HAS been said that electric light and power company advertising is, much of it, too dignified. And this is true. It is a matter that deserves a little thought and some attention, for every dollar of stockholders' money spent in advertising should have every possible opportunity to bring profitable results either in good will or in sales. The trouble is that the activity of most light and power companies is too often criticised and approved by an executive whose thoughts are more of engineering than of publicity. Unconsciously his preferences in diction will express themselves. Yet, though dignity is admirable, though pure classic English is commendable, still the purpose is often not to express a literary style, but to interest many average human beings and to make them think. And even as we pick our words in conversation to suit the man we are talking to, so must we do in advertising. We must talk the language of the many. We must be simple, lucid and above all human, for we must arouse attention and awaken interest before we can hope to influence. All this can be done without the slightest bad taste either in expression or display.

The best way to test advertising matter from this point of view is to compare it with the advertising of a variety of other successful concerns in different lines of business. Their lead may be worth following if they have proved by their prosperity that they know how.

Water-Power Development on the St. Lawrence River

THE American and Canadian commissioners on the St. Lawrence-Lakes-to-Sea. Waterway have submitted their report, on which a large staff of American and Canadian engineers have labored for more than a year and a half. Although the work of the commissioners was primarily devoted to the question of providing a deep waterway from Lake Ontario to Montreal so that oceangoing steamships might navigate from as far west as Duluth, Milwaukee and Chicago to the Atlantic Ocean, incidental to the scheme there are vast water-power projects aggregating 1,750,000 hp. It is estimated that the deep waterway can be built for approximately $250,000,000, this cost to be divided between the United States and Canada, and that the water power would pay for the entire project within a reasonable time. Whether canalization would ever bring about navigation by oceangoing vessels from the ocean to the head of the Great Lakes only time can determine. There are still sites on the St. Lawrence River readily capable of economic development. Such difficulties as are encountered have to do with ice more than anything else, and even the ice troubles on the St. Lawrence, formidable as they are, can be mastered. Arthur V. White, consulting engineer of the Commission of Conservation at Ottawa, Ontario, has estimated the low-water power of the international portion of the St. Lawrence River at about 800,000 hp., of which Canada is entitled to one-half, and the potential low-water power on the portion of the river which lies wholly within the Dominion of Canada at 1,400,000 hp. Thus Canada stands to gain more than the United States through deep-waterway development, so far as water power is concerned; and the financial condition of the Dominion is such as to make it questionable whether at this time she would be willing to join with the United States in the further canalization of the St. Lawrence. It is in the United States where the power is mostly needed, and if some means can be provided whereby the St. Lawrence may be developed by private capital and in keeping with the plans of the joint commission, navigation might be improved in spots and hydro-electric energy made available sooner. If none of the numerous sites can be developed until the project as a whole is completed, electricity from the St. Lawrence will be a long while in coming.

Formulas for Heat Losses in Armature Conductors of Alternating-Current Machines

IT IS only in recent years that attention has been called to certain peculiar extra-resistance effects in the armature windings of alternating-current machines. At the recent A. I. E. E. convention, however, Prof. W. V. Lyon contributed a valuable paper on the subject. He is able to derive short, compact and powerful formulas by resorting to complex hyperbolic angles. The complex angle bids fair to be as powerful a tool as the complex number in alternating-current engineering computations. Without the use of these complex angles Professor Lyons' results would be unreadably unwieldy and complicated.

The effective working resistance of alternating-current armatures is in some instances several times the stationary cool resistance. The greater part of the increase is usually caused by a redistribution of the current density over the cross-sections of the conductors, due to alternating magnetic fluxes across the slots. The current density tends in general to crowd to the outer surfaces of the conductors, near the tops of the slots, and to empty the lower surfaces, near the bottoms of the slots. This change of current density always means more heat loss and more effective resistance. Uniform current density over the conductor cross-sections invariably reduces, in other words, the heat loss I^2R to a minimum. This is essentially the same type of phenomenon as produces skin effect in a rod or cable carrying alternating currents or edge effect in a conducting strap. The internal oscillation of magnetic flux in the conductors sets up alternating electromotive forces which disturb the distribution of current density. The computation of the extra losses due to skin effect or edge effect in aërial conductors is complicated by the geometrical complexity of the magnetic flux paths. As a general rule the problems cannot be solved in the present state of engineering mathematics. In the case of armature conductors embedded in rectangular slots there is a simplification in one direction, that the magnetic flux paths are assumed to lie in parallel straight lines, all at right angles to the walls of the slot. On the other hand, the subdivision and transposition of the slot conductors, taken together with the nonferric end connections, make for more complexity.

Keep Your Load Factor in Focus

POWER-PLANT operation analysis demands extra care wherever more than one type of prime mover is involved in the supply of energy to the buses. In a "simple" steam plant or in a water-power station *per se* little difficulty arises in attempting to interpret the relations between outputs and costs, loads and performance. The plot thickens, however, with interconnection. Clear thinking is necessary in order not to confuse the different load factors, outputs, peaks and plant services in judging the efficiency of individual stations tied in with others. If the exact sort of load factor meant in such analyses is not kept sharply in mind and if necessary repeated in conversation and written records and communications, false ideas as to how different stations are functioning may easily creep in. Due allowance must be made for purchased energy, for local peak loads and for system peaks and interchanges if sound conclusions are to be drawn. Owing to the purchase of secondary power, for instance, the peak load at a local plant in a particular district may run high in relation to its steam generating capacity, and in judging the station performance its own output and production must be separated from the district peak and kilowatt-hour readings. Accurate work pays here as elsewhere.

Theory of Probabilities Applied to Electron Behavior

AN EXCELLENT summary of the latest results of researches in radioactivity, including Millikan's determination of *e*, the electronic charge, has been presented by Sir Ernest Rutherford in a series of lectures which he recently delivered in London. A remarkable aid in some of these investigations has been the theory of probabilities. The groupings, in time, of successive electronic impacts on a charged conductor and the groupings, in space, of electronic reflections from an atomic structure appear at first sight as heterogeneous and erratic associations until analyzed in the light of crowd behavior or the theory of probabilities. It then appears that these groupings are rationally erratic, and their apparent inconsistencies come to form valuable evidence.

The most recent evidence obtained in this way suggests that an atom of matter may well be a microcosmic sun-and-planet system in which the positive electrons, condensed at the center, form the sun and the separate negative electrons the planets. The negative-electron planets revolve in orbits of diameters that are large relative to the diameter of the positive nucleus around which they move. Foreign positive electrons coming into such a planetary system are likely to be repelled by its positive nucleus, and the path of the invading electron appears to be a plane hyperbola.

When a satellite mass invades our solar system it is able to move off in a path which may be elliptical, parabolic or hyperbolic, according to the velocity of the invader and to the geometry of the system. In the case of a positive electron invading a microcosmic atomic system the ellipse seems to be ruled out of possibility, the hyperbola becoming the standard form of trajectory, with the parabola as a limiting case.

Saving Time and Brains in the Coil-Winding Shop

THERE is probably no greater chance for waste of time and energy than in the plant where motor coils are wound and all construction details must be explained to the workmen by the foreman. Because of their nature these instructions must be written, and they should be in such form that they can be handed successively to all workmen engaged in making the coils. A system which meets these requirements and minimizes the amount of writing which must be done by the foreman is described in this issue by A. C. Roe. The article also explains how to keep information on the construction of different types of coils which must be made permanently available to the man who specifies the kind of coil and insulation that must be used. Being kept on permanent file, the cards serve as a convenient reference in writing specifications for coils which duplicate some made before. This is no small advantage, since many jobs in a winding shop are repetitions of former work.

California Gets Maximum from Hydro-Electric Developments

MUCH has been written of the advantages of interconnection of power companies and the creation of superpower zones for the best utilization of natural resources, whether these be coal mines or water powers. A valuable example of such interconnection on a large scale has been worked out in California. Here a scheme of operation was formulated during the war by which energy could be interchanged between systems to insure against the wasting of water in by-passing hydro-electric plants when plants in other systems were burning oil. Oil had been in great demand for war purposes and oil prices had risen accordingly. Interconnections were made, therefore, under the direction of a state power administrator, to handle sufficient energy to insure the maximum use of hydro-electric plants, and the scheme worked out so well that it was continued after the war. In this issue F. B. Lewis gives an excellent account of the practical working of this power administration.

In California, where hydro-electric development plays such an important part in the economic life of the community, the load characteristics are also favorable to the use of water power, since heavy loads occur in the summer as well as in the winter. In fact, the irrigation load in the summer reaches a higher peak than combined lighting and industrial loads reach in the winter. It was possible, by the creation of a central authority and a careful study of all loads, to operate the combined systems to prevent wasting water in one system when a demand for hydro-electric energy existed in a neighboring system. This centralized management of power resources has worked out splendidly in California, and Mr. Lewis shows how the base load is carried by new and highly efficient hydro-electric stations. As the load comes on during the day other hydro-electric plants are put on the system, until finally short-time peaks are carried by steam plants, the least efficient ones being added as a last resort.

Under this plan a most careful water-storage program can be worked out to insure the use of modern hydro-electric plants on the base load. Account must also be taken of the fact that in some cases only limited storage exists and these stations must be used when the water is available.

The experience in California and elsewhere shows that there should be no difficulty in the matter of settlement for energy interchanged. The existence of different voltages or even different frequencies proves no obstacle to interconnection. The maximum use of water resources is sound policy both from the point of view of the central-station company and from broad national considerations.

Wood Poles Have Been Found Suitable Even for Lines of Extra-High Voltage

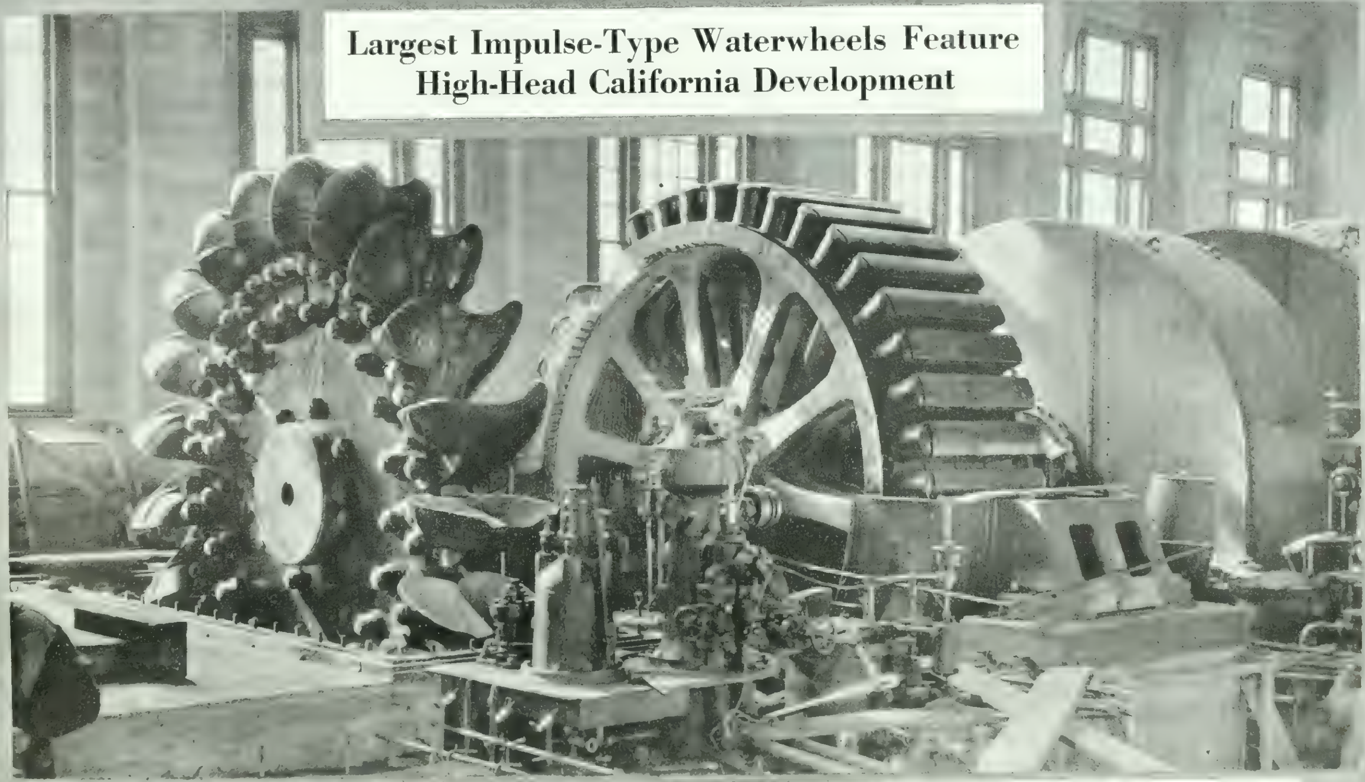
OWING to the difficulty of obtaining steel during the war, some electric service companies employed wood poles even for lines of the highest voltage. The experience gained indicates that it is still worth while under certain conditions to consider such construction for high-voltage lines. This phase of the subject, together with comparisons of costs for steel and wood lines and forms of construction which have been found desirable, is discussed in the article by J. A. Sirnit beginning on page 59 of this issue.

In line construction more than the first expense and yearly upkeep must be taken into consideration. If interruption of service over the line would involve great financial loss to the consumers or operating company, and if the line is subjected to severe climatic conditions, steel tower lines may be preferable, although wood-pole line construction has given excellent service in Montana, for example. If no serious wind, snow or sleet storms prevail in the vicinity of the line, service over wood-pole lines can be made as secure as with other construction.

The duration of the load and the prospects of its growth are dominating factors in any choice between wood and steel. If the load is known to be temporary and there is no certainty that other business may be developed along the line, then steel construction may hardly be justified. However, one should be careful to distinguish between a line extended through sparsely settled territory for a temporary load and one built through fast-growing country to serve the same load.

While serious difficulty is experienced in financing lines, initial cost may be more important than yearly operating expense. Under ordinary conditions, however, the annual charges should have first consideration in any comparison of wood and steel construction. Replacement of poles is also an important consideration, because it may be a very expensive operation. In comparing the annual charges on wood and steel, special attention should be given to the kind of soil in which the line supports are set, since in some places wood poles might without butt impregnation remain for an unusually long period, whereas in other places impregnation is almost imperative if any reasonable pole life is to be expected. In this connection, too, it must not be forgotten that the effect of galvanizing on the permanency of steel towers is not always the same. There is galvanizing and galvanizing.

Largest Impulse-Type Waterwheels Feature High-Head California Development



ANOTHER record in prime-mover design has been broken in the new impulse-type waterwheels placed in operation in the Caribou station of the Great Western Power Company, in California. Two units are now in service, each consisting of a 22,223-kva. General Electric revolving-field generator directly driven by two overhung Allis-Chalmers impulse wheels with a combined rating of 30,000 hp. Six sets will compose the ultimate installation. The plant will operate under a head of 1,008 ft. and will constitute the largest and most important station to be built in bringing about the comprehensive utilization of the Feather River. Stone & Webster, Inc., are the designers and builders.

Power Administration Effects Economy

Methods Which Have Been Adopted in California to Operate Steam and Hydro-Electric Plants for Maximum Efficiency and Economy of Resources—General Interconnection Between Various Companies Makes This Possible

By FRED B. LEWIS
Assistant Manager of Operation Southern California Edison Company

OWING to the difficulties experienced in obtaining money and materials, the development of generating facilities during the war had to be delayed by most operating companies in California. As a result an acute power shortage was experienced throughout California in 1920. To offset this companies in the northern and southern halves of the state were interconnected so that the utmost use could be made of all available equipment. This arrangement has been in force long enough for two marked benefits to be observed. One is that the character of the load curves of the companies differed to a degree that permitted considerable benefit to be experienced from the demands. The other—and very important—benefit is the possibility of making use of the energy which costs the least to produce and of substituting the greatest possible amount of hydro-electric for steam generation. In other words, the interconnected group can be operated exactly as a well-managed individual system should be—*i.e.,* for the least possible cost consistent with good service and to insure the maximum conservation of fuel.

INTERCHANGE BETWEEN SYSTEMS WITH DIFFERENT FREQUENCIES

Two methods of settling for energy interchanged between companies are employed: A company purchasing in order to meet the demands upon its system pays the selling company the actual out-of-pocket cost at the point of metering plus 15 per cent. If the interchange is made because one company can afford to sell cheaper than the other company can produce the energy, then the price is determined by splitting the saving effected.

In the southern half of the state there are seven systems interconnected, the largest and most extensive in territory being that of the Southern California Edison Company. In this group two frequencies are standard, 50 cycles and 60 cycles, necessitating frequency changers at some points of interconnection. In one instance, where a frequency changer is not at hand, exchange of 3,000 kw. is handled by operating nominally rated 50-cycle motor-generator sets on 60-cycle energy, allowing the direct-current generators to remain in parallel with those operating on the 50-cycle energy. In this way the shifting is accomplished without interruption of service.

The total territory covered by the interconnected companies is approximately 350 miles (560 km.) north and south by 150 miles (240 km.) east and west, and the maximum demand of the combined load is about 300,000 kw., which occurs in the forenoon during the month of July, on account of the heavy demand of the agricultural load. In addition, the daily load factor is greater in the summer, making the kilowatt-hour demand heaviest at that time. The winter load has an evening peak only slightly less than that of the summer, but the daily load factor is materially less.

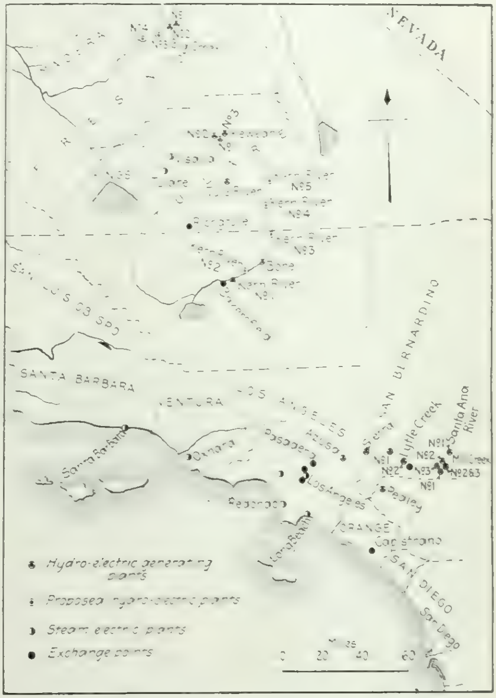


FIG. 1—SEVEN SYSTEMS INTERCONNECTED FOR POOLING ENERGY RESOURCES IN SOUTHERN CALIFORNIA

The schematic chart (Fig. 3) illustrates a typical 1920 summer-day load curve of the Southern California Edison Company, together with the sources of power that were utilized. These sources, of capacities noted, are operated in the order of their cost factor, as is shown. It will be noted that the more expensive sources of energy, whether on the Edison system or another, are used for the shortest period of time on the peaks, and that the cheaper energy is used throughout the greater possible period. Naturally the order of operation changes with a change in the price of fuel and other items that go to make up the cost factor. This factor is the increment cost over and above fixed stand-by cost determined, by including losses, at the point on the system to which the energy must be transmitted. This is equivalent to the amount that is saved when the particular source is not required.

During the year 1921 it will not be necessary to operate plants or utilize energy from interconnected companies having cost factors greater than the Redondo steam plant of the Southern California Edison Company, for the reason that considerable additional hydro-

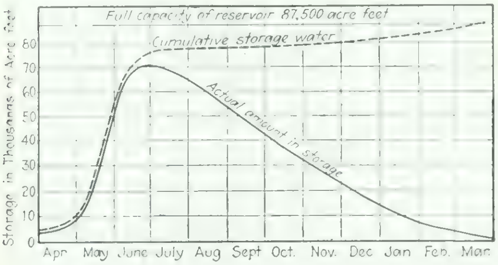


FIG. 2—WITHDRAWAL SCHEDULE FOR HUNTINGTON LAKE RESERVOIR. SOLID LINE SHOWS HOW MUCH IS AVAILABLE

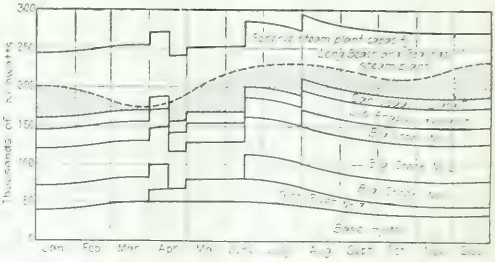


FIG. 4—PROBABLE PEAK DEMANDS (DOTTED) AND USE OF POWER RESOURCES, SOUTHERN CALIFORNIA EDISON COMPANY IN 1921

electric capacity has been developed by the companies since the interconnection. The Southern California Edison Company alone has added 48,000 kw., and by August another 22,500 kw. will be added.

USE OF STORED WATER IN ESSENTIAL PLANTS

The Huntington Lake withdrawal schedule for 1920-21 (Fig. 2) illustrates by a dotted line the accumulative, and by a solid line the actual, amount of storage water during the fiscal year from April 1 to April 1, the run-off beginning usually during April. As soon as the maximum storage is determined, which is usually possible during June, the withdrawal schedule is predetermined for the season. In doing this consideration is given to the fact that the plants operated from this storage water are absolutely essential for peak capacity throughout the year, that only a certain amount of water can be used per month on account of the load absorption, the minimum amount to which it is safe to withdraw in view of the uncertainty as to the exact time of run-off, and the desirability of maximum withdrawal during periods of increased fuel costs. It will be noted that the rate of withdrawal is greater during the summer months than during the winter months, which is due to the better load factor, this in turn permitting greater load absorption.

In actual operation base-hydro, or stream-flow, plants are operated to the utmost capacity obtainable from water available. Likewise steam plants are operated on block loads so as to obtain maximum economy, for, as is well known, fractional loads or variable loads on steam units are attended by serious losses. Therefore the regulating is done with storage-hydro plants, and the operation of steam units is "blocked out" or scheduled so as to obtain the lake withdrawal desired.

In the operation of steam-turbine units, if maximum economy and reliability are to be obtained, it is imperative that allowance be made for periodic inspection, overhauling and perhaps reblading. In order to predetermine the overhauling program for all units, knowledge of the peak demand and of available capacity throughout the year is necessary. The amount of steam capacity required for the system of the Southern California Edison Company during the present year is shown in Fig. 4. This takes into account the variation of base-hydro plant capacity due to the seasonal variation of stream flow, the influence that certain run-off conditions have upon storage-hydro capacity, and also the additional capacities due to the completion of new water-power plants. For this system it clearly shows that the best time of the year for turbine overhauling is from Jan. 1 to June 1. Likewise repairs to base-hydro units or to tunnels, flume lines, etc., in connection therewith are scheduled for the season of minimum water.

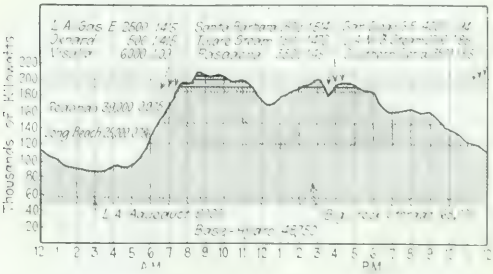


FIG. 3—OPERATION SCHEDULE, SHOWING ECONOMICAL USE OF STATIONS FOR A TYPICAL SUMMER DAY

On systems where the base-hydro capacity exceeds the load demand during certain hours of the day or during certain seasons of the year interconnection with steam-operated systems is most desirable in order that fuel can be conserved by the substitution of water power.

Hydro-Electric Progress in France

THE steady progress being made by the French Republic in the development of its hydro-electric resources, to which many references have been made in the ELECTRICAL WORLD, is referred to in a recent commercial report from the United States Vice-Consul at Lyons, who says:

"Special interest is being shown in the completion of a large hydro-electric plant of 20,000 hp. by the Société Hydro-Electric of Lyons, a branch of the Compagnie du Gas of Lyons and the Compagnie Continentale Edison of Paris, at Seyssel, Haute-Savoie. Southwest France, with its many streams and mountains, offers wonderful opportunities for development of hydro-electric power. Much progress has been made along this line in the last few years, particularly in the Department of Isere. The plant recently completed, however, is the largest one yet put in operation. A measure is now being considered by the French government for the navigation of the Rhone River above Lyons, in which provisions are considered for the utilization of the hydraulic force of this swift-flowing stream. It therefore appears to be only a question of time before the growing industries of this region will have gone a long way toward solving the perplexing fuel problem by obtaining the necessary power from hydro-electric plants. The new plant will supply about one-third of the energy required for such a city as Lyons."

Wood-Pole Structures for 110,000-Volt Transmission Lines

Factors to Be Considered in Using Wood Poles for High-Voltage Lines — Costs Vary from $3,950 to $9,600 per Mile — Details of Line Construction — Comparisons Between Wood-Pole and Steel Structures

By J. A. SIRNIT
Designing and Electrical Engineer Alabama Power Company

OWING to the necessity for rapid construction of transmission lines during the war and the scarcity and high cost of ordinary materials going into the usual steel transmission structure, the Alabama Power Company investigated the possibility of high-voltage wood-pole transmission lines very carefully. As a result of this study the first line was built for the government from Warrior to Muscle Shoals, at Sheffield, Ala., in the latter part of 1918. The results obtained from this line were quite satisfactory, but certain details of construction were improved upon in a line which was built in the latter part of 1919 as a regular part of the Alabama Power Company system. This type of line construction is being used also, and with apparently good results, by several other companies, particularly in the Northwest, where there is abundance of suitable poles and timber.

CONDITIONS WHICH JUSTIFY WOOD-POLE STRUCTURE

Before deciding to build a wood-pole tower line for voltages as high as 110,000, certain economic studies should be made comparing this with other types of construction. War conditions in 1918, were, of course, exceptional and out-weighed any other consideration at that particular time. However, in the light of experience with such lines, it can be said that certain factors may carry enough weight to justify the construction of these lines even at the present time.

The initial cost of a line as compared with other forms of construction is probably the most important consideration. However, first cost must not be considered the dominating factor in the decision. The upkeep cost which follows as the line becomes older must also be taken into account, and this may entirely outweigh the consideration of first cost. Assuming, then, that raw materials such as wood and steel are equally obtainable, the important considerations would seem to be as follows: First cost, location, type of load served, probable duration of load and probable line-maintenance cost. Geographical location of a line would have a definite bearing on the cost of a wood-pole structure as compared with steel. Considering that the life of a wood structure is not so long as that of one built of steel, the question of type of load served becomes an interesting point. That is, the load may be neither large enough to warrant nor show signs of developing to the point of warranting an expensive steel transmission line; or, as in the case of the war industries which had to be served by this line, the duration of the load may be of uncertain nature.

TABLE 1—COST PER MILE OF 110,000-VOLT WOOD-POLE TRANSMISSION LINE *

Built 1919. Single-circuit, No. 1/0 aluminum steel-reinforced (No. 2 copper equivalent) conductors.

Poles and fixtures (material)		$1,678 00
Eighteen poles at $24 50 each	$441 00	
Eleven cross-arms, at $11 each	121 00	
Hardware, 1,800 lb., at 12 cents per lb.	216 00	
Insulators, 260 units, at $2.50 per unit	650 00	
Miscellaneous	50 00	
Poles and fixtures (labor)		676 00
Digging holes for eighteen poles at $11 each	196 00	
Distributing material, 105 ton-miles, at $1.80 per ton	189.00	
Framing poles, nine towers, at $12 50 each	112 50	
Erecting poles, eighteen, at $6.40 each	116.00	
Unclassified	62 50	
Wire (material)		869 00
Conductors (No. 1/0 aluminum), 2,300 lb., at 25 cents per lb.	575 00	
Ground wire (½-in. stranded), 3,600 lb., at 8 cents per lb.	288 00	
Splicing sleeves, etc., at $6 per mile	6 00	
Wire (labor)		217 00
Distributing material, 8 ton-miles, at $1.50 per ton	12.00	
Stringing conductors, at $105 per mile	105 00	
Stringing ground wires, at $85 per mile	85.00	
Miscellaneous	15 00	
Construction superintendence, per mile		510.00
Total construction cost, per mile		$3,950 00

* To these figures must be added engineering, right-of-way, clearing and general overhead costs, also costs of special structures, such as river crossings, to get the total costs of any particular line, as these items are dependent on local conditions, and at times may amount to as much per mile as the direct costs given above.

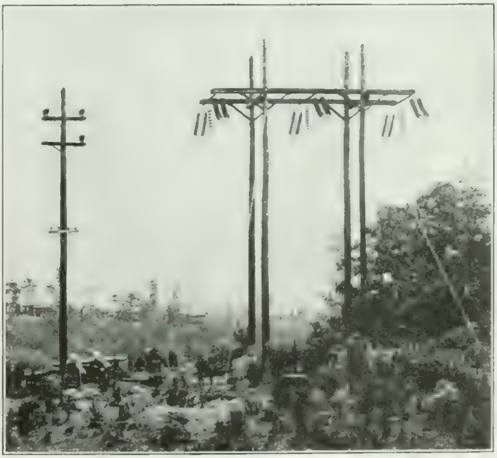


FIG. 1—FOUR-POLE, DOUBLE-ARM STRAIN TOWER FOR SPANS OVER 1,000 FT.

But even where the above-mentioned conditions would favor steel-tower line construction, the financial question should be carefully analyzed. Quite frequently it is found that it is decidedly more advantageous to build a cheaper line with wood poles at the start, even at the expense of larger maintenance and ultimate replacement costs, than to construct a steel-tower line.

The first line from the Warrior steam plant of the

Alabama Power Company to Muscle Shoals consisted of a single circuit of 250,000-circ.mil copper conductors, each supported by eight insulator units in suspension or ten units in strain. Long-leaf yellow-pine creosoted poles 50 ft. (15 m.) high were used to bring the conductors 35 ft. (10.5 m.) above the ground at the supports. Cross arms were of 6-in. x 8-in. (15-cm. x 20-cm.) creosoted long-leaf yellow pine. The direct construction cost of this line was approximately $9,600 a mile. The construction cost of a steel line of the equivalent capacity and to give the same service would probably have been $12,500 a mile.

The second line, which was 62 miles (100 km.) in length, cost $3,950 per mile, as shown in the itemized cost for a single mile of this line given in Table I. This cost is based on unit prices existing during the latter part of 1918. The general features of this line were the same as those of the line from Warrior to Muscle Shoals, the lower cost being due to smaller conductors and ground wire and also to the longer spans used on that account and the use of chestnut instead of creosoted poles. The substitution of tension rods for bow braces further helped to reduce the cost.

For the first line four main types of transmission structures were employed, namely, four-pole, double-arm strain towers, single-arm suspension-type towers, double-arm suspension-type towers and double-arm strain-type towers. In Fig. 1 is shown a four-pole, double-arm structure for spans over 1,000-ft. (300 m.) and angles under 10 deg. On longer spans with angles above 10 deg. similar construction is used but with strain insulators. The poles are 50 ft. (15 m.) in length, set 7 ft. 6 in. (2.3 m.) in ordinary ground and with a cross arm 35 ft. 4 in. (10.7 m.) above the surface. Four 6-in. x 8-in. x 29-ft. (15-cm. x 20-cm. x 8.7-m.) cross-arms are employed with bow braces made of 3-in. x ¼-in. (7.5-cm. x 6.3-cm.) angle iron. The distance between poles at right angles to the line is 14 ft. (4.2 m.), and the distance between poles parallel with the line in the structure is 10 ft. (3 m.). The cross braces at the poles are 6-in. x 8-in. long-leaf yellow pine, while the small cross braces shown in the photograph are 3-in. x $\frac{5}{16}$-in. (7.5-cm. x 7.9-mm.) angle iron. The particular tower is known as an anchor structure and is also used for strain purposes on angles above 10 deg.

A two-pole tower of the anchor type is shown in Fig.

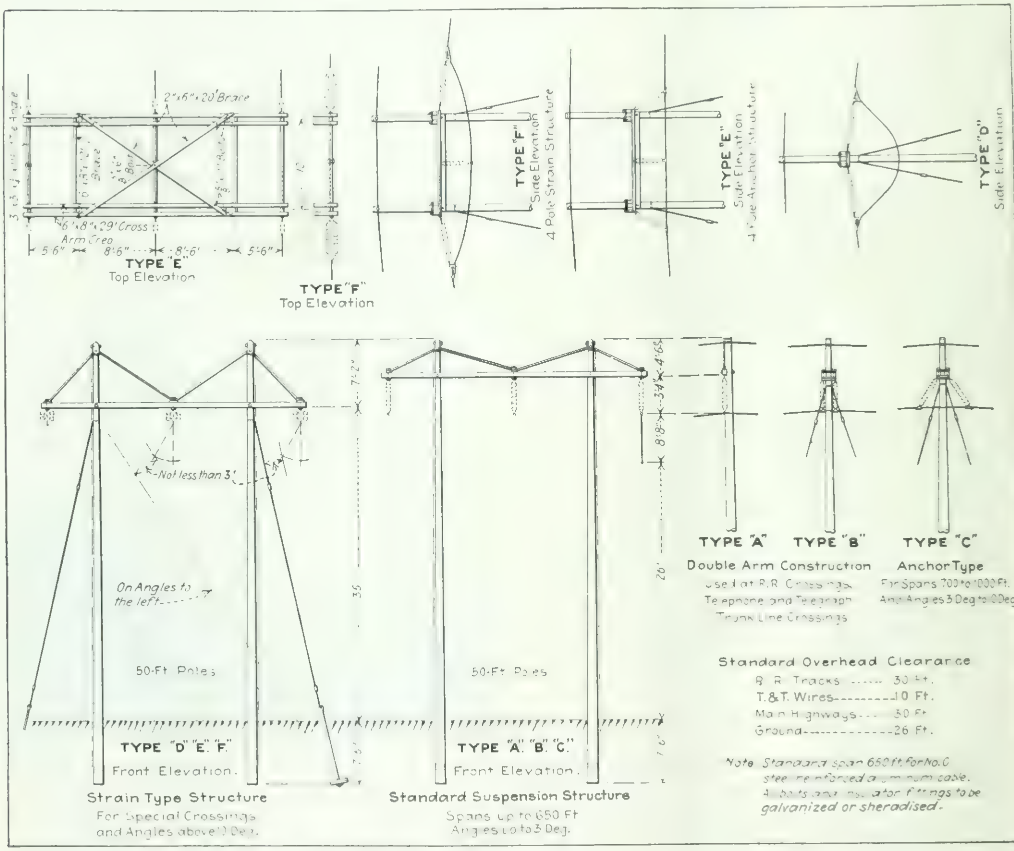


FIG. 2—UNDER CERTAIN CONDITIONS WOOD-POLE LINES OFFER A CHEAP METHOD OF HANDLING THE TRANSMISSION PROBLEM

High-voltage wood-pole structures built by the Alabama Power Company are divided into two main types—four-pole and two-pole structures. For different locations and spans there are various arrangements of the insulators, number of cross-arms, method of guying, height of and size of poles. The conditions under which each type is used are outlined in the body of the article.

3 for spans of 700 ft. to 1,000 ft. (210 m. to 300 m.) and angles of 3 deg. to 10 deg. The pole and cross-arm sizes are the same for this structure as for the four-pole tower.

A double-arm suspension structure which is used at railroad crossings, telephone and telegraph trunkline crossings is shown in Fig. 4. For ordinary straight runs with spans of 440 ft. to 700 ft. (133 m. to 210 m.) and angles up to 3 deg. this same type of tower is used with the exception that one cross-arm is used instead of two.

The standard span for this line is 400 ft. (120 m.), although the special four-pole structure is designed for spans of more than 1,000 ft., and the anchor-type, two-pole structure for spans from 700 ft. to 1,000 ft. The clearance allowed over railroad tracks is 30 ft. (9 m.), while 10 ft. (3 m.) is allowed over telephone and telegraph wires. Over main highways the clearance is 30 ft., and at other places the clearace above the ground is 25 ft. (7.5 m.).

TABLE II—BILL OF MATERIAL FOR 110,000-VOLT SINGLE-CIRCUIT WOOD-POLE TRANSMISSION LINE

Type of Construction A	B No. Required	C	D	E	F	Description	Material
2				..	..	50-ft pole, 8-in top	Chestnut
.	2	2	..	..	..	50-ft. pole, 8-in. top	Chestnut
	.		2	4	4	50-ft pole, 8-in top	Chestnut
1	2	2	2	4	4	6x8-in x 29-ft cross-arm, creo. L.L. Y.P.	Chestnut
.	.	..	.	2	2	6x8-in. x 12-ft brace	Chestnut
				2	2	2x6-in. x 20-ft brace	Chestnut
.	3	3	3	.	.	3x3x¼x23-in. tie angle	Steel-galvanized
..	..	..	..	3	3	3x3x¼-in. x 11 ft., 11-in. tie angle	Steel-galvanized
	3	3	3	6	6	3x¼x18¼-in. tie plate	Steel-galvanized
3	..	..	..	..	..	⅝x13-in. eye bolt with two washers	Steel-galvanized
2	4	4	..	..	..	⅝-in. diameter tension rod	Steel-galvanized
2	4	4	..	..	..	⅝-in. diameter tension rod	Steel-galvanized
..	..	..	4	8	8	⅝-in. diameter tension rod	Steel-galvanized
..	..	..	4	8	8	½-in. diameter tension rod	Steel-galvanized
1	2	2	2	4	4	Tension rod ear R.H	Steel-galvanized
1	2	2	2	4	4	Tension rod ear L.H	Steel-galvanized
2	.	.	..	..	.	¾x10-in mach bolt, 4-in threads, one washer	Steel-galvanized
..	8	8	8	16	16	¾x10-in. mach. bolt, 4-in. thread, no washer	Steel-galvanized
2	..	.	..	4	4	¾x18-in mach bolt, 4-in thread, two washers	Steel-galvanized
..	2	2	2	4	4	¾x24-in. mach bolt, 4-in thread two washers	Steel-galvanized
2	2	2	2	4	4	¾x11-in mach bolt, 4-in thread, one washer	Steel-galvanized
..	..	.	.	8	8	⅝x11-in. mach bolt, 4-in thread, two washers	Steel-galvanized
..	..	..	..	1	1	⅝x6-in. mach. bolt, 4-in. thread, two washers	Steel-galvanized
4	4	4	4	16	16	¾-in. standard round washer, 1-in. thick	C.-I.
2	..		.			4x4x¼-in washer, 13/16-in hole	Steel-galvanized
8	2	2	2	22	22	3x3x¼-in. washer, 11/16-in. hole	Steel-galvanized
2	10	10	14	16	16	Three-bolt clamp with ⅝-in. bolt for ⅜-in. cable	M.I. galvanized
2	4	4	4	8	8	Ground clamp American Bridge Co	Steel-galvanized
..	4	4	6	6	6	¾-in x 7 ft "Never Creep" anchor rod	Steel-galvanized
.	4	4	6	6	6	¾-in. thimble	Steel-galvanized
..	200	200	300	300	300	⅜-in. seven-strand guy wire, S. M.	Steel-galvanized
120	120	120	120	120	120	No. 6 double-galvanized solid wire	Steel-galvanized
50	50	50	50	50	50	Wire staple 1¼ in	Steel-galvanized
25	25	25	25	25	25	⅝x9-in pole steps	Steel-galvanized
21	42	48	96	69	117	Suspension insulator units, O.B. cat. No. 12464	Porcelain
3	6	6	..	9	3	Insulator hook, O.B. cat., No. 7092	M.I. galvanized
3	6	.	..	3	3	Susp. clamp, O.B. cat., No. 11551	M.I. galvanized
..	..	6	..	6	..	Strain clamp, O.B. cat., No. 11949	M.I. galvanized
..	..	..	6	..	6	Strain clamp	M.I. galvanized
..	..	..	6	..	6	Strain yoke, upper O.B. cat., No. 11-686	M.I. galvanized
..	..	.	6		6	Strain yoke, lower O.B. cat., No. 11688	M.I. galvanized
3	6	6	6	9	9	Cable shields	Aluminum

In the second line the same general construction type was followed, the most important change being that tension rods were substituted for the bow braces, as it was believed that thus less trouble would be experienced and a longer life obtained. Besides, a further saving in cost was effected by this method of bracing.

As shown in Fig. 2, two main types of structures were used, although each of these has several arrangements, making a total of seven types of structures.

The distance between the poles of each H-frame was also changed to 17 ft. (5.1 m.), since it was found on the first line that the cross arms with the 14-ft. (4.2-m.) pole spacing had a tendency to bow up in the middle of the arm and sag at the ends, especially on long spans where the load was appreciable. With the larger pole spacing the cross-arms are standing absolutely straight.

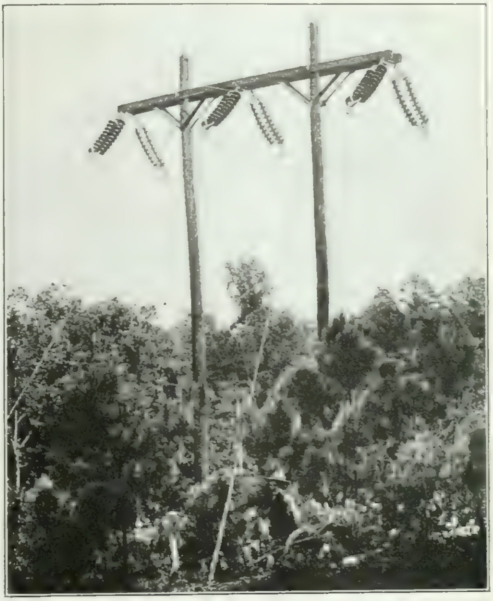


FIG. 3—TWO-POLE TOWER OF THE ANCHOR TYPE USED FOR SPANS OF 700 FT. TO 1,000 FT.

The standard span is 650 ft. (195 m.) for No. 1/0 steel reinforced-aluminum cable. Over railroad tracks

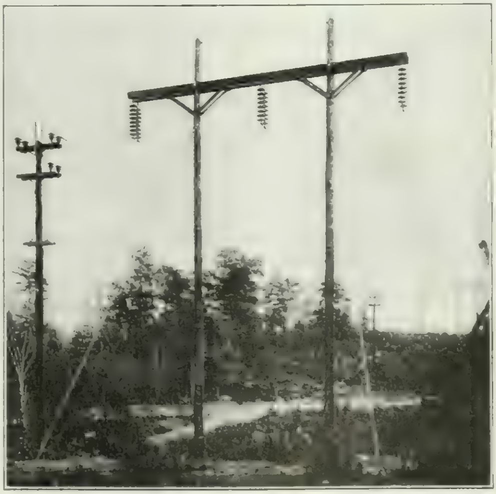


FIG. 4—DOUBLE-ARM SUSPENSION STRUCTURES USED AT RAILROAD, TELEGRAPH AND TELEPHONE CROSSINGS

For ordinary runs of from 440-ft. to 700-ft. span this same type of tower is used with only one cross arm. When the second line was built the bow braces were changed to tension rods above the cross arms.

the clearance allowed is 30 ft.; over telephone and telegraph wires it is 10 ft., over main highways 30 ft., and at other places 26 ft. from the ground. The four-pole tower known as type E and F is used for special crossings and angles above 10 deg. as well as for an anchor structure. The method of insulator arrangement can be noted in Fig. 2. The bill of material shows the items that go into the various types.

The type D tower is a two-pole structure with double cross-arms and is used for special crossings. Type E, which is a four-pole tower, is used as an anchor structure with the insulator arrangement shown in Fig. 2. It should be noted that the method of cross bracing differs slightly from that used in the first line. The end bracing of the four-pole structure consists of 3-in. x 3-in. x ¼-in. (7.5-cm. x 7.5-cm. x 6.3-mm.) angle iron, and at the poles 6-in. x 8-in. (15-cm. x 20-cm.) long-leaf yellow pine is used. Two diagonal braces made up of 2-in. x 6-in. (5-cm. x 15-cm.) creosoted long-leaf yellow pine are added to give rigidity. One of the 3-in. x 3-in. x ¼-in. angle-iron braces is also provided at the center of the structure.

Types A, B and C are used for spans up to 650 ft. (195 m.) and angles up to 3 deg. The type A is a single cross-arm double-pole structure used for ordinary straight-line suspension runs. The type B structure is very similar, with the exception that two cross-arms are used, one on each side of the poles, to give additional strength. This particular type is used at railroad crossings and telephone and telegraph trunk line crossings. The chief difference between the type B and the type C is the arrangement of insulators.

From the cost data in Table I it may be seen that the largest item in the cost of this line was for poles and fixtures, this material amounting to $1,678. The labor in connection with erecting the structure cost $676, while the labor cost of stringing the wires was $217 per mile. The cost of the wires and miscellaneous items used with the wire was $869. The direct construction cost came to $3,950.

The first line has now been in operation more than three years, and the maintenance costs have been practically nil. The same applies to the second line, which has been in operation about two years. Another line of the same type is now in course of construction which is identically the same as the second line described above, with the exception that the tension rods are made of ⅝-in. diameter instead of ½ in. (1.25 cm.) and creosoted poles are used for this line. Any further lines of this type will follow the design of this latest line.

Repair Defects Before They Mature

Trouble Must Be Anticipated by Means of Detailed Inspection at Prescribed Intervals If Costly Interruptions to Operation Are to Be Avoided—Typical Arrangement of Schedules and Forms

By W. G. SCHMAUDER
Assistant General Manager Texas Power & Light Company

ENGINEERS responsible for maintenance of mechanical equipment in a generating station have long since learned that good maintenance does not consist in repairing failures as they occur. Experience has taught them that defects must be found early in their development and repaired before they mature. Consequently they have established maintenance schedules which bring about detailed inspections at prescribed intervals. Station forces who have become accustomed to such schedules swear by them and accept them as their religion. They have faith in equipment that is properly maintained. They do not live in dread of unexpected failures.

Maintenance schedules for electrical equipment, more especially stationary apparatus, has not been adopted as generally as for mechanical equipment, but they are no less important. An insulator breakdown may cause just as serious and just as costly an interruption as a turbine failure. Systematic inspection combined with authentic detailed records is the basis of good maintenance, whether the scheme is carried out by means of a calendar tickler file and a day book or a more elaborate schedule of card files, form notices and ledgers.

A schedule cannot be prescribed to suit any and every property, but an outline of a working schedule will carry fundamental ideas that can be applied to suit individual cases. In general, inspections to fit the apparatus are tabulated and serially numbered, either on cards or in book form. Inspections in book form are very convenient for employees responsible for maintenance, in that they enable them to carry inspection records with them. The following examples of inspections give a general idea of their nature:

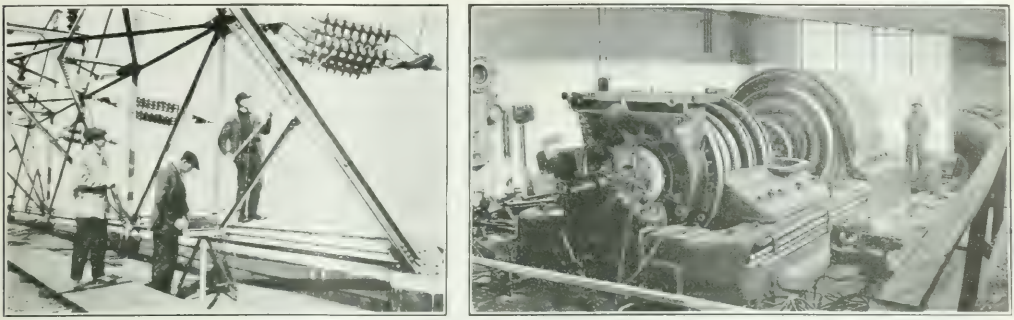
No. 17, Lightning Arresters, 104 Weeks.—Aluminum cell: Complete overhaul. (See manufacturer's instruction book).

No. 52, Low-Tension Wiring, Thirteen Weeks.—General inspection: Note particularly that all accessible live parts such as current and potential transformers, connection lugs and oil-switch terminals are insulated either by taping or fiber board. The insulation of switch terminals is of particular importance to prevent short circuits by rats, mice and other animals.

No. 67, Potential Regulators, 156 Weeks.—Completely dismantle for internal and external inspection, paying particular attention to upper and lower bearings and to clearance between rotor and stator. Change or filter oil. Paint motor windings with air-drying varnish, and note condition of bearings. (See Handbook, S-25).

The engineer who is responsible for maintenance must exercise his judgment on the theory of probabilities and fix inspection periods for every piece of apparatus. Knowing what is to be inspected and how often, the next step is to lay the scheme out on the calendar. The task is so to juggle the inspection dates as to carry on the work with a minimum crew and a minimum amount of traveling.

On the system of the Texas Power & Light Company maintenance work is in charge of division engineers, each being responsible for approximately fifty stations and 500 miles (926 km.) of line. These divisions are subdivided into patrolmen's districts, including five to ten stations and 50 miles to 100 miles (92 km. to 185



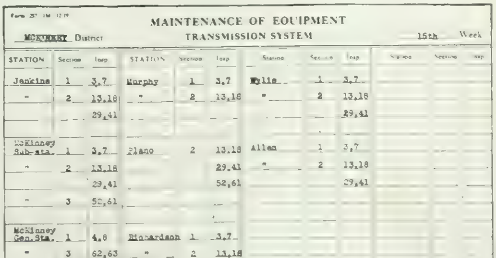
CAREFUL MAINTENANCE WORK HAS BEEN FOUND TO PROLONG THE USEFUL LIFE OF APPARATUS, BESIDES ASSURING CONTINUITY OF SERVICE

km.) of line. Cards are prepared showing inspections due in each individual district for any given week, as shown in the illustration, and these are filed in date order. A clerk in the division engineer's office on Monday of each week picks the cards for the following week and advises the patrolman or maintenance foreman by written memorandum as to inspections due at each station. When the inspections are completed, the memorandum is returned with notes as to what was found, and where work is not finished its status is indicated on the returned memorandum and such inspection then continues to show on the weekly list as "delayed" until it is cared for. The field notes are transcribed by the clerk into a ledger, classified first as to district, second as to station, third as to section, building and yards, high-tension, low-tension or transmission. With space allowed for individual pieces of apparatus, it is usually desirable to show name-plate rating, from whom purchased, date installed, etc., at the beginning of the sheet, so that the ledger will constitute a complete history.

The rugged equipment of today requires little care, but if it is to be maintained in a reasonable state of operating efficiency, the little care must be administered methodically. High-tension transformers have operated ten years without care, filtering or replenishment of oil and then, when they were dismantled for inspection, promptly failed upon being returned to service. Delayed maintenance permitted early deterioration. True, had the transformers not been disturbed they might have operated for twelve or even fifteen years, but, on the other hand, had reasonable care been accorded to them from the date of installation their useful life could have been doubled.

Experience must be applied and good judgment exercised in fixing the inspection period. A half-way point must be reached between too frequent inspections, which unnecessarily and unreasonably burden maintenance costs, and prolonged periods, on the other hand, which permit unexpected failures. Insulator deterioration illustrates this point. Ten-inch disks under tension, installed in 1913, began to fail in 1916. Preliminary tests indicated that strain units had deteriorated at the rate of 5 to 10 per cent per year, while suspension units were only going at the rate of 1 to 5 per cent. Considering the high cost of replacing units in tension, all strains were removed and replaced with new porcelain. The disks passing test were then used in replacing faulty suspension units. During the years 1916, 1917 and 1918 all insulators were tested annually, but when not a single failure developed on the new units under tension and no more rapid depreciation took place on those in suspension, the schedule was changed to read every three years for the strain units and every two years for those under suspension. Tests in 1921 have developed the fact that some of the porcelain installed in 1916 has not developed a single failure to date. The same story is true in regard to pin-type porcelain. One 22-kv. line constructed in 1916 has had but twelve insulator failures, and these insulators were shattered by flashover, whereas other 22-kv. lines built at the same time have had their insulators culled at the rate of 8 per cent a year. Obviously, the inspection period for porcelain will depend wholly upon the quality.

The only criticism of periodic inspections is with reference to costs. Are they warranted? Do they pay meager or handsome returns on the investment represented by cost of breakdown? The results tell their own story. On a recent inspection five arrester grounds out of twenty-five were found to have a resistance of 25 ohms or more. The five arresters represented an investment of $240, which protected equipment valued at $2,500. The tests on the twenty-five grounds cost $3.50. The testing of grounds, too, should be mandatory from a safety standpoint. Broken bellows, leaks in dash pots and welded contacts on relays, inoperative toggles on oil switches, broken connections on trip coils, all render useless equipment which has been installed at a big cost. Systematic maintenance can be overdone, but the common fault lies in its being underdone.



MAINTENANCE OF EQUIPMENT

McKINNEY District TRANSMISSION SYSTEM 15th Week

STATION	Section	Insp	STATION	Section	Insp	Station	Section	Insp	Station	Section	Insp
Jenkins	1	3.7	Murphy	1	3.7	Wylie	1	3.7			
"	2	13.18	"	2	13.18	"	2	13.18			
		29.41						29.41			
McKinney Sub-sta.	1	3.7	Plano	2	13.18	Allen	1	3.7			
"	2	13.18			29.41	"	2	13.18			
		29.41			52.61			29.41			
"	3	52.61									
McKinney Gen. Sta.	1	4.8	Richardson	1	3.7						
"	3	62.63	"	2	13.18						
					29.41						

INSPECTIONS BY PATROLMEN ARE DIVIDED INTO DISTRICTS AND SCHEDULED BY WEEKS

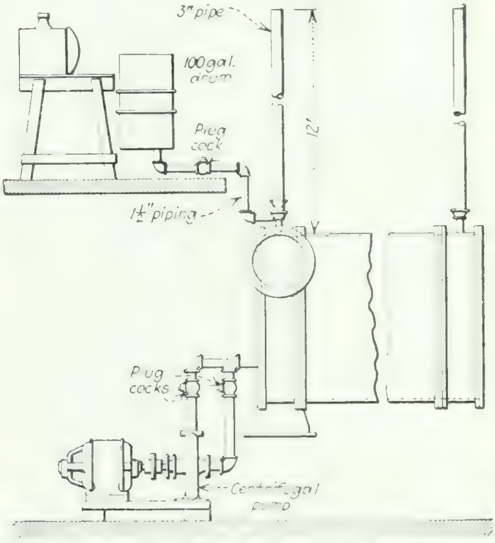
Acid Cleaning of Condensers

Cost Is About 20 per Cent that of Mechanical Cleaning of Old Water-Tube Condensers, Because Loss of Tubes Is Negligible

By Norman G. Hardy
Chief Electrical and Mechanical Engineer Arizona Copper Company, Ltd.

Hydrochloric acid has been used to clean condensers the past two years with very good success at the generating station of the Arizona Copper Company, Ltd., Clifton, Ariz. The condensers on which this outfit is used have a tube area of 7,600 sq.ft. in 2,500 ¾-in. x 15-ft. 1-in. Muntz-metal tubes and are used for condensing steam from 2,000-kw. turbo-generators. The condensers have two passes with vertical diaphragms between water inlet and outlet compartments. The arrangement of apparatus is shown in the drawing.

Before using the acid both heads are removed from the water boxes, the tubes are washed out with hose, and the scale is cleaned from the water boxes, the heads and, so far as practicable, from the tube sheets also. After drying thoroughly, the water boxes, heads and tube sheets are painted with two coats of roofing cement, which is better than acid-proof or asphaltic paints.



ARRANGEMENT FOR CLEANING CONDENSER WITH ACID

Cover plates with gaskets are fastened over the water inlet and outlet with cap screws tapped into the water box. The heads are then replaced and the apparatus connected up. A temporary platform is erected on the operating floor from which the acid is poured into the mixing tank. This tank is a 100-gal. steel drum with one head cut out and having 1½-in. pipe connecting from the bottom of the tank to the top of the water box on the condenser. Vent pipes about 12 ft. long are placed at the top of each water compartment. The water boxes are tapped for a 1½-in. pipe and have a short nipple and reducer to connect to the 3-in. vent pipe. These vent pipes are very necessary as it has been found that the generated gas will blow water out if a height less than 12 ft. is used.

To circulate the solution a 2-in. brass centrifugal pump with direct-connected motor drive is the most satisfactory. It is desirable to circulate the solution at as high a velocity as possible to prevent the gases generated from forcing the solution out of the tubes.

Commercial hydrochloric acid averaging about 24 per cent HCl is employed. The water boxes and tubes hold 7,800 lb. of water and 1,000 lb. of acid for one cleaning, making the solution about 3 per cent HCl. The condensers are filled by running the acid and the water in at rates calculated to give the proper mixture. As soon as the level in the condenser rises above the pump suction the pump is started. The pump is run for four to five hours, when the acid is entirely neutralized. The solution is usually not drained from the condenser until the following day. After removing the solution one head is removed and each tube is washed out with a stream of water. Each tube is then brushed with a round wire brush on the end of ¼-in. pipe, through which water is supplied to the brush.

The amount of scale actually dissolved is relatively small, being equivalent to a thickness of about 0.001 in. The great benefit of acid treatment is that it softens and loosens the scale so that it can be easily removed by washing and brushing. If a condenser is very dirty, it is more economical to treat it several times with a weak acid solution, washing out the loosened material between treatments, rather than to use a stronger solution less often.

Objections to the use of acid for cleaning are the high cost and the possibility of injury to the tubes and packing. The first of these is undoubtedly justified and eliminates this method in any case where the tubes are in good condition and the scale is not too hard to permit mechanical cleaning. As regards the second objection, the experience of two years indicates no serious deterioration of the tubes as a result of using acid. These condensers have been in service for seven and one-half years. For several years they were cleaned with mechanical cleaners very satisfactorily, but later, as the tubes became brittle from dezincification, the tube loss increased rapidly until two years ago it amounted to several hundred tubes at each cleaning. Since using acid for cleaning the loss has been negligible.

CLEANING CONDENSERS WITH ACID CHEAPER THAN WITH MECHANICAL CLEANERS

(Condenser tube area 7,600 sq.ft. in 2,500 ¾-in. x 15-ft. Muntz-metal tubes)

	Acid Process	Mechanical Process
Labor, cleaning, etc.	$43.71	$51.12
Hydrochloric acid (1,000 lb.)	147.00	
Brushes, paint, etc.	5.00	....
Cleaner tools, repairs, etc.	....	10 00
*Tubes, 200	....	958 00
Labor, replacing tubes		70 00
Total	$195.71	$1.089 12
Saving by acid-cleaning		893 41

* With present condition of condensers at least 200 more tubes would be lost by mechanical than by acid cleaning.

Some indications have been found of local corrosion of the cast-iron tube sheets and heads resulting from defects in the paint film, but it is thought that the damage will not be serious for several years. As yet there is no indication that the tube packing is being injured by the acid solution. Tests on samples of the tubes and iron showed little destructive action.

With labor and material costs as they were in the early part of 1921, the cost of cleaning a condenser averaged as shown in the appended table.

Order System for Coil-Winding Shop

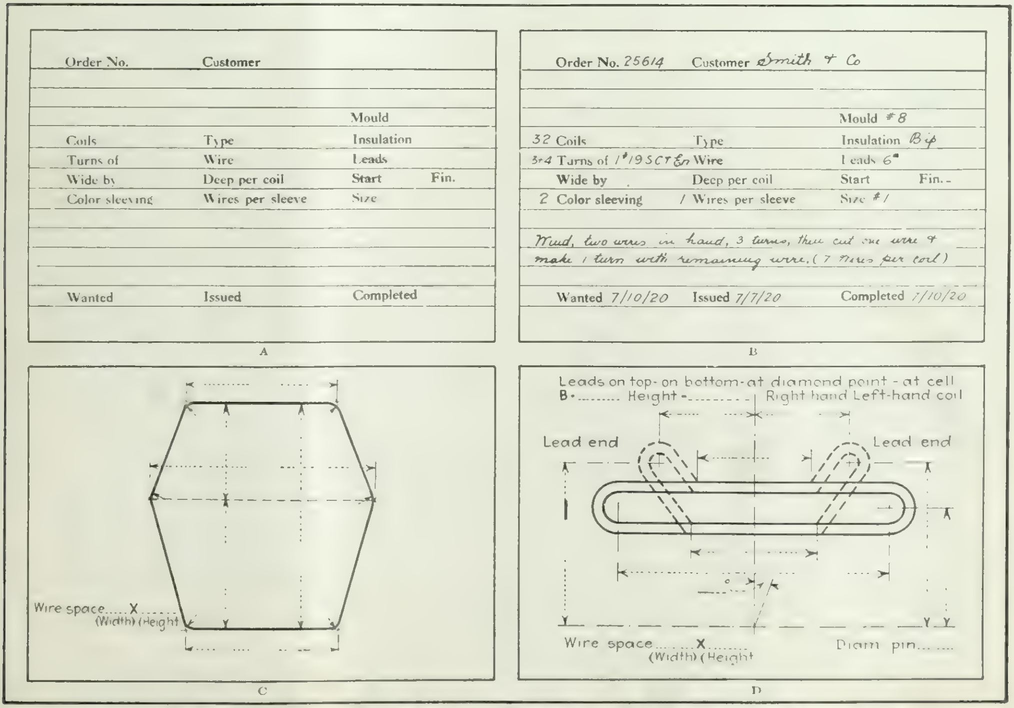
A 4-in. x 6-in. Card Holds All Information Necessary for Carpenter, Coil Winder, Puller and Taper to Wind, Shape and Insulate Set of Coils for Almost Any Machine—Saves Much Written Instruction and Repetition of Orders

By A. C. ROE
Detroit Service Department, Westinghouse Electric & Manufacturing Company

IN ANY large motor-repair shop where coils are wound many instructions must be given to the coil department telling what type of coil and insulation to use in making up a set of coils. Moreover, there is much repetition of work as the methods of making and insulating coils are often the same for motors of different manufacture, speed, size, etc. In order to set down this information in a concise form and to obviate the repetition of instructions on duplicate work a system has been developed which saves much time and trouble. All the instructions for a set of coils are placed on a small card, which is handed to the coil department. This card is passed successively to the carpenter who makes the mold or the shuttle, to the winder and to the coil puller and taper, etc. In developing the cards the coil records of a large shop for two years were studied, with the result that a few symbols and instructions were chosen to cover virtually all types of coils.

For holding the necessary information a standard 4-in. x 6-in. card (A, Fig. 1) is used. The arrangement of the card and the wording were carefully thought out to make it apply to all types of coils. The back of the card is used for coil dimensions shown diagrammatically. The top line on the face of the card is reserved for the order number and the name of the customer to whom time and material are charged. The next three lines may be used, if desired, for such data as type of motor, horsepower, voltage, serial and style numbers, etc., but as each motor repaired receives a separate order number the nameplate data are not necessary for this card. It is a simple matter to find such data in a file in which a 6-in. x 8-in. card is kept for each customer.

On the fourth line of the card *MLD* (mold) is printed to give the mold number on which the coils are to be made. This number is entered only when a mold already in stock is to be used or when it is necessary to make a mold valuable enough to warrant storing. In a later issue the system of storing molds will be described.



Order No.	Customer		
		Mould	
Coils	Type	Insulation	
Turns of	Wire	Leads	
Wide by	Deep per coil	Start	Fin.
Color sleeving	Wires per sleeve	Size	
Wanted	Issued	Completed	

A

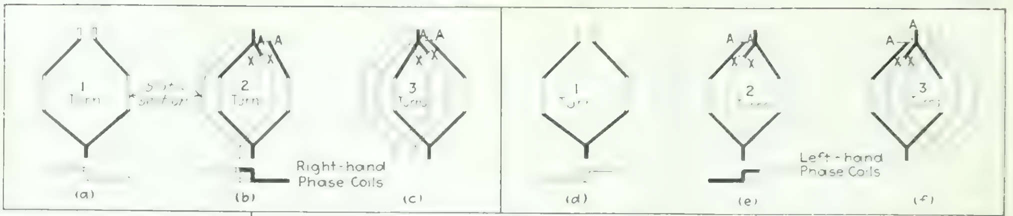
Order No. 25614	Customer Smith & Co		
		Mould #8	
32 Coils	Type	Insulation Bip	
3+4 Turns of 1#19 SCT En Wire		Leads 6"	
Wide by	Deep per coil	Start	Fin. -
2 Color sleeving	1 Wires per sleeve	Size #1	
Wind, two wires in hand, 3 turns, then cut one wire &			
make 1 turn with remaining wire. (7 turns per coil)			
Wanted 7/10/20	Issued 7/7/20	Completed 7/10/20	

B

Wire space.....X......
(Width) (Height)
C
Leads on top- on bottom- at diamond point - at cell
B•........ Height -......... Right hand Left-hand coil
Lead end
Lead end
Wire space.......X........
(Width) (Height)
Diam pin.......
D

FIG. 1—CARD FOR DATA TO DIRECT MOLD MAKER, COIL WINDER, PULLER AND INSULATOR IN MAKING COILS

Used for all types of coils. A is face of card and diagrams C or D are on reverse side. B shows form filled for a special mush coil. This shows the use of the blank lines at the bottom of the card. A mush-coil diagram is on the reverse side. C is the diagram for mush coils, while D is the diagram which is used for puller coils.

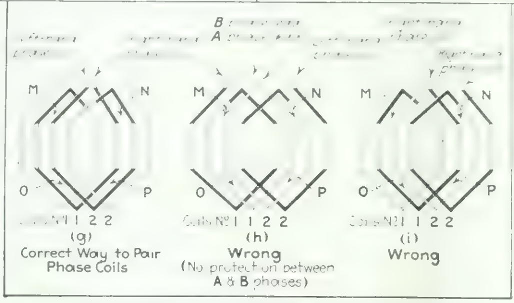


The accompanying drawings, *a, b, c, d, e* and *f*, illustrate how phase coils are insulated and paired for induction motors wound with strap-copper coils and having partly closed slots into which the coils are threaded, one conductor at a time. First, the total number of phase coils required is found by the formula: P. C. = 2 × number of poles × number of phases. For instance, a four-pole, three-phase motor would have 2 × 4 × 3 = 24 phase coils. Then the total number of phase coils are divided into two equal piles, one pile being called left-hand phase coils and the other pile being called right-hand phase coils.

The first right-hand turn for right-hand phase coils (with leads away from you) as *AA* to *XX* in drawings (*b*) and (*c*) should be taped with one-half-lapped layer of Empire tape (0.008 in. thick), this tape being applied to the section of coil that is shown dark in the drawings, i.e., the end parts of the coil (from wrapper to wrapper). Then one layer of red cotton tape is applied over the Empire tape, the red tape being wrapped also over the insulating cell on the slot section of the coil. Red tape starts at *AA* and ends at *XX*, from which point one layer of white tape is applied, the manner of lapping depending upon the insulation desired. The left-hand phase coils are taped in the same manner except that the taping starts on the left-hand turn of the coil as shown as in the drawings *d, e* and *f*.

The correct method of pairing phase coils is shown in drawing *g*. Two incorrect methods are shown in *h* and *i*. First, a left-hand phase coil and a right-hand phase coil must be paired together. The extra-insulated leads for both coils (those leads with the red tape) must be placed adjacent to each other as in Fig. *g*. When the coils are placed in this position the end portions of the coils which are adjacent, as *M, N, O* and *P* in Fig. *g*, are doubly insulated from each other.

When a right-hand and a left-hand phase coil are paired together, as shown in Fig. *h*, there is no extra protection between the adjacent end portions of the coils, as at *M, N, O* and *P* in Fig. *h*. This method of connection is accordingly incorrect. Likewise, it is wrong to connect two right-hand or two left-hand phase coils together as in Fig. *i*. In this case only half the insulation required is present between the end portions of the coils as illustrated at *M, N, O* and *P*, in Fig. *i*.


B phase end
A phase end
M
N
O
P
Coils No 1 1 2 2
(g)
Correct Way to Pair Phase Coils
(h)
Wrong
(No protection between A & B phases)
(i)
Wrong

HOW PHASE COILS ARE INSULATED AND PAIRED

TABLE I—SYMBOLS FOR DIFFERENT TYPES OF COILS WITH OPERATIONS AND TIME REQUIRED

Symbol	Manufacturing Information	Operations Involved	Days*
M	(Mush). Coils wound hit-and-miss, i.e., not wound in layers	Make mold, wind	1-2
M-P	(Mush pullers). Coils mush-wound on shuttle and pulled to final shape. Starting and finishing leads sleeved while winding and tied in place when pulling with two turns of light flax cord. knot tied on top, four cord bands per coil two at each end one inch either side of the diamond point	Make shuttle and puller blocks, wind pull	1-3
C-M	Same as M, except C-M coils require more than one mold		1-4
T-P	(Threaded puller). Wire-wound coils, for partially closed slots, the coils being wound in layers on a shuttle and pulled to final shape. Starting lead only is taped with 0.004-in. x ¾-in. cotton tape, while winding. When pulling, the lead end of coil is taped around the diamond point and one inch either side with 0.007x¾-in. cotton tape, half over-lapped. The coil leads are not caught under this tape, but are tied down with cord bands consisting of $\frac{1}{16}$-in. diameter cord, twelve turns per band, four bands per coil, two at each end. Coils are dipped in thin plastic varnish before pulling.	Make shuttles and blocks, wind, pull, dip, bake	1-5
Mld-A	(Mold A). Coils wound to final shape on a mold for 110-volt to 220-volt open-slot A.C. and D.C. machines. All leads sleeved while winding, and a thin paper cell glued in place on slot section of coil to hold it rigid. The required number of single coils are then assembled (with glue between) to make a whole coil, then hot-pressed, a one-and-a-half turn treated cloth wrapper is applied on slot section, and the coil is then taped all round with 0.007x¾-in. cotton tape half lapped on ends and spaced on wrapper. Phase coils same as for P-C-A.	Make mold, wind, assemble press, dip in plastic varnish, wrap, dip in varnish, tin leads	3-6
Mld-B	(Mold B). Same as Mld-A, except for 440 volts and 550 volts. Insulate as per P-C-B	See Mld-A	3-6
Mld-H	(Mold H). Same as Mld-A, except for 1,000 volts and 2,300 volts. Insulate as per P-C-H	See Mld-A	3-9
Bip	(Bipolar). Coils wound flat mush, for open-slot machines. Leads sleeved while winding, coils taped with 0.004-in. x ¾-in. cotton tape, half-lapped all round (semi-tight), coils not dipped.	Mold, wind, tape	1-3
Bip-B	(Bipolar B). Same as Bip, except that coils are taped on ends only, i.e., from slot section to slot section.	See Bip	1-3
C-W	Diamond-point pulled coils, which are wound in layers on a shuttle, sleeved while winding, pulled to shape, then taped all round with 0.007-in. x ¾-in. cotton tape, half-lapped (holding wires square and even while taping). Dip once after taping in plastic varnish.	Make shuttle and blocks, wind, pull, tape, dip	2-5
P-C-A	(Puller coil A). Wire-wound and insulated coils for open slots, 110 to 220 volts, A.C. and D.C. Coils are wound in layers on a shuttle, starting and finishing leads sleeved, slot section of coil held rigid by shellacked strips or paper cells; pulled to shape, leads tied, dipped in plastic varnish. While taping a one-and-a-half turn treated-cloth wrapper is applied on slot sections and whole coil is taped with 0.007-in. x ¾-in. cotton tape, half overlapped on ends and spaced on the wrapper. For A.C. machines the phase coils are reinforced with one layer of 0.008-in. x ¾-in. black treated-cloth tape, half overlapped on each end, sealing the ends of wrapper and extending from wrapper to wrapper. The phase coils are painted red at the lead end, or longer leads used to distinguish these coils	Make shuttle and blocks, place strips on coils, pull, tape, paint, varnish, tape, dip in clear varnish, tin leads	[illegible]
P-C-B	(Puller coil B). Same as P-C-A, except that it applies to 440-550-volt A.C. and D.C. machines and that a one-and-a-half turn mica and fishpaper wrapper is used, instead of treated cloth	See P-C-A	3-5
P-C-H	(Puller coil H). Same as P-C-B, except that it applies to 1,000 to 2,300-volt A. C. machines. A two-and-a-half-turn mica and fishpaper wrapper is used for 1,000 volts to 1,100 volts, and for 1,100 volts to 2,300 volts a three-and-a-half-turn mica and fishpaper wrapper is used, and all coils (1,000-2,300) are reinforced on ends with one layer of 0.008-in. x ¾-in. black treated-cloth tape half-lapped, the phase coils having two layers of treated-cloth tape with varnish brushed on between layers and all coils dipped three times in a clear varnish. After taping coils are sandpapered between dips to give a smooth and glossy finish.	See P-C-A	3-4
Ren-A	(Reinsulate A). Reinsulating strap-copper coils for A.C. and D.C. 110-volt to 220-volt open-slot machines, having one to five straps per coil. Tape odd-numbered straps, on ends only (part outside of slot section), with one layer of 0.007-in. x ¾-in. cotton tape half lapped, extend this tape ¼ in. onto slot section of coil and dip coils in plastic varnish. Then use a one-and-a-half-turn mica and fishpaper wrapper, interwoven between straps, on slot section; tape with 0.007-in. x ¾-in. cotton tape, half-lapped on ends and spaced on wrapper. When phase coils same as P-C-A are required dip coils in clear varnish; otherwise dip coils in plastic varnish.	Clean, tin leads, reform, assemble, dip, wrap, dip, tin or clean leads	1-14
Ren-B	(Reinsulate B). Strap-copper coils for 440-volt and 550-volt open-slot machines, same as Ren-A, except tape all straps on ends and use a two-and-a-half-turn mica wrapper.	See Ren-A	1-14
Ren-C	(Reinsulate C). Strap-copper coils for threaded-in (partly-closed-slot) machines. Each strap should have a one-and-a-half-turn mica and fishpaper wrapper on the slot section, i.e., a two-turn coil would have four wrappers and a three-turn coil six. The coil is taped with one layer of 0.004-in. x ¾-in. cotton tape, half-lapped on ends and spaced on cell part. Phase coils should be half rights and half lefts, see Figs. a, b, c, d, e, f, g, h, i (above), which show how the phase coils are insulated and assembled		1-14

*Days required to make one set of coils, minimum and maximum time.

TABLE II—LINEAR SPACE OCCUPIED BY DOUBLE-COTTON-COVERED WIRES LAID SIDE BY SIDE (INCHES)

No. of Wires	Wire Size, B. & S. Gage Number 5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	13/64	3/16	5/32	[illegible]	[illegible]	[illegible]	[illegible]	5/64	[illegible]	[illegible]	[illegible]	3/64	3/64	3/64	3/64	1/32
2	13/32	23/64	21/64	19/64	[illegible]	[illegible]	13/64	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	5/64
3	19/32	17/32	31/64	[illegible]	[illegible]	11/32	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4	25/32	45/64	21/32	19/32	[illegible]	[illegible]	13/32	23/64	21/64	[illegible]	[illegible]	[illegible]	[illegible]	3/16	11/64	[illegible]
5	1	29/32	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
6		1 [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7		1 [illegible]	1 [illegible]	1 1/32	[illegible]	25/32	23/32	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
8	.	1 13/32	1 17/64	1 [illegible]	1	29/32	13/16	23/32	41/64	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
9				1 11/32	1 1/8	1 1/64	29/32	13/16	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	23/64
10				1 [illegible]	1 [illegible]	..	1 1/32	57/64	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	13/32
11					1 [illegible]	..	.	1	29/32	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	29/64	29/64
12			..		1 [illegible]	..			1	[illegible]	[illegible]	23/32	43/64	[illegible]	35/64	[illegible]

On line 5 of the card are entered the number of coils, type and insulation required. In entering the last item certain symbols are used to designate certain types of coils. These symbols with their meanings are given in Table I, which also shows the operations and the time necessary for making a set of coils. This table should be readily accessible to the man who makes out the orders, and a copy should be posted in the coil-winding shop so that all who handle the order may know how the coil is to be made and insulated.

The turns per coil, size and kind of wire and length of leads are shown on line 6. The seventh line is used for the arrangement of the wires in the coil, *i.e.*, number of wires wide by number of wires deep. This line is not filled out for mush coils. At the end of the seventh line are the expressions "Start" and "Fin," signifying "start" and "finish," which are used only when one lead must be longer than the other. The words start and finish are used in preference to top and bottom as the average coil winder would not know the top lead from the bottom but would understand what lengths of wire to leave outside the mold when starting and finishing the coil. It is the duty of the person making out the order to apply these terms to the proper leads.

Line 8 is used to denote the number of colors of sleeving to use. For instance, an armature with forty-nine slots and ninty-eight bars would require two colors, while three colors would be required for 147 bars. The size of sleeving (diameter) to use should also be specified as well as the number of wires per sleeve. A sample sleeving card is quite helpful for determining the correct size. A snug fit should be chosen. If this choice is left to the coil winders they may select a sleeve that is too large because it will slide on the wire easily. Too large a sleeve will make a baggy appearance after dipping in paint.

Any other information that is absolutely necessary can be added on the following lines. On line 13 are entered the date on which the coils are wanted, the date the order was issued and the date on which the job was completed. An example of a card which has been filled out is shown at B, Fig. 1. The use of the extra lines at the foot of the card is illustrated. These

TABLE III—DIMENSIONS AND CROSS-SECTIONAL AREA OF BARE AND DOUBLE-COTTON-COVERED RIBBON WIRE

Size, Inches: Bare: Thickness	Bare: Width	Insulated: Thickness	Insulated: Width	Area of Copper: Circ. Mils	Area of Copper: Square Inches
0.0126	0.1875	0.0295	0.2015	2,964	0.002328
0.0126	0.2500	0.0295	0.2645	3,967	0.003116
0.0159	0.1875	0.0330	0.2015	3,727	0.002927
0.0159	0.2500	0.0330	0.2645	4,992	0.003921
0.0201	0.2500	0.0370	0.2645	6,288	0.004939
0.0254	0.2500	0.0425	0.2645	7,909	0.006212
0.0285	0.1200	0.0455	0.1332	4,133	0.003246
0.0285	0.1500	0.0455	0.1635	5,222	0.004101
0.0285	0.2070	0.0455	0.2210	7,291	0.005726
0.0320	0.1000	0.0490	0.1130	3,794	0.002980
0.0320	0.1320	0.0490	0.1453	5,098	0.004004
0.0320	0.1800	0.0490	0.1938	7,084	0.005540
0.0320	0.2500	0.0490	0.2645	9,906	0.007780
0.0320	0.3750	0.0490	0.3900	14,999	0.011780
0.0370	0.0920	0.0540	0.1050	3,960	0.003110
0.0390	0.1230	0.0560	0.1363	5,693	0.004471
0.0390	0.1700	0.0560	0.1838	8,027	0.006304
0.0390	0.2630	0.0560	0.2778	12,645	0.009931
0.0403	0.1600	0.0573	0.1735	7,765	0.006099
0.0403	0.2050	0.0573	0.2190	10,075	0.007913
0.0403	0.2500	0.0573	0.2645	12,383	0.009726
0.0403	0.3150	0.0573	0.3300	15,719	0.012346
0.0403	0.3750	0.0573	0.3900	18,798	0.014764
0.0420	0.1350	0.0590	0.1473	6,683	0.005249
0.0430	0.1100	0.0600	0.1230	5,517	0.004333
0.0453	0.0880	0.0623	0.1010	4,515	0.003546
0.0453	0.1450	0.0623	0.1585	7,804	0.006129
0.0470	0.1700	0.0640	0.1838	9,570	0.007516
0.0474	0.1500	0.0645	0.1635	8,439	0.006628
0.0474	0.2700	0.0645	0.2848	15,682	0.012316
0.0474	0.3150	0.0645	0.3300	18,397	0.014449
0.0490	0.0950	0.0660	0.1080	5,271	0.004140
0.0490	0.1340	0.0660	0.1473	7,704	0.006051
0.0490	0.1810	0.0660	0.1948	10,637	0.008354
0.0490	0.3740	0.0660	0.3890	22,678	0.017811
0.0490	0.4370	0.0660	0.4520	26,608	0.020898
0.0508	0.0700	0.0678	0.0868	3,822	0.003002
0.0508	0.1170	0.0678	0.1303	6,863	0.005390
0.0508	0.1610	0.0678	0.1745	9,708	0.007625
0.0508	0.2500	0.0678	0.2645	15,464	0.012146
0.0520	0.2050	0.0690	0.2190	12,834	0.010080
0.0540	0.0780	0.0710	0.0950	4,566	0.003586
0.0550	0.0950	0.0720	0.1080	5,826	0.004576
0.0570	0.1340	0.0740	0.1473	8,836	0.006941
0.0590	0.1500	0.0760	0.1635	10,317	0.008103
0.0590	0.2050	0.0760	0.2190	14,449	0.011348
0.0590	0.3150	0.0760	0.3300	22,712	0.017838
0.0600	0.1170	0.0770	0.1303	7,954	0.006247
0.0600	0.1300	0.0770	0.1433	8,948	0.007028
0.0620	0.0880	0.0790	0.1050	5,896	0.004631
0.0641	0.0950	0.0810	0.1120	6,686	0.005252
0.0641	0.2500	0.0810	0.2645	19,337	0.015187
0.0641	0.3120	0.0810	0.3270	24,397	0.019161
0.0660	0.1540	0.0830	0.1675	11,874	0.009326
0.0670	0.1120	0.0840	0.1250	8,487	0.006666
0.0670	0.1250	0.0840	0.1383	9,596	0.007537
0.0680	0.0910	0.0850	0.1080	6,812	0.005350
0.0680	0.1800	0.0850	0.1938	14,518	0.011402
0.0680	0.4000	0.0850	0.4150	33,565	0.026362
0.0700	0.2500	0.0870	0.2645	21,215	0.016662
0.0700	0.2650	0.0870	0.2798	22,552	0.017712
0.0720	0.1300	0.0890	0.1433	10,851	0.008522
0.0720	0.1500	0.0890	0.1635	12,684	0.009962
0.0720	0.2100	0.0890	0.2240	18,184	0.014282
0.0720	0.3150	0.0890	0.3300	27,810	0.021842
0.0740	0.2050	0.0910	0.2190	18,248	0.014332
0.0760	0.1340	0.0930	0.1473	11,900	0.009346
0.0780	0.1550	0.0950	0.1685	14,326	0.011252
0.0790	0.1250	0.0960	0.1383	11,506	0.009037
0.0808	0.1080	0.0978	0.1250	10,043	0.007888
0.0808	0.1150	0.0978	0.1323	10,764	0.008454
0.0808	0.1500	0.0978	0.1635	14,365	0.011282
0.0808	0.1750	0.0978	0.1888	16,937	0.013302
0.0808	0.2000	0.0978	0.2140	19,509	0.015322
0.0808	0.2500	0.0978	0.2645	24,653	0.019362
0.0808	0.5000	0.0978	0.5150	50,372	0.039562
0.0830	0.1450	0.1000	0.1585	14,256	0.011197
0.0830	0.1810	0.1000	0.1948	18,061	0.014185
0.0840	0.1180	0.1010	0.1353	11,553	0.009074
0.0840	0.3000	0.1010	0.3150	31,019	0.024362
0.0840	0.3600	0.1010	0.3750	37,436	0.029402
0.0850	0.1520	0.1020	0.1655	15,383	0.012082
0.0850	0.1950	0.1020	0.2090	20,037	0.015737
0.0880	0.4370	0.1050	0.4533	47,897	0.037618
0.0920	0.1540	0.1090	0.1675	16,972	0.013330
0.0940	0.3150	0.1110	0.3300	36,634	0.028772
0.0960	0.2050	0.1130	0.2190	23,990	0.018842
0.0960	0.4500	0.1130	0.4650	53,937	0.042362
0.0980	0.1300	0.1150	0.1473	15,154	0.011902
0.1000	0.3150	0.1170	0.3300	39,040	0.030662
0.1020	0.1320	0.1190	0.1493	16,076	0.012626
0.1020	0.1750	0.1190	0.1888	21,660	0.017012
0.1020	0.2050	0.1190	0.2190	25,556	0.020072
0.1020	0.2700	0.1190	0.2840	33,998	0.026702
0.1060	0.2420	0.1230	0.2560	31,594	0.024814
0.1060	0.2860	0.1230	0.3000	37,533	0.029478
0.1080	0.1150	0.1250	0.1320	14,747	0.011582
0.1100	0.1880	0.1270	0.2020	25,264	0.019842
0.1140	0.1440	0.1313	0.1610	19,835	0.015578
0.1140	0.4120	0.1313	0.4270	58,735	0.046130
0.1160	0.3350	0.1333	0.3500	48,411	0.038022
0.1160	0.3500	0.1333	0.3650	50,627	0.039762
0.1200	0.2200	0.1334	0.2340	32,546	0.025562
0.1230	0.4650	0.1403	0.4800	71,756	0.056357
0.1290	0.1750	0.1493	0.1950	27,676	0.021737
0.1290	0.2100	0.1493	0.2270	33,425	0.026252
0.1290	0.2500	0.1493	0.2670	39,995	0.031412
0.1290	0.3200	0.1493	0.3380	51,492	0.040442
0.1290	0.4120	0.1493	0.4300	66,603	0.052310
0.1440	0.3000	0.1645	0.3180	53,937	0.042362
0.1460	0.1860	0.1665	0.2060	33,509	0.026318
0.1560	0.3120	0.1768	0.3300	61,103	0.047990
0.1620	0.2500	0.1845	0.2690	50,499	0.039662
0.1820	0.2900	0.2068	0.3120	64,800	0.050894
0.2040	0.2700	0.2290	0.2950	67,728	0.053194
0.2040	0.3200	0.2290	0.3420	80,715	0.063394
0.2150	0.2350	0.2403	0.2600	61,929	0.048639
0.2290	0.3000	0.2543	0.3260	85,070	0.066814
0.2580	0.3650	0.2835	0.3910	115,631	0.090817
0.2700	0.2830	0.2958	0.3080	93,018	0.073057
0.2890	0.3100	0.3150	0.3360	109,800	0.086237
0.3000	0.4000	0.3260	0.4260	148,519	0.116647
0.3000	0.5000	0.3260	0.5220	186,716	0.146647
0.3250	0.3500	0.3513	0.3760	140,561	0.110397

TABLE IV—CROSS-SECTIONAL AREA OF BARE COPPER STRAPS AND BARS*

Size, Inches Thickness	Size, Inches Width	Area in Square Inches
0.0100	3/4	0.007479
0.0126	0.300	0.003746
0.0126	0.350	0.004376
0.0126	1/2	0.006266
0.0126	5/8	0.007841
0.0159	0.300	0.004716
0.0159	3/8	0.005908
0.0190	0.300	0.005693
0.0201	1/2	0.009963
0.0201	3/4	0.014988
0.0201	1	0.020013
0.0201	1 1/4	0.025038
0.0226	0.300	0.006670
0.0226	0.350	0.007800
0.0254	1/4	0.006212
0.0254	0.350	0.008752
0.0254	0.400	0.001002
0.0254	1/2	0.012561
0.0254	1	0.025261
0.0254	1 1/2	0.037962
0.0285	3/4	0.021201
1/32	3/8	0.011509
1/32	1/2	0.015415
1/32	9/16	0.017368
1/32	5/8	0.019321
1/32	3/4	0.023227
1/32	7/8	0.027134
1/32	1	0.031040
1/32	1 1/4	0.038852
1/32	1 1/2	0.046665
1/32	2	0.062290
1/32	3 1/8	0.097446
0.0320	1/4	0.007780
0.0320	0.350	0.010980
0.0330	0.180	0.005706
0.0359	3/8	0.013186
0.0159	0.400	0.014083
0.0159	5/8	0.022161
0.0159	1 1/4	0.044598
0.0159	1 1/2	0.053573
0.0365	0.300	0.010664
0.0365	0.562	0.020227
0.0365	1 1/8	0.040777
0.0365	1 9/32	0.046479
0.0380	0.350	0.012990
0.0403	0.150	0.005696
0.0403	1/4	0.009726
0.0403	0.400	0.015771
0.0403	5/8	0.024839
0.0403	1 1/2	0.060101
0.0415	1 1/8	0.046318
0.0420	0.300	0.012221
0.0420	3/4	0.031121
0.0430	3/8	0.015728
0.0430	1 9/32	0.054696
3/64	3/8	0.017106
3/64	7/16	0.020036
3/64	1/2	0.022965
3/64	9/16	0.025896
3/64	5/8	0.028825
3/64	3/4	0.034684
3/64	7/8	0.040544
3/64	1	0.046403
3/64	1 1/8	0.052263
3/64	1 1/4	0.058122
3/64	1 1/2	0.069840
3/64	1 3/4	0.081559
3/64	2	0.093278
0.0490	0.181	0.008354
0.0508	1/4	0.012146
0.0508	3/8	0.018496
0.0508	1/2	0.024846
0.0508	3/4	0.037546
0.0508	1	0.050246
0.0508	1 1/2	0.075646
0.0508	1 7/8	0.094696
0.0508	2 1/2	0.126446
0.0520	0.300	0.015019
0.0550	0.400	0.021351
0.0550	3/4	0.040601
0.0550	1 1/16	0.057788
0.0580	0.400	0.022478
0.0580	0.860	0.049158
0.0587	1	0.057961
1/16	3/8	0.022599
1/16	0.400	0.024162
1/16	7/16	0.026505
1/16	1/2	0.030411
1/16	5/8	0.038224
1/16	3/4	0.046036
1/16	7/8	0.058498
1/16	15/16	0.057755
1/16	1	0.061661
1/16	1 1/8	0.069474
1/16	1 1/4	0.077286
1/16	1 3/8	0.085099
1/16	1 1/2	0.092911
1/16	1 3/4	0.108536
1/16	2	0.124161
1/16	2 1/8	0.131975
1/16	2 1/4	0.139787
1/16	2 1/2	0.155411
1/16	3	0.186662
1/16	3/16	0.010880
1/16	1/4	0.014787
0.070	7/8	0.060198
0.072	0.400	0.027687
0.072	1	0.070887
0.072	1 1/8	0.079888
5/64	1/4	0.018221
5/64	5/16	0.023104
5/64	3/8	0.927987
5/64	7/16	0.032869
5/64	1/2	0.037752
5/64	5/8	0.047518
5/64	3/4	0.057283
5/64	7/8	0.067049
5/64	1	0.076815
5/64	1 1/8	0.086580
5/64	1 1/4	0.096346
5/64	1 1/2	0.115877
5/64	2	0.154940
0.0808	0.150	0.010719
0.0840	0.300	0.023685
0.0860	0.615	0.051303
3/32	3/8	0.033271
3/32	7/16	0.039129
3/32	1/2	0.044988
3/32	5/8	0.056707
3/32	3/4	0.068426
3/32	7/8	0.080145
3/32	1	0.091863
3/32	1 1/8	0.103582
3/32	1 1/4	0.115301
3/32	1 3/8	0.127020
3/32	1 1/2	0.138738
3/32	1 3/4	0.162176
3/32	2	0.185613
3/32	2 1/8	0.197332
3/32	2 3/8	0.220770
3/32	2 1/2	0.232488
0.100	1/4	0.022854
0.100	3/8	0.035354
0.100	7/16	0.041604
0.100	1/2	0.047854
0.100	5/8	0.060354
0.100	3/4	0.072854
0.100	7/8	0.085354
0.100	1 7/8	0.185354
0.100	2 3/8	0.235354
7/64	3/8	0.039129
7/64	1/2	0.052120
7/64	9/16	0.058956
7/64	5/8	0.065792
7/64	3/4	0.079464
7/64	7/8	0.093136
7/64	1	0.106807
7/64	1 1/4	0.134151
7/64	1 1/2	0.161495
7/64	1 3/4	0.188839
7/64	2	0.216183
0.118	0.690	0.078432
1/8	1/4	0.029364
1/8	3/8	0.044988
1/8	11/32	0.042801
1/8	1/2	0.059146
1/8	9/16	0.066959
1/8	5/8	0.074771
1/8	3/4	0.090396
1/8	7/8	0.106021
1/8	0.900	0.109146
1/8	1	0.121646
1/8	1 1/8	0.137272
1/8	1 1/4	0.152896
1/8	1 3/8	0.168521
1/8	1 1/2	0.184146
1/8	1 5/8	0.199771
1/8	1 3/4	0.215396
1/8	2	0.246646
1/8	2 1/4	0.277897
1/8	2 1/2	0.309146
1/8	3	0.371647
9/64	1/2	0.068426
9/64	5/8	0.083647
9/64	7/8	0.118803
9/64	1 1/8	0.153959
5/32	3/8	0.056707
5/32	1/2	0.076238
5/32	5/8	0.095770
5/32	3/4	0.113834
5/32	7/8	0.133366
5/32	1	0.152806
5/32	1 1/4	0.191959
5/32	1 3/8	0.211491
5/32	1 1/2	0.231021
5/32	1 5/8	0.250553
5/32	1 3/4	0.270084
5/32	2	0.309146
5/32	2 1/4	0.348209
0.200	0.900	0.176647
0.229	0.300	0.065914
0.300	0.400	0.118113
3/16	3/8	0.068426
3/16	1/2	0.091836
3/16	9/16	0.103582
3/16	5/8	0.115301
3/16	3/4	0.137271
3/16	7/8	0.160709
3/16	1	0.184146
3/16	1 1/8	0.207584
3/16	1 1/4	0.231021
3/16	1 3/8	0.254459
3/16	1 1/2	0.277896
3/16	1 5/8	0.301334
3/16	1 3/4	0.324771
3/16	2	0.371646
3/16	2 1/4	0.418521
3/16	2 1/2	0.465396
3/16	2 5/8	0.488834
3/16	2 3/4	0.512271
3/16	3	0.559146
3/16	3 1/2	0.652896
7/32	3/8	0.080145
7/32	1/2	0.107488
7/32	9/16	0.121161
7/32	5/8	0.133365
7/32	3/4	0.160709
7/32	7/8	0.188053
7/32	1	0.215396
7/32	1 1/4	0.270084
7/32	1 1/2	0.324771
1/4	3/8	0.091863
1/4	1/2	0.123113
1/4	9/16	0.138738
1/4	5/8	0.152896
1/4	3/4	0.184146
1/4	7/8	0.215396
1/4	1	0.242455
1/4	1 1/8	0.273705
1/4	1 1/4	0.304955
1/4	1 5/16	0.320580
1/4	1 1/2	0.367455
1/4	1 3/4	0.429955
1/4	1 7/8	0.461205
1/4	2	0.492455
1/4	2 1/4	0.554955
1/4	2 1/2	0.617455
1/4	3	0.742455
1/4	4	0.992455
1/4	5	1.221250
9/32	1/2	0.138738
9/32	7/8	0.242738
5/16	1/2	0.154363
5/16	5/8	0.191959
5/16	3/4	0.226830
5/16	1	0.304955
5/16	1 1/4	0.383080
5/16	1 1/2	0.461205
5/16	1 3/4	0.539330
5/16	2	0.617455
5/16	2 1/2	0.773705
5/16	3 7/8	1.203390
3/8	3/8	0.138738
3/8	1/2	0.184146
3/8	5/8	0.231021
3/8	3/4	0.273705
3/8	7/8	0.320580
3/8	1	0.367455
3/8	1 1/4	0.461205
3/8	1 1/2	0.554455
3/8	2	0.742455
3/8	2 1/4	0.836205
3/8	2 1/2	0.929955
3/8	3	1.117455
3/8	4	1.49245
15/32	3/4	0.347924
7/16	1	0.429955
7/16	1 3/4	0.758080
1/2	5/8	0.299087
1/2	1	0.486587
1/2	1 1/4	0.611587
1/2	1 1/2	0.736587
1/2	2	0.986587
1/2	3	1.48659
9/16	1 3/4	0.970962
5/8	2	1.23659
3/4	1	0.736587
3/4	2 1/4	1.65773
1 1/4	2 1/2	3.07135

* Circ.mils = 0.0000007854 sq.in.

TABLE V—DIAMETER AND AREA OF ROUND AND SQUARE COPPER WIRE WITH VARIOUS INSULATIONS

*(Blackface type means square wire)

Gage No. B & S	Maximum Diameter				Area of Copper	
	Bare	S.C.C.	D.C.C.	T.C.C.	Circ mils	Square Inches
***4 0**	**0.460**	....	**0.483**	**0.492**	**265,152**	**0.20825**
4 0	0.460	.....	0.478	0.487	211,600	0.16619
***3 0**	**0.410**	.....	**0.433**	**0.442**	**209,345**	**0.16442**
3 0	0.410	....	0.428	0.437	167,800	0.13179
***2 0**	**0.365**		**0.388**	**0.397**	**165,037**	**0.12972**
2 0	0.365		0.383	0.392	133,100	0.10454
*** 0**	**0.325**		**0.348**	**0.357**	**130,124**	**0.10220**
0	0.325		0.343	0.352	105,500	0.08286
*** 1**	**0.289**	....	**0.312**	**0.321**	**102,292**	**0.08034**
1	0.289		0.307	0.316	83,690	0.06573
*** 2**	**0.258**	....	**0.281**	**0.290**	**80,203**	**0.06300**
2	0.258	....	0.276	0.285	66,370	0.05213
*** 3**	**0.229**	..	**0.252**	**0.261**	**62,732**	**0.04927**
3	0.229		0.247	0.256	52,630	0.04134
*** 4**	**0.204**	...	**0.227**	**0.236**	**50,737**	**0.03985**
4	0.204	.	0.222	0.231	41,740	0.03278
*** 5**	**0.182**		**0.205**	**0.214**	**39,725**	**0.03120**
5	0.182		0.200	0.209	33,100	0.02600
*** 6**	**0.162**		**0.183**	**0.191**	**32,340**	**0.02540**
6	0.162		0.178	0.186	26,250	0.02062
*** 7**	**0.144**		**0.163**	**0.171**	**25,439**	**0.01998**
7	0.144		0.160	0.168	20,820	0.01635
*** 8**	**0.129**		**0.146**	**0.153**	**19,951**	**0.01567**
8	0.129		0.143	0.150	16,510	0.01297
*** 9**	**0.114**		**0.129**	**0.135**	**16,221**	**0.01028**
9	0.114		0.126	0.132	13,090	0.01274
*** 10**	**0.102**		**0.115**	**0.120**	**12,783**	**0.01004**
10	0.102	0.107	0.112	0.117	10,380	0.00815
*** 11**	**0.0907**		**0.103**	**0.108**	**10,033**	**0.00788**
11	0.0907	0.096	0.101	0.106	8,234	0.00647

Gage No. B & S	Maximum Diameter								Area of Copper	
	Bare	S.C.C.	D.C.C.	T.C.C.	Enamel	S.C.C. Enamel	D.C.C. Enamel	S.SilkC. Enamel	Circ mils	Square Inches
***12**	**0.0808**	**0.093**	**0.093**	**0.098**	.....		.....	.....	**7,868**	**0.00618**
12	0.0808	0.086	0.091	0.096	0.0832	0.08825	...	.....	6,530	0.00513
***13**	**0.0720**		**0.083**	**0.088**					**6,162**	**0.00484**
13	0.0720	0.077	0.081	0.086	0.0743	0.07925			5,178	0.00407
14	0.0641	0.069	0.073	0.078	0.0663	0.07125			4,107	0.00323
15	0.0571	0.062	0.066	0.071	0.0593	0.06425	0.0683		3,257	0.00256
16	0.0508	0.056	0.060	0.065	0.0529	0.05775	0.0620		2,583	0.00203
17	0.0453	0.050	0.054	0.059	0.0472	0.05225	0.0563		2,048	0.00161
18	0.0403	0.045	0.049	0.054	0.0422	0.04725	0.0513		1,624	0.00128
19	0.0359	0.041	0.045	0.050	0.0377	0.04275	0.0468		1,288	0.00101
20	0.0320	0.037	0.041	0.046	0.0338	0.03875	0.0428		1,022	0.00080
21	0.0285	0.033	0.038	0.043	0.0302	0.03525	0.0393	..	810.1	0.00064
22	0.0254	0.0305	0.035	0.039	0.0271	0.03225	0.0360	....	642.4	0.00050
23	0.02260	0.029	0.032	0.037	0.0242	0.02900	0.0333		509.5	0.00040
24	0.0201	0.025	0.029	0.034	0.0216	0.02650	0.0305		404.0	0.00032
25	0.0179	0.023	0.027	0.032	0.0193	0.02450	0.0283		320.4	0.00025
26	0.0159	0.020	0.025	0.030	0.0172	0.02225	0.0263		254.1	0.00020
27	0.0142	0.018	0.023	0.028	0.0155	0.02025	0.0245	0.0173	201.5	0.00016
28	0.0126	0.016	0.022	0.027	0.0139	0.01875		0.0155	159.8	0.00013
29	0.0113	0.014	0.020	0.025	0.0125	0.01750		0.0143	126.7	0.00010
30	0.0100	0.013	0.019	0.024	0.0111	0.01600	..	0.0130	100.5	0.000079
31	0.0089	0.011	0.018	0.023	0.0100	0.91500		0.0120	79.70	0.000063
32	0.0080	0.010	0.017	0.022	0.0090	0.01400	..	0.0110	63.21	0.000050
33	0.0071	0.009	0.016		0.0080	0.01325		0.0098	50.13	0.000039
34	0.0063	0.008	...	...	0.0072	0.01225		0.0090	39.75	0.000031
35	0.0056	0.007	....	....	0.0064	0.01150		0.0083	31.52	**0.000025**
36	0.0050	0.006	.....	.	0.0058	0.01100	.	..	25.00	000020
37	0.0045	0.006	..	...	0.0052	.....		.	19.83	0.000016
38	0.0040	0.005	...	.	0.0046	.....	.....	...	15.72	0.000012

S.C.C. = single-cotton-covered; D.C.C. = double-cotton-covered. T.C.C. = triple-cotton-covered. S.SilkC. = single-silk-covered.

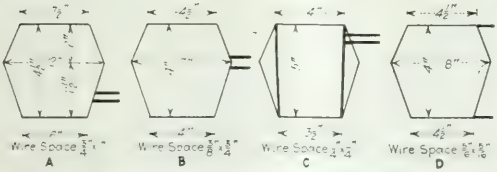


FIG. 2—METHOD OF FILLING IN DIAGRAMS FOR MUSH COILS (C FIG. 1)

Note how the position of the leads is indicated (heavy lines). A is a basket mush coil. C and D are bipolar coils. In C two vertical lines have been added, showing that the coil ends are straight instead of diamond-pointed.

cards can be run off on a duplicating machine or can be printed at a small cost.

On the reverse side of the card are shown the coil dimensions. Only two forms of diagrams are used, one for mush coils (C, Fig. 1) and one for puller coils (D, Fig. 1). These are printed on the cards as desired by means of rubber stamps. If the work is done by a printer the diagrams might be printed from cuts.

The method of filling out the diagram for mush coils is seen in Fig. 2. It will be seen that the position of the leads is indicated by the heavy lines added to the diagram. In *C* two vertical lines have been added, showing that the coil ends are straight instead of diamond-pointed. By such slight modification one diagram is applied to any mush coil.

Information on the puller coil is more complicated. In the diagram (D, Fig. 1) the notations "Leads on top," "on bottom," "at diamond point," "at cells," are used to indicate the position of the coil leads. The top of a coil is that part farthest from the shaft on a rotor and closest to the shaft on a stator (see d, Fig. 3). The terms *B* and *HT* in the next line refer to the width and height of the puller coil as shown at (b), Fig. 3. *RH* and *LH* mean right hand and left hand respectively. One of these pairs of terms is crossed out when the card is being filled.

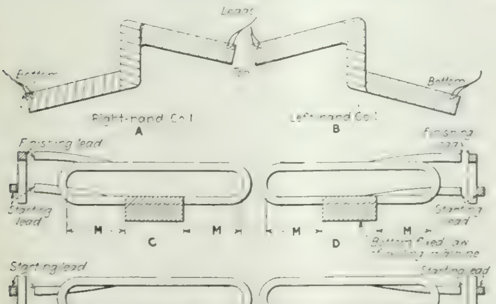


FIG. 4—DIFFERENCE BETWEEN RIGHT-HAND AND LEFT-HAND COILS

A—Right-hand coil, because when leads are toward observer right-hand side of coil would be in top of slot of a rotor. B is a left-hand coil because the left side of the coil would fall in the top of the slot when leads are toward observer. C—Position for pulling right-hand stator coils. D—Pulling position for left-hand stator coils. E—Position for induction-motor, wound-rotor right-hand coils. F—Position for induction-motor, wound-rotor left-hand coils.

The difference between right-hand and left-hand coils should be studied carefully. Using a left-hand coil in place of a right-hand in a direct-current wave-wound armature would reverse the direction of rotation in a motor or the polarity in a generator, and would cause other troubles in compensated interpole machines. Fig. 4 shows a right-hand and a left-hand coil. To determine the kind of coil hold it as it would fit in a rotor with the leads toward the observer. If the high side (the side that would fall in the top of the slot) is to the right it is a right-hand coil (*A* in Fig. 4). The reverse holds for a left-hand coil (*B*, Fig. 4). When winding a right-hand coil in a shuttle the groove for the starting lead should be on the left-hand side of the shuttle. For a left-hand coil the groove should be at the right.

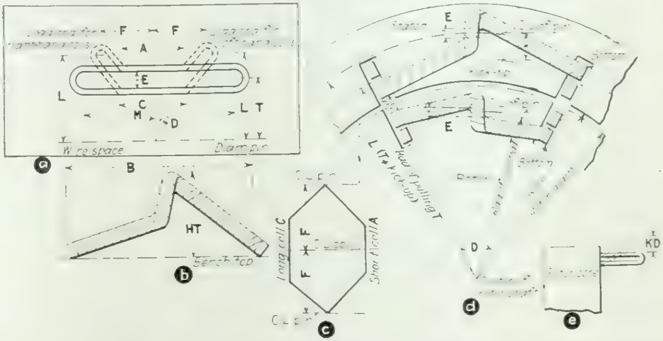


FIG. 3—HOW DIMENSIONS OF COILS IN A MOTOR ARE ENTERED ON CARD DIAGRAM (D FIG. 1)

(a) Is card diagram filled in. (d) Dimension letters to correspond to card at (a). (b) Shows how height of coil (HT) is measured. (c) Shows how length of coil is figured. (e) "Kickdown" of rotor coil is shown at *KD*. The dotted lines in (e) show the coil as pulled and the full lines show the coil with a correct "kick-down" so that the coil ends are below the level of the rotor iron.

At (a), Fig. 3, a puller-coil diagram is shown lettered to correspond with the cross-section of a motor at *d*. All dimensions are obtained from the motor and a sample coil. The length *A* is the length of the slot section of the coil. *B* is the distance from the center line of the bottom of the top half of the coil to the center line of the upper part of the bottom half of the coil. It is more easily measured as at (b) in Fig. 3. *D* is the angle to which the coil is pulled and is equal to (360 deg./N) × coil pitch, where N is the total number of slots in the machine. The total inside length of the shuttle is $M + E$, where E is the diameter of pins used on the shuttle. T is the distance from the rotor-shaft center to the center of the slot. To get T for a rotor subtract one-half the depth of the slot from the radius of the rotor. For a stator add one-half the slot depth to the radius of the stator. The dotted line in the card diagram represents the coil pulled to its final shape with the "kick-up" put in the coil. This "kick-up" is put in a stator coil so that the ends of the coil will not project above the level of the stator iron and rub on the rotor or prevent its being put into place. The dimension L is best determined by winding a trial coil, placing it in the stator and noting the amount of "kick-up" necessary to make the coil ends come below the iron. This

TABLE VI—NUMBER OF WIRES OF ONE SIZE WHICH IS EQUIVALENT TO A CERTAIN NUMBER OF WIRES OF ANOTHER SIZE

Wire sizes (B. & S. gage) are on top line. In body of table figures on the same horizontal line show the number of wires of each gage equivalent in cross-section. Column on left shows the wire size which is equivalent to the number of wires indicated in body of table under the respective gage sizes on top line

Size of wire (B. & S. gage) one of which is equivalent to number of wires on same horizontal line to right	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2
0000	2,105	1,670	1,324	1,050	833	661	524	415	329	261	207	164	130	103	82	65	52	41	32	26	20	16	13	10	8	6	5	4	2
000	1,670	1,324	1,050	833	661	524	415	329	261	207	164	130	103	82	65	52	41	32	26	20	16	13	10	8	6	5	4	3	
00	1,324	1,050	833	661	524	415	329	261	207	164	130	103	82	65	52	41	32	26	20	16	13	10	8	6	5	4	3		
0	1,050	833	661	524	415	329	261	207	164	130	103	82	65	52	41	32	26	20	16	13	10	8	6	5	4	3		2	1
1	833	661	524	415	329	261	207	164	130	103	82	65	52	41	32	26	20	16	13	10	8	6	5	4	3		2		
2	661	524	415	329	261	207	164	130	103	82	65	52	41	32	26	20	16	13	10	8	6	5	4	3		2			
3	524	415	329	261	207	164	130	103	82	65	52	41	32	26	20	16	13	10	8	6	5	4	3		2			1	
4	415	329	261	207	164	130	103	82	65	52	41	32	26	20	16	13	10	8	6	5	4	3		2			1		
5	329	261	207	164	130	103	82	65	52	41	32	26	20	16	13	10	8	6	5	4	3		2			1			
6	261	207	164	130	103	82	65	52	41	32	26	20	16	13	10	8	6	5	4	3		2			1				
7	207	164	130	103	82	65	52	41	32	26	20	16	13	10	8	6	5	4	3		2			1					
8	164	130	103	82	65	52	41	32	26	20	16	13	10	8	6	5	4	3		2			1						
9	130	103	82	65	52	41	32	26	20	16	13	10	8	6	5	4	3		2			1							
10	103	82	65	52	41	32	26	20	16	13	10	8	6	5	4	3		2			1								
11	82	65	52	41	32	26	20	16	13	10	8	6	5	4	3		2			1									
12	65	52	41	32	26	20	16	13	10	8	6	5	4	3		2			1										
13	52	41	32	26	20	16	13	10	8	6	5	4	3		2			1											
14	41	32	26	20	16	13	10	8	6	5	4	3		2			1												
15	32	26	20	16	13	10	8	6	5	4	3		2			1													
16	26	20	16	13	10	8	6	5	4	3		2			1														
17	20	16	13	10	8	6	5	4	3		2			1															
18	16	13	10	8	6	5	4	3		2			1																
19	13	10	8	6	5	4	3		2			1																	
20	10	8	6	5	4	3		2			1																		
21	8	6	5	4		3	2			1																			
22	6	5	4		3	2			1																				
23	5	4		3	2			1																					
24	4		3	2			1																						

Obtained from the Rome Wire Company

amount of "kick-up" is given to the coil, and it is tried again. For rotor coils a "kick-down" is often required; *i.e.*, when the distance between the rotor iron and the top of the coil is less than ⅛ in. The lettering on either side of diagram a in Fig. 3 and the sketches *C*, *D*, *E* and *F*, Fig. 4, explain the way the loops should be put in the pulling machine for right-hand or left-hand coils. *A* and *C*, Fig. 3 (a), are the slot section (cells) of the coil which fit in the blocks on the pulling machine. As these blocks have ends rounded with ¼-in. radius, they are ½ in. longer than the lengths *A* and *C* in (a), Fig. 3. In this diagram *C* is shown longer than *A*, which holds for all stator coils, as *C* will be the top half of the coil. A stator coil is pulled inverted. For a rotor the side *A* will be the top of the coil and should therefore be the longer.

At the bottom of the card is a notation, "Wire Space," which tells what size to make the slots on shuttles and the space in the jaws of the pulling machine. In figuring this size the wire-space table (Table II) will save time. This table shows the width of slot necessary for any number of double-cotton-covered round wires up to twelve. For instance, with a coil of No. 8 gage wire, two wide by three deep, under No. 8 in the top row and in line with 2 of the first column is the figure $\frac{19}{64}$, which is the width in inches of the coil. Similarly $\frac{11}{16}$ in. is the height. Table III likewise may be used for double-cotton-covered copper ribbon, Table IV for bare strap copper and Table V for square and round with cotton, enamel and silk insulation. These tables give also the cross-sectional area of the wires. Table VI is used for finding wires of equivalent cross-section when the wire size is changed or for substituting when out of stock, etc. For instance, suppose two No. 10 wires may be replaced by wires of other sizes. To find how many No. 14 wires should be used in place of two No. 10 trace down from 10 in the top line to figure 2. Then follow to the left until under 14 is found figure 5. This means that five No. 14 wires may be substituted. Similarly four No. 13 might be used or one No. 7, depending upon the slot space and the formation of the wire in the slot.

To check the new coils against the old coils the dimension *F-F* in (a) and (c), Fig. 3, and the dimensions *B* and *HT* in (b) and (d), Fig. 3, are used. *F* is the distance between the center lines of the shuttle pins and of the coil when pulled to shape. This is a check on the coil length, and the total inside length of the coil is *E* + 2*F*. *B* is a check on the angle *D* or the coil pitch. This is measured as shown in (b) and (d), Fig. 3. *HT* is the height of the coil at the diamond point from the bench on which the coil lies as in (b), Fig. 3.

When filling out the coil-order cards a requisition for material should be made at the same time, the necessary data being obtained from a sample coil taken from the motor. A copy of the coil order can be made on plain paper and filed on the "incompleted" file of the shop as a tickler.

Complete instructions on making molds and winding, insulating and pulling coils will be given in a later issue of the ELECTRICAL WORLD.

THE *legislation which took from the municipalities the regulation and control of public utilities and vested the power with the utility commission has been welcomed by the public and the public utility companies alike. But it should not be forgotten that successful regulation must be fearless and fair and accommodated to the exigencies of changing conditions. Whenever the administrative agency appointed to arbitrate the public and the utility is influenced by public sentiment rather than considerations of justice, the purpose of the law will fail, not because of its infirmities but because of its weak and servile administration. Critics should appreciate that private capital devoted to public service is entitled to a fair return and that it requires more courage and character to render just than popular decisions.*—From a decision by Justice Owen of the Wisconsin Supreme Court.

Readers' Views and Comments

This is a readers' forum. Comments on questions before the electrical industry presenting economic, financial, engineering or commercial aspects and new or supplementary viewpoints on published articles are cordially invited

Disturbances from X-Ray and Radio Outfits

To the Editor of the ELECTRICAL WORLD:

SIR: Owing to the increasing use of X-ray and radio equipment, it seems advisable that electric service companies give immediate attention to some of the difficulties of serving such apparatus before the objectionable features become serious obstacles. The objection to the X-ray machine is that a large transformer capacity is required with but little return for the service rendered. The actual use of the equipment takes relatively large capacity and but little energy, so that if charges are made for the energy consumption only, the return is not commensurate with the investment required to serve; in fact, the losses in the transformer will in most cases exceed the consumption of the equipment in use.

To meet this situation the central-station company must necessarily make a demand or readiness-to-serve charge adequate to compensate for the carrying charges on the excess transformer capacity required and the losses through the transformer itself.

With radio outfits there is actual disturbance to the service of other consumers. We have had a number of actual cases, the experience in a few of them being as follows:

Case (a).—A radio outfit was installed in a high school with some patented device for preventing "kickback." The device did not perform the function for which it was intended and the disturbances were transmitted to other consumers supplied from the same transformer, resulting in the burning off of wires in the house and actual sparking from lighting fixtures.

Case (b).—An outfit was installed in the laboratory of one of the colleges supplied by us which when put in use caused a flickering in the lights on all of the service supplied from the same transformer. There was enough disturbance to cause a jumping of the current from the service wires to the steam pipes in the building in which the installation had been placed to such an extent that a person able to do so could read the messages being sent out when sitting in the room in which the jumping occurred.

Case (c).—A wireless outfit was installed by one of our consumers in a shed, with a separate service line direct from the distribution transformer. As soon as this set was placed in service adjacent consumers commenced to complain of serious flickering of the lights, which continued until the set was placed on a separate transformer.

These three cases are typical of the effect of wireless outfits, and at the time they were first observed we notified the consumers that it would be necessary for them to install independent transformers from the primary distributing voltage to 110 volts, or to install 1-kw. one-to-one transformers on the service lines.

Informal complaints were made by two of these consumers to the commission, and the chief of Bureau of Rates and Tariffs of the commission, in the correspondence concerning these informal complaints, advised us that in his opinion:

"It is incumbent upon the electric company to supply service for these radio plants, and it would also appear that the investment in the transformer should be made by the electric company. . . . If the cost of supplying this equipment is such that it would be unfair to other consumers to absorb that expense in the general operating expenses, it would appear logical that a rate might be made especially for service to radio apparatus."

Acting on this advice from the chief of bureau, we amended two of our rates to provide for service to X-ray machines and radio outfits—one when the service is supplied under a domestic schedule and the other when it is under power schedule. These schedules have a minimum based upon the connected load, and the schedules state:

"X-ray machines, wireless outfits or other apparatus of highly fluctuating load characteristics will be included in the connected load at their full load requirements. If it is necessary for producer to install excess transforming capacity or an individual transformer to prevent detrimental effect of such apparatus upon service to other consumers, the normal rated capacity of transforming equipment so installed will be the measure of the connected load of the apparatus necessitating it."

Under this provision we charge a minimum based on the capacity of the transformer required to absorb the disturbances, thereby obtaining revenue to compensate for the additional investment and losses incurred. This action was taken about a year ago, and since that time all consumers have been paying the minimum charge without complaint and no further trouble has been reported by consumers adjacent to the outfits. So far as experience extends, the separate transformer has been found the only adequate means for absorbing the disturbances.

G. M. GADSBY,
Vice-president.

West Penn Power Company,
Pittsburgh, Pa.

Measuring Speed of Small Motors with Rotating Disk

To the Editor of the ELECTRICAL WORLD:

SIR: The writer was very much interested in the method of determining the speed of small motors by rotating-disk comparison as presented by W. H. Farr in the ELECTRICAL WORLD of May 7. To be sure, this is not a new method and apparently is not so held to be by the author. The exact method of making the comparison and determining the speed of the motor, however, is probably unknown to a great many engineers. A detailed description of the method is therefore of value.

In spite of the author's apparent familiarity with the method and his experience in making speed determinations, certain statements are made which would no doubt lead an inexperienced operator to errors in making speed determinations. For instance, the author states that with an arrangement as shown in the illustration (one spot on pulley of motor and four slots in rotating disk) "when a synchronous speed has been reached only one spot is seen, and it is apparently standing still." He further states in the same example that the speed of the disk multiplied by the number of slots in the disk gives the speed of the motor under test. It can be readily shown that these statements are incongruous.

Assume the motor and disk synchronized, the motor rotating at four times the speed of the disk. Suppose the spot on the pulley is directly back of a slot at some given position. If the motor is running at four times the speed of the disk, the spot on the pulley will overtake the next slot in the disk at some point having an angular distance from the first position which we will call x. While the spot on the motor was reaching this point the slot in the disk traveled an angular distance of $x/4$, since its speed was assumed to be one-fourth of the speed of the motor. But this slot in the disk was already 90 deg. from the first position at which the spot was visible. We, therefore, have the equation $x = 90$ deg. $+ x/4$, and $x = 120$ deg. Similarly, the next point at which the spot is visible is 120 deg from this point, and thus it is seen that there are visible three apparently stationary spots at the time of exact synchronism. By means of similar calculations it can be shown that if the disk is rotated at one-half the speed of the motor two stationary spots will be visible, and if it is rotated at three-fourths the speed of the motor only one spot will be visible.

In order to obtain a solution for all problems of this nature an equation has been derived which is of general application. Let $N =$ the number of slots in the disk; $R =$ the ratio of speed of motor to speed of disk, and $x =$ the angular distance between successive appearances of the spot. Then $x = \frac{360\,R}{N(R-1)}$. If x is 360 deg., or an aliquot part of 360 deg., then there will be one or more stationary spots.

ALVA G. HUSTED,
Assistant Engineer.

Department of Public Service,
Cleveland, Ohio.

Refilling Inclosed Fuses

To the Editor of the ELECTRICAL WORLD:

SIR: My article on "Refilling Inclosed Fuses" in the ELECTRICAL WORLD for April 9, page 829, was certainly not intended to upset any recognized standard practice, nor was its purpose to cause the use of *any* size of fuse instead of the proper one. An old fuse properly refilled is far safer in emergencies than exposed wire solder or copper or iron wire, such as is sometimes used to keep a motor or circuit working.

An instance came to my attention not long ago where a company had no fewer than 500 blown-out fuses of various sizes up to 60 amp. and was hopelessly short of the new ones needed to operate some motors carrying very unsteady loads, such as electric tractors, iron-pot crushers, foundry-sand cutters and cranes. Wire of all sorts, and even pieces of iron, were used by the men to get along. The manufacturer of the fuses was asked to refill them but refused to fill any under 65 amp. As many of the fuses were needed for immediate use, the idea of refilling some with tested fuse wire was tried.

When a motor rated at 40 amp. draws close to 100 amp. to get its load started, a fuse of any smaller size does not stay on the job very long, and as the larger size is needed to start things going, there is no protection while running under normal loads. Thus the fuse in this case is little save an ornament. Here is a pot crusher in a foundry doing splendid work with a 15-hp. motor rated at 27 amp. per terminal on 440 volts, but for one critical moment it requires 40 amp. to break a casting in two. The motor has a rating of 25 per cent overload for two hours, but even 50 per cent or more overload for one or two minutes does absolutely no harm to it. No fire risk is present so long as the line installed is made extra heavy to care for sudden overloads. This motor would not operate three minutes with 35-amp. fuses, so 40-amp. fuses were used. Even the 50-amp. size were blown repeatedly, much to the disgust of the operator; yet the motor is large enough for 90 per cent of the castings broken up. In the running of this motor the last of many fuses in stock is sometimes used up, and to finish the work the old ones are often refilled in a hasty manner and used again.

The writer mentioned that the refilling of fuses was generally condemned; but where something has to be used immediately, in the absence of new fuses, the old ones refilled as near to their rating as possible under conditions of haste cause no worrisome risk. It is evident to every one that there is no need of renewing fuses when time and quick transportation permit of new ones being kept in stock; but when shipments are delayed for one or two months in transit and even get lost entirely, the safest makeshift is not a bad substitute to keep the wheels moving. Furthermore, when hot iron is flowing and molders yelling like Indians for the metal refilling a fuse allows the work to go along, whereas an exposed fuse wire of any sort would probably arc in the operator's face or otherwise cause serious trouble.

Of course, this is no defence for using an unapproved refilled fuse, but when a hard-working motor fails to function right in the middle of a hurried performance, with no good fuses at hand, perhaps in an emergency others would do the very thing that my article mentions and call it the best and safest thing to do under the circumstances. Since the occasion which inspired my article on refilling fuses our New Britain firm has received a quantity of approved fuses and also a goodly number of oil and air circuit breakers, which need no refilling.

H. S. RICH.

Little River, Conn.

The Danish Small Belt as a Source of Hydro-Electric Energy

To the Editor of the ELECTRICAL WORLD:

SIR: Great efforts are at present being made in Denmark to develop the country's natural resources. Denmark produces no coal, and for its fuel supply the country is entirely dependent upon foreign importation.

Some time ago the Danish government appointed a special commission of experts to study the power resources of the country. In a report now submitted the commission advocates the utilization of the water power in the Small Belt. The current in this Danish bay, situated between Jutland and the Funen Island, is extremely strong, and the technical experts of the commission are of the opinion that by means of proper installations a large amount of energy can be rendered available for electrical purposes. The government is seriously considering the expediency of this gigantic project.

HENRY L. GEISSEL.

Beaurivage, Thoune, Switzerland.

Station and Operating Practice

A Department Devoted to Problems of Installation,
Operation and Maintenance of Equipment for Economical Generation and
Distribution of Electrical Energy

Economic Comparison of Three-Wire and Two-Wire Distribution

ALTHOUGH it is known that three-wire has advantages over two-wire distribution, the accompanying table is of interest in that it compares concretely the operating costs of both systems. These figures are for a territory and load requiring either three 5-kva. transformers for a two-wire secondary system or two 7½-kva. transformers for a three-wire system. Calculations show that when a load of 5 kva. or more is to be connected it is practicable to run two two-wire circuits 1,000 ft. each side of the transformer. This is the condition where the cost of interest, depreciation and transformer loss of the transformer installation is equal to the cost of interest, depreciation and copper loss of the two-wire secondary circuit. Moreover, for the same voltage drop at the end of the line it is practicable to run a three-wire system 1,500 ft. or 50 per cent further than a two-wire system, before the operating cost of the three-wire system overbalances the operating cost of the transformer installation. This relation is followed in the tabulation, six two-wire circuits 1,000 ft. long being employed with three 5-kva. transformers and four three-wire circuits 1,500 ft. long with two 7½-kva. transformers. It is seen that the saving in operating expense is $16 per year.

Besides the fact that the larger transformers cost less per kva. rating, their efficiency also is higher. Since a greater territory can be served from each transformer, a greater load can be connected, which will increase the load diversity factor. This in turn permits a saving in transformer capacity, which further decreases the investment in transformers.

COSTS OF THREE-WIRE AND TWO-WIRE DISTRIBUTION LINES COMPARED

Investments	Two-Wire	Three-Wire
Cost three 5-kva. transformers and installation	$283 65	
Cost six two-wire circuits, No. 4 (6,000 ft. total)	415 00	
Cost six lightning arresters and grounds	90 00	
Cost two 7½-kva. transformers and installation	....	$242 00
Cost four 3-wire circuits No. 6 (6,000 ft. total)	....	367 00
Cost four lightning arresters and grounds	....	60 00
Total	$788 65	$669 80
Saving on three-wire construction		118 85
Yearly operating cost:		
Interest and depreciation, transformers	$45 30	$38 75
Interest and depreciation, copper wire	41.50	36 78
Interest and depreciation, lightning arresters	14.40	9.60
Copper line loss, six circuits	9 00	9 00
Total yearly cost	$110 20	$94 13
Saving per year on three-wire operation	....	16.07

These two conditions—serving a greater territory and connecting a greater number of services—make it possible to balance the load better across the 220-volt wires. This in turn makes it possible to use a smaller neutral wire, and a further saving in copper is made. In ordinary practice a wire at least one size smaller is used for the neutral wire; and generally where the load can be well balanced it is safe to use a wire two sizes smaller. A saving is also made in the installation of lightning arresters and ground wires.

The only additional cost due to the installation of a three-wire system that could be subtracted from the saving in copper is the cost of the insulators for the neutral wire and the extra time necessary to run the neutral wire. However, this extra cost is almost offset by the advantage of handling the smaller secondary wires.

W. A. DARTER,
Superintendent of Engineering.
Brenham Compress, Oil & Manufacturing Company,
Brenham, Tex.

Local Repairs of Transformer Coils Possible

REPAIRS of high-tension transformer coils that have been damaged in operation has been found profitable by the Consumers' Power Company. The damaged stack is torn down and any coils with badly burned copper or a large percentage of insulation damaged are thrown aside and scrapped. Those with only the outside tape or insulation between turns damaged in spots are sent to the repair shop. All tape is removed, and the coils are scraped or brushed with a stiff brush to remove all carbon and bits of copper. They are then placed in an oven made up of a box lined with asbestos and a heating element made up of No. 9 B. W. gage iron wire, which heats the oven to 80 deg. or 90 deg. C., to dry out the coils thoroughly. They are then straightened and insulation is put between turns at damaged points. Any conductor turns that have been burned are built up with small bits of copper and solder to normal size. The coil is then clamped and taped, after which a heavy coat of General Electric No. 152 clear varnish is applied and the coil is put in the oven to dry. This generally requires from three to six hours, and the operation is repeated four or five times or until the coil is filled between edges of the turns and smooth on the outside. The clamps are removed during the process to allow thorough distribution of the varnish to all parts of the coil. The coil is then retaped, lead supports are put on, and the varnish and baking process is repeated three or four times.

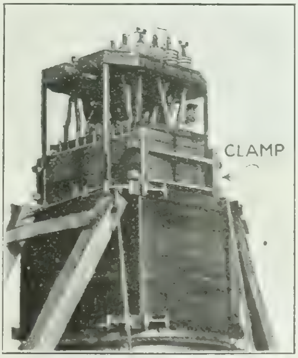


FIG. 1—CLAMPS PREVENT DISTORTION OF COILS

In the older type of transformers considerable difficulty has been encountered with the old form of spacer, which will allow one turn of a coil to buckle over the next on a short circuit. The button spacer (Fig. 2) is substituted in reassembling the stacks.

It has also been found worth while in reassembling to use a heavy steel clamp (Fig. 1) on both the top and bottom projections of the coils from the core.

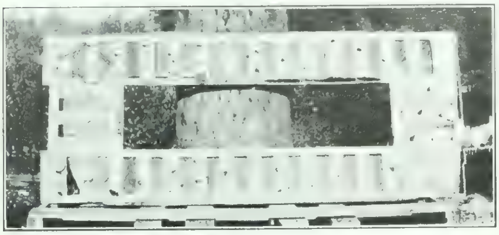
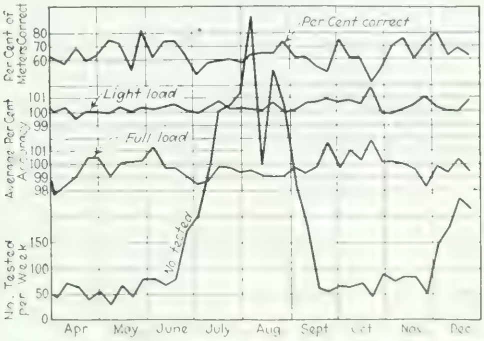


FIG. 2—BUTTON-TYPE SPACER PREVENTS BUCKLING UNDER SHORT-CIRCUIT STRESSES

Consumers' Power Company, E. O. SLAYBAUGH.
Battle Creek, Mich.

Graphic Diagrams Show Condition of Customer's Meters

TO SHOW whether the accuracy of customers' meters is holding within the required limit between tests, graphic reports are plotted by the Worcester (Mass.) Electric Light Company. The curves on these reports show the percentage of the meters tested which are within the required limits of accuracy, the average accuracy of the meters at light load and at full load, and the total number of meters tested. The curves are kept up to date from week to week. If the number of inaccurate meters increases, this is quickly shown by the chart and the period between tests can be shortened. The large increase in number of meters tested in the summer months as shown by the curve is due to the employment of students who are engaged temporarily by the company for this work.



CURVES SUCH AS THESE SHOW WHEN METERS ARE BEING TESTED TOO INFREQUENTLY

The distribution department of this company uses curves of this nature for improving operation and management along other lines than meter work (see past issues of the ELECTRICAL WORLD and issues which will be published later). George M. Hardy, superintendent of the company, furnished the diagrams.

Boston, Mass. FIELD EDITOR ELECTRICAL WORLD.

How Oil Should Be Filtered for Horizontal Steam Turbines

THERE are two methods of oil filtration in use with horizontal turbines. One is the batch system, and the other partial filtration with a circulating system. The batch filter is most commonly used. The entire batch of oil is drained from the turbine at stated intervals, preferably every two weeks, and a new batch at once pumped back to the turbine. The filter should have a precipitation compartment large enough to hold the entire batch of the largest turbine. The clean-oil compartment of the filter generally holds more than one batch and may also be used for the storage of new oil. When the batch has been let down into the filter from the turbine it is heated, allowed to stand at perfect rest for a period of time to precipitate its impurities, and then run through the straining medium to the clean-oil compartment.

One batch filter will serve a number of turbines and the oil will be made cleaner at less expense of operation than if partial filtration with circulating systems were used.

It is sometimes not convenient to shut down a large turbine so that the oil can be filtered as often as it should be. In this case a circulating filter is installed that will receive by overflow and return to the turbine a certain percentage of the total batch each hour. What percentage this should be is governed by the kind of oil used, the amount of water that leaks into it, the condition of the bearings, the amount of oil in the turbine, and its rate of circulation to the bearings. The writer believes that if 10 per cent of the batch passes through the filter each hour the oil will be kept in good condition. The oil should be taken from the lowest point in the reservoir and allowed to rise to an overflow sight set to maintain a given level in the turbine before it runs to the filter. From the clean-oil compartment of the filter the oil is pumped back to the turbine reservoir.

It is desirable to add to this system a storage tank large enough to hold the entire batch of oil, so that when the turbine is shut down all of the oil may be run through the filter into the storage tank. The filter should not be required to work to capacity when changing 10 per cent of the oil per hour, but should be large enough to clean the entire quantity of oil in from three to four hours.

The principal reason for turbine-oil filtration is to prevent the formation of an emulsion of oil and water and of sludge. Sludge when passed over the bearings stops up the oil grooves. The heat of the bearings, with the constant circulation of air through the oil, causes a mineral acid known as SO_2 to form, which in turn breaks down the good oil.

If 10 per cent of the contents of the turbine reservoir are removed from the bottom of the reservoir each hour, the oil will not have an opportunity to emulsify under normal conditions, and the breaking down of the oil will be impossible.

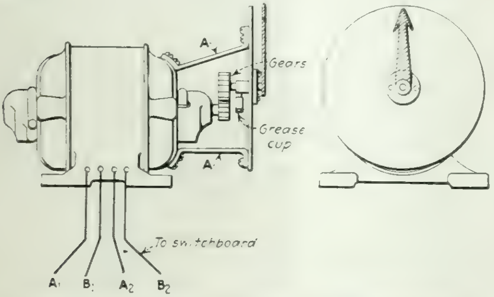
This information was contained in an article by Carver Wood in the *Journal* of the American Society of Lubrication Engineers.

Industrial Applications

The Economical Utilization of Electrical Energy
in Mills and Factories, Together with Practical Details of Installation, Control,
Testing and Repair of Equipment Required

Rotation Indicator for Testing Repaired Compensators

After an auto-starter has been repaired or overhauled it is necessary to see that the phase rotation on the secondary side is the same for both starting and running position. This purpose is accomplished conveniently in a New York repair shop by means of a rotation indicator connected to the switchboard, to which the leads from the auto-starter may be attached. This indicator consists of a dial mounted on top of the switchboard with the hands driven through gears by a slow-speed motor. For this purpose an old ¼-hp. polyphase industrial motor which had been cast aside was cleaned and rewound for 440 volts, two-phase, 60 cycles, with twenty-four poles which gives a synchronous speed of 300 r.p.m. The rewinding operation of this motor has already been described in the ELECTRICAL WORLD for Oct. 9, 1920, page 741. The motor shaft is fitted with a pinion having sixteen teeth, and this meshes with another pinion having forty-nine teeth mounted on a shaft in the rear of a 12-in. metal disk. The disk is fastened to the motor by means of the brackets shown at *A* in the illustration. A steel bushing fitted into the center of the disk serves as a bearing. Lubrication is accomplished by a grease cup taken from an old fan. A wick is used for lubricating and the cup is packed with vaseline. The indicator shaft extends through the front of the disk approximately ½ in., where a pointer, made up of ⅛-in. sheet brass, is pinned to the shaft. The disk is painted a dull black to serve as a background for the pointer, which is painted with aluminum paint to afford a better observation of the direction of rotation.



DIRECTION OF ROTATION OF PHASES OF AUTO-STARTER IS CHECKED BY ROTATION OF POINTER

Four leads run from the motor to binding posts on the switchboard. The secondary side of the auto-starter is connected to these binding posts. Voltage is put on the auto-starter, and after the handle is thrown to the starting position the direction of rotation of the indicator is noted. The handle is then thrown to the running position and the direction of rotation is again watched. If a reversal of rotation takes place, the leads of the auto-starter are improperly connected and must be changed.

The indicating motor has a two-phase winding with each phase separated from the other. When testing two-phase, four-wire starters, two leads of one phase are connected to A_1 and A_2, and the other two leads to B_1 and B_2. In testing a two-phase, three-wire starter or in testing a three-phase, three-wire starter, the studs marked A_2 and B_1 are tied together. This forms a connection for one phase leg, and the studs A_1 and B_2 serve as the other two legs. The motor may be used on either 220 volts or 440 volts.

This device has proved to be a decided time saver for the tester, as it eliminates the necessity of checking the internal connections.　　　E. R. DEBMAN.

East Orange, N. J.

Safety Standard for Industrial Control Equipment

In ORDER to study the problem of safety protection the Electrical Safety Conference, which is made up of the United States Bureau of Standards, the Underwriters' Laboratory, the National Workmen's Compensation Service Bureau and the electrical manufacturers, appointed a joint committee. In January, 1921, the Electrical Safety Conference published the proposed safety standards as drawn up by this committee. The proposed standard for industrial control will form part of a more complete standard to be used in conjunction with the National Electrical Safety Code.

The principal hazards may be briefly stated as follows: (1) Touching live parts; (2) arc or flash; (3) touching hot parts; (4) explosion of fuses; (5) gas or dust explosion; (6) injury from moving parts of controllers; (7) phase reversal; (8) unexpected starting; (9) overspeed; (10) lack of emergency stop; (11) overtravel; (12) failure of power; (13) overload. Most of these hazards can be avoided by the proper design and installation of the electrical equipment. The two hazards which most often result in accidents are the touching of live parts and injury from arc or flash.

The first six hazards may be guarded against by (1) inclosure, (2) isolation and (3) guarding. Some types of control apparatus such as push-button stations and drum controllers provide the requisite safety features by their construction and are, therefore, independent of the method of installation, provided that the inclosure is grounded. Other control apparatus, such as large contactor panels, often require protection by isolation or guarding. The control equipment should be placed so that it is readily accessible for operation, inspection and repairs. Sufficient working space should be provided about the control equipment to permit its being readily repaired or adjusted by qualified persons. This space should provide a secure footing and should be large enough to provide freedom of movement without the danger of interference from moving parts of that or other machinery.

The proposed safety code covers the subject in considerable detail and merits the careful attention of all persons interested in the manufacture or use of electrical control equipment. H. D. James, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., is chairman of the sub-committee which drafted this standard.

Motor Mounted on Drill Pedestal for Individual Drive

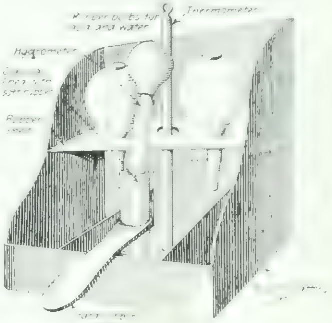
A COMPACT motor mounting for individual drive of a power drill is illustrated in the accompanying photograph, which shows a 1-hp. motor mounted on the rear of the drill pedestal and driving the drill by means of a belt. The motor takes up only the free space between an oil pump and the machine frame. Considering the large number of different speeds required at the drill and pump and the amount of shafting necessary, the drive is particularly compact. The starting switch is mounted upon 1½-in. x ¼-in. strap-iron pieces bolted to the frame. It is arranged at a convenient height for the left hand of the driller. Connection between the starting box and the motor is made through flexible conduits attached by clips to the drill frame. This installation is at East Springfield, Mass., in the plant of the Westinghouse Electric & Manufacturing Company. FIELD EDITOR ELECTRICAL WORLD.

Boston, Mass.

MOTOR MOUNTED ON LOWER PART OF FRAME DRIVES DRILL THROUGH BELT

Tray for Hydrometer, Thermometer and Syringes Used in Battery Work

AS A HANDY aid in equalizing the specific gravity of batteries, a tray for carrying hydrometer, thermometer and water and acid syringes is used in the vehicle-battery department of the New York Edison Company. The tray is made by cutting away part of the sides of an old hard-rubber battery jar in the manner shown in the accompanying drawing. At the middle of the jar a shelf of hard rubber made from an old jar is mounted. This is cut to fit in a groove on the front edges and has two projecting pieces which are inserted in holes in the back side of the jar to support the shelf. In this shelf are two holes for the syringes, one of which is used for water and the other for acid. Through a third and smaller hole a thermometer is placed. The bottom end of the thermometer rests in a rubber vent cap or nipple such as is employed in the vent hole of a cell. This cap is fastened in place with sealing compound. The hydrometer rests in a glass tube on the bottom of the jar in front of the shelf. This tube is lined with soft rubber to prevent breaking the hydrometer. For convenience in handling, a hard-rubber handle is placed on the tube. The handle is made by cutting a round hole in a length of battery-jar rubber, and the tube is inserted into this hole.



EQUIPMENT FOR EQUALIZING BATTERY ACID CARRIED CONVENIENTLY IN THIS TRAY

When equalizing a battery this tray, a bucket of water and one of acid are placed near at hand. All the necessary pieces are convenient to reach. Hydrometer and thermometer are replaced in their holders instead of being laid on top of the battery, from which they might fall off and break. The tips of the syringes are kept clean.

A. SHEINAUS,
Fore Battery Man, Auto Department.
New York Edison Company,
New York, N. Y.

Wear of Brushes, Commutator and Rings Lessened by Proper Attention

CARE in the operation of motors will be amply repaid by decreased trouble and wear of such parts as brushes, commutator and slip rings. If the commutator is very rough, a few fine turns taken off in a lathe will help exceedingly; but if only slightly rough or dirty, an application of No. 00 sandpaper will improve the surface. If the brushes flash steadily, a close examination of the mica between the bars will probably show an open circuit in the winding.

If a slip ring is quite rough, the indication is that its brush does not make good contact, owing to its being wedged by dirt, to too short a brush or to a weak tension spring. If a brush is excessively hot, it probably has no pigtail to conduct the current, and this omission will probably heat the spring also and spoil its temper. If the brushes squeak, apply a little vaseline or light oil; but a too generous application of any commutator compound is liable to clog the brushes in the holders.

If necessary to renew any brushes, take time to do the work right; that is, provide a good contact for each brush by drawing fine sandpaper under its surface. When the carbon seems to cut the commutator and makes much noise, a hard graphite brush may give better results if the commutator is very smooth; if rough, the graphite will wear down like chalk.

See that all brushes are free in the holders; renew short ones and clean the dirty ones. Brush tension should not be so strong as to wear out the brushes rapidly and cut the commutator, nor so light as to allow them to spark, but uniform and fairly strong for even wear and good contact. Any missing tension springs should be replaced. With electroplating generators the brushes, being of copper, should have only very slight tension, so as to reduce to the minimum any cutting of the commutator.

Brushes must be staggered in pairs of sets, the first two sets being in line and the next two sets in line with each other but staggered from the first two. This arrangement should be repeated taking in all sets.

East Berlin, Conn. H. S. RICH.

Detachable Platforms Keep Industrial Trucks Working

INTENSIVE study should be made to reduce costs in handling goods between freight stations or piers and warehouses and between the various buildings of large industrial plants, such as steel mills, shipyards, etc. Costs can be decreased by electric trucks designed to run both out of doors and indoors, with separable platforms to be loaded and unloaded while the truck is kept constantly busy hauling.

An example of this method of hauling goods is shown in the accompanying photograph illustrating a truck and platform used on a New York pier. The empty platform can be left for loading, while the loaded one is taken to the warerooms, where another gang is unloading the platform brought on the previous trip.

PLATFORM LEFT FOR UNLOADING WHILE THE TRUCK MAKES ANOTHER TRIP

FIELD EDITOR ELECTRICAL WORLD.

New York, N. Y.

Electrical Heating of 166 Rivets Cost 1 Mill per Pound

TWO months' experience with electric heating of rivets in this plant has shown notable economies over the old coal-fired furnace method now gradually being superseded on these premises. The best results are being attained by a Berwick rivet heater capable of heating five rivets in multiple at once. This equipment will handle rivets up to 7 in. maximum length, and on a recent run 166 ¾-in. x 3¼-in. rivets were heated at an energy cost of 1 mill per pound, the time required for the batch being only forty-five minutes. These were machine-driven rivets and were not heated to so high a temperature as hand-driven rivets. About 60 kw. input is taken by the machine when in service at full load. There are three heats, easily controlled by a switch accessible to the operator, and the average rate for energy purchased is 2.8 cents per kilowatt-hour.

Under present conditions of business it is difficult to determine the best economy of this machine over a considerable period. The figure above given represents the lowest cost attained in a run of which the input was metered carefully, and it may be noted that on another run only sixty hand-driven rivets were heated in seventy-five minutes. An energy cost of 7.8 mills was entailed. This was the maximum required in any run, and the average under present conditions is about 3.5 mills per pound. With a busier shop the demand for rivets naturally increases to a point yielding higher economies in energy consumption. Under pressure of heavy demand, 150 ¾-in. x 3½-in. rivets have been heated in twenty minutes in this machine, and a 5-in. rivet ⅞ in. in diameter can be heated for driving in fifty seconds. With the four coal-fired heaters formerly used sixteen hours per week, including overtime, was required for their care, and at least one and one-half times a year the furnaces had to be rebricked, the task taking the time of two men for a day, including overtime. Under such conditions the first cost of an electric riveter would be more than covered in its first year's service. The increased comfort to operators in the shop is also a strong point in favor of electric service. In selecting a rivet heater it was found helpful to secure the benefits of multiple rather than series operation, and thus to gain full-speed production under such conditions. In times of light business the facility with which the electrical supply can be controlled and cut off proves of great value in comparison with the expense of maintaining coal fires, which must in large measure be run regardless of the volume of heating demanded.

Eastern Bridge & Structural Co., A. S. MILL,
Worcester, Mass. Master Mechanic.

Protecting Commutators Against Oil

COMMUTATORS exposed to oil or to gas-engine fumes should be protected by double cords on both ends and several coats of baked Sterling varnish. When baking is impossible several air-dried coats of shellac should be used. All parts of the commutator not actually used for brush contact should be varnished, particularly the sections between the tails and at the front corner of the bars.

A commutator that is exposed to oil or fumes should have all of the insulation cleaned off weekly with a damp gasoline rag and should be revarnished at frequent intervals.

Central Station Service

A Department Devoted to Commercial Policy and Management Topics, Including Methods of Increasing the Use of Electric Light, Power and Heat

Central Maine Power Company Goes After Fan Business

ALTHOUGH it has been said that electric fans will sell themselves, almost, during the months of July and August, the Central Maine Power Company believes that much more profit can be realized by an active campaign in the fan season. Accordingly a plan has been mapped out on this basis: The thing to do is not to waste time telling people that there is such a thing as a fan. They know it already. When it is hot the problem is to convince people that they can afford a fan at home as well as in their place of business. The company placed its advertising matter in the hands of the newspapers, to be released when the first hot wave struck.

To further assist the sales force in pushing the fan business, the company issued the following suggestions as to the principal places where, for hot weather use, fans are sold:

1. Homes.—In addition to the usual argument for greater comfort during the hot days, emphasize the value of the fan on sultry nights. Tell how it makes for restful sleep and greater efficiency, giving the folks at home the same comforts you get in your office. If you can't go away for the summer, bring the cool breezes to your home.

An electric fan brings sleep to helpless infants on sultry nights.

An electric fan will dry the clothes indoors even if it is damp and muggy outside. Fans are particularly useful in kitchens in the summer, to blow the heat and cooking odors out of the window.

2. Stores, Hotels and Restaurants.—In stores fans help preserve perishable stock such as fruits and vegetables, keep candy in better condition and keep flies off all stock. They keep the vitality and "pep" of clerks up to a higher pitch, making them more comfortable and therefore more cheerful.

Fans have been found more effective than the banging screen door. The screen door, while necessary in some stores, is objectionable in that it shuts off the view of the store interior from the street almost as effectively as a solid door. A ceiling fan hung just outside and over the entrance will produce a strong down draft which will effectively bar flies. This same breeze will be equally effective in cooling the passerby and inviting him into the cooler store interior—or at least causing him to pause and look in your windows as he cools off.

Fans blowing across large mirrors are more effective than soap or netting in keeping off flies and are far more attractive to look at.

In hotels and restaurants the value of the fan is obvious. In all places where customers call fans improve the buying conditions by making the buyer comfortable. In short there is little use in going to great pains and expense to make the store, hotel or restaurant attractive to the eye if it is not attractive otherwise—to the body.

3. Offices.—Coolness in an office is considered essential to good work, and yet you will still find some offices where fans are not used to the extent that they might be. Mental effort is dependent on bodily comfort. Mistakes multiply, work slows down and brain keenness diminishes when the "dog days" arrive—unless the humid heat is driven out of the window by electric fans. Often, too, office space which would otherwise be wasted because of lack of ventilation is made useful by the addition of a fan. Dark, stuffy inside offices are made comfortable by electric light and fans.

4. Institutions of All Kinds.—If coolness prevents sickness, it just as surely relieves suffering and promotes recuperation. Not only are fans desirable in an institution for comfort's sake, but they are even more necessary for sanitary reasons. Fans are a necessity to ventilate sick rooms and make the life of the old and infirm more bearable.

Utility Rates for Service Should Be Made Clear to Customers

AS THE business of distributing electricity for power has grown and the field for its application has widened the difficulty of charging for this service so as to treat with justice a great variety of industries and to encourage the extension of its use into still wider fields has led to a considerable complication in the problem of rate making. E. L. Wilder of the Rochester (N. Y.) Gas & Electric Corporation, in discussing methods of expressing rates before the recent commercial meeting of the Empire State Gas & Electric Association, pointed out that minimum charges, service charges, delayed-payment excesses and prompt-payment discounts are not readily understood by customers.

"The fundamental trouble with our rates," said Mr. Wilder, "especially the more complicated ones, is that they are not understood. It is a well-established psychological principle that persons are suspicious of anything they don't understand. We are all built that way, and we must not expect that our consumers will accept the bills which we hand them month by month if we make no effort to explain what they are being charged for and why. Why does your grocer or meat dealer set his scales right out on the counter where you can check his weights, and what would you think of him if he kept them back of the counter and out of sight where you could not do so? The question is, then, how shall we make these rates understandable? I am going to assume that these more complicated forms of rates are necessary for the handling of industrial business. The main difficulty is that the terms we use are not understood, and in order that we may have something definite to talk about I will assume that we have to deal with a rather complicated three-charge schedule in which the kilowatt-hour charge involves the quantity 'hours' use of maximum demand,' and I propose that we insert in our rate book or print for distribution to our power consumers the following brief discussion of the underlying philosophy of rates and explanation of terms used:

" 'Our rates for power are based upon the theory that each consumer should pay in proportion to the cost of the service rendered. The surest and simplest way of accomplishing this seems to be to divide the charge into three distinct parts so that the total bill is the sum of these three. While this method of charging is not so easily understood as the simpler forms of rate schedules, still the experience of our own company and of many other companies throughout the country is that the advantages both to the company and to the consumer far outweigh the disadvantages.' "

Mr. Wilbur then followed with a detailed explanation of the principles involved and the reasons for minimum, consumer, demand and kilowatt-hour charges. When these are clearly understood by customers he thought much of the dissatisfaction with rates will be eliminated.

Good Citizenship and the Public Utilities

BACKING up the national campaign of good-will publicity, the Central Arizona Light & Power Company of Phoenix, Ariz., has run a series of advertisements in the local newspapers which was very productive of beneficial results. The advertisements were so well received that H. L. Aller, vice-president and general manager of the company, has had them set up in a booklet entitled "The Good Citizen and the Public Utility" and distributed to all of the company's customers. To explain the relation of utility service to the welfare of the community the introduction of the booklet says:

> The Good Citizen is one who is always alert to exert his influence constructively for the good of the community in which he lives and to make life fuller for his neighbors and himself. Ignorance breeds destruction, whereas knowledge is a prerequisite of any constructive activity.
>
> It is with the intention of bringing to every citizen of Phoenix intimate knowledge of the utilities in this city—what they have accomplished and are trying to accomplish in the upbuilding of the city, and the problems confronting them today—that this series of statements appears.
>
> The good citizen realizes that, although his own vocation requires no knowledge of the gas and electric industries, nevertheless since this is a subject touching the life of the whole community, he must seek that knowledge which will enable him to exert his influence in the most constructive manner.
>
> When a whole people are so dependent upon a commodity and a service, the character of that service is a vital force in the upbuilding of the community. Industries cannot become established where gas and electric services are not of the best. People will not come to a city to live where street lighting is poor, where electric and gas services are not available.
>
> Since this service is so essential, it is right that these industries be regulated by the state to insure that the public shall have good service, that facilities be added to meet the growing demands of the city, that the charges for service be reasonable and just.

The duties and problems of regulatory bodies are discussed as follows:

> Public utility regulation a few years ago was synonymous with rate reduction. The public service companies were frequently earning more than a reasonable return on their investments and were pared down in their earnings by the commissions until they earned only the minimum allowable return on the value of their properties. This made the regulating commissions very popular.
>
> Today a different condition exists. During the past five years the costs of operation have continually advanced. Rates for gas and electricity have had to be advanced a sufficient amount to enable the companies to exist. The regulating commissions have fought against rate increases, granting partial relief here and there, but very seldom granting the full relief necessary for the public utilities. The public has not been fully informed of the facts so that the commissions have been condemned by the public for increasing rates and also by the public service companies for not increasing rates enough to compensate for advances in costs of operation.
>
> No community can prosper and grow when poor service is rendered by the public utility companies. For community growth and prosperity these companies must be maintained in a healthy condition, able to keep their properties well maintained, able to pay for a good and efficient staff of employees and able to pay a good return to the investor who purchases their securities. With a dilapidated property, a poorly paid, inefficient corps of employees, and no new money flowing into the property from the sale of its securities to keep up with community growth, a public utility cannot give service. The good citizen will insist that the corporation commission shall regulate public utilities in a way which will give a square deal to the companies as well as a square deal to the public
>
> The public service company under regulation must secure the money necessary for its additions to plant, distribution system, meters, transformers and all similar property from the sale of its securities, namely, its stocks and bonds. The gas and electric utilities in Phoenix invested more than $800,000 in new property during the past two years. The construction budget for the next two years totals approximately $1,500,000. The extent to which these added facilities can be furnished to Phoenix depends upon the salability of the securities.
>
> When regulating commissions do not permit the public utilities to charge rates for gas and electricity which will permit the companies to pay interest rates that will attract capital, the companies cannot build additions to plant and cannot adequately serve the public.

In conclusion the pamphlet says:

> The good citizen has seen from the foregoing statements that a public utility's well being is essential to the public welfare. He realizes that without the support of the people —without his individual moral support—this essential industry cannot properly function.
>
> It is the careless word spoken by the man in the street, the destructive criticism that unthinkingly slips out "to make conversation" at the tea table or elsewhere, that injures not only the public service companies but also the city as a whole.
>
> When a public utility is exerting its every effort to build up its community, giving good service, operating efficiently under rates much lower than those current in the country as a whole, the good citizen will endeavor to assist constructively in meeting the difficulties that confront that industry from time to time.

One Way to Advertise Service

A VERY striking display board has been mounted by the Adirondack Power & Light Corporation at various points along the automobile routes in its territory, showing the layout of its transmission system. Locations of substations, water-power and steam-power stations are shown. Sites for these signs have been carefully chosen so that they will make the greatest impression upon automobilists.

DISPLAY BOARD PICTURING TRANSMISSION SYSTEM

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
of the World

Generators, Motors and Transformers

The Propelling Motors of the U. S. S. Tennessee.—H. L. BARNHOLDT.—It is said that the wound-rotor type of induction motor was selected owing to the fact that with the squirrel-cage winding the heat developed in the rotor during reversal was so great that it could not be dissipated. Moreover, the power factor was higher with the wound-rotor motor. Speed control was obtained partly by changing the number of poles in the stator windings and partly by controlling the speed and frequency of the turbine generator. There are four main motors, each driving one propeller and rated at 7,000 hp. at 170 r.p.m. Design and constructional problems involved in the motors are also discussed.—*Electric Journal*, June, 1921.

Generation, Transmission and Distribution

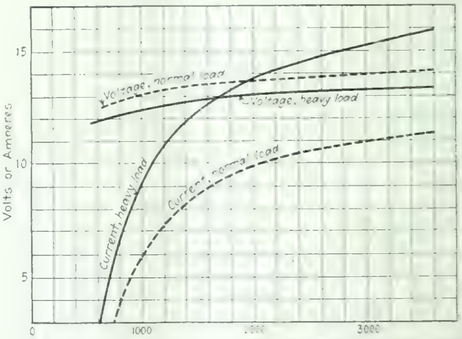
High-Tension Transmission Projects for the Electrification of France.—C. DUVAL and C. LAVANCHY.—The insufficient coal supply of France demands a more thorough utilization of all existing water powers. To make this effective and efficient a close study has to be made of the amount of power needed in the different consuming centers, the location of these and the possibility of transmitting the energy needed to them. The authors have studied these varied problems and show where it would be economical to locate power stations. One of these plants and lines, chosen as an actual example, is the line from Bellegarde to Paris, and it is shown that by adopting a three-phase system at 150,000 volts and 50 cycles about 25,000 kva. may be transmitted over a distance of 450 km. by one line at an over-all line efficiency of about 84 per cent, including transformer and synchronous-motor losses.—*Revue Générale de l'Electricité*, May 21, 1921.

Transmission Ring of Duquesne Light Company.—E. C. STONE.—A discussion of the method of power distribution adopted by this company, consisting of a closed ring of 66,000-volt lines around the Pittsburgh district.—*Electric Journal*, May, 1921.

New Type of Synchronous Vibration Rectifier.—L. SCHÜLER.—A number of mechanical rectifiers using a synchronously vibrating, magnet-operated contact have been known for many years, though little has been published about their theory. Two conditions must be fulfilled to obtain perfect rectification—the vibrator must operate absolutely in synchronism with the line frequency, and contact must be made and opened always at exactly the right time. The author has gone into the theory of these rectifiers and has succeeded in designing a new type. Its swinging armature is controlled by two strong springs. The weight of the swinging system, the pull of the springs and the amount of the artificially introduced mechanical damping are so exactly determined and adjusted that the contact opens virtually at the zero instant, obviating the need for a condenser. The connection and the principle of the rectifier are, however, such that only one-half of the alternating current is rectified, that is, the armature must swing but once during each period. This is achieved by superimposing a direct voltage over the alternating voltage. This in turn means that the new rectifier can be used only for charging storage batteries.—*Elektrotechnische Zeitschrift*, May 12, 1921.

Lamps and Lighting

The Latest Bleriot "Phi" Starting and Lighting Equipment.—The generator and starting motor of this equipment are separate units, the "single-unit" system having, according to the author, been found unsuitable for large engines. The generator, called a "bi-compound" machine, contains one shunt field and one series field, the series winding exerting a demagnetizing action. To improve the control a voltage regular of the vibrating type introduces a resistance into the shunt winding when the voltage of the machine rises above a certain value. There is also a tap on the series field winding from which current is led off in case of extra-heavy demands for it, thus decreasing the demagnetizing action of the series field. The starter is a series-wound motor. This equipment is said to be particularly suited to high-priced cars.—London *Electrician*, May 27, 1921.



VOLTAGE CONTROL OF HIGH-CLASS AUTOMOBILE GENERATOR

Traction

Electrification at 3,000 Volts on Paulista.—Details of locomotives, substation and power distribution system for one of Brazil's best railroads are given by engineers of American manufacturers who supplied equipment. Greatly increasing activities in the electrification in Brazil are indicated.—*Electric Railway Journal*, June 11, 1921.

Scientific Fundamentals in the Design of Rolling Stock.—DR. E. SEEFEHLNER.—The low ebb of all the Austrian street-railway systems is regarded as of only temporary character, and they are expected to revive and begin reconstruction in the near future. The author therefore takes occasion to review theoretically a few important details of street-railway construction to aid car design. Among these details are studies of wear of wheels and rails and of the best construction of brakes, car bodies and gears.—*Elektrotechnische und Maschinenbau,* May 29, 1921.

General Electrification of Jugoslavia.—M. DIMITRIJEVIC.—The favorable geographical location of Jugoslavia, with its abundance of water power and vast coal fields, justifies an extensive general electrification of the new republic. The article is an abstract of an official electrification program to be presented shortly before the Jugoslavian parliament.—*Elektrotechnische Zeitschrift,* May 19, 1921.

Electrochemistry and Batteries

Ozone.—ALBERT CLARKE.—The electrical production of ozone and some of its uses, such as for water purification and sterilization, are discussed.—*Beama* (British Electrical and Allied Manufacturers' Association), May, 1921. Systems are grouped according to whether a dielectric is inserted between electrodes.

Installations, Systems and Appliances

Present Limits of Electrical Machinery—III and IV —Switching Apparatus and Lines.—W. REICHEL.—The increasing capacities of electrical central stations necessitated the development of electric switches capable of safely rupturing huge amounts of energy. The hand operation of such switchgear was no longer possible, and motor or magnet power was introduced instead. The most severe endurance test is imposed upon a large-capacity switch when it is closed upon a still existing short circuit. The largest direct-current switches are probably used in the electrolytic industries, comprising sizes up to 250-volt and 20,000-amp. A 17,000-amp. switch, operated by a magnet with turning armature, is shown. For alternating-current switches such high currents are never encountered, but values may reach 10,000 amp. A three-pole, 6,000-amp., 500-volt motor-operated air-break switch is shown. All alternating-current switches for high voltage must have oil-immersed contacts to quench the arc properly. The problem with oil switches of large rupturing capacity is the proper care of the gases generated in the oil during the break. For this reason all multipolar switches are subdivided into individual switches for each phase. No other way of safeguarding has been found than to build the oil containers fully pressure-proof, withstanding as high a pressure as 15 atmospheres. Photographs and sketches are given of several 6,000-volt to 150,000-volt, three-phase switches. The article closes with a short description of high-voltage lines using disk-type insulators. Sketches are given for single and double strings up to 100 kv., and vector diagrams for compensated and uncompensated lines up to 260 kv. Special attention is given to the proper transposition of such high-voltage lines to prevent inductive disturbances.—*Elektrotechnische Zeitschrift,* May 14, 1921.

Novel Methods for Use of a Grounding Choke Coil.—PROF. REIHOFFER.—The well-known, and in Europe much used, Petersen grounding choke coil can be employed on Y-connected generators or transformers, being connected between the Y point and ground. The author also shows several different ways to use such a protection coil on delta systems. The usefulness of these methods is proved mathematically.—*Elektrotechnische und Maschinenbau,* May 22, 1921.

Units, Measurements and Instruments

Influence of an Electric Current on the Photo-Electric Effect. — ALLEN G. SHENSTONE. — Experiments were made to show whether there was any relation between the Hall effect in bismuth and the photo-electric effect. It was found that the total photo-electric current was so much influenced by the current passing through the bismuth that the variation of this apparently new effect was investigated.—*Philosophical Magazine,* June, 1921.

Oscillographic Measurements of the Instantaneous Values of Current and Voltage in the Battery Circuit of Automobiles.—GEORGE W. VINAL and C. L. SNYDER. —An investigation to study the demands upon starting and lighting batteries in the operation of various types of automobiles. Oscillographic records of current and voltage were obtained. In addition to the data relative to the battery requirements, the interpretation of the records has indicated the possibility of using this method for the study of lubrication and engine problems relating to speed, friction, ignition, compression and distributer action.—*Technologic Paper No. 186, U. S. Bureau of Standards.*

Telegraphy, Telephony and Signals

Radio Developments for Airplane Use—Indirect Excitation Apparatus — II. — M. BERNARD.—This article gives a detailed description, diagrams and many illustrations of the different types of sending and receiving apparatus used on French airplanes and seaplanes during the war. All the more recent models were energized from high-frequency generators driven by small propellers. In their principle all types were identical, using a step-up transformer, two mica condensers, a variable inductance, a wave-length variometer and a paid-out-wire antenna. The proper resonance to a desired wave length was determined by readings on a hot-wire ammeter. An interesting detail was the spark gap, which was cooled and quenched by a specially collected and directed current of air taken in by a rubber funnel mounted on a wing and connected to the gap by a rubber hose.—*Radioelectricité,* May, 1921.

Some Improvements in the Poulsen Arc.—P. O. PEDERSEN.—A study showing the importance of getting the correct magnetic field in the operation of the Poulsen arc.—London *Electrician,* June 3 and 10, 1921.

Miscellaneous

Hydro-Electric Power Possibilities Along the Main-Danube Canal in Bavaria.—The possibilities of large water powers along this canal have been investigated, and the results of this preliminary work have been published in a book by J. Hallinger, Munich. The canal in its present form would yield about 100,000 hp., but with some additions and connections with other watersheds up to 1,000,000 hp. may be obtained. All data are based upon careful hydrographic observations and rough cost estimates. Sketches of the proposed sites are included in the paper.—*Elektrotechnische Zeitschrift,* May 19, 1921.

Scottish Water-Power Schemes.—It is proposed to utilize the yield of a catchment area in the vicinity of Loch Laggan and Loch Treig in which the annual rainfall is probably fully 70 in. (178 cm.). The average available head at the turbines will be nearly 700 ft. (213 m.), giving an average development of 72,000 horsepower. The works will be constructed so that over 100,000 hp. can be developed when sufficient water is available.—London *Engineer,* May 20, 1921.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

State Development of Water Power Means Taxation

"STATE development of water powers presupposes bonding property for millions of dollars, taxation for weary ages to pay the bonds, operation by state employees without the incentive of competition or pride in one's work, and a population leisurely operating until the hour for presenting their pay checks," declared Charles P. Barnes, speaker of the Maine House of Representatives, in a recent address at Rockland, Me. After sketching the early development of water powers in the state, Mr. Barnes pointed out that a survey of its rivers from the thoroughly developed Presumpscott to the distant Aroostook, furnishing light and power for all of northeastern Maine, tends to demonstrate that development by private capital has gone hand in hand with demand. State development, he contended, would drive away the men of its population gifted with initiative, energy and courage who have built up the present systems of supply and profited on their investment. It is not the duty of the state, he intimated, to supply electricity to every homestead regardless of its remoteness from the trunk lines of commerce.

Progress in Standardization Is Reported by A. M. E. S. at New London

THE summer meeting of the Associated Manufacturers of Electrical Supplies was held at the Hotel Griswold, New London, Conn., on Monday, Tuesday, Wednesday and Thursday of last week. Far from normal as general business conditions are, the attendance at the various section meetings was the largest in the history of the association. Naturally much of the discussion centered on present conditions in the electrical industry. It was evident that many manufacturers are finding it difficult to conduct business profitably even though prices of materials have been considerably reduced. Some wire manufacturers find themselves in grave financial straits, while others are preparing to shut down for a month or so to get rid of accumulated stocks.

Efforts at standardization are going forward and will become effective within the year. The Radio Apparatus Section, which was formed in May, elected its committees and laid plans for a publicity campaign on radio matters to offset the erroneous information often printed by the daily press. The manufacturers of panelboards and switches held a very long session in an effort to arrive at certain standards acceptable to all. Particular attention was given to interpretations, usages and safety matters in connection with rulings of the underwriters. Meter entrance service standards were also proposed. Similar questions came up before the Knife Switch Section, the name of which was changed to Knife and Inclosed Switch Section. An arrangement has been effected among eleven manufacturers of attachment plugs and receptacles to turn out a standard plug and receptacle for lighting fixtures which will carry the name "Elexit." Models were on exhibition for wall and ceiling application, and it is expected that production will take place in the late fall or winter.

The Heating Appliance Section elected Walter Stearns chairman.

Los Angeles Wins Fight to Condemn Property of Southern Sierras

LOS ANGELES has acquired through a suit in the United States District Court in San Francisco the right to condemn the Owens River Gorge property of the Southern Sierras Power Company, the price which the city must pay being fixed at $525,000. The city claimed that this property was essential to its own plans of power development, while the company declared that the area was needed by it to supply future demands from Riverside, Redlands, San Bernardino and Imperial Valley towns. The city contended that the company had other sources of power in Leevining and Bishop Creeks.

Riparian water rights alone were considered, it being agreed that no value attached to the 320 acres of land itself. The rights were bought by the Southern Sierras Power Company shortly before the filing of the suit on Feb. 9, 1920, for $400,000. Engineers testifying for the company fixed the value at $722,000 and $900,000.

No damages were allowed for the Adams power plant erected by the company on the site in dispute, on the ground that this improvement was begun subsequently to the filing of the suit. The company may appeal.

Why Utility Rates Are Not Dropping

A NUMBER of reasons for maintaining utility rates at their present levels are given in a public statement just issued by J. P. Pulliam, president of the Wisconsin Electrical Association and Wisconsin Gas Association. The statement is in reply to questions coming from various parts of Wisconsin asking why prices of public utility services are not dropping with those of other commodities. It is prefaced by the declaration that public utilities are the only business whose operating sheets did not record payment of excess-profit taxes during the war.

"One reason that many people seem to forget is that utility rates did not advance comparably with commodity prices during the period when farmers', laborers', retailers', manufacturers' and property owners' profits soared sky high," said Mr. Pulliam. "Utilities' earnings were anchored to earth by regulation. They were not permitted to earn profits of 100 per cent and more all those years, like other businesses were. Utilities obtained increases only within the last year or so, and those increases limited them to 6 and 8 per cent returns. If utility rates did not double, treble or quadruple, naturally it is impossible to contract them like other commodities. Utilities were and still are the cheapest commodities necessary to life on the market today.

"Another reason is that during this period when utility earnings were not permitted to soar their operating costs steadily increased. Drops in prices of commodities used by utilities have been more apparent than real. To get back to pre-war levels would mean that commodities used by utilities would also have to be based on pre-war prices. That would mean that coal screenings which now cannot be contracted for at less than \$2.50 a ton at the mines would again have to go down to 80 cents a ton, where they were four years ago. Pre-war rates would also mean basic freight rates 60 per cent lower than they are today, and labor would also have to be on a pre-war basis.

"A further reason is that utilities are being bowed under a constantly accumulating tax load. In Wisconsin taxes on utilities have increased in the past ten years 238 per cent, and I am just informed that the tax commission has announced another increase of 11 per cent or more for 1921. In many instances increases in taxes alone are such as to offset all reductions in cost of coal, materials, supplies and operation. In some instances taxation is forcing rates higher.

"People did not show a great concern about such small items as utility rates when they were being kept down while all other prices went up, but now when they are being raised 2 and 3 cents for street-car rides and a small amount per month for gas and telephone services, to meet higher operating costs, people who generally will be reasonable when they stop to think are persistently refusing to do so.

"The utilities seek the co-operation of the public with the strong desire to give the people the best service possible, if for no other reason than a selfish one, for the more and better we please the public the more of our service the public will use. The interests of the public and of the utilities therefore are in accord, not in conflict."

International Commission Gets St. Lawrence Report

THE International Joint Commission received this week the report of Col. W. P. Wooten and W. A. Bowden, the engineers appointed respectively by the American and Canadian governments to make a survey of the possibilities of canalization of the St. Lawrence as a means of shipping and the relation thereto of hydro-electric power. They report that the work would cost \$250,000,000 and would result in the development of 1,700,000 hp. at the ten locks planned. Plans are submitted for 25 and 30 ft. depth waterways 120 miles long.

Four methods are suggested: (1) Locks and navigation dams in the river, (2) locks and side canals, (3) a combination of the two previous, and (4) by means of locks and power dams. The report recommends a combination of the four, declaring that the power so developed would pay for the entire project in a few years.

The report now awaits the action of the International Joint Commission.

House Passes Radio Bills

THE House of Representatives has passed a bill authorizing the Secretary of the Navy to use all the radio stations of that department for the transmission of press messages and private commercial messages. The bill in the form passed by the House provides that the rates must not be less than those charged by privately owned radio stations. The authority is to cease when the privately operated stations are sufficient to handle the business offered. The bill now goes to the Senate for consideration.

The committee on military affairs of the House also has reported favorably the bill authorizing the Secretary of War, the Attorney-General and the Secretary of the Navy to adjust all meritorious claims against the United States arising from the use by the United States of patented inventions relating to radio communication. The bill as recommended by the committee appropriates \$2,500,000 for the settlement of these claims.

Delegates to the 1921 Canadian Electrical Convention at Quebec

Energy Sales of Pacific Gas & Electric Increases 50 per Cent in Year

GROSS operating revenue of the Pacific Gas & Electric Company for 1920, according to the annual report of the directors, just issued, was $34,475,372, as compared with $25,938,372 in 1919, and net earnings from operation were $11,024,773, as compared with $9,689,245. In its four branches of service—gas, electric, water and steam—the company served 569,360 customers, a gain of 386,745 in thirteen years. Electric service customers increased from 54,772 to 266,132 in that period, and in 1920 30,413 electric customers were added, as against 18,328 in all three other branches. Sales of electric power last year reached nearly $11,000,000, an increase of 170½ per cent over 1915. Total sales of electrical energy in 1920 to all classes of customers were $21,571,321, or $7,096,437 more than in 1919.

Homer Electric Company Wins in Inductive Interference Dispute

REAFFIRMING its previous grant to the Homer Electric Light & Power Company of a certificate of convenience and necessity to establish a 13,000-volt service to rural customers along a country road, the Illinois Public Utility Commission on June 30 handed down its decision in the Homer inductive interference case. Specifically stating that the issues were whether one utility could bar another from the highways by reason of its prior occupancy and whether the creation of an additional parallel line would increase existing disturbances to such an extent that substantial interference with the commercial service of the telephone company would result, the commission holds that the needs of the property owners who have dedicated the roads for purposes of travel must receive first consideration. These owners cannot be deprived of a needed service through the application of the "prior rights" theory. On the second point the commission holds that to receive consideration interference must be of a character distinctly injurious to the commercial service given over the telephone circuits. In the case at issue the evidence was held to be conjectural and not to show that substantial interference would be the result of the new transmission line.

The Homer Electric Light & Power Company therefore received the right to proceed with the operation of its newly constructed circuit. The telephone companies are instructed to submit a plan of co-ordinated transpositions that will be needed if interference develops. The power company will be required to eliminate the single-phase taps from its three-phase lines by making them three-phase. The division of the expense of a co-ordinated system of transpositions will be considered by the taking of further evidence, in case it becomes necessary, though the commission expressed the opinion that in cases involving new construction each company should bear its own expense.

The case involved the right of the power company to construct in addition to the 7½ miles of its present circuit approximately 5 miles of 13,000-volt circuit along a country road. This construction had once been forbidden because the consumer—a coal mine—could be reached by another route. In September, 1920 when farmers along the route petitioned for service, permission to construct the line was granted, and the present decision is the result of a rehearing on the petition of the telephone companies interested. Jurisdiction for further consideration of the case is expressely retained by the commission.

Utilities Oppose Depreciation Fund Ruling of Oklahoma Commission

REPRESENTATIVES of the gas, natural-gas, telephone and electric light and power companies of the State of Oklahoma were unanimous on June 21 in opposing the order of the state Public Utility Commission relative to depreciation funds. This order which was to have become operative July 1, required the creation and maintenance of a separate depreciation reserve fund. No dividends in excess of 6 per cent were to be permitted until the full amount of allowed depreciation had been paid into the fund. The fund could be used only (a) for depreciation, (b) for investment in high-grade securities at not less than 4 per cent, or (c) the company might borrow for not more than three years to the extent of not more than 60 per cent of the cost of extensions, additions, etc. The rule is in many respects almost identical with the Crown Point Telephone Company order of the Indiana commission of Dec. 28, 1918. This order was suspended in January, 1920.

The utilities had twenty days in which to submit briefs. Fred Herbert, director of the service department of the N. E. L. A., was present at the hearing and has submitted a brief. The utilities are contending for a reserve sufficient to take care of recurring replacements as against a definite fund separately maintained. Under the proposed ruling, the utilities contend, it would be almost impossible to obtain money for construction purposes. Besides, they see no reason why the public should be burdened with high money costs when the funds are available in a depreciation reserve.

Municipal Board in Centralia, Wash., Backs Utility Against Commission

AN UNUSUAL, if not unprecedented, utility situation is presented at Centralia, Wash., where the municipal Department of Public Works is backing the North Coast Power Company, the former holder of the city lighting contract, against the Sherman County Light & Power Company, an Oregon company authorized to do business in Washington and to which, on the expiration of the North Coast company's contract, the city transferred its lighting business.

The arrangement with the Sherman County company, whose proposed Centralia rates are uniformly lower than those of its competitor, was made after an increase in the wholesale rates of the North Coast company. The Department of Public Works, however, maintains that the prior occupant of the field did not realize undue profit, pointing out that it is essential to continuous and adequate service that rates be sufficient, and dwelling on the statutory requirement that the department shall make such rates as will produce adequate net income for continuous and prosperous business and prevent unjust discrimination between individuals and communities. The department holds that the rates of the newly established company are too low to insure good service with proper repairs and extensions.

Chicago Appliance Sale Ordinance Laid Over

AT A RECENT meeting of the gas, oil and electricity committee of the Chicago City Council it was decided to lay over until fall the proposed ordinance to license the sale in Chicago of electrical appliances. The proposed ordinance has been the target of much opposition, and at the last meeting of the committee the original ordinance was considerably amended in order to reduce this opposition. Consideration of various amendments was so prolonged that it became impossible to get the bill before the Council previous to the summer vacation.

Commercial and Merchandising Problems Before New York Association

COMMERCIAL department organization and merchandising methods were the chief topic of discussion at the meeting of the Commercial Section of the Empire State Gas & Electrical Association held in Cooperstown, N. Y., June 24. Advocating the solicitation of new lighting customers because this business nets the utility a higher return considering the investment involved than any other class, W. J. Reagan of Utica pointed out that because of the constant development of new appliances the so-called saturation point in sales can never be reached. He further stated that the central-station company should maintain a repair service for socket appliances, as in many communities it is estimated that only 25 per cent of the appliances that have been sold are in service. In connection with the securing of new house-wiring contracts Mr. Reagan described a co-operative plan which had been worked out by the central-station company, the contractor-dealers and one of the principal banks whereby the company's salesmen secured this business, the contractor-dealers did the actual work and the bank carried the deferred payments of the customer. This plan has been found highly satisfactory to all the parties concerned.

In a paper on the "Method of Expressing Differential Rates for Commercial and Industrial Consumers," E. L. Wilder of Rochester presented an interesting analysis of the various classes of rates and the different factors which enter into rate making.

That many of the complaints received by utilities from their customers are due to the indifferent attitude of some company employee was brought out by John H. Ghegan in a paper on "Meeting the Public in the Commercial Office."

Good service and systematic maintenance of appliances are primary essentials to successful merchandising, asserted S. Smith of the New York State Gas & Electric Corporation in discussing the sale of appliances to commercial and industrial consumers.

Under existing financial conditions extensions of service must be most carefully considered, according to H. A. Doering of the Westchester Lighting Company, who pointed out that new extensions should be made only on a profitable basis in order further to attract new capital.

In presenting the preliminary report of the committee on rural lines, B. H. Shepard brought out the fact that even though the farmers pay the entire first cost of a rural line, the fixed charges, such as maintenance, taxes, depreciation and ultimate renewal, must be paid by the electric light and power company. As a means of decreasing the cost of construction and reducing the service charges to consumers on these lines Mr. Shepard suggested the organization of highway lighting systems. As a further means of reducing cost of construction Mr. Shepard thought that it would be possible, on single-phase lines, to use 250-ft. spans instead of 125-ft. spans, the total cost of which per mile of line would be $1,088.13 and $1,510.85 respectively, or a saving of $422.72 per mile on the longer spans.

N. E. L. A. Executive Committees Lay Groundwork for New Year

MEETINGS of the executive committee of the N. E. L. A. and of the executive committees of the Public Relations and the Accounting Sections were held last week at headquarters in New York. The Technical Section executive committee meeting was postponed, probably until late in July. The Commercial Section's executive committee is scheduled to meet later this month at Association Island.

The national executive committee went over details incidental to laying out a program for the year. Pending the organization of the Eastern Geographic Division of New York, New Jersey and Pennsylvania, it was resolved that the Pennsylvania Electric Association be recognized as the Eastern Geographic Section. The next meeting of this committee is scheduled for Sept. 1 in New York.

At the meeting of the executive committee of the Public Relations Section the question of interesting women employers in public relations was taken up, with the thought that perhaps they could reach the women of any community better than could the men. A committee on public speaking is to be formed, also one in each geographic division and then one in each state. The committees of last year are to be continued.

Final action was taken on the association's good-will film, "Back of the Button," and distribution of this film will begin about Aug. 1. The first public showing of this film will take place at the New York Hippodrome, where it will start a two weeks' run next week.

In the Accounting Section steps were taken whereby every Class A member will be advised of the status of the commission accounting system in his state in relation to the uniform classification of the association. Every effort will be made this year, it is said, to make this classification national as far as possible.

Contractors to Emphasize Spirit of Optimism at Convention

EMPHASIS will be placed on the spirit of optimism at the annual convention of the National Association of Electrical Contractors and Dealers to be held week after next in Buffalo. The convention, which will be held at the Lafayette Hotel, July 18 to 23, will be built around the theme of looking forward to better business, according to W. H. Morton, general secretary of the association.

From present indications the convention will be as large as, if not larger than, previous ones. Some of the state associations in the East are planning to hold their annual convention in conjunction with the national convention. The program was printed on page 1010 of the ELECTRICAL WORLD for April 30.

Reclassification of North American Stock Proposed as Aid to Financing

IN ORDER to raise new capital and make the company's stock attractive to investors, a plan for reclassification and readjustment of the capital stock of the North American Company has been proposed to stockholders. At present, there is $29,793,300 outstanding of $30,000,000 authorized capital stock, all of one class. Under the proposed plan two classes of stock will be provided, 6 per cent cumulative preferred and common, each authorized to the amount of $30,000,000 The preferred is to be redeemable at 105. It is not proposed to increase the outstanding stock at present, but to issue for each $100 of stock outstanding $50 of new preferred stock and $50 of the new common.

In submitting the plan the committee says:

"The subsidiaries of your company serve rapidly growing districts comprising some of the most important industrial centers in the country. The demand for increased facilities has grown continuously and rapidly. With this demand have come large requirements for new capital. Continued exclusive use by subsidiaries of bonds and notes to finance the cost of such added facilities tends in time to produce a financial set-up topheavy in debt and generally to impair the credit of your company and its subsidiaries.

"The rapid growth of the properties has required a larger amount of capital than the subsidiaries could provide, and it has been necessary to make up the balance from surplus earnings, the quoted market discount on the stock of your company as now organized making it impossible to meet these capital requirements from the sale of additional amounts of such stock. It thus becomes imperative that a readjustment of capitalization be effected which will make it practicable to raise new capital and permit the distribution of a larger proportion of these earnings to stockholders."

The total net earnings of the company available for dividends, depreciation and surplus during the past twelve years have amounted to $41,607,582.82, or $139.65 per share. Of this $24,600,574.07, or $82.57 per share, was reinvested in the properties, while $17,007,008.75, or $57.08 per share, was distributed to stockholders as dividends.

Coosa River Development Again Going Forward

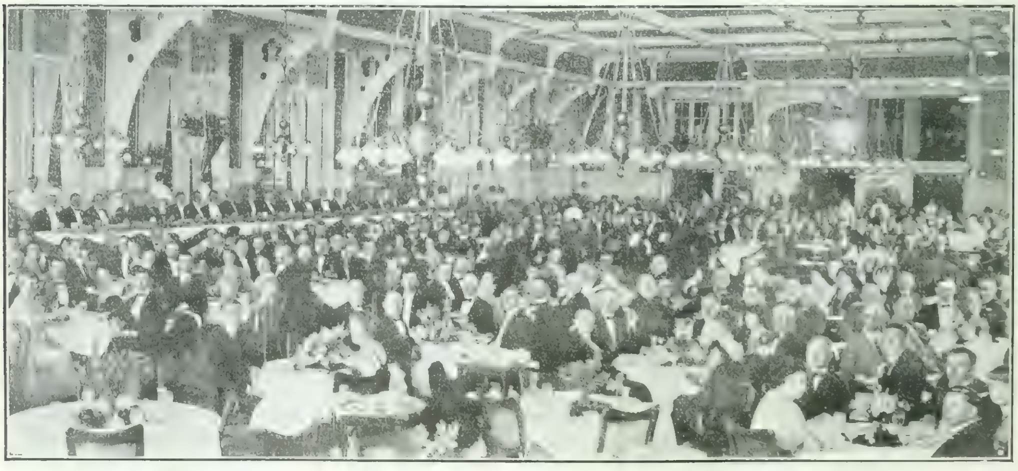
WORK has been begun by the Alabama Power Company on the Duncan's Riffle project on the Coosa River, a permit for which was granted by the Federal Power Commission June 27. The dam, to be known as the "Mitchell dam," will be completed in about two years.

It is interesting that this project, which is named after the late James Mitchell, was authorized in 1912 by both houses of Congress but was vetoed by the president. This was at the beginning of the controversy over water-power legislation. The existing plant at "Lock 12" was authorized in 1907 and placed in operation in 1913. It is now proposed to follow along the plan originally laid down by Mr. Mitchell.

The dam will be 1,200 ft. long and develop a head of 68 ft. The initial installation will be two single-runner, vertical, 24,000-hp., direct-connected units. with provision for three more units.

It is planned to introduce two noteworthy departures from previous designs of similar plants. One of these is the location of the units, which will be on the upstream side of the dam, each in a separate inclosure and on its own concrete foundation and with electrical connection through a gallery connecting the several units. The other departure is in the design of the draft tubes. An improvement is introduced here which will reduce the loss of head during a period of high water by causing the draft tubes to discharge upward at the toe of the dam.

Pacific Coast Division, N. E. L. A. Banquet



MANY notables, some from the Atlantic Coast, attended and took part in the annual convention of the Pacific Coast Division of the National Electric Light Association, held this year in June at Del Monte, Cal., to which representatives of California industries were invited to hear of the dependence of the Pacific Coast on electrical progress.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest

Arlington Radio Plant Little Affected by Lightning Bolt.—Last week during a severe electrical storm the navy radio station at Arlington, Va., was struck by lightning and had temporarily to suspend operation. Men were at once set to work to put the plant back into operation, and the interruption was of short duration. No one was injured by the bolt.

Alabama Power Company Completes Interstate Transmission Line.—The interconnecting line between Gadsden, Ala., and Lindale, Ga., has been completed by the Alabama Power Company and is now in operation. It connects the power systems of the two states, permitting the importation of energy by either from the other in case of low water or accident to the service.

Milwaukee to Have Electrical Show.—An electrical show will be put on in the auditorium at Milwaukee. Oct. 24 to 30, 1921, by the Milwaukee District of the Wisconsin State Association of Electrical Contractors and Dealers. A bungalow, 30 ft. x 60 ft., to be erected at a cost of between $15,000 and $20,000, will be fitted up as an electrical home. Every possible use of electricity in the home will be represented.

Another Great Battleship to Be Electrically Propelled.—The Maryland, the latest and most powerful of the United States Navy's superdreadnoughts and the first to mount 16-in. guns, is, like her sister ship, the California, electrically propelled and electrically equipped throughout. Her electric propulsion equipment was manufactured by the General Electric Company. The Maryland is 624 ft. long, with a beam of 97 ft., and displaces 32,000 tons. She carries eight 16-in. guns in four turrets, giving her the longest range of all the vessels in the navy. She is expected to go into service early in the fall.

Combating Insects with an Appetite for Insulation.—The installation of electrical apparatus in the tropics where bugs and insects abound has given rise to a number of problems not met with in the temperate zone, says a house-organ article issued by the United States Rubber Company. In some tropical countries ants have shown an amazing appetite for the insulating covers of electric wires, while in others electrical systems have been sadly disarranged by spiders, which seem to regard the wires as gymnasium apparatus put up for their special amusement. In Southern India white ants have discovered that the paraffine finish of annunciator wire is very good eating and that the cotton braid underneath is a genuine delicacy. To circumvent the insects wire sent to this section is now covered with a black weatherproofing compound for which bugs have no appetite. There is also a type of borer that will bore its way through any thickness of lead covering used on armored cables. This presents a serious problem, as moisture works its way through into the conductor, causing short circuits.

Wireless Men Entertained at Top of Eiffel Tower.—The fifty delegates attending the international wireless conference at Paris were recently entertained, with their wives, at the highest level in the Eiffel Tower—a point beyond where the public is permitted to ascend. Their host was Alexandre Gustave Eiffel, the builder of the tower, who is eighty-nine years old. He met his guests at the bottom of the tower and escorted them by elevator to the top. Major-General Squier, chief of the Signal Corps of the United States Army, with others, thanked Mr. Eiffel for his "surprise party."

The English Electricity Supply Bill.—No progress had been made at last report on the bill introduced into the British Parliament to amend the electricity supply bill. This amendment was looked upon as highly desirable in order to promote the co-operative measures of the existing act and especially to make their financing more easy. However, the London *Electrician* is of the opinion that there need not be any break in the activities of the electricity commissioners. They can, it says, continue the work of defining and delimiting electricity areas, the investigation of existing sources of supply and the collection of data. Their powers are sufficiently wide to enable them to bring great pressure to bear upon both municipal and company "undertakers" in order to co-ordinate and standardize methods of supply and distribution, and they can, apparently, set up joint boards or committees of local authorities as temporary substitutes for the joint electricity authorities authorized in the act.

Exciting Time in Pine Bluffs (Wyo.) Generating Plant.—There seems room for improvement in customer relations at Pine Bluffs, Wyo., to judge from the following account of trouble sent to the ELECTRICAL WORLD by the superintendent of the local generating plant: "On June 18 we had a real attempt to wreck a generator in the Pine Bluffs plant. On this day we had disconnected thirty-eight customers who had been failing to pay their bills. As the town night watch had recently left, the night engineer had instructions to make short trips, about two blocks from the plant, to watch the town and stores. About half-past one he locked the doors and when about two blocks away a heavy load came on the engine. Running back to the plant, he found the room full of insulation smoke and started up a 100-hp., 72-kva. unit and transferred the load to it. Getting to the plant myself by this time, we were unable to find anything wrong or burned about the small 40-kva. generator and put the load back on it. Further search showed a window screen torn off, and, noticing some solder on the foundation of the 72-kva. unit, we saw that the generator had been switched in on the line when not running, and the rotating field generated had developed enough heat in the outer 1½ in. of the field poles and coils to char the insulation. As there are only about three or four volts across the coils and they were built out away from the iron, leaving an air space, we are still using the machine, which is a Westinghouse connected to a Fairbanks-Morse engine. About a month ago some one fired a shotgun through the door at the 40-kva. generator but did no damage to it. The shot glanced off and went through some new Cutter street hoods, spoiling the enamel. This generator is a 40-kva. connected to a 50-hp. Fairbanks-Morse engine. The little engine stalled when the switch was thrown in. Incidentally," adds our correspondent, "the night engineer does not have to do any more watching outside the plant."

Associations and Societies

West Virginia-Kentucky Association of Mine, Mechanical and Electrical Engineers.—The annual convention of this association will be held in Huntington, W. Va., on Sept. 20 to Sept. 23.

Empire State Gas and Electric Association.—The annual convention of this association has been set for Oct. 6 and 7 next, when public relations will be discussed from various standpoints.

Indiana Electric Light Association.—The annual meeting of the Indiana Electric Light Association will be held at French Lick Springs in September, according to an announcement by the secretary, Thomas Donohue of Lafayette.

Coming Meetings of Electrical and Other Technical Societies

Ohio Electric Light Association — Cedar Point, Ohio, July 12-15. (For program see issue of July 2, page 37.)

National Association of Electrical Contractors and Dealers—Buffalo, July 18-22. (For program see issue of April 30, page 1010.)

American Physical Society, Pacific Coast Section—Berkeley, Cal., Aug. 4 and 5.

Michigan Electric Light Association — Ottawa Beach, Mich., Aug. 24-25.

N. E. L. A., New England Division—New London, Conn., Sept. 6-9.

N. E. L. A., Great Lakes Division —French Lick Springs, Ind., Sept. 14-16.

Association of Iron and Steel Electrical Engineers—Chicago, Sept. 19-24.

Illuminating Engineering Society—Rochester, N. Y., Sept. 26-30.

American Electrochemical Society — Lake Placid Club, N. Y., Sept. 29-Oct. 1.

American Electric Railway Association — Atlantic City, N. J., Oct. 3-7.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities

Surcharge on Energy Purchased by Municipality.—The city of Redlands having complained to the California Railroad Commission against having to pay a surcharge on energy purchased from the California Railroad Commission, the commission overruled the protest, declaring that a municipality which is not primarily engaged in the operation of a municipal electric utility but uses the major portion of the energy it purchases for operating pumps is not entitled to exemption from the surcharge.

Low Rates with Inadequate Service Is a Short-sighted Policy.—"This commission," the Arizona Corporation Commission declared in a recent rate decision, "is in a position where it can by a short-sighted policy gain certain popular approval by regulating the public utilities of the state down to a position of insolvency. The temporary public benefit which would result from such a policy would be many times offset by the inferior and inadequate service that is always the result of such conditions, and the restriction to extension of service to developing territories is manifestly prejudicial to public interest."

Oklahoma Commission Reduces Rates.—The Oklahoma Corporation Commission has issued a temporary order reducing the electric rates of the Oklahoma Gas & Electric Company in the cities of Oklahoma City, Norman and Moore to correspond to decreases in the fuel costs of the company. "It has been the policy of this commission," the decision says, "during war times and during the times of constantly increasing fuel costs properly to adjust the rates for utilities engaged in the production and distribution of electricity so as to keep fuel costs and the rate as near as possible on the same level. It now becomes its duty when fuel costs are shown to have decreased and the cost of production per kilowatt-hour of electrical energy has substantially decreased to be equally prompt in readjusting the rates in conformity to such decrease."

Taxation of Utilities in California.—In handing down the decision of the California Railroad Commission still further reducing the surcharge that had been allowed the Pacific Gas & Electric Company and the Great Western Power Company (see ELECTRICAL WORLD, June 4, page 1329), Commissioner Rowell made these observations on utility taxation: "The present method of taxation applicable to corporations such as the Pacific Gas & Electric Company is to a certain extent a hybrid between an ad valorem and an income tax. In legal theory it is a property tax, but the measure of the tax is computed on a gross income basis. The taxes which become a lien on the company's property in March, 1921, are computed at 7½ per cent of that amount to the state during the succeeding fiscal year. Where a company's business continually increases, as applicant's has done, computation will show that the amount due in July of each year and which becomes a lien upon the property in March of that year is less than the amount which would be estimated on an accrual basis for the same period, so that a fund will accumulate in any such reserve."

Test of Confiscatory Rates in a Combined Utility.—A test of confiscatory rates in a combined electric and steam-heating utility is whether the particular service sustains itself, the Montana Public Service Commission observed in denying for the time being an increase in the rates charged for electricity at Glendive by the Eastern Montana Light & Power Company—not whether it can subsist by operating at the expense of some other service or from the private purse of its owner. Rates should not be higher in either of two combined services rendered by a public utility than the value of that service to the public standing alone.

Indorsement of Service Charge.—The Public Service Commission for the Second District of New York, which has been superseded by a new regulating body, often declared its belief in the propriety, fairness, reasonableness and legality of a service charge. Declaring in one of its later decisions that "It is but just that each customer should only pay for what he receives, and the imposition of a service charge on all alike to cover those items which apply to all alike seems best calculated to attain that end," it went on to cite thirteen state commissions as having approved this principle, asserting that there seemed to be no contrary decision.

Past Profits Cannot Effect Valuation.—In valuing the property of a telephone company the Nebraska State Railway Commission emphasized the point that the past profits of a utility, even where these have been excessive, have no bearing upon a valuation proceeding, in which all the physical property used and useful in the business of a utility must be considered, notwithstanding that some of it may have been built out of surpluses over and above a moderate rate of return. "Testing the effect of rates in the past," the commission observed, "is a judicial process; making rates for the future is legislative. The two processes ordinarily merge in a rate case. In a valuation case, however, the commission has no power to take part of the property of a utility and restore it to the public or deny its ownership to the utility. In a rate case the commission can take cognizance of the effect of past rates and whether they have been unusually remunerative."

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies

Court Erred in Seeking to Compel Electric Service Where Ability and Willingness to Pay Were Denied.—Ruling once more against the Southern Power Company in its renewed attempt to have the suit brought against it by the North Carolina Public Service Company to compel electric service transferred to the federal courts (see ELECTRICAL WORLD, Dec. 25, 1920, page 1282), the Supreme Court of North Carolina none the less set aside the finding of the lower court giving judgment for the plaintiff in mandamus proceedings. The Supreme Court declared that inasmuch as the allegation of the plaintiff that it was able and willing to pay a reasonable rate for electrical energy furnished to it by the defendant was denied by the answer, the judgment was erroneous, since a public service company cannot be compelled to sell its product to an insolvent concern. (107 S. E. 226.)*

Rights of Utilities as to Abrogation of Rates.—In the course of the litigation over the increase of gas rates in New York City the Appellate Division of the New York Supreme Court has made the following pronouncement on the rights of utilities to abrogate existing contract rates—a question which had given rise to the dispute between the gas utilities and the municipality and on which the lower courts were in conflict: "The gas corporation may not legally assume to be vested with the rate-making powers and to be the arbiter of the adequacy and reasonableness of the rates. It may not assume power to decide these questions in its own favor and proceed to abrogate the contract whose benefits it has long enjoyed. It may not, of its own motion, say that it will no longer be bound by a contract because it has become unprofitable. The courts even will not relieve parties from hard bargains simply because they are such. The gas corporation has the same right to ask modification of the contract in the public interest that the municipality would have if the physical property and apparatus used by the corporation became insufficient or dangerous to health or if the rates in the course of time became exorbitant and unreasonable—the right to appeal to the sovereign state or its delegated agent having dominion over such matters. The corporation has no greater right than the municipality to determine for itself the merits of such a disputed question."

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*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel—Responsibilities and Association Appointments of Men Engaged in Professional, Executive, Operating and Commercial Branches of the Industry

Arthur B. West, who was elected president of the Pacific Coast Division of the N. E. L. A. at the recent convention at Del Monte, Cal., is vice-president and general manager of the Nevada-California Electric Corporation, a holding company for the following properties of which Mr. West is operating head: Southern Sierras Power Company, Nevada-California Power Company, Holton Power Company, Holton Interurban Railway Company, Interstate Telegraph Company and Imperial Ice & Development Company. Mr. West was born in Rochelle, Ill., in 1875 and was graduated from the Stanford University law school in 1899. He became in 1909 a member of the firm of Potter, West & Potter, attorneys for the Nevada-California Power Company, with offices in Denver. In 1911 he moved to California to become vice-president and assistant to the president and general manager of a group of utilities controlled by the Nevada-California Electric Corporation. Three years later, on the death of President and General Manager Delos Chappell, Mr. West succeeded him in office.

A. B. WEST

Charles E. Neil, editor of *Rate Research*, has also assumed the editorship of the *N. E. L. A. Bulletin*, succeeding H. M. Platt, who has become associated with the Society for Electrical Development. Mr. Neil, who formerly was rate expert for the Public Utilities Commission of Colorado, became editor of *Rate Research* about one year ago. He will continue his work with *Rate Research* under the supervision of Fred W. Herbert, superintendent of the N. E. L. A. service department, and in connection with the editorship of the *Bulletin* will be associated with the publicity department.

L. R. Nichols has been appointed resident manager at Oneida, N. Y., of the Adirondack Power & Light Company, Glens Falls, N. Y. Mr. Nichols succeeds West Gillson.

Frank J. Sprague, Elmer A. Sperry, Col. William Barclay Parsons and **John W. Lieb** were made honorary doctors of engineering recently at the fiftieth anniversary of the founding of the Stevens Institute of Technology, Hoboken, N. J.

Howard M. Raymond has been appointed acting president of the Armour Institute of Technology to fill temporarily the vacancy caused by the recent death of **Dr. F. W. Gunsaulus**. Professor Raymond is a graduate of the University of Michigan and is well known throughout the Middle West. He has been connected with the institute for the past twenty-six years and became dean of engineering in 1903.

H. G. Butler, Power Administrator under the California State Railroad Commission, resigned on July 1 to engage in private practice as a consulting engineer. In June, 1918, Mr. Butler was made Power Administrator by the commission to cope with the very serious situation that then confronted the state by reason of the protracted drought and the heavy wartime demand for power. Through his efforts co-operation of the various power companies was brought about, and by a program of rigid conservation the available power was so distributed that essential industries were fully taken care of and there was besides no serious public inconvenience. Mr. Butler was intrusted with the right arbitrarily to order connections, interchange of power, use of steam generation, change and shift of loads and in some instances curtailment of the use of power in less essential industries. Although clothed with such power, no complaint as to the justice of his orders was made to the commission either by the power companies or the consumers during his entire term as Power Administrator. Mr. Butler has completed eight years of service with the commission. He went to California to become the commission's first assistant engineer and after eighteen months was made assistant chief engineer. He had previously been employed in engineering work on the Panama Canal and in railroad and street-railway building in the Middle West.

W. R. Putnam, vice-president and general manager of the Idaho Power Company, Boise, Idaho, was elected to the presidency of the Northwest Division of the N. E. L. A. at the recent convention of that body. Mr. Putnam gained considerable prominence in the electrical industry a few years ago for his extensive studies of the electric range and its commercial possibilities. As chairman of the electric range committee of the N. E. L. A. his reports were always looked upon as the latest and most authoritative information on the subject. Mr. Putnam is a graduate of the University of Minnesota. For some time he was manager of the Red Wing (Minn.) Gas, Light & Power Company. In 1909 he became superintendent of the Menominee & Marinette Light & Traction Company, now part of the Wisconsin-Minnesota Light & Power Company. Two years later he went to Rapid City, S. D., to take charge of the construction of the hydro-electric plants of the Dakota Power Company on Rapid River. He next became connected with the Utah Power & Light Company, Salt Lake City, where as sales manager he displayed considerable executive ability. As a consequence late in 1916 he took on the additional duties of manager of the Salt Lake division of the company. Mr. Putnam has been engaged in his present duties in Boise for two years.

W. R. PUTNAM

Dr. Livingston Farrand, chairman of the central committee of the American Red Cross, formerly professor of anthropology at Columbia and at one time president of the University of Colorado, has been elected president of Cornell University, where he succeeds Dr. Jacob Gould Schurman, who resigned a year ago and whose appointment as Minister to China was confirmed about a month ago. Dr. Farrand was born June 14, 1867, and was graduated from Princeton in 1888. He received his doctor's degree in medicine in 1891. After two years of study abroad he returned to this country, joining the Columbia faculty. He has since then specialized in anthropology.

Darwin Curtis of the National X-Ray Reflector Company has sailed for Europe, where he will spend some time in the interest of his company.

Fred A. Anderson, formerly electrical engineer with the United States Shipping Board in San Francisco, has resigned that position to become sales engineer with the Safety Electric Company.

R. S. Holland, formerly in charge of the electrical sales department of the Capital Electric Company, Salt Lake City, Utah, has been promoted to the position of credit manager and will also act as secretary of the company.

W. I. Savidge, formerly with the Live Wire Supply Company, Macomb, Ill., has resigned from that firm to go into business for himself as an electrical engineer and contractor. He will also handle a special line of appliances. His headquarters will be at Macomb.

R. C. Cosgrove has been appointed manager of the farming section of the industrial department, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. Mr. Cosgrove has been actively in charge of this work for the Westinghouse company since the resignation of R. B. Harvey several months ago.

C. M. Heintz, formerly publicity representative of the Los Angeles district of the Westinghouse Electric & Manufacturing Company, has been appointed field representative of the merchandising bureau of that company and will supervise its merchandising and advertising activities in the entire Western territory.

R. S. Folland, who was formerly in charge of the electrical sales department of the Capital Electric Company, has been promoted to the position of credit manager of that company and will also act as secretary. Mr. Folland has been with the company for more than twenty years, serving in the capacities of secretary and sales manager.

J. M. Gilchrist, who was recently elected vice-president of the Federal Electric Company and the Federal Sign System, Chicago, has been with the Federal organization almost since its inception, joining it in 1901, soon after his graduation from college, as secretary of the company. He obtained the degree of electrical engineer at Cornell University, class of 1900.

Robert E. Rae, general manager of the Northwestern Electric Equipment Company, electrical jobber in New York City, has resigned to enter business on his own account. Mr. Rae was for five years sales manager of Stanley & Patterson (as manufacturers, not jobbers) and was for twenty-two years with the Western Electric Company. His position with the Northwestern Electrical Equipment Company will be assumed by W. M. Fallon, secretary and assistant treasurer, who will in addition to his other duties take charge of sales.

R. W. Stanley has been elected first vice-president of Rauch & Lang, Inc. Mr. Stanley was formerly general manager in charge of production and engineering.

John B. McFerran, Jr., formerly with the American Creosoting Company, has become associated with the Louisville (Ky.) Electric Manufacturing Company as secretary and treasurer and will also have charge of the sales end of the business.

H. G. Thompson, who resigned from the Edison Storage Battery Company in the fall of 1919 to form the Transportation Engineering Corporation, of which he was elected president, has been appointed sales manager of the American Radio Research Corporation, Medford Hills, Mass. Mr. Thompson has been identified with the storage-battery field for many years, particularly in its application to train lighting and other railway uses. He was born in Massachusetts in 1875, and at the age of twenty-one entered the employ of the Pullman Car Company. Two years later he was advanced to be foreman of electricians. In 1905 he was employed by the Pennsylvania Railroad to take charge of car lighting at Jersey City. Later he became associated with the Safety Car Heating & Lighting Company, then with the railway department of the Westinghouse Storage Battery Company. In the spring of 1910 he joined the sales organization of the United States Light & Heating Company and later that year the Edison Storage Battery Company. He became manager of the railroad department and was elected vice-president of the company and in 1915 was appointed general sales manager.

H. G. THOMPSON

A. J. Callaway has been appointed to succeed C. H. Talmage as manager of the Salt Lake City office of the Western Electric Company, Mr. Talmage having been granted a six months' leave of absence. Mr. Callaway has been assistant to Mr. Talmage for about a year.

A. C. Nelson, formerly of S. B. Condit, Jr., & Company, Boston, has been appointed New England sales manager of the Arrow Electric Company, Hartford, Conn. Mr. Nelson will make his headquarters at room 621, Rice Building, Boston.

A. W. Calendar has joined the Canadian sales staff of the Torrington Company, manufacturer of electric vacuum cleaners, with headquarters in Toronto. Mr. Calendar was formerly office manager of the Springfield (Mass.) needle plant of the Torrington Company.

C. H. Carter, formerly manager of the Los Angeles office of the Pacific States Electric Company and recently in the agricultural implement supply business at San Francisco, has re-entered the electrical business as head of C. H. Carter & Company, electrical jobbers.

C. H. Talmage, manager of the Salt Lake City office of the Western Electric Company, has received a six months' leave of absence and will become associated temporarily with the insurance department of the Columbia Trust Company of Salt Lake City. Mr. Talmage has been connected with the Western Electric Company for twenty years.

James Dixon, who for the last year has been production manager of the Reliance Electric & Engineering Company of Cleveland, Ohio, has been appointed works manager. Mr. Dixon is a graduate of Columbia University and a member of the A. I. E. E. Prior to his association with the Reliance company he was connected with the Crocker-Wheeler Company as superintendent of construction, assistant chief engineer and works manager of the small-motor department. He has been a frequent contributor to the pages of the ELECTRICAL WORLD, chiefly along the lines of industrial applications. During the world war he was a junior lieutenant in the United States Naval Reserve.

John L. Pratt has been appointed general manager of the accessory division of the General Motors Corporation, Detroit, with headquarters in New York City. This relieves Alfred P. Sloan, Jr., vice-president of the corporation, of direct supervision over the activities of the following accessory units: Hyatt Roller Bearing Company, Remy Electric Company, Jaxon Steel Products Company, Dayton Engineering Laboratories, Harrison Radiator Corporation, Lancaster Steel Products Company, New Departure Manufacturing Company, United Motors Service, Delco Light Company, Klaxon Company, Champion Ignition Company, Frigidaire Corporation and Dayton-Wright Airplane Corporation. Mr. Pratt was formerly special assistant to the president of the corporation and chairman of the inventories committee and the appropriations committee. Prior to becoming connected with the General Meters Corporation he was director of the motors development division of E. I. du Pont de Nemours & Company, Inc.

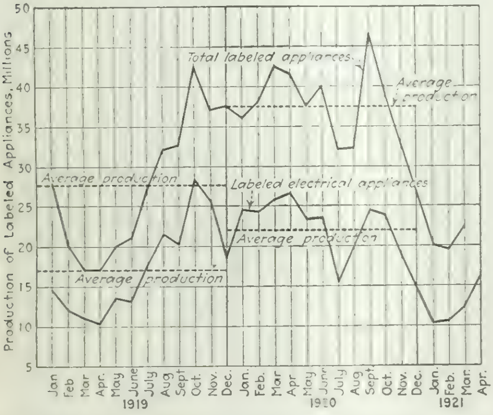
Trade and Market Conditions

Business Reviews, Together with Market Letters
from Important Trade Centers, on the Supply, Demand and Prevailing Prices of
Electrical Apparatus and Supplies

Return of Production Shown in Underwriters' Curves

THE Underwriters' Laboratories, Inc., in its April issue of *Laboratories Data* printed a chart which is reproduced below showing by a graph the production of labeled appliances during the years 1919, 1920 and through March, 1921. To this has been added a graph showing the production of labeled electrical appliances for the years 1919 and 1920 and through April, 1921.

In making up the total graph approximately 100 industries and 1,300 factories were taken into consideration, the factories represented being situated as far north as Calgary, Alberta, Canada, as far south as Galveston, Tex., west as far as San Francisco and east to Boston. In forming the curve of labeled electrical appliances about fifty industries were represented, and figures were taken from points as widely separated as those mentioned above.



PRODUCTION OF LABELED APPLIANCES INCREASING THIS YEAR

The two curves follow each other in their ups and downs very evenly, keeping apart to the extent that the electrical labeled appliances run from 40 to 60 per cent of the total labeled. It is interesting to see how closely the production of labeled electrical appliances follows that of other labeled appliances in the construction field. Furthermore, there stands out clearly the sudden rush of business in September, 1920, just prior to the break, and the turn in production this year. After the steep decline ending in January, February almost held its own and the sharp advance in March was continued through April.

One-Design Lighting Fixture Plug and Receptacle to Be Made

ONE of the foremost steps in standardization has been taken by manufacturers of attachment plugs and receptacles for lighting fixtures by eliminating the soldered joint necessary in present-day attaching and hanging of chandeliers, etc. Arrangements have been made by eleven representative manufacturers of attachment plugs and receptacles whereby this fixture plug and receptacle will be made according to a set of models which have been accepted as standard. Up to date only the one set of models is available, but it is expected by the manufacturers that by late fall or early winter they will have their own dies and other necessary apparatus so that production can be started by that time.

For some months manufacturers have been conferring among themselves on the matter, satisfied on the one point that the best interests of the trade would be met only by a single standardized unit for the electrical and mechanical connections in the attaching and hanging of lighting fixtures, both side-wall and ceiling. Out of these meetings there has finally come a harmony of action whereby the best features of all the designs submitted by different producers have been combined in the types selected under the name "Elexit." One type has been developed for ceiling attachment, but this is adapted for flush or raised work and can be used with one of several styles of canopies, depending on conditions that will be met in existing outlet-box installations. With the flush plate the canopy used is of miniature size. The suspending hook supports the weight of the fixture.

In the side-wall unit ample provision is made in the one type for support of the fixture, ease of adjustment and ease of removal. A small oval flush plate is provided for small types of fixture.

Tariffs on Electrical Goods Provided in New Bill

THE Fordney tariff bill, designed to afford full protection to American industries, was formally reported into the House of Representatives on June 28. It is thought that under this measure duties will be in the neighborhood of 30 per cent higher than under the existing tariff. Splitting of duties is common and the American valuation plan is the basis of lists. Paragraphs referring to the electrical industry are printed below:

Mica, unmanufactured or rough-trimmed only, 6 cents per pound and 17 cents ad valorem; cut or trimmed, splittings, plates, built-up mica and all manufactures of mica or of which mica is the component material of chief value, 12 cents per pound and 17 per cent ad valorem; ground mica, 6 cents per pound and 20 per cent ad valorem.

Carbons and electrodes of whatever material composed and wholly and partly manufactured, for producing electric arc light; electrodes of carbon or graphite for electric furnace or electrolytic purposes; brushes for electric motors, generators, etc.; plates, rods and other forms for making into brushes; other wares not especially provided for, 35 per cent ad valorem.

Incandescent electric light bulbs and lamps, with or without filament, 35 per cent ad valorem.

Storage batteries and parts and materials, 30 per cent ad valorem.

Anti-friction balls and rollers for ball and roller bearings, and parts, 35 per cent ad valorem.

Aluminum, scrap and alloys in crude form, 5 cents per pound; in plates, sheets, bars, etc., 9 cents.

Copper wire not coated nor covered and also tin-coated, 1½ cents per pound; in rolls, rods or sheets, 2½ cents; seamless tubing, 7 cents; brazed tubing, 11 cents; brass wire, rods, sheets, etc., 4 cents per pound; seamless tubing, 8 cents.

Telephone, light, power or railway poles of cedar or other woods, 10 per cent ad valorem.

Asbestos paper and millboard of long-fiber asbestos and electrical papers not exceeding 0.05 in. thick, 8 cents per pound; of other asbestos fibers, 1½ cents; sheets and plates not exceeding ⅛ in. thick, 1 cent per square foot, up to 2½ cents for over ¼-in. thickness.

Electrical insulators and other articles wholly or partly or in chief value of shellac, copal or synthetic phenolic resin, not especially provided for, 30 per cent ad valorem.

New Ruling on Marking Goods for Canada

THE National Association of Purchasing Agents, New York City, is calling the attention of its members to a new ruling in the Canadian customs act which will become effective on Oct. 1 next. The ruling is as follows:

"12-a. That all goods imported into Canada which are capable of being marked, stamped, branded or labeled, without injury, shall be marked, stamped, branded or labeled in legible English or French words, in a conspicuous place that shall not be covered or obscured by any subsequent attachments or arrangements, so as to indicate the country of origin. Said marking, stamping, branding or labeling shall be as nearly indelible and permanent as the nature of the goods will permit."

The penalty for non-observance of this ruling is an additional 10 per cent on the value of the goods.

30,000 "Already-Built" Minneapolis Homes Wired in Eight Years

TWENTY-ONE Minneapolis homes are wired every day, on an average, according to figures supplied by contractor-dealers of that city. This rate of installation has been maintained for the sixteen-month period including all of the year 1920 and the first four months of the current year, the compilation being made on figures available up to May 1, 1921. In the last eight years more than 30,000 "already-built" Minneapolis homes have been wired, according to these figures, in addition to the many homes wired while in the course of construction.

The steady, rapid growth of the electrical industry and the general use of electricity in the homes is emphasized by a comparison of the rate of wiring in the various years of the period from 1913 to 1920 inclusive. In 1913 755 already-built homes were wired in Minneapolis. That was an average of slightly more than two a day. In 1920 6,300 old residences were wired, an average of twenty-one a day and about ten times as many as were wired seven years before.

To the middle of May this year more than twice as many homes have been wired as were wired in the whole of 1913. This is slightly below the average set for 1920, but it is significant in view of two facts, that there is an industrial slump and that there is an ever-increasing number of houses not on the wiring market because they are already wired. The rapid progress in wiring activities is attributed to the fact that whereas electricity was formerly installed for lighting only, today there are innumerable other domestic needs for it.

Birmingham District Shows Gradual Awakening

ON THE whole business is showing an increase in Birmingham and in the Birmingham district. During the past few weeks announcement has been made that several shops and factories which have been closed down for some time will open up during the next few weeks. The opinion prevails that there will be a general revival of business commencing early in September, when, it is felt, the cotton crop should begin to move and a number of industries be placed in operation.

A considerable amount of Birmingham steel rails is now being shipped to Japan, 5,000 tons having been shipped on one order alone. Other big orders to Japan and the Orient are to follow. The amount of coal now being mined in the Birmingham district is somewhat below normal, but it is believed that with the approach of the fall season the output will be greatly increased with the receipt of heavier orders due at the mines.

There is quite a volume of building activity in the district, and this has had a tendency to stimulate the trade in electrical wiring and electrical equipment of various kinds. While the electrical dealers announce that business is below normal, still they say their trade is holding up fairly well, and they also look for an increase in business with the coming of the fall season. Dealers in vacuum cleaners, washing machines and other electrical appliances are well stocked on these goods. They say that business has decreased considerably during the past few weeks, but they are optimistic and are holding to the opinion that their trade will open up better within a few weeks.

The Southeast as a Market for Radio Apparatus

AN INCREASING interest in Atlanta and its vicinity in amateur wireless sets is worthy of comment, and the more progressive jobbers have realized the fact that an excellent potential market awaits development. They are therefore engaged in developing channels for a wider distribution. There are several campaigns proposed and designed with the idea of stimulating the sale of this equipment, especially in the city of Atlanta, whch has become virtually the radio center for the amateur wireless operators in the Southeast.

Manufacturing concerns having plants scattered over a wide area are seriously considering the installation of wireless-telephone equipment for communication between the respective plants, and experiments are being conducted with the idea of substituting this type of communication for the present long-distance telephone calls. The hope is that business can be transacted over the wireless telephone at certain times of the day more satisfactorily and economically than by means of the regular toll lines. Should the scheme prove practicable, it is probable there will be a broad market opened up for this class of material as there are a large number of executive offices in Atlanta with manufacturing plants scattered over the territory within a radius of 100 miles of that city. The experiments, therefore, are being watched with considerable interest.

The Metal Market Situation

CONDITIONS remain about the same in the copper market. Prices are without essential change, with large producers still loath to sell July copper under 13 cents per pound, though occasionally going under this, it is reported. In the outside market spot shipment copper is available at 12.75 cents delivered, July at 12⅞ cents and August at 13 cents.

Official price on lead is still held at 4.40 cents in New York although the market is about 4.50 cents and is firm.

The Bethlehem Steel Company has announced a reduction of from $4 to $10 on steel products, effective July 5. Producing costs are stated to be no lower.

NEW YORK METAL MARKET PRICE

	June 28, 1921	July 5, 1921
Copper	£ s d	£ s d
London, standard spot	70 5 0	72 5 0
	Cents per Pound	Cents per Pound
Prime Lake	13.00	13.00
Electrolytic	12.87½—13.00	12.87½—13.00
Casting	11.87½	11.75—11.87½
Wire base	15.00—15.25	15.00—15.25
Lead, trust price	4.40	4.40
Antimony	4.75	4.75
Nickel, ingot	41.00	41.00
Sheet zinc, f. o. b. smelter	10.00	10.00
Zinc, spot	4.75	4.85
Tin	29.12½	29.87
Aluminum, 98 to 99 per cent	28.00	28.00

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	9.50—10.00	9.25—9.50
Brass, heavy	4.75—5.00	4.25—4.50
Brass, light	4.00—4.25	3.50—3.75
Lead, heavy	3.50—3.62½	3.25—3.50
Zinc, old scrap	2.50—2.62½	2.00—2.25

THE WEEK
IN TRADE

Prices When Quoted Are Those Prevailing at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

ACTIVITY in the supply trade continues on a spotty basis. Building of residences is holding up well in the Intermountain, Northwest and New England territories. In St. Louis the trade is quiet, and in New York activity is not especially noticeable. The movement of fan motors has been good all over the country as a result of the warm weather commonly experienced.

Reduction of export rates on the Pacific Coast is expected to help cities there. Lowering of freight rates on iron ore consigned to the St. Louis district is expected to help the industries in that region. There is increased activity in textile mills in New England. Heating appliances are moving well in Chicago. Ranges are picking up. Pins and poles and cross-arms are being bought a little better around St. Louis. There, however, business is virtually on the decrease.

Unemployment is quite noticeable in several sections of the country although it is not at this time serious in its nature. New York, St. Louis and the Intermountain regions report this as a feature.

Effective July 5 the Bethlehem Steel Company issued a new schedule of prices showing reductions varying from $4 to $10 per ton on its steel commodities. The desire to re-establish conditions in the steel trade rather than any reduction in manufacturing costs is given as the reason for the cut.

NEW YORK

Fans are about the only really active item in the electrical trade in this territory at present. General business has not picked up appreciably, though the consensus of opinion is that it will show an improvement in the fall months. Non-employment is existent to a very considerable extent. Collections show no change, being good with some but slow with a great many more. Price cutting is very general and keenly competitive conditions rule today. A feature of this is the advent of two new supply-jobbing houses in New York City. Inventories are being held low and buying is only for maintenance.

Building construction plans in this section continue to show encouraging gains, according to the Dodge reports, but on Manhattan and nearby there is little actual building work under way other than some of a speculative character. The chief obstacle to normal activity is felt to be the existing high wage scale of building mechanics. The first action leading to a remedy of this condition has been taken, however, which calls for a meeting of employer delegations from each trade group with labor representatives. It is proposed to obtain definite statements regarding the attitude of the various trade unions on reducing wages. In view of the prevalence of non-employment in the industry it is rumored that a cut of at least $1 per day would be accepted.

Schedule Material.—Price reductions have aided demand some, especially on sockets, but this is largely felt to be but temporary, as stocks ran low anticipating a price decrease.

Lead-Covered Wire.—Small stocks are carried and there is not much call. No. 14 duplex, lots of 1,000 ft., sells for about $35 per 1,000 ft.

Metal Molding.—A good supply is held, but not much is moving. In 1,000-ft. lots the three-wire to four-wire size sells for about $6.90 per 1,000 ft.

Switches.—A change in the list and discounts on safety switches by one manufacturer make a price decrease of about 20 per cent, effective July 1. A representative open switch, single-throw, two-pole, 30-amp., fused, is listed at $1.06 each with about 10 per cent discount in lots of a dozen. Demand for both types is spotty, with a good supply held.

Dry Cells.—Price reductions have stimulated buying somewhat, and there is a fair vacation demand. In barrel lots No. 6 regular sells for 29 cents each and igniters at 30 cents each. Good stocks are on hand.

Panel Boxes.—Very few are carried in stock, for manufacturers can make one-day deliveries. There is little call, however, and prices are unchanged recently.

Flexible Armored Conductor.—The general situation is very quiet, though one or two jobbers report better sales. The usual selling price of No. 14, two-wire, single and double-strip, is $55 per 1,000 ft. in that quantity, though this price ranges down to $50. A good quantity is carried.

Conduit.—In 2,500-ft. lots prices are as follows: Black, ½-in., $58.75 to $63.50; ¾-in., $76.38 to $83.75; 1-in., $109.85 to $118; galvanized, ½-in., $63.34 to $68.68; ¾-in., $82.59 to $90.62; 1-in., $118.03 to $128. The sentiment among jobbers is that further price decreases will be made. Demand is poor and stocks are fair.

Rubber-Covered Wire—From $6.50 to $7 per 1,000 ft. is the current price of No. 14 single-braid in 10,000-ft. lots, but stocks are more than adequate as sales are slow.

Power and Light Outfits.—Effective July 1, the Western Electric Company has made reductions on its plants ranging from $60 to $190 each, depending upon which of eight types is considered.

CHICAGO

Last week prospective work took a jump and permits to the extent of $2,700,000 were issued, the highest in seven weeks. Now, however, with the wage ruling still indefinitely postponed and with the carpenters refusing to be bound by the arbitration proceedings, things are about as quiet as ever. A decision in regard to the new wage scale is expected any day and should be followed by a season of activity. Such a result would be of immediate benefit all along the line in the electrical industry as all hands are carrying light stocks. With the exception of heating appliances, especially of the better class for gift purposes, all retail trade is quiet. This condition is general throughout all lines, the shrinkage in electrical demand being perhaps less than that experienced by other specialty merchandise lines.

The vacation season is fairly on and all houses seem content to handle current business in a routine way, reserving their effort for the better days which are felt to be approaching in the fall. There is nothing of importance reported in regard to price changes or special electrical activity.

Wire.—Reasonable quantities of bare copper wire are moving at the unchanged price of 16½ cents per pound for No. 8 in 1,000-lb. lots. Insulated wire is also unchanged in price and is very quiet owing to the lack of new building construction. Some weatherproof is being bought by central-station companies. Rubber-covered, at $7 per 1,000 ft. in 10,000-ft. lots, is unchanged.

Conduit.—Construction demand is very light, and demand for both black pipe and flexible conduit is correspondingly slow. Price uncertainty continues, with the larger concerns holding to the old quotation of $59 per 1,000 ft. for ½-in. black conduit in 5,000-ft. lots. Flexible non-metallic conduit is quoted as representative at $22.75 per 1,000 ft. for the $\frac{7}{32}$-in. size in 1,000-ft. lots.

Lock Nuts and Bushings.—Demand is not so good as was noted a month ago. Rewiring jobs are plentiful but are not in sufficient volume to make good business. While some shading is reported leading jobbers adhere to a quotation of $1 per 100 on lock nuts and 1.85 cents on bushings. Stocks are being held by jobbers to about a thirty-day supply at the present rate of consumption.

Percolators.—Throughout the month of June business has been excellent in percolators, some dealers and jobbers actually having difficulty in supplying the demand, particularly for the nine-cup size. Prices are unchanged, but in spite of that the complaint that they are too high, which was frequently heard a month ago, is no longer voiced.

Ranges.—Continual effort at publicity is having its effect and manufacturers are reporting fair business. The excessive heat of the present season favors the pushing of this line, and many dealers are maintaining permanent demonstrations with excellent results.

Fans.—Warm weather is keeping the demand up, particularly for the 6-in. inexpensive type and the 16-in. oscillator for office use. Prices are rigidly adhered to all along the line, and while no difficulty is experienced in filling the demand, business is good. Sales are generally for lots of one or two rather than for large installations.

Motors.—Jobbers state that things are quiet, yet all manufacturers report some business. Orders are largely restricted to the smaller sizes, and those for industrial use are going to concerns that are getting rid of the old line-shaft drive and installing direct-connected motors.

BOSTON

Trade was quiet last week, the holiday period tending to postpone business. Building and engineering contracts placed in New England increased more than $1,000,000 during the week ended June 28, compared with the previous seven days. The total was $4,196,900, comparing very favorably with the same week in recent years with the exception of 1920. Jobbers are slowly beginning to buy manufactured products, as in some lines stocks have now been pretty well liquidated. Prices changed very little during the past week. Collections are rather slow and are being followed up closely. Deliveries are good in all lines. New England textile mills are fairly active and in the rubber industry conditions are improved. It is reported that one large woolen organization is running at 80 per cent capacity, and one of the largest cotton-cloth establishments is working full time with 16,000 employees, some overtime also being required. Labor is still in process of liquidation.

Flexible Armored Conductor.—Movement is slow, with ample stocks. No. 14 single-strip sold at $52 per 1,000 ft. in 5,000-ft. lots before the week end.

Lamps.—A leading distributer reports business within 25 per cent of normal. Mill-type tungsten lamps are in good demand and flashlamps are selling well. Prices are steady.

Meters.—A moderate demand is reported and house-wiring campaigns are yielding good results in various localities.

Ranges.—Demand is spotty, some representatives reporting dull market conditions and others increased activity. Several carload orders have been received lately by a prominent range manufacturer who also reports a good small-lot business. A representative retailer reports selling about twenty ranges per month at present.

Fans.—The recent hot weather stimulated fan sales and reduced stocks considerably. One distributer sold 2,500 fans in about three days. This spurt subsided quickly and stocks are still ample.

Industrial Lighting Portables.—Considerable interest in industrial lighting apparatus is evident during the present period of plant rehabilitation. A leading specialty in the portable line is selling at $12 per unit to dealers.

Flatirons.—Improved demand is reported. Distributers' stocks are lower and some buying has set in, although not of large volume.

Washing Machines.—A better market is apparent for the time being. One distributer reports it difficult to maintain more than a nominal stock.

Wire.—Slightly improved demand is reported. No. 14 rubber-covered wire is selling at $6.35 per 1,000 ft. in 5,000-ft. lots and No. 6 weatherproof at 21.5 cents per pound in 100-lb. lots. Bare base is 16 cents with dull sales.

Rigid Conduit.—Good stocks with light movement, somewhat better than a few weeks ago, are reported. On ½-in. black $62.18 is being paid the jobber per 1,000 ft. on less-than-carload lots, and the galvanized is moving at $67.21 in this size.

Motors.—A few sales are being handled, mostly in small units. Prices are steady in the main. Stocks are more than equal for all normal requirements along standard-design lines.

ST. LOUIS

Efforts are being made to get the cost of building down, but only meager results have been attained so far. A number of wage contracts in the building trades expired on July 1, and contractors are endeavoring to effect a reduction. Some decrease will probably be agreed upon, but it is not expected to be large. Several million dollars of construction work are reported to be awaiting lower building costs. A freight-rate reduction on iron ore from the Michigan-Wisconsin ranges to the St. Louis district, just ordered by the Interstate Commerce Commission, is expected ultimately to be of considerable benefit in building up this territory industrially. The rate was cut from $4.05 to $3.25 per ton, placing this district on substantially the same basis in the steel industry as Pittsburgh. Only recently, with the development of a process of coking Illinois coal, has St. Louis entered the steel-refining field.

Business generally in this territory is showing a tendency to decline. Purchasing is on a much more cautious basis than prevailed a few weeks ago. Industries are reducing operations and non-employment is increasing. Electrical jobbers and dealers are beginning to feel the effect of the change. Most of the jobbers report no change in demand, but some find a slight decrease. As an example of the cautious buying one jobber reports that he received nine orders for fifteen fans in one day from a dealer that would ordinarily buy at least fifty at a time. However, some improvement is found in the South as the farmers have placed more acreage this year in other products than cotton and the prospects point to a good yield. Cotton is being gradually marketed and the buying power of the South has increased.

Fans. — Steady demand continues owing to the warm weather prevailing throughout this entire territory. Jobbers are maintaining their prices, but some dealers, principally department stores, have made heavy reductions.

Heating Appliances.—These are moving rather slowly, though some seasonal increase prevailed in June. The reductions announced for July 15 have had no appreciable effect upon the demand. Stocks are maintained by every one on a very conservative basis.

Poles and Cross-Arms.—A reasonably good demand in these items continues, the demand being for small extensions on the part of the utilities. The large jobs contemplated this spring show no signs of materializing. Present quotations on 3¼-in. x 4¼-in. Rainier fir arms, f o.b. St. Louis, in amounts exceeding 1,000 linear feet, are: 4-ft., $53.90 per 100 arms; 5-ft., $67.38; 6-ft., $80.86; 8-ft., $107.81; 10-ft., $134.76.

Locust Pins.—Pins, 1¼ in. x 9 in., are quoted as follows: In quantities less than 1,000, $46.70 per 1,000; 1,000 to 2,000, $41.20; 2,000 to 3,000, $38.90; over 3,000, $36.60. The demand is good and stocks are reported to be in good shape.

Insulators.—Immediate delivery can now be given on porcelain insulators either from the factory or from local stocks. The demand remains on a parity with that for the other pole-line materials. No price changes have been announced since the general price level started downward. It is the opinion of some that the prices should be lowered but that the reduction would not materially effect the demand.

Lamp Cord.—Large stocks are still reported by the jobbers, and the demand shows no improvement. No. 18 twisted cotton is quoted at $15 to $16.50 per 1,000 ft. in 5,000-ft. lots and No. 18 twisted silk at around $23.

Tape.—Demand for both rubber and friction tape continues reasonably good. Local stocks are being kept on a low basis by most jobbers. Friction tape is selling at 50 cents per pound in small lots down to 35 cents to 36 cents for 100 lb. or more. Rubber tape brings about the same prices.

Wire.—It is reported that there is no change in the call for wire and No. 14 rubber-covered is the best seller. It continues to be quoted at $6.75 per 1,000 ft. in 5,000-ft. lots, though somewhat better prices are sometimes made if the size of the order is sufficiently attractive.

ATLANTA

Business for the month of June continued to hold out to the extent that this month was the best of the year, with the possible exception of March. The tone of business in general is improving and jobbers are in a more optimistic mood than has been evident for several months past. The number of orders continues to increase though the volume of the individual orders is considerably below that of a year ago and inquiries for heavy purchases are in evidence. The report of the Sixth Federal Reserve Bank shows considerable activity in the building line, particularly in Jacksonville, Knoxville, Nashville, Birmingham and Montgomery, while the permits in Atlanta for June number 335, valued at $855,716. The local building inspector states that if the present rate of construction of residences is continued for the balance of the year, 1921 will provide for 1,600 new homes.

While collections show a slight improvement there is little ready money in the rural districts; banks reporting through the Federal Reserve Bank show that 90 per cent to 100 per cent of the agricultural paper is being renewed as it comes due and in all probability this condition will continue until fall harvest. The settling of the marine strike has permitted shipping conditions in port towns to return nearly to normal.

Washing Machines.—Little or no activity is to be observed in this line and stocks remain very heavy in spite of reduced prices offered by retailers.

Electric Fixtures.—To date the fixture business has been the best on record, particularly for the moderate priced residential type, though commercial fixtures continue to move very well. Stocks are reported in good condition with no reductions in price.

Storage Battery Charging Sets.—This specialty has shown a little life recently but orders continue far below those of the corresponding period of last year. Stocks are very heavy and no immediate price reductions are in prospect.

Safety Switches.—A price reduction ranging from 20 per cent to 25 per cent became effective July 1. Practically all of the larger towns have adopted ordinances requiring safety switches and this is creating an active market. Anticipation of this situation accounts for excellent stocks throughout the section.

Vacuum Cleaners.—Summer weather has served to create a brisk market in this line, sales and inquiries being in better volume than for any other time this year.

Heating Devices.—Jobbers are notifying the trade of a reduction in price of from 10 per cent to 15 per cent on heating devices to become effective on July 15. The jobbers anticipate that this cut will serve to move some of the heavy stocks they have on hand.

Ventilating Fans.—This has been an excellent year for ventilating fans and the public seems to have awakened to the utility of adequate ventilating apparatus. Stocks are in fair condition, but factory shipments are necessary in many instances.

Fans.—The continued hot weather has revived the movement of desk fans and the outlook for the disposal of stocks is much better, although one or two jobbers are likely to carry over a surplus. Ceiling fans are somewhat slow, due to so-called high prices.

Churns.—The territories in and around the smaller towns are taking a fair allotment of electrically driven churns and the movement is quite steady. Stocks are in good shape and no price reduction is in sight.

Outlet Boxes.—Little activity is to be noted in this line, the movement being steady but rather sluggish. All jobbers have excellent stocks on hand.

SEATTLE—PORTLAND

In the Seattle and Puget Sound district trade in electrical materials, with the exception of those used in smaller construction, continues to hold a quiet course. Throughout the district as a whole bright weather has been helpful to retail buying, especially from stores which include electrical shops. Erection of homes in this district continues on the increase, owing not only to the urgency of the housing situation but also to the decreasing costs of lumber and other constructional materials as well as labor. Advices state that reduction in export rates which will assist Seattle and other Pacific Coast cities materially in their fight to rebuild their trade were agreed upon by executives of various railroads in a recent conference. The reductions cover a long list of commodities ranging from 5 to 33⅓ per cent and will apply from all points east of Chicago.

The changes to be made will tend to restore the parity formerly existing between the export rates via the Transcontinental route and the Panama Canal route and should bring to Pacific Coast cities by rail for trans-shipment to the Orient much export freight that otherwise would go by all water route through the canal.

The state Department of Labor and Industries, which recently made a survey of the Washington coal industries in an effort to settle a strike that has been in effect since March 15, recently stated that mine workers must accept wage reductions and mine operators must reduce corresponding overhead cost of mining to enable Washington coal mines to reopen and produce coal at a price that will permit competition with foreign coals and fuel oil sold in this market.

Motors.—Light buying of small motors for replacements and betterments in local lumber and shingle mills during the midsummer shutdown was reported this past week. From indications the motor business, which has been far below normal, has turned the corner toward a noticeably better demand. Stocks are in good shape, and there are many second-hand motors in the market.

Knobs and Tubes.—Movement is showing a nice increase; stocks are ample and prices are tending downward, although the decreases are almost negligible.

Hollow Ware.—With the advent of warm weather and increased use of toasters, chafing dishes, etc., the retail market particularly is showing improvement.

SALT LAKE CITY—DENVER

Building operations in the large city centers are one of the best indications of business at the present time. A gain of more than 50 per cent in money invested in these operations is recorded for the month of June this year over the corresponding month of 1920. This increase, in spite of the heavy reductions recorded in building prices as compared with a year ago, is considered a certain indication of general improvement industrially. Construction work consists of small contracts, and there are almost no big jobs under way. This fact, however, lends especial significance to the showing.

New homes continue to be in big demand, and the mortgage firms report ample money for conservative loans on residential construction. Electrical contractors are experiencing a corresponding impetus in their business. They report an unusual demand for wiring jobs that provide ample outlets for the attachment of electrical conveniences and a good diminution of the use of the lamp socket for all sorts of connections, a healthy tendency just in its inception.

Dealers say there is a considerable movement on hollow ware, although the demand is still away below normal. No shortages of stocks are reported, but there is still a persistent tendency to stock small orders. Jobbers are unable to unload in sizable consignments. Non-employment is still a problem to reckon with in the Intermountain region. The farms could readily absorb thousands of idle men if money were available to pay them for their services. Farmers find it utterly impossible to get advances on their crops, the marketing of which is at present an uncertain quantity. There are no serious labor disputes at the present time in the region.

Manufacturers' Activities

Devoted to the Business Side of Manufacturing, Distribution and Sales, News from Jobbers and Foreign Fields and a Record of New Devices and Trade Literature

New Factory for Quasi-Arc Weldtrode Company

The Quasi-Arc Weldtrode Company, Inc., Atlantic Avenue and Warwick Street, Brooklyn, N. Y., announces that since July 1 it has been in its new quarters at 114 Hudson Avenue, Peekskill, N. Y. In the new location, which is adjacent to both the New York Central Railway and the Hudson River piers, the company has not only much better shipping facilities than before but also better arrangements and machinery for the manufacture of its "weldtrodes."

The new works will also be completely equipped for the manufacture of all arc-welding accessories and for the building of the entire line of welding apparatus, including controllers (for both alternating and direct current) and welding generators driven by belt, direct-connected motor or gas engine.

Centrifugal Production for Arrow Pump Company

The Arrow Pump Company, with general sales offices in the Buhl Building, Detroit, announces that it is now prepared to manufacture centrifugal and other rotating types of pumps in which there will be incorporated a unique design of packing gland with ring oiling principle.

Frigidaire Plant to Be Moved from Detroit to Dayton

Following the announcement of the consolidation of the Frigidaire Corporation and the Delco-Light Company, both subsidiaries of the General Motors Corporation, Detroit, Robert H. Grant, general manager of the consolidated companies, states that the manufacturing plant of the Frigidaire Corporation will be moved within the next few months from Detroit to Dayton.

New Organization to Make and Distribute Safety Goods

The Standard Safety Equipment Company, 168 North Michigan Avenue, Chicago, has been organized to manufacture and distribute electrical and mechanical safety equipment and supplies, embracing gloves, linemen's blankets, first-aid cases, etc. C. A. Kingsbury and L. W. Dickson, both formerly with F. A. Hardy & Company, are respectively president and secretary. F. L. Hurlbutt, for the last ten years safety engineer of E. I. du Pont de Nemours & Company, is treasurer and in addition will have charge of all service work. A. U. Barnes of the Hardy company has been appointed Eastern manager with offices in the Clinton Building, Newark, N. J. There is also a Detroit office at 414 West Grand River in charge of O. L. Smith. A Cleveland connection and stockroom is under consideration. In addition to safety supplies the company will market a full line of welding equipment. "Standardize for safety" has been taken by the company for a slogan.

Diamond Holfast Rubber Plans to Erect New Factory

The Diamond Holfast Rubber Company, 33 Auburn Street, Atlanta, Ga., manufacturer of friction tape, fan belts, etc., has purchased a site of eleven acres of its proposed new factory for the manufacture of its "Diamond Holfast 2-plex" insulating tape, for which it was granted a patent last February. At present the company produces about 2,000 lb. per day of the insulating tape. On completion of the new factory it will be able to turn out a much increased quantity.

Report of Hurley Machine Company for 1920

When the balance sheet of the Hurley Machine Company, Chicago, manufacturer of Thor washing and ironing machines and vacuum cleaners, was made up for the year ended Dec. 30, 1920, total assets were shown to be $7,335,044. This figure included inventories of raw material, work in progress and finished stock to the amount of $1,797,390 and a figure of $1,201,704 for notes and accounts receivable (customers'), less reserve for doubtful accounts. Outstanding common stock amounted to $4,707,405 and preferred stock to $376,600.

Net income, after providing for federal taxes, amounted to $706,663; net profit was $1,489,731. Gross profit amounted to $2,740,928 after deducting $6,087,095 as total cost of sales from $8,828,024, the figure of net sales. Gross sales were $9,082,959. An amount of $189,433 was written off the inventory account because of reductions in cost or market value.

F. J. Ryan Acquires Electric Furnace and Selling Rights

The electric furnace department of the Lancaster (Pa.) Iron Works has been acquired by F. J. Ryan & Company, Philadelphia, who have also taken over the selling rights in North, South and Central America for the electric furnace developed by the Bario Metals Corporation.

C. D. Parker & Company, Inc., Moves to New Home

C. D. Parker & Company, Inc., investment bankers and controlling managers of central station properties at Amesbury, Palmer, Plymouth, Franklin, Great Barrington, Marion and Provincetown, Mass., and elsewhere, have moved from 67 Milk Street, Boston, to a remodeled six-story office building at 150 Congress Street, in the heart of that city's banking district. Offices of the banking house are on the street floor, and the legal department, power engineering department and other offices are on the sixth floor.

Winding-Spool Manufacturer in Production

The American Wood-Working Company, Chicago, manufacturer of winding spools, has announced that it has started production on its patented metal-covered spool and is in a position to make immediate deliveries.

Enlarged Distribution of Motors by Roth Brothers & Co.

Roth Brothers & Company, Chicago, in expanding their contact with the trade, have added the following firms to their list of distributers: W. H. Shirey, Dime Bank Building, Detroit; H. B. Squires Company, Pacific Coast representative, San Francisco; J. E. Chamberlain, 613 Lincoln Building, Philadelphia. After a recent swing around the branch offices of the company R. H. Barber, sales manager of the company, reported business somewhat slow but was satisfied that there were sufficient indications that it would improve considerably during the fall.

Benson Electric Company Opens New York Office

The Benson Electric Company is opening a New York office at 44 Dey Street, in charge of Edward Knapp, to engage in contracting, retailing and jobbing. The company manufactures electric steering gear for steamships, whistles and flashlights under the thirty-three patents held by M. B. Benson, president. The main office and factory is at Superior, Wis., and a store is also maintained at Superior and at Duluth, Minn. Besides its selling end the company engages in wiring houses, steamships, piers, etc., and also substation work, having just completed construction of the Raritan Valley Hydroelectric Company's plant and transmission lines in New Jersey. Under the laws of Minnesota the company was capitalized at $150,000, which was increased to $1,000,000 last week under Delaware law. A staff of specialty and sales engineers will be maintained at the New York office, where a stock of lamps, wire, conduit, appliances, motors and other electrical goods will be carried. A display room will feature the "Benson" electric telemotor for steering ships, of which more than 200 have been sold to the U. S. Shipping Board.

New Quarters for Maker of Power-Plant Piping

The M. J. Dougherty Company has completed and moved into its new quarters, which occupy the block from Twenty-fourth to Twenty-fifth Street at Washington Avenue in Philadelphia. These increased facilities for the fabrication of piping of every design, the company says, enable it to offer prices and deliveries which had never before been possible with its smaller factory.

Increase in Representation by E. O. McDowell

The item appearing on page 1516 of the June 25 issue should have referred to E. O. McDowell and not E. O. McDonald, manufacturers' representative at 30 Church Street, New York City.

Worcester Electric Tool Takes Over Three Companies

The Worcester Electric Tool Corporation, Worcester, Mass., has recently been organized to take over the business of the Stenman Electric Valve Grinder Company, Inc., the Stenman Electric Tool Company and the Consolidated Machine Tool Company, all of Worcester. The principal products of the company for the present will be the "HusKee" three-in-one combination service tool and the "HusKee" service drills. These tools have been on the market in a small way for the past six months and are the result of over two years' development work. The officers of the company are: H. P. Gleason, president; A. G. Sandberg, treasurer; J. J. Kelleher, sales manager, and Harold Raine, advertising and service manager.

Buffalo Forge Company Remodeling Fan Shop

The Buffalo Forge Company, Buffalo, which in 1917 started the conversion of its factory into a brick and steel sawtooth construction building, extending it over 116,023 sq.ft. of working area, including 44,916 sq.ft. of assembling galleries, is now pushing this construction to remodel the entire fan shop. This shop, when completed, will be one of the largest fan shops in the United States, covering 64,235 sq.ft. including 23,873 sq.ft. of assembling galleries. While this extension is in progress production continues without interruption, and when it is completed all fan construction will be accomplished with a minimum of handling.

National Lamp Holds School in Illuminating Engineering

Representatives of twenty-three jobbers' organizations attended the illuminating engineering school held at Nela Park, Cleveland, under the direction of the National Lamp Works of the General Electric Company, June 6 to 10. A total of fifty-five men, each actively engaged in the sale of lighting, attended the "short course" in illuminating engineering. Walter Sturrock, engineering department, National Lamp Works, was director of the school.

Fourteen speakers from the national organization gave nineteen talks, each talk taking up one particular phase of the general subject of lighting, covering both the engineering and sales sides. This class work was supplemented by several inspection trips, one to the Electrical League of Cleveland, where the league's lighting demonstration was given; one to the league's modern electrical home, one through the factories and engineering buildings at Nela Park, and one to a Cleveland factory that had requested recommendations for a new lighting layout.

At this factory the "students" obtained the necessary data and later in the school made the actual lighting layout under the supervision of the National's engineers. Prizes were awarded for excellency in this particular design work.

The Illuminating Engineering School was all business. "We came for information and we got it. It was worth many times its cost," an executive of a jobbers' organization that sent twenty-two representatives to the school declared.

TWENTY-THREE JOBBERS REPRESENTED IN SCHOOL FORMED TO TRAIN SALESMEN IN GENERAL SUBJECT OF ILLUMINATION

Pettingell-Andrews Takes Axcess Lighting Equipment Agency

The Sampson Axcess Lighting Company, Lynn, Mass., has appointed the Pettingell-Andrews Company, Boston, distributer for the equipment which it manufactures. The Pettingell-Andrews Company will market this apparatus through its industrial lighting department, in charge of Milton D. Riley, illuminating engineer.

Radio Section A. M. E. S. Designates and Elects Committees

At the summer meetings of the various sections of the Associated Manufacturers of Electrical Supplies, held in New London, Conn., last week the newly formed Radio Apparatus Section held its second meeting since its formation. D. R. W. Murdock of the Wm. J. Murdock Company had previously been made chairman of the section. The following committees were designated by name and their chairmen chosen: Executive committee; committee on the advancement of the art, L. G. Pacent of Pacent Electric Company, chairman; receiving sets and associated equipment, M. C. Rypinski of Westinghouse Electric & Manufacturing Company, chairman; transmitting sets and associated equipment, C. F. Cairns of Acme Apparatus Company, chairman; aural receiving devices and accessories, D. R. W. Murdock, chairman.

The section held two sessions and took up several questions tending to elevate the plane of manufacture of radio apparatus out of the amateur class to that of a high-class industry. Publicity and advertising also were discussed. It was decided to have a booth in charge of the section at a radio exhibit and convention to be given by the Ninth Radio District in Chicago in August.

The Battery Service Company, Muskogee, Okla., recently incorporated, contemplates the construction of a one-story plant, 110 ft. x 170 ft., to cost about $30,000. J. H. Schmidt is president and manager.

The Peerless Light Company, Peerless Building, 663 West Washington Boulevard, Chicago, has established a Pacific Coast branch in San Francisco under the name of the Peerless Light Company of California at 149-152 Second Street. Joseph H. Reiss is manager.

The Chicago Lighting Fixture Company during the week of June 25 formally opened its remodeled showrooms at 28 West Lake Street, Chicago. There was on display there a new line of lighting fixtures made from designs prepared by the company's own organization. Special designs for office buildings, stores, bungalows, homes and apartmeent buildings were exhibited.

Foreign Trade Notes

LARGE HYDRO-ELECTRIC PROJECT STARTED IN ITALY.—Word has been received by Renello Bella, American representative of the Banco di Roma, that construction work has started on the great dams of the hydro-electric power development on the Sila River in southwestern Italy. The present plans provide for five artificial lakes and three waterfalls. It is estimated that a total of 300,000 hp. will be developed at the beginning, which will furnish sufficient power for industrial and other requirements of the surrounding country, as well as the electrification of the local railways. On completion of the hydro-electric project power sufficient to supply the eastern coast of Sicily will be developed.

S. N. CLARKSON, formerly on the editorial staff of the ELECTRICAL WORLD and at present practicing as a consulting engineer in the Star Building, St. Louis, has been appointed American representative of Hay & Vickerman, Wellington, N. Z., to select turbines and other electrical equipment for a paper mill in New Zealand. Exact details of the work have not been announced as yet, but it is estimated that the cost of the electrical equipment will be between $50,000 and $75,000.

POSSIBLE HYDRO-ELECTRIC PROJECT IN NIGERIA, AFRICA.—The Keffi Consolidated Tin Company, which operates tin mines in Nigeria, Africa, according to the *Electrical Times*, is considering the use of electricity to operate its properties. The company has no intenion of using its own capital resources in an undertaking of this character, but negotiations are pending with a concern which has gone a long way in developing hydro-electric power. It is proposed to submit to the shareholders a scheme to organize a power company to which the shareholders individually would be able to subscribe.

THE NETHERLANDS CHAMBER OF COMMERCE, 44 Beaver Street, New York City, announces that the time is nearly up to receive applications for participation in the fair which will be held at Utrecht, Holland, Sept. 6 to 16, 1921. The chamber believes that the present time is not one that can be allowed to slip by without resorting to every means possible for extending the American market in Holland.

FRENCH THOMSON-HOUSTON 1920 BUSINESS.—Gross receipts for the year 1920 of the Thomson-Houston Company of France have been reported as 33,850,420 francs, while the gross receipts for 1919 amounted to 24,760,680 francs. Net profit in 1920 amounted to 22,900,070 francs as compared with 15,685,320 francs the year previous. While the dividend in 1919 was 40 francs it was raised in 1920 to 45 francs.

THE NEWARK TOWN COUNCIL in England has decided to apply to the Electricity Commissioners, says the Guaranty Trust Company, New York City, for the grant of a special order for the generation and distribution of electricity and for the provision and maintenance of the necessary apparatus. The initial capital outlay will be £200,000.

NEW MICA DEPOSIT FOUND IN AUSTRIA. — The Department of Commerce, Vienna, asserts that mica of considerable extent and thickness has been disclosed in the Styrian Alps south of Köflach and elsewhere. The utility of mica in electrotechnical industries and the fact that it has not been found in any quantities in other countries of Europe give the Styrian deposit a promise of a good market.

PROPOSED HYDRO-ELECTRIC SCHEMES IN VICTORIA, AUSTRALIA.—According to Sir John Monash, chairman of the Victorian Electricity Commissioners, approximately $1,000,000 worth of electrical machinery will be required in connection with the various hydro-electric schemes now receiving consideration by the State of Victoria. The commission has already been able to formulate outline proposals for the utilization in due course, when the time is appropriate and the market for energy develops, of the hydraulic resources of the Kiewa and Rubicon basins, the Acheron, King, Howqua, Snowy and Womnangatta Rivers and the Goulburn River above the Sugarloaf weir.

JOHNSON & PHILLIPS 1920 REPORT.—At the sixteenth annual general meeting of Johnson & Phillips, Ltd., Charlton, London, held on May 5, the report of the company for the year 1920 showed that the profits for the year, after charging to revenue upward of £23,000 for maintenance of building, plant, etc., amounted to £98,[illegible], which is nearly £1[illegible] more than in the preceding year. During the year [illegible] were expended in additions to buildings and plants as a consequence of largely increased business. In the same way stock in trade and work in progress are valued at £563,356, or an increase of nearly £100,000 over the previous year. The company's order books at the end of the year were reported to be as full as it was considered safe to permit. Some departments had from eight to ten months' work on hand, including large and important government contracts so that prospects for the current year may be thought highly satisfactory. Orders are still coming in, which gives warrant for the fullest confidence in the future.

PROPOSED EXTENSION TO ELECTRIC PLANT IN CALCUTTA, INDIA.—Trade Commissioner Batchelder reports that the Calcutta Electric Supply Corporation, Ltd., has applied for an extension of its charter until 1938, with the period of renewal twenty years instead of the existing ten years. It claims that these changes are necessary in order to enable it to raise the 13,000,000 rupees (a rupee is normally worth 32 cents) required to meet the increasing demand for electricity, which is estimated to be 22,000 kw. for 1921 and 33,000 kw. for 1922. It is impossible, it is said, to secure additional capital without changing the present arrangement, which permits the Calcutta municipality to buy the plant in 1928. The proposed improvements include new lines, substations, transformer houses, submarine cables across the river, coal-handling and pumping plants, extensions to existing power house, with increased boiler capacity and an additional generating plant of 21,000 kw.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

A manufacturing company in Greece (No. 35,069) desires to purchase a complete installation of machinery for a twine and rope-making plant, with a capacity of 1,000 kg. daily output, using hydraulic power of 900 hp. to 1,000 hp.

A firm of general merchants in India (No. 35,075) desires to purchase 50, 100, 200, 500 and 1,000-cp. lamps, with 50, 100 and 200-cp. fittings with nipples for ordinary ⅝-in. lamp holders, suitable for hanging, provided with T's with insulators on the top and two-wire leads, with enameled reflectors painted black outside, white inside; 50 and 1,000-cp. globes with hole in the glass for ventilation, all to be arranged so that if so desired insulated T's can be removed so as to take ½-in. gas pipe instead; insulated suspenders, threaded for ½-in. gas pipe, with two separate wire leads, with insulators on top, and ½-in. and ¾-in. recessed base plates, threaded for gas pipe, with round flange for fixing.

A merchant in Trinidad (No. 35,082) desires to purchase a motor and separate generator for repairing and charging batteries.

A firm in Canada (No. 35,091) desires to purchase electric curling irons.

A mercantile company in Canada (No. 35,094) desires to purchase washing machines.

An engineering firm in British East Africa (No. 35,100) requests catalogs of self-contained lighting sets, centrifugal pumps, electrical accessories, etc.

PROPOSED ALUMINUM PLANT IN INDIA TO BE OPERATED BY ELECTRICITY.—According to C. C. Batchelder, trade commissioner, a plan is under consideration for the construction of a plant on the western coast of India to produce aluminum (about 2,500 tons a year) from bauxite, the plant to be operated by electricity. The plans provide for a plant of about 20,000 kw. capacity, power for which would be secured by the construction of a large reservoir to collect and store the annual rainfall and the flow of a small stream, with a head of about 1,700 ft. Considerable quantities of aluminum are now being imported for the manufacture of cooking and other utensils.

THE ROYAL FORWARDING COMPANY, INC., 24 Stone Street, New York City, advises manufacturers in the United States that it is in a position to secure for them a list of merchants in Reval, Esthonia, and Riga, Latvia, who would be willing to dispose of American merchandise in those countries.

New Apparatus and Publications

BELLS, BUZZERS.—Edwards & Company, Inc., manufacturers of bells, buzzers, annunciators, etc., has issued a new catalog, dated June 1, canceling all previous price lists, bulletins and catalogs.

ARC WELDER. — The Railway Track-Work Company, Philadelphia, has placed on the market a new "Ajax" resistance-type arc welder.

TEMPERATURE CONTROL.—The Fulton Company, Knoxville, Tenn., has issued two folders on its "Sylphon" temperature regulators.

TEMPERATURE REGULATOR CHART.—A "Temperature Regulator Chart, or Engineering Data Sheet," has been copyrighted by the Fulton Company, Knoxville, Tenn., for use in figuring tank regulators.

RIGID CONDUIT.—In the June 15 issue of the *Youngstown* (Ohio) *Sheet and Tube Bulletin* an article appears on the production of the company's rigid conduit and flexible armored conductor.

BALL BEARINGS.—The Fafnir Bearing Company, New Britain, Conn., in its July issue of the *The Dragon*, discusses the use of ball bearings on fractional-horsepower motors in domestic use.

REINFORCED CORD.—The Rome Wire Company, Rome, N. Y., has developed a "superservice" cord for portable electric tools, etc.

REINFORCED CABLE.—"Spiralweave" cables for portable light and power service, mining, etc., have been put on the market by the Hazard Manufacturing Company, Wilkes-Barre, Pa.

TIME STUDY WATCH.—A new instrument termed the "duration time study watch," designed to handle the timing, analysis and observation of from one to ten operations up to and including five minutes of duration, has been brought out by the Mortimer J. Silberberg Company, People's Gas Building, Chicago.

ELECTRIC GLUE POT. — "Glue Pot Service" is the title of a pamphlet issued by the Automatic Electric Heater Company, Warren, Pa., covering its electric glue pots.

STOKER COAL CRUSHER.—The Jones automatic coal crusher for use on Jones standard stokers has been put on the market by the Under-Feed Stoker Company of America, 721 Book Building, Detroit, and a descriptive leaflet has been issued.

INSULATION.—The Mica Insulator Company, 68 Church Street, New York City, has developed a flexible oiled cotton tube for withstanding high temperature in electrical machine and instrument winding.

AIR PURIFYING APPARATUS.—"Carrier Air Washers and Humidifiers" is the title of catalog No. 480, recently issued by the Carrier Air Conditioning Company, Buffalo, covering its air washers, generator coolers and other apparatus.

EXPORT TRADE DIRECTORY. — The *American Exporter*, 370 7th Avenue, New York City, has just published the 1921-22—the seventh—edition of the "Export Trade Directory." There are 1,036 pages in the book, the price of which is $10.

ELECTRIC SERVICE FOR FARMERS.—The Delta-Star Electric Company, Chicago, is distributing special publication, No. 55, devoted to central-station service for farmers.

FIRE PROTECTION.—The Oil Conservation Engineering Company, Wade Building, Cleveland, is distributing a pamphlet describing the 10-gal. "Oceco" chemical engine recently developed by the company. The engine is designed particularly for use in electric power stations, transformer, relay and storage-battery stations.

INSULATING TAPE. — The Diamond Holfast Rubber Company, 33 Auburn Avenue, Atlanta, Ga., is distributing a leaflet covering the "Diamond-Holfast" two-plex insulating tape recently placed on the market.

CONDUIT BENDER. — The Henderson Electric Company, Ampere, N. J., is distributing a pamphlet covering the Henderson "E-Z" stationary conduit bender, recently put on the market.

PRESSURE REGULATOR. — The Fisher Governor Company, Marshalltown, Iowa, has issued Bulletin No. 210 on its series 90 pressure regulators.

New Incorporations

THE UNITED ELECTRIC PRODUCTS COMPANY, New York, N. Y., has been incorporated by A. Rappaport and M. S. Solomon. The company is capitalized at $30,000 and proposes to manufacture electric goods. Dreschler, Orenstein & Leff, 225 Fifth Avenue, represent the company.

THE McLELLAND ELECTRIC BAKE OVEN CORPORATION, 36 South State Street, Chicago, has been incorporated with a capital of $100,000 to manufacture and install electric conveyor ovens and other baking apparatus. The incorporators are Charles E. Weadley, Julius Slora and William McLelland.

THE ABSOLUTE CONTACTOR CORPORATION, 126 Shirland Avenue, South Beloit, Ill., has been incorporated at $100,000 to manufacture electrical and mechanical apparatus, accessories and machinery. Louis M. Phelan, Chicago, is president.

THE CHAPEL ELECTRIC COMPANY, Jackson, Mich., has been incorporated by Ralph D. Chapel, F. Bling and Charles D. Dixon, Jackson. The company is capitalized at $20,000 and proposes to manufacture electrical equipment.

THE AXILROD POWER TRANSMISSION COMPANY, Philadelphia, Pa., has been chartered with a capital of $280,000. The company proposes to manufacture power transmission machinery, gearing, etc., and is represented by F. R. Hansell, Land Title Building.

THE STAMP ELECTRIC HOIST COMPANY, San Francisco, has been incorporated by William T. Burney, C. S. Somers and Horace W. Lash, Monadnock Building. The company is capitalized at $75,000 and proposes to manufacture electrically operated hoisting machinery.

THE SHELBY (MISS.) LIGHT & POWER COMPANY, has been incorporated with a capital of $40,000 by Daniel Bradera and L. B. Wilkinson.

THE DOMESTIC APPLIANCE COMPANY, 315 South Jefferson Avenue, Peoria, Ill., has been incorporated with a capital of $50,000 by E. C. Knecks, M. V. Stagg and R. B. Perry.

ELECTRIC REFRIGERATORS, LTD., Toronto, Ont., has been incorporated by R. L. Kellock, Harold W. Keyes and F. C. Carter. The company is capitalized at $40,000 and proposes to manufacture refrigerators, etc.

THE HOOSIER FARM LIGHT COMPANY, Evansville, Ind., has been incorporated with a capital of $150,000 to manufacture farm-lighting systems. The incorporators are J. Morris, W. A. Koch and Charles F. Dickmann.

THE MASSACHUSETTS RADIO & TELEGRAPH COMPANY, Boston, Mass., has been incorporated with a capital of $20,000 to manufacture radio and other electrical equipment. The officers are: Guy R. Entwistle, president, and Raymond F. Trop, treasurer.

H. J SHAFFER & COMPANY, INC New York, N. Y., has been incorporated by H. J. Shaffer, W. L. Coston and W. C. G. Wahle. The company is capitalized at $35,000 and purposes to manufacture motors, etc. Dunn & Daley, 261 Broadway, represent the company.

WALTER KNAPP & COMPANY, New York, N. Y., has been incorporated by Walter Knapp, J. J. [illegible], Jr. and F. H. Sander. The company is capitalized at $10,000 and proposes to manufacture electrical devices and systems.

THE ELECTRIC SAFETY EQUIPMENT COMPANY, Angola, Ind., has been incorporated by J. B. Fitch, H. G. MacLellan and E. A. Skinner, all of Angola. The company is capitalized at $2[illegible],000 and proposes to manufacture electrical equipment and accessories.

THE LIGHTING PRODUCTS CORPORATION, Wauwatosa, Wis., has been incorporated by Clarence Ullman, W. F. Zack and J. J. Meyer, all of Wauwatosa. The company is capitalized at $10,000 and proposes to manufacture electric lighting fixtures, line materials, etc.

THE PAUL E. FLOTRON COMPANY, Philadelphia, Pa., has been incorporated with a capital of $[illegible] to manufacture ice-making and refrigerating machinery. Paul E. Flotron, 207 North Thirty-fifth Street, is treasurer.

THE STANTON (KY.) UTILITIES COMPANY has been incorporated with a capital of $10,000 by Jesse Swangon and James Proffitt

Record of Electrical Patents

Notes on United States Patents

(Issued June 14, 1921)

1,381,772. ELECTRICAL CONNECTOR; Flake M. Wakefield, Anniston, Ala. App. filed May 1, 1920. Multiple connection embodying aligned sockets.

1,381,7[illegible]. SECONDARY WINDING FOR INDUCTION MOTORS; Henry Bewlay, Mansfield, Ohio. App. filed May 18, 1918. High-resistance secondary without joints.

1,381,807. TROLLEY HEAD; Hencel Daffron and Clyde C. Pullem, Detroit, Mich. App. filed Feb. 5, 1921. Accidental jumping from wire prevented.

1,381,827. WIRELESS PHONOGRAPH FOR HOSPITALS; Earl C. Hanson, Los Angeles, Cal. App. filed June 3, 1918. For reproducing music.

1,381,838. INSULATOR SUPPORT; Berry B. Jackson, Mudlock, Ky. App. filed March 30, 1920. Cross-arm easily fastened on pole.

1,381,852. AUTOMATIC CAR AND ELECTRIC COUPLING AND REVERSING SWITCH; Charles H. Tomlinson, Mansfield, Ohio. App. filed June 7, 1916. Simple and improved.

1,381,875. TROLLEY RETRIEVER; George E. Harpham, Los Angeles, Cal. App. filed May 16, 1918.

1,381,882. ELECTROLYTIC APPARATUS AND PROCESS; Matthew M. Merritt, South Middleton, Mass. App. filed Nov. 2, 1917. Manufacture of sheet copper.

1,381,883. ELECTROLYTIC PROCESS, PRODUCT AND APPARATUS; Matthew M. Merritt, South Middleton, Mass. App. filed Aug. 2, 1918. Manufacture of wire.

(Issued June 21, 1921)

1,381,903. TELEPHONE DESK SET; Peter C. Burns, Chicago, Ill. App. filed June 16, 1920. Improved rubber cushion.

1,381,959. STORAGE BATTERY; Arthur J. Baracree, Chicago, Ill. App. filed March 24, 1919. Supporting means for battery plates.

1,381,968. ELECTRICAL MEASURING APPARATUS; John L. Clarke, Montreal, Canada. App. filed Feb. 10, 1920. To determine transmission losses.

1,381,985. ELECTRIC MOTOR; Alfred C. Gilbert, New Haven, Conn. App. filed Nov. 26, 1917. Small and portable for home use.

1,382,012. LINE-SWITCH SYSTEM; Winfred T. Powell, Rochester, N. Y. App. filed May 14, 191[illegible]. Automatic telephone.

1,382,099. JUMP-SPARK ELECTRIC GAS-LIGHTER; Alvin J. D. Lenz, Evanston, Ill. App. filed Oct. 21, 1920.

1,382,101. ELECTRICALLY HEATED ARTICLE TO AVOID DAMAGE THROUGH OVERHEATING; George H. Lofts, Hobart, Tasmania, Australia. App. filed April 15, 1920. Pin melts at high temperature.

1,382,129. STORAGE-BATTERY CONNECTOR; Lytton J. Shields, St. Paul, Minn. App. filed Aug. 8, 1918. Connects cells together.

1,382,156. APPARATUS FOR HEATING LIQUIDS; Luis G. Abogado, Mexico, Mex. App. filed May 12, 1919. Liquid flows in very thin film.

1,382,157. PROCESS OF HEATING LIQUIDS; Luis G. Abogado, Mexico, Mex. App. filed May 12, 1919. Heats thin spirally moving film of liquid.

1,382,158. APPARATUS FOR STERILIZING LIQUIDS; Luis G. Abogado, Mexico, Mex. App. filed June 4, 191[illegible]. By electric current.

1,382,159. PROCESS FOR STERILIZING LIQUIDS; Luis G. Abogado, Mexico, Mex. App. filed [illegible] 4, 1919. By electric current.

1,382,177. RADIO-SIGNALING APPARATUS; William Dubilier and Philip Dubilier, New York, N. Y. App. filed July 1[illegible], 191[illegible]. For producing high-frequency oscillations.

1,382,206. TRANSMITTING APPARATUS; David G. McCaa, Lancaster, Pa. App. filed Jan. 19, 1920. Transmitting high-frequency energy.

1,382,234. DEHYDRATOR FOR PETROLEUM OILS; Henry R. Quinby, Maricopa, Cal. App. filed Feb. 25, 1920.

1,382,257. VARIABLE-SPEED CONSTANT VOLTAGE GENERATOR; William A. Turbayne, Niagara Falls, N. Y. App. filed Nov. 6, 1916. Inherent regulation.

1,382,270. STORAGE BATTERY; Alvin Bugbee, Trenton, N. J. App. filed April 21, 1920. Container of acid-resisting material.

1,382,440. YIELDING TERMINAL CAP FOR DRY-BATTERY CELLS; Adolph C. Recker, Oakville, Conn. App. filed Feb. 28, 1921. Prevents lamp breakage.

1,382,483. ELECTRIC LINE-WIRE INSULATOR; John G. Decker, Stroudsburg, Pa. App. filed May 24, 1918. Telegraph, telephone and trolley wires.

1,382,494. PURIFICATION OF ZINC SOLUTIONS; Samuel Field, London, England. App. filed Dec. 17, 1920.

1,382,510. WIRING-CONDUIT CAP; Frederick I. Johnson, Warren, R. I. App. filed July 18, 1919. Elbow-shaped body with rotatable coupling.

1,382,547. COMMUTATOR CLEANER; Matthew W. Roberts, Lumberton, Miss. App. filed March 28, 1921. For electric railway signaling motors.

1,382,590. SUBMARINE WIRELESS SYSTEM; William G. Zeigler, Chicago, Ill. App. filed Jan. 3, 1920. Wireless transmitted through water.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

PORTLAND, ME.—The Cumberland County Power Company has disposed of an issue of bonds, the proceeds to be used for improvement, etc.

SEARSBURG, VT.—Announcement has been made of further details in connection with the large hydro-electric project of the New England Power Company, Worcester, Mass., at Searsburg. The plans provide for the development of an additional 40,000 hp. on the Deerfield River and the construction of a power plant at Searsburg and also at Davis Bridge, below Searsburg, the latter to develop 30,000 hp. The total cost of the project is estimated at $6,000,000.

ABINGTON, MASS.—The Massachusetts Department of Public Utilities has approved an increase of $56,100 in the capital stock of the Electric Light & Power Company of Abington and Rockland, to meet the cost of plant extensions.

PROVIDENCE, R. I.—Bids have been rejected by the Narragansett Electric Lighting Company for a proposed new power house and machine and service building, two stories, 114 ft. x 172 ft., estimated to cost about $200,000. The project will be held in abeyance. Jenks & Ballou, Grosvenor Building, are architects.

NEW BRITAIN, CONN.—The Hart & Colley Manufacturing Company, manufacturer of steel specialties, plans to build a new one-story power house, 39 ft. x 50 ft., at Corbin Avenue.

Middle Atlantic States

ENDICOTT, N. Y.—The Binghamton Railway Company, we are informed, is not considering the construction of a power house at Endicott as reported in these columns in the June 18 issue. The company is about to connect up the high-tension line in Pennsylvania with its present Endicott substation. It is not in the market for supplies of any kind. W. G. Phelps [illegible]

GENESEE, N. Y.—The Mount Morris Illuminating Company is considering extension to its system to Genesee to furnish electricity here.

NEW YORK, N. Y.—The New York Edison Company, it is reported, will take bids at once for the foundation work for its proposed new two-story substation, 25 ft. x 40 ft., to be built at 10-12 Elizabeth

Street. Plans are being prepared for the superstructure and equipment installation. William Whitehill, 12 Elm Street, is engineer.

NIAGARA FALLS, N. Y.—Negotiations are under way between the Niagara Falls Gas & Electric Company and the city of Niagara Falls for the purchase of the former's local power plant.

SANBORN, N. Y.—The Cambria Power Company, recently incorporated with a capital of $100,000, proposes to establish and operate a local electric light plant. G. G. Mattern, Kenmore, is interested in the company.

NEWARK, N. J.—Arrangements are being made with the Public Service Electric Company for the installation of a new lighting system on various streets, to cost about $7,500. The plans provide for lamps of 1,500 cp. on Broad Street and 1,000-cp. lamps on Market Street, Clinton, Springfield and South Orange Avenues, and 600-cp. lamps to replace the 400-cp. lamps now in use in the outlying sections.

ALLENTOWN, PA.—Resolutions have been adopted by the City Council providing for the installation of additional lamps on Rye and Lewis Streets and other thoroughfares in the city.

CHARLEROI, PA. — Steps have been taken by the Chamber of Commerce to secure the installation of a new ornamental lighting system in the business district.

GLEN ROCK, PA.—The Enterprise Furniture Company is having plans prepared by W. E. S. Dyer, engineer, Land Title Bldg., Philadelphia, for the construction of a power plant at its works.

HARMONY JUNCTION, PA.—Contracts between the Harmony Electric Company and the Boroughs of Enoch Valley and Connoquenessing have been approved by the Public Service Commission to construct and maintain a lighting system in those places.

PHILADELPHIA, PA.—Plans are being prepared by the W. H. & E. A. Margerison & Company, Jasper and Huntingdon Streets, for the construction of a power house at their towel factory.

FROSTBURG, MD.—An ordinance has been passed by the City Council providing for the installation of an ornamental lighting system on Main Street from Bowery to Water Street. The plans provide for thirty-two steel standards carrying two lamps each.

FARNHURST, DEL.—Plans are being prepared for the construction of a one-story power house at the Delaware State Hospital at Farnhurst.

KINGWOOD, W. VA.—The construction of an electric power plant in the vicinity of Kingwood for commercial service between Rowlesburg and Cumberland, Md., is under consideration. The cost is estimated at $3,000,000. Col. C. C. Pierce, Kingwood, is interested.

PRINCETON, W. VA.—Plans are under way by the Micajah Pocahontas Coal Company, Princeton, recently organized with a capital of $300,000, for the establishment of a plant including a power house, equipped with rotary converter, at its properties at Micajah. Coal cleaning and screening equipment, etc., will also be required. L. R. Taylor is president.

PORTSMOUTH, VA.—The City Council has requested the City Manager to submit an early report on the advisability of establishing a municipal lighting plant in Portsmouth.

WASHINGTON, D. C.—Bids will be received at the office of the Chief Signal Officer of the army, Washington, D. C., until July 16, circular PR 6930-20CP, for 7,000 porcelain insulators.

WASHINGTON, D. C.—The Bureau of Yards and Docks, Navy Department, Washington, D. C., plans to make improvements to the power plant at Iona Island. Applications accompanied by a deposit of $10 may now be filed for plans and specifications (4215), and necessary data for bidding will be forwarded in the near future. All communications should be addressed to the Chief of the Bureau of Yards and Docks.

North Central States

LANSING, MICH.—D. C. Milburn, efficiency engineer for the State Administrative Board, has submitted report recommending improvements to the power and heating plants at the State institutions.

TRAVERSE CITY, MICH.—Bids wll be received by O. C. Moffatt, city clerk, until July 13, for furnishing certain material and labor for the construction of a hydroelectric plant about 13 miles from Traverse City. The plans include a dam 1,600 ft. long. Plans and specifications can be obtained from the Fargo Engineering Company, Jackson, upon a deposit of $10.

WAYLAND, MICH.—An option has been secured on the local electric light plant by Clarence L. Miller and Walter F. Wolfe of Otsego. It is planned to purchase power from the Consumers' Power Company at Monteith Junction for distribution in Wayland, Martin, Hopkins and adjacent vicinity. Bids are being asked on line material.

CLEVELAND, OHIO — The Cleveland Electric Illuminating Company is having plans prepared for the construction of a one-story power substation on Cedar and Lee Roads, to cost about $40,000. A. Gallagher, Illuminating Building, is architect.

HICKMAN, KY. — Henry Ford, Detroit, Mich., it is reported, is considering the construction of a dam on the Mississippi River between Dorena and Hickman for hydroelectric development.

BREWERSVILLE, IND.—The Hoosier Electric Light, Heat & Power Company, recently incorporated with a capital of $20,000, it is reported, plans to harness streams in Jennings County for hydro-electric development to supply neighboring towns includng Westport and North Vernon.

LAFAYETTE, IND.—Plans are being prepared for the construction of a new power plant and one-story automobile service and repair works at St. Elizabeth's Hospital, Fourteenth and Hartford Streets. D. X. Murphy, Louisville Trust Building, Louisville, Ky., is architect.

MAXWELL, IND.—The local substation of the Union Traction Company was recently damaged by fire.

DIXON, ILL.—The Northern Illinois Utilities Company plans to erect a transmission line to serve the rural territory southeast of Franklin Grove near Dixon.

EAST, ST. LOUIS, ILL.—A movement has been started for the installation of street lamps in Collinsville Avenue between Broadway and Illinois Avenue. The plans provide for fifty-four posts, to cost about $11,000.

WILLMAR, MINN.—Improvements are contemplated to the municipal electric light and power plant to cost about $45,000.

REMSEN, IOWA.—Bonds to the amount of $60,000 have been voted for the construction of a municipal light and power plant.

COLUMBIA, MO.—Plans are being prepared by Prof. G. D. Newton of the School of Engineering, University of Missouri, for the construction of a power house and heating plant at the university.

LINN CREEK, MO.—The construction of a power plant and dam on the Niangua River is under consideration. J. B. Quigley, Lebanon, is interested.

ST. LOUIS, MO.—The Missouri Gas & Electric Company, St. Louis, has applied to the State Public Service Commission for permission to erect an electric transmission line between Liberty and Lexington, passing through Missouri City, Orrick, Camden, Richmond and Henriette.

QUENEMO, KAN.—Arrangements are being made by the city officials of Quenemo to erect an electric transmission line to connect with the plant at Ottawa to secure energy for the municipal electric system, to cost about $10,000. Electricity for operating the local system was formerly obtained from the Lyndon plant, which was recently destroyed by fire. Lyndon will be served from Osage City.

Southern States

CHAPEL HILL, N. C.—Extensions to the lighting, water and sewerage systems at the University of North Carolina, to cost about $100,000, are under consideration. T. C. Atwood, Chapel Hill, is engineer.

DUNN, N. C.—An agreement has been reached whereby the Carolina Power & Light Company will purchase and operate the municipal light and power plant, subject to the approval of the voters. The company also proposes to purchase the transmission line between Selma and Benson, owned by the town of Benson, and extend the line from the latter town to Dunn, rebuilding a portion of the local lines. The purchase of the line and improvements in connection with same are estimated to cost about $100,000.

OTEEN, N. C.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until July 20, for the installation of a fire-alarm system in the public health service hospital at Oteen.

JEFFERSONVILLE, GA.—The local electric light station was recently destroyed by fire, leaving the town without electric service. Work will begin in rebuilding the plant as soon as possible.

ROCK MART, GA.—At an election to be held July 12 the proposal to issue $15,000 in electric light and power bonds will be submitted to the voters.

BRONSON, FLA.—The Bronson Manufacturing Company is considering increasing its capital from $15,000 to $25,000, the proceeds to be used for the installation of an electric light, ice and cold-storage plant for Bronson. B. B. Stokes is secretary.

GREEN COVE SPRINGS, FLA.—The question of submitting to the voters a proposal to issue $150,000 in bonds for improvements and additions to the electric light and power plant, etc., is under consideration.

RUSSELLVILLE, ARK.—Plans are under consideration for the installation of a lighting system on Oak, Main and River Streets from the railroad to David Street, and on Main Street from Oak Street to Mary Street. Electrical energy will be furnished by the Arkansas Light & Power Company.

KERRVILLE, TEX.—Plans are under consideration for the construction of a refrigerating and ice-making plant at the proposed new sanitarium at Kerrville to be erected by the American Legion Memorial, Austin. The plans provide for the construction of a power plant. The cost is estimated at about $1,200,000. Phelps & Dawes, 715 Gunter Building, San Antonio, are architects.

MOULTON, TEX.—F. W. Wise, Victoria, is considering the establishment of an electric light and ice plant in Moulton.

Pacific and Mountain States

RIVERSIDE, CAL.—The installation of ornamental lamps on several streets and in Fairmount Park is under consideration.

DUCHESNE, UTAH.—A preliminary permit has been issued to the Great Basin Power Company, Salt Lake City, for a 4,000-hp. hydro-electric development on the West and North Forks of the Duchesne River. The plans provide for the construction of a storage dam on the North Fork and diversion dams on the West Fork and on Wolf Creek, pipe lines to run from the reservoir and the two diversion dams to a common forebay from which a penstock to the power house will be built, and conduits totaling 70,000 ft. in length. The company also proposes the erection of four transmission lines, one to Salt Lake City and the others serving communities within a radius of 60 miles from the power site.

GUERNSEY, WYO.—The next project to be undertaken by the United States Reclamation Service in this section of the country will be the Guernsey dam. The proposed dam will supply water for irrigation purposes, covering an area that has not yet been covered, and in addition will supply power to generate electricity to be distributed throughout the entire North Platte Valley, and also to the iron mines of Sunrise, Wyo., and to large coal and oil fields.

Canada

PEACE RIVER, ALTA.—The construction of a municipal electric lighting plant and system is under consideration.

ERIE BEACH, ONT.—The Hydro-Electric Power Commission of Ontario has prepared estimate of cost of the installation of hydro-electric service at Erie Beach.

LONDON, ONT.—Bids addressed to the chairman and members of No. 2 committee will be received at the office of the city clerk until July 21 for the installation of four sewage pumps and complete electrical equipment. Specification and form of bid may be obtained at the office of H. A. Brazier, city engineer.

SARNIA, ONT.—Extension of the Sarnia Hydro-Electric System in the beach district is under consideration.

Electrical World

New York, Saturday, July 16, 1921

The New World Needs Something New in Personal Attitude

TIMES have changed of late in the electrical business. A very big change has taken place about us. As big a change must come within us.

During the war-born period we had a hungry market—more demand for goods than goods to fill demand. Sellers were very "choosy," and buyers took what they could when they could get it. Moreover, central-station companies were oversold in power to war-stimulated industries. They were not looking for more business. They were dodging it. Every kind of a salesman became more and more of an order taker and less of a developer of business. Many central-station companies practically disbanded their sales departments. Then the pendulum swung.

The result is a new combination of conditions, demanding a new attitude and different treatment. Orders must be sought. Opportunities must be developed. Customers must be won and held by service. Business must be built up again before times can be normal, and business men must do the building. There is no use in waiting for the world to settle down. It is each man himself who must restore his business by his own good work and thinking. And, in the main, just as he meets this test will he come into more prosperity.

As to the central station—read the figures. The total maximum load in 1920 was 12,870,000 kw. It is estimated that on January 1, 1922, this load will have increased to 13,500,000 kw. With the added installations that the year will bring, the total generator capacity at that time will take care of a total load of 14,100,000 kw., or 600,000 kw. more than the expected burden. That power plus the large idle capacity that idle factories have made available — less adequate reserve—must now be sold. And Samuel Insull says, *"Get busy with your business-getting departments."*

So there is plenty of material to sell, plenty of appliances, plenty of power, and there is plenty of need for sales. It is a different world we have today to work in. Business has simply turned around in its mental attitude because conditions have reversed. The problem for the individual is how to conform, how to line up his habits both of thinking and of working, how to pull with the times and not against them, how to recognize the actual situation as it is and progressively adapt himself to it.

Surely the first thing is really to *know* the times as they unfold. Therefore, watch and understand the changes as they come. Study the broader trend of our industry's affairs by reading more broadly and more thoughtfully in the ELECTRICAL WORLD.

Henry Hobart Porter

An engineer and executive of broad experience and high professional and business standing who has an exceptional record of achievement in planning and directing the activities of many important organizations

TO KEEP a public service company strong and healthy is no sinecure, but much greater is the task of one who takes weak, ill-managed and generally run-down properties and makes of them profitable and well-managed servants of the public. Although an engineer by education and profession H. Hobart Porter is essentially an executive and organizer. Such a combination of attributes has enabled him to take public utilities in a state of disorganization and disintegration often regarded by the financial world as almost hopeless and, by hard work and quick thinking and through efficient reorganization, put life and vigor into them and place them on a sound operating basis. The engineer in the man has observed the mechanical and physical deficiencies and prescribed the remedies. The intuition of the natural executive has seen the weaknesses in the corporate structure and known almost instinctively the proper reorganization measure to apply. From such work the public utility industry has benefited not only by the immediate lesson of each case but also because every important utility that has been kept off the rocks of financial disaster has helped to strengthen public confidence in this industry.

A notable example of Mr. Porter's achievements in this direction was the reorganization of the American Water Works & Guarantee Company of Pittsburgh, now the American Water Works & Electric Company of New York. He is at present engaged in a similar work as vice-president and general manager of the Brooklyn (N. Y.) City Railroad.

Mr. Porter was born in New York City, March 12, 1865, and was graduated in 1886 from the School of Mines of Columbia University. The following year he spent at Columbia as a fellow in geology. He then engaged in mining in Mexico and later in Arizona, where he operated some mining properties controlled by the late George Westinghouse, who in 1891 brought him to East Pittsburgh to work for the Westinghouse Electric & Manufacturing Company. Later he went to New York for this organization, becoming assistant to the vice-president and general manager. In 1906 he resigned to form with E. N. Sanderson what is now the well-known engineering firm of Sanderson & Porter, which at the start devoted its energies largely to engineering and construction work, later branched out as manager and owner of public utilities and is now active in the operation of approximately a hundred public service companies. He is now taking a prominent part in the proposed [illegible] of the transit systems of Greater New York.

Mr. Porter has always taken an active interest in engineering association work. He is a member of the [illegible] national engineering societies, of the Engineering Foundation and of the executive committee of the engineering division of the National Research Council.

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Death of Prof. Francis B. Crocker

IN THE DEATH of Prof. Francis Bacon Crocker the industry loses a pioneer who contributed greatly to its upbuilding professionally as well as commercially. Long before many of the present electrical manufacturing companies were known, Crocker with C. G. Curtis formed the C. & C. Electric Company, and in 1888, with Schuyler Skaats Wheeler, he founded the Crocker-Wheeler Company. In those days, also, electrical engineering as a profession was becoming recognized, although very few universities gave place to electrical engineering courses in their curricula. Among those giving instruction in electrical engineering was Columbia University, and after serving in the department Crocker was appointed professor in 1893. It was, therefore, Crocker's privilege and good fortune to help build and guide the fast-growing electrical industry. He devoted many active years to standardization and fire protection work, out of which grew the standardization rules of the American Institute of Electrical Engineering and the National Electrical Code. Being free from family ties (Professor Crocker was a bachelor) he gave liberally of his time in the service of his profession, and the Institute, the Power Club and other electrical associations chose him as president. Prof. Crocker was therefore not without honor in his own country and certainly no greater tribute could be shown to any man, and few were more deserving of it.

Some Desiderata in Superpower Transmission

THE admirable and daring superpower scheme being planned for the North Atlantic States is gradually taking shape. In reporting and planning so colossal an undertaking, however, there is a greater responsibility for certainty and permanence of results than usually rests upon an electric supply system. If the great plan is carried out, there will be reliance on electric power to an extent hitherto unknown, and the fortunes of manufacturing interests within the districts served will rest upon the successful continuity of their power supply. Few people realize to what an extraordinary extent the great interests of the country have, through the manner of their growth, become absolutely dependent on transportation of something or everything, and how easily a little disorganization of this transportation can produce results of the greatest import. The old political economy, based on the idea of free competition in somewhat self-supporting communities, has long since gone by the board. Now a superpower system simply puts transportation of very vital necessity into another form. What men do and what men produce depend then upon electric wires rather than railway tracks. If one were to stop to think what absolute cessation of electric power supply would mean to New York City, he would stand appalled. It therefore will become necessary to plan the great system not only for continuous efficiency but in such wise that no reasonably supposable series of accidental or malicious injuries could put it out of service for any considerable period. It is a case that calls for the most thoroughly worked-out network that ingenuity can devise, so planned that no important point can be accidentally isolated. Much more than a trunk line is necessary—it must be a trunk network.

The Homer Inductive Interference Case

THE relative rights of telephone and electric lighting companies in the use of the public highways has been the subject of needless bickering and strife and of not a little litigation. Fortunately, the National Electric Light Association and the American Telephone & Telegraph Company have taken the question in hand as a matter of public policy, and before long an amicable settlement of all inductive interference troubles may be hoped for. An interesting case, that of the Homer Electric Light & Power Company, has been decided by the Illinois Public Utilities Commission. The decision contains important findings affecting the use of the highways which will give aid and comfort to all electric public utility managers. It is evident that neither the courts nor the commissions will stand for any dog-in-the-manger attitude on the part of any utility, and while it may gladden the hearts of lawyers to pile up precedents, as a practical matter no utility should unnecessarily cumber the records of the courts or the commissions with such cases. The cost of all public utility litigation must be borne eventually by the consumer, and it is therefore to his interest that all differences be adjudicated honestly and expeditiously. The man in the street is not concerned with the technical issues involved, and as a plain business proposition he has little patience with the legal aspects of such cases. To his thinking it is a poor industry that cannot settle its disputes in private.

Appliances and the Diversity Factor

EVERY manager of an electric light and power company who looks ahead beyond the prospects for this year's dividends must have had forced upon his attention the importance of building appliance load for the future. Motor and industrial load of various sorts is always an important element in the growth of output, but it brings with it serious responsibility in the way of station equipment and distribution network. At the present moment the most vital problem in the economics of central-station operation is the full utilization of the plant and of the copper which has been paid for and laid down. To this end domestic appliances, if properly handled, may become of very great importance. Motors and industrial equipment generally come on at a fairly definite time, lapping the main lighting load with somewhat disastrous results in the late afternoon, and then going off not to reappear until the next morning. The load of minor household appliances, however, presents a diversity factor of rather astonishing value. People do not use vacuum cleaners vigorously in the hour before dinner, nor is the heating pad or the coffee pot likely to go on the line at this undesirable period.

Taking the list of household appliances from start to finish, it offers exceptional advantages in the way of keeping off the peak. Moreover, the use of cooking appliances in particular is likely to fall after the main peak, affecting it only in a slight degree except by increasing the period of fairly heavy load. In general, therefore, there results from the domestic appliance load not only a call for energy off the usual peak, but also, owing to the various habits of customers, an advantage in diversity factor which can hardly be overestimated. Even in the same community and among persons living under approximately similar conditions the diversity factor will usually be found advantageous. For instance, a hundred families living in adjacent apartment houses will prove to be very far from having the same dinner hour, so that, instead of the combined load of all their cooking appliances falling on the system together and at a time when it is already heavily loaded, the aggregate amount is quite certain to be scattered over two or three hours, beginning at the point where the general load has already started to decline. If properly handled, the appliance load will come pretty near to adding itself to the domestic lighting load without material increase of the maximum, and without demanding either more copper or more transformer capacity.

Relation of Boiler Ratings to Performance

THE co-ordination of boiler capacity with peak requirements on the one hand and furnace and stoker design on the other presents today some questions difficult of solution. The old system of rating boilers is, of course, now an international joke, but it still gives a starting point from which to reckon. The relation of boiler rating to performance of the furnace may therefore prove of interest, and it can be studied in detail elsewhere in this issue.

With steady loads steam at minimum cost can probably be obtained with only a moderate output above the regular rating. The more the load varies and the longer the peak, the better it pays to make preparations for operations at big overloads. At these loads the boiler efficiency may drop 5 or 10 per cent, but the requirements can be met without cutting in other boilers which are kept banked or otherwise ready for prompt service.

The point of maximum combined efficiency of boiler and furnace can be widely varied by changing the proportion of the grate area to the heating surface. At low ratings extra-large heating surface raises the efficiency, while with an exaggerated furnace high ratings are helpful. Of course, the grate area is widely influenced by the character of the fuel, so that for steadily efficient operation uniform fuel becomes almost a necessity.

The forcing of boilers, of course, increases the maintenance cost on settings and stokers, particularly if these were not originally designed for high output. The whole story is that not only the boiler but its setting and the stokers must, in order to secure maximum economy, be arranged with overload requirements very clearly in view. Foresight in this respect will always pay.

Surge Protection on Lines and Cables

RADICAL improvements in line and cable protective devices have been somewhat rare of late. In the case of long lines disturbances are now reasonably well handled by the aluminum arrester, improved circuit breakers and the well-known auxiliaries. Conditions are far from satisfactory, however, in the mixed cable and moderate-voltage overhead systems of large centers. Cable breakdowns and losses of transformers and even of machines in these systems are still of frequent occurrence. It is in these cases that the lag of protection behind expansion is most noticeable.

The disturbances in large alternating-current distributing systems usually arise from the mixed character of the lines and equipment. The combination of cables, overhead lines and station machinery results in points of sharp change of the circuit constants, inductance and capacity. Load changes invariably cause some oscillation of stored energy, and the trouble begins when these oscillations or surges are asked to ride smoothly over these humps or sinks in the electric highway.

Recently renewed attention has been given to two old protective devices with the aim to adapt them more exactly to various circuit conditions. It is now proposed to shunt a protective reactance with a relatively high resistance, it being claimed that this will relieve the topmost strain caused by an abnormally steep wave, absorb some of the energy, and so save the coil and the apparatus beyond it. Although there is some difference of opinion as to the accuracy of this reasoning, there seems to be none that a shunted capacity to ground at the ends of cables or lines tends to relieve a voltage rise in much the same way, and this device with series resistance added is now receiving attention.

An account is given in the June number of the *Journal* of the Engineering Institute of Canada of the installation of a number of these so-called absorbers in a large system. The operating data over a period of years show a marked decrease in the number of disturbances which have occurred since the installation of the absorbers.

The theoretical deduction of the phenomena occurring when an electric wave passes over a uniform line and strikes another uniform line with different circuit constants is well known. It is a simple matter to extend this treatment to the case of a shunted condenser at the point of change, and it is almost obvious without resort to the mathematics that such a shunted circuit tends to ease up the steep fronts of both the transmitted and reflected waves. These theoretical deductions are, of course, of the first importance, but it must be remembered that they are only a first and very short step toward the solution of the great problem of disturbances in mixed networks of large distributing systems. In these cases the conditions are so complex as to make it virtually impossible to predict either the character of the initial disturbance or the resultant way in which it will spread through the various points of discontinuity in the network. Obviously, since these large systems are always the results of growth, the distribution of circuit constants is in large measure beyond control. It appears, therefore, that the present needs of the situation can probably be met to best advantage by a further multiplication of protective devices either of the type mentioned or an improvement thereon.

The Economic Importance of Varied Load

THE usefulness of building up a varied load even in a station of comparatively modest output is emphasized in this issue by E. S. Hamblen. He shows a power load increasing in five years from about 2,000,000 kw.-hr. to nearly 8,000,000 kw.-hr., and the commercial lighting load increasing almost in the same ratio but never reaching a point in the least comparable with the power output. The Franklin (Mass.) plant of which he is writing is clearly in the power business to a very large proportion of its total load, and in spite of loss of motor customers owing to trade conditions, it has been able to keep up its power business with unusual success, because—and here is the point of the whole matter—it has systematically endeavored to obtain as varied a load as local conditions permitted. For instance, it has been able by steady effort to acquire a considerable amount of business in ranges and refrigeration, besides which it operates a municipal pumping plant. Items of this kind mean a large and steady load especially free from fluctuations due to temporary business depression. Appliances have been vigorously pushed, and a deliberate drive has been made for off-peak load by offering special power rates between 11 p.m. and 6:30 a.m. The resulting growth of business has been extremely gratifying, and in particular the stabilizing of income is noteworthy. Electrical supply stations need diversity just as much as does the farming community, although the principle is too often neglected by both classes.

Power Possibilities in Montana

THOSE of our readers who are following hydro-electric development closely will find very much of interest in E. W. Kramer's consideration of the potential power situation in Montana. As has more than once been shown, Montana is rich in water powers, but the present article reports even more wealth than would be anticipated.

The question of utilizing these great powers is chiefly one of demand, for none of the proposed developments presents formidable difficulties from the hydraulic standpoint with our present view of what difficulties mean. In only a few instances would exceptionally high dams have to be built. Montana is certainly a state of magnificent possibilities in the development of power. At present this power awaits an active market, for there is little steam in the state to replace. Here it would seem is a vast power supply for railway electrification when it shall be judged wise to attempt its extension. Some of the transmission lines would have to be long, but the West does not fear this, and the power is undeniably there.

Clark's Fork of the Columbia is by all odds the most important stream for potential power because it has a watershed exceptionally well timbered and provided with lakes, glaciers and perpetual snow in the high mountains to steady its flow. The untouched possibilities on this river aggregate more than 500,000 hp., more than 200,000 hp. being at a single site using Flathead Lake for storage. There is here 187 square miles of water area, and a 30-ft. dam would come near to equalizing the flow in the stream through any ordinary season. The available head is moderate, according to Western notions, but quite sufficient for economical development—about 240 ft. The other Clark's Fork sites are also of moderate head, as are in fact the majority of the Missouri powers, but they foot up to the total of more than 530,000 hp.

Will Mutual Companies Be Successful?

THE rural-service plan for utilizing the energy generated on the Minidoka project, outlined by T. W. Halliday elsewhere in this issue, should be interesting to companies engaged in furnishing such service. However, it should be remembered that this project is not comparable with the ordinary rural-service situation. The Minidoka project was built primarily for irrigation purposes, the demand for such power being limited to the spring, summer and fall months. The Reclamation Service is not in the general utility business, which makes it necessary for some other agency to undertake the distribution of the surplus power. Apparently the plan outlined has been the most feasible so far. The real question is, What is to be the ultimate result of the formation of mutual companies? Will their maintenance be properly cared for? Can these companies with their small means and lack of experience build up the organizations that must be available if the service is to be an ultimate success? Can they continue over a period of years to meet the requirements of the public service commissions successfully? Answers to these questions and many others must be returned before the success of mutual companies can be fully judged. That the plan will result in the rapid building up of a distribution system goes without saying, since it is clearly evident that the farmer is determined to have electric service, be it from the central-station company through his own organization or from a farm-lighting plant.

Nickel-Copper Alloy that Has Distinct Magnetic Properties

AMONG the more modern nickel-copper alloys is a very noteworthy one, discussed in this issue by Dr. Charles W. Burrows, which is distinctly, although not strongly, magnetic. It has the remarkable property of a very low critical temperature, whereas iron and steel lose their magnetic susceptibility at a temperature that may roughly be described as red heat. The alloy discussed loses its magnetic susceptibility near the temperature of boiling water. That is, it becomes virtually non-magnetic at and above 100 deg. C., but regains its magnetic properties when its temperature is lowered a few degrees below the critical point. The alloy is not easily corroded by exposure, may be cast into molds and possesses considerable strength. As the article points out, such a magnetic material has many useful applications. Because the metal is neither strongly magnetic like steel nor very weakly magnetic like certain compounds of iron, a special testing technique becomes desirable for it. The methods worked out and briefly described by Dr. Burrows are noteworthy.

Freedom of Layout Permitted with Electric Drive

THE electrically propelled battleship "Tennessee" has recently completed her official trial tests. Her fuel economy was 10 per cent better than promised and she was brought from full speed (21.4 knots) to a dead stop in less than three minutes. While stress has been laid on economy of electric drive and has been justified, the greatest advantage is its freedom of layout and flexibility of control.

Rural Service in Southern Idaho

History of Methods Adopted, Rates of Mutual Companies and Type of Line Construction Employed in This District—Distribution Systems Growing Rapidly

By T. W. HALLIDAY
Engineer Rupert (Idaho) Electric Company

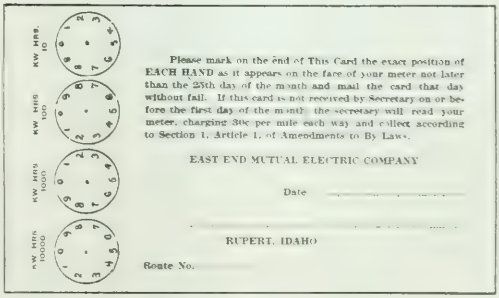
THE plan for handling rural extensions that has been in successful operation for several years on the Minidoka Project in southern Idaho is of interest because of the satisfactory solution of the problem it has afforded under the conditions existing and for the contrast it affords to the Wisconsin method as outlined by G. C. Neff in the Dec. 18, 1920, issue of the ELECTRICAL WORLD, under the title of "Factors Governing Rural Extensions." This plan has been approved by the Idaho Public Utilities Commission.

The Minidoka Irrigation Project, constructed by the United States Reclamation Service, furnishes water for 121,057 acres (299,000 hectares) of land, of which 72,093 acres (178,000 hectares) are under gravity systems and 48,964 acres (131,000 hectares) are under pumping plants. Primarily to take care of the pumping system, a power plant of 10,000 hp. rating was built. As towns grew up on different portions of the project the Reclamation Service ran transmission lines to them and furnished power for all general purposes, including heating. The latter service is possible only because the main portion of the rating of the power plant is used for pumping during the irrigating season, which falls in the summer months and furnishes a surplus of power during the remainder of the year.

In 1910 a contract was entered into between the Reclamation Service and the village of Burley and with individuals in Heyburn and Rupert whereby power should be delivered to substations in each locality. From these points the distribution was to be handled by the village or individual. As the surrounding country developed a demand for rural service grew up. At first lines were run from the various substations installed to handle the villages, but as the practicable limit of 2,200-volt distribution from these points was reached the Reclamation Service engineers worked out a plan of building outdoor substations along the 33,000-volt transmission lines to make 2,200-volt energy available at various points. Mutual companies were then organized among the farmers to contract for the power at wholesale rates and to build and operate distribution lines to serve the members.

There are 2,275 farms on the Minidoka Project, and at the present time the rural service extends to 1,160, or about 51 per cent of the total number. The distribution system embraces 265 miles of pole line carrying single or three-phase service. In serving the 1,160 customers the lines make service available to a total of approximately 1,750 farms. The percentage of saturation—that is, the ratio of farms served to the farms capable of being served by the existing lines—is therefore approximately 65 per cent.

The state laws of Idaho provide for the formation of mutual or co-operative incorporations, which are to be conducted without profit and wherein each member has equal voice and right. The rural electric companies are organized under these laws. The membership fee of these mutual companies is set by assessing the pro rata cost of the initial construction of the distribution line to each of the original members, and this fee must be paid by all succeeding additional members. Clauses governing this fee and the requirement that only members of the company be served from its lines are made a part of the bylaws. All service wires, transformers and other equipment utilized only to serve the individual member are the property of that member and are paid for by him. An extract from the bylaws of one of these companies indicates the general method of handling these matters:


KW HRS. 10
KW HRS 100
KW HRS 1000
KW HRS 10000

Please mark on the end of This Card the exact position of **EACH HAND** as it appears on the face of your meter not later than the 25th day of the month and mail the card that day without fail. If this card is not received by Secretary on or before the first day of the month the secretary will read your meter, charging 30c per mile each way and collect according to Section 1, Article 1, of Amendments to By Laws.

EAST END MUTUAL ELECTRIC COMPANY

Date ____

____

RUPERT, IDAHO

Route No. ____

FIG. 1—STAMPED POST CARD USED BY RURAL CUSTOMERS IN REPORTING METER READINGS

> The initial membership fee in this company shall be $——. This fee may be increased or decreased by the board of directors from time to time as they find necessary, except that no person may receive service under a more favorable condition than the other members. In case the expenditure necessary for the company to make in serving a new member is greater than the membership fee, then the member shall be required to pay such additional amount as shall be necessary and as shall be determined by the board of directors, but under no condition will the company be required to carry the primary line to a point closer than —— feet from the member's house, except at said member's expense.
>
> No person may receive service from the lines of the company unless he is a member and has paid all fees and has complied with such other requirements as the board of directors may prescribe. No member shall receive service upon more than one farm unit or other property unit except by payment of such additional fee as may be determined by the board of directors.

OPERATION AND RATES OF MUTUAL COMPANIES

Like ordinary corporations, the business of the mutual companies is handled by a board of directors, but the secretary-treasurer is usually the active managing agent. Upon him falls the duty of rendering statements, making collections for services, supervising the maintenance of the system and generally enforcing the rules and regulations of the company.

When a public utility serves a territory oftentimes too great a portion of its consumers do not realize that their failure to co-operate with it only causes additional expense of operation which they must ultimately pay. This lack of harmony is reflected in the rates that must be paid, as the overhead expense of the utility is greatly increased to the detriment of all concerned. In the mutual organization, however, each member is his own as well as his brother's keeper, and the overhead expense of service is very small. The direct method used by the mutual companies to accomplish this result will be apparent by quoting from the "rules and regulations" used:

No. 1. All dues and charges for electrical energy shall be due and payable at the office of the treasurer on or before the tenth day of each month following that month in which the same is used or a service charge accrues, and if not so paid a collection charge of 10 per cent shall be added. If said charges and dues together with said collection charge are not paid before the first of the month following the assessment of said collection charge, then it shall be the duty of the treasurer, or of some person by him authorized, to shut off the electrical energy of such delinquent until such charge, dues and collection charge, together with all costs of disconnecting service and reconnecting same, are paid in full, and he shall have the right to go upon the premises of such delinquent member for such purpose and remove the plugs from the transformer, or such other means as he shall deem proper.

No. 2. Every member of this association shall remove all obstructions along his line of service and along his farm or premises which interfere with the wires running to and from the same, upon notice from the secretary, and if the same be not so removed within ten days from and after date of such notice, it shall be done by the company and all charges therefor shall be paid by such member and collected in the manner provided in rule No. 1.

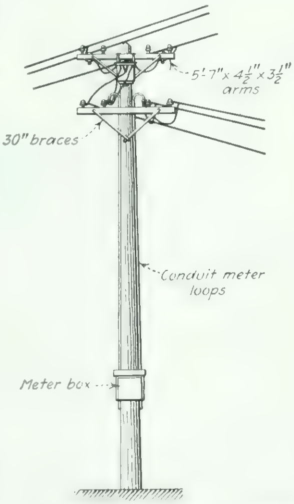


FIG. 2—TYPE OF RURAL SERVICE POLE-LINE CONSTRUCTION EMPLOYED IN SOUTHERN IDAHO

No. 4. Each member shall read his own meter and shall report the same to the secretary on cards to be furnished by the secretary and shall mail said report to the said secretary on or before the twenty-fifth day of each month, and upon failure so to do the secretary shall upon the first day of the month read said meter or meters and charge all expense up to such member at the rate of 30 cents per mile or fraction thereof going to and coming from his place, and such charge shall be collected in the manner provided in rule No. 1.

While the rates of the different mutual companies vary slightly, virtually all of them use a sliding scale which falls within the following limits:

Minimum charge for first 15 kw.-hr. to 50 kw.-hr. use	$1.00 to $2.00 per month
Next 100 to 150 kw.-hr. per month	0.03 to 0.05 " kw.-hr.
Balance used during the month	0.01 to 0.015 " kw.-hr.

These rates have been found sufficient under this form of operation to meet all operation and maintenance and to lay aside a fund to meet accruing depreciation.

Wholesale Rates

The wholesale rate now used by the Reclamation Service is a combination of a demand charge plus a kilowatt-hour charge which follows a sliding scale and to which a discount schedule is applied. This gives a rate of sufficient flexibility to serve contracts from the smallest mutual company to the larger municipalities and also allows any company served to sell at wholesale to any smaller organization, or to one of its own size, at a profit by simply applying this same schedule. In fact, the Reclamation Service contracts provide that all resale on a wholesale basis must follow this rate.

As is usually the case in developing a new form of distribution, these rates were not conceived in their present form but are the result of evolution. At first all service was on a flat-rate basis. This gave way to a metered basis wherein the meter readings of the individual consumers were taken and a differential applied to leave an operating margin for the distributer. Under this plan separate metering of each class of service was required and a separate rate was applied. The present schedule permits all service to be metered together. A synopsis of the Reclamation Service rates is given in the following paragraphs:

The contractor will pay monthly for energy used as follows:

	Per Kw.-Hr.
(a) For equivalent of first 50 hours' use of maximum demand, $2 per kilowatt of maximum demand.	
(b) For equivalent of next 50 hours' use	$0.03
(c) For equivalent of next 50 hours' use	0.02
(d) For equivalent of next 150 hours' use	0.01
(e) For remainder of energy used	0.005

The above rates will be increased 25 per cent during June, July and August. (This is to discourage commercial loads from building up the peak during the pumping season.)

Quantity discounts varying from 2 per cent for an agreed maximum demand of 2 kw. to 30 per cent for an agreed maximum of 100 kw. are applied. An additional discount of 10 per cent is allowed if electricity is delivered and metered at 2,200 volts.

In the winter months the surplus capacity of the plant is sold for heating purposes at a flat rate of $1.25 per kilowatt per month, but this service must be delivered over separate lines and is subservient to all other demands for service.

The Idaho Power Company is contemplating two forms of rate for this class of service, one very nearly following the Reclamation Service rate, except that the 25 per cent increase for the summer is more evenly distributed over the entire year, and the other a modification of its irrigation pumping rate. In the final analysis both rates yield about the same monthly charge when applied to the average rural or small municipal organization.

Rural Distribution Lines and Type of Construction Used

All distribution lines must conform to the standards of construction of General Order No. 10 of the Public Utilities Commission of Idaho and are subject to approval and acceptance by the wholesaler. The standard voltage of the Reclamation Service is 2,200, either single-phase or three-wire three-phase, while the standard of the Idaho Power Company is 11,430 6,600 volts, four-wire, three-phase.

At either voltage the ridge-pin type of construction is discouraged and four pin arms are used throughout, as this provides for greater flexibility in the 2,200-volt lines and is essential in the 11,430 6,600-volt system.

For the lighter loaded lines iron wire is used extensively. As a system develops it is necessary to convert the trunk lines to copper and the iron is then transferred to the branches. Under the mutual form of organization it will be seen that new members do not pay any portion of the cost of the lines already built if the cost of their extension exceeds the membership fee, but it has become the custom that should the addition of these members increase the loading of the existing line to such an extent that the service of the original members may become impaired, then such new members must replace the trunk line serving them with heavier wire. The wire removed is available to them for use of the extension.

Under general order No. 10 of the Idaho Public Utilities Commission the practice of using a distribution pole with a secondary bracket is not permitted. This order provides that a clear space of at least 30 in. (75 cm.) between pole pins must be maintained on this service.

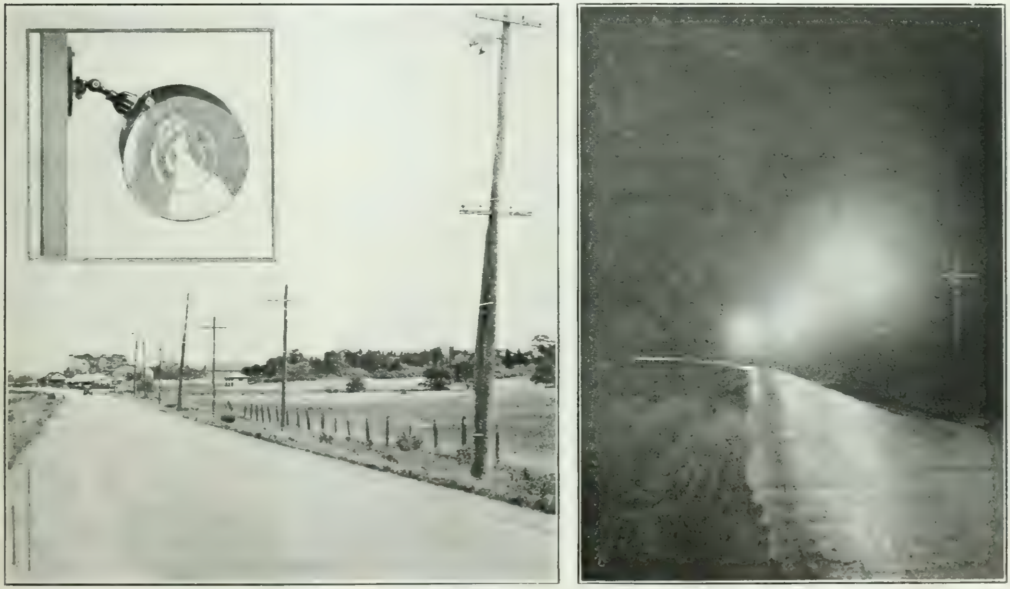
Since the rates in general use permit the combined metering of all classes of service, the general custom is to place the meter in a box on the distribution pole. By giving this pole a central location it is possible to serve all portions of the premises with a minimum amount of service wires.

For the ordinary farm load, such as lamps and house pump, flatiron and other lamp-socket appliances, a standard watt-hour meter is used, but where larger motors, ranges and similar devices are connected a demand type of meter is usually employed. In lieu of the latter a minimum charge is sometimes applied in conjunction with the watt-hour meter and is based upon the estimated monthly demand.

Highway Lighting Reduces Hazard Due to Glaring Headlamps

With a view toward reducing the possibility of automobile accidents due to glaring headlights, an experimental installation of highway lighting with a new type of unit has recently been made on the Paradise Road, Swampscott, Mass. It has been said that a large percentage of the night automobile accidents can be ascribed to headlight glare, although many types of headlight reflectors have been developed which were supposed to eliminate or at least reduce this glare. The present plan of lighting the country highways, particularly dangerous curves, so that the use of headlamps will be unnecessary is said to decrease this accident hazard.

The new type of apparatus which has been developed by the General Electric Company for highway use consists of a nest of reflectors, one within the other. Two of these nests direct the light toward the roadway at an angle of 10 deg. below the horizontal. There is also some light directed below the unit owing to the opening just below the tip of the lamp. The bracket holding the reflector is adjustable in both vertical and horizontal directions so that the fixture can be mounted on poles close to the edge of the highway or at locations which may be some distance away from the roadway. The units are designed for a gas-filled lamp and are supposed to be placed at a height of about 30 ft. (9 m.) above the road and from 400 ft. to 600 ft. (120 m. to 180 m.) apart.



HIGHWAY LIGHTING THAT REDUCES THE DANGER OF AUTOMOBILE ACCIDENTS AT NIGHT

Several communities have already became interested in this method of highway illumination and plan installations of the new units for experimental purposes so that the advantages of highway lighting may become known. Eventually it is felt that such lighting improvements will be apportioned as a part of the expense of highway work and will be taken up by the state. It is thought that this is an improvement to traffic just as essential as a smooth road surface. There is little doubt that the rural communities would also benefit from the development of highway lighting as it would open up new possibilities for rural service and electricity on the farm.

Economic Value of Load Diversity

Stable Earnings of Companies that Have Built Up a Small-Appliance Business and Paid Attention to Municipal Pumping, Refrigeration and Industrial Heating

By E. S. Hamblen
Manager Union Light & Power Company, Franklin, Mass.

With the ever-increasing applications of electrical energy for industrial, chemical, manufacturing and domestic purposes the central-station company is enabled to build up a more diversified load, thereby filling up some of the valleys and smoothing out the peaks in its daily load curves. Ten years ago the word "power" brought to the mind of the average manager of a small central station the picture of a mill or factory having a connected load of not more than 100 hp. in motors. Today he thinks of the power load as being made up of motors, industrial heating, electric furnaces, ranges, water heaters and many other energy-consuming devices. With this great change in the past ten years, what will the next decade bring forth? It is the duty of every manager to keep ahead of his organization, and by studying the results of the past he can forecast with some degree of accuracy the trend of future developments.

In obtaining any class of new business or soliciting old customers for additional business the question of cost enters largely into the negotiations. Although the electric light and power company is regarded as having a monopoly in the community, in reality it has competition in lighting from gas and oil and in heating from gas, oil, wood and coal. To procure power business it must be able to quote a rate low enough to compete with isolated-plant costs. While there are many sound arguments in favor of central-station service at a slightly higher cost, this difference must not be too great. However, regulated as the central-station rates are by public service commissions, there is little likelihood of anything but a fair and equitable rate being quoted to any power customer.

To maintain a steadily increasing income and earn sufficient revenue to meet the interest on its outstanding securities through periods of depression a company must develop all available classes of business. The more diversified the load the more stable are the earnings of the company. If, for instance, it devoted all its efforts to obtaining new power business, the company's earnings would be large when general business conditions were good, but the company would be unable to pay dividends during business depression because of heavy interest charges on that part of its investment which was idle. Many companies try to offset this by a monthly service charge of $1 or more per horsepower, and while a power customer knows that he would have to stand the fixed charges on his own plant, he dislikes paying money to the central-station company during a time when "it's all going out and nothing coming in."

A few figures shown in Table I on the kilowatt-hour output of the writer's own company are suggestive. The ratio of increase in power and lighting is fairly consistent during the five-year periods. This is because of the fact that we make no especial effort to obtain any one class of business, or, more correctly, we make particular effort to get every class of business.

TABLE I—KILOWATT-HOUR OUTPUT FOR FIVE-YEAR PERIOD

Year Ended July 1	Kilowatt-Hours Power	Kilowatt-Hours Lighting
1916	2,258,371	263,986
1917	3,892,740	313,045
1918	5,825,871	410,552
1919	6,583,398	449,401
1920	7,867,732	600,901

Years ago it became evident that the central-station company could not depend upon lighting alone to make commercial and residential business profitable. This company has actively pushed the sale of electric appliances, and in certain territories particular attention has been paid to the sale of electric ranges. These offer a very profitable load if several can be sold in one neighborhood so as to be served from the same transformer and secondaries.

The value of a diversified load has been well demonstrated within the past year. During the last eight months this company suffered a loss of 27 per cent on power business because of industrial conditions. However, largely on account of our range and refrigeration load and municipal pumping, our ratio of operating expense to gross revenue was within 2.5 per cent of last year.

Table II, which gives a comparison of the number of lighting customers, total kilowatt-hours consumed and the average annual consumption per customer for the past five years, shows the results of the sale of electric appliances. Daylight saving has no terror for the company with a good appliance load on its lines.

TABLE II—EFFECT OF APPLIANCE SALES ON LIGHTING LOAD

Year Ended July 1	No. Lighting Customers	Kilowatt-Hours Lighting	Average Kilowatt-Hours per Customer
1916	1,422	263,986	186
1917	1,562	313,045	200
1918	1,604	410,552	256
1919	1,726	449,401	260
1920	1,951	600,901	308

We write to all of our power customers about once in three months notifying them of any change in the policy of the company, changes in or additions to generating equipment, further "tie-ins" for the betterment of the service, and any other items which would be of interest and which would develop better relations with customers.

Our company has made an effort to build up its off-peak load and offers special rates for power service from 11 p.m. until 6:30 a.m. A great deal of progress has been made in industrial heating in the last five years, and as this is a twenty-four-hour load in many cases it should soon be a very profitable business. From our experience we consider municipal pumping, electric ranges and refrigeration to be the best classes of load, as the income is nearly constant regardless of industrial conditions. These, together with industrial heating, which will require considerable missionary work, particularly in the smaller cities, seem to offer the best opportunities for building load and revenue for the small central station.

Hydro-Electric Possibilities in Montana

Total Water Power Available Placed at Approximately 1,000,000 Hp., of Which 225,000 Hp. Has Been Developed—Study of the Four Principal Watersheds Showing Possible Developments of Over 10,000 Hp.

By **E. W. KRAMER,**
Hydro-Electric Engineer United States Forest Service, Missoula, Mont.

A STUDY of the possible development of water power in Montana shows that the four principal watersheds in that state should develop 1,000,000 hp., of which approximately 225,000 hp. is being utilized at the present time. As emphasized later in this article, the development of these resources naturally will depend upon the demand for power and the economy of its utilization. The principal uses for power lie in the mining industry and the electrification of trunk-line railroads. Other uses that either are developing or will probably materialize are electrometallurgical plants, irrigation, paper mills and possibly the fixation of atmospheric nitrogen.

Montana has four large rivers of prime importance, the Missouri and Yellowstone east of the Continental Divide and the Clark's Fork of the Columbia and the Kootenai west of the divide. The last named stream entering the northwest corner of the State from British Columbia, cuts across the northwest corner for a distance of about 90 miles. Both the maximum and minimum flows are about equal to those of the Missouri River at Great Falls, Montana. The Clark's Fork of the Columbia with its tributaries drains all of Montana west of the divide except the small area drained by the Kootenai and has a watershed area of 22,000 square miles (57,000 sq.km.). At the point where it leaves the state the Clark's Fork has a stream flow much greater than any other stream of the state. Its watershed is well timbered, and it includes several lakes and glaciers and numerous ranges on which there is snow for the major part of the year. The proportion of valleys to mountains in this area is small. The stream has the most uniform flow of the large streams of the state, due largely to the timbered areas, lakes and snow fields. There are a number of power sites in the Clark's Fork watershed in Montana of the premier class totaling more than a half-million horsepower. These nearly all lie between Flathead Lake, elevation 2,890 ft. (881 m.), in Montana and Pend Oreille Lake, elevation 2,050 ft. (624 m.) on the Clark's Fork River in Idaho near the Montana line. Of this 840 ft. (256 m.) drop it will probably be feasible to develop 632 ft. (192 m.) in nine projects.

There is one power site of prime importance in the Yellowstone watershed in Montana, the Big Horn Canyon site, about 30 miles (48 km.) above Hardin. There are other smaller sites the principal one of these being the Buffalo Rapids site below Miles City.

In point of area drained and in point of developed power projects the Missouri River is the most important stream in the state, though not in point of power possibilities or stream flow. The Missouri and its four tributaries receive all the drainage from the east slope of the Continental Divide in Montana from the Yellowstone Park to Canada. Along the Missouri River and the Madison, which is the largest of the three streams forming the Missouri, there is almost a continuous chain of developed and undeveloped power sites from the Hebgen Reservoir, near the Yellowstone Park, to Fort Benton. The Gallatin has one or two undeveloped sites of secondary importance. The Jefferson, including its principal tributary, the Big Hole, has one developed site near Divide, Mont., known as the Big Hole plant of the Montana Power Company, with an installed capacity of 4,000 hp.; but with this exception it cannot be considered a power stream. The Sun River has power possibilities. These, however, are tied in with United States reclamation projects to such an extent that their development by private capital is unlikely.

In a study of the water power of Montana, including only projects with capacity of 10,000 hp. or more of primary power, all streams except the Clark's Fork, Flathead, Kootenai, Big Horn, Madison, Missouri and Yellowstone can be eliminated.

STORAGE POND ABOVE THE THOMPSON FALLS ON CLARK'S FORK

Beginning with the Madison and Missouri, which can be considered as one stream, it appears practicable to develop 1,740 ft. (530 m.) of the total 3,700 ft. (1,127 m.) of fall between the Hebgen Reservoir, elevation 6,500 ft. on the Madison (1,980 m.), and Fort Benton, elevation about 2,800 ft. (853 m.), the head of navigation on the Missouri, in probably fourteen projects. Seven of these are now developed and operated by the Montana Power Company* with a total head of about 628 ft. (209 m.). Hebgen reservoir has a capacity of 345,000 acre-feet (425,000,000 cu.m.) and an area of about 13,500 acres (5,460 hectares). The water can be controlled through a vertical distance of 60 ft. (18 m.). The capacity is almost sufficient for complete regulation of the flow of the Madison River from years of great run-off to years of small run-off, with the object in view of keeping the combined minimum power capacity of the sites, utilizing the water below, at the highest possible figure. The flow of the Madison River into the reservoir varies from an extreme minimum of about 400 sec.-ft. (11.3 cu.m. per second), the minimum usually occurring in February, to an extreme maximum of 7,000 sec.-ft. (198 cu.m. per second), the maximum usually occurring in June.

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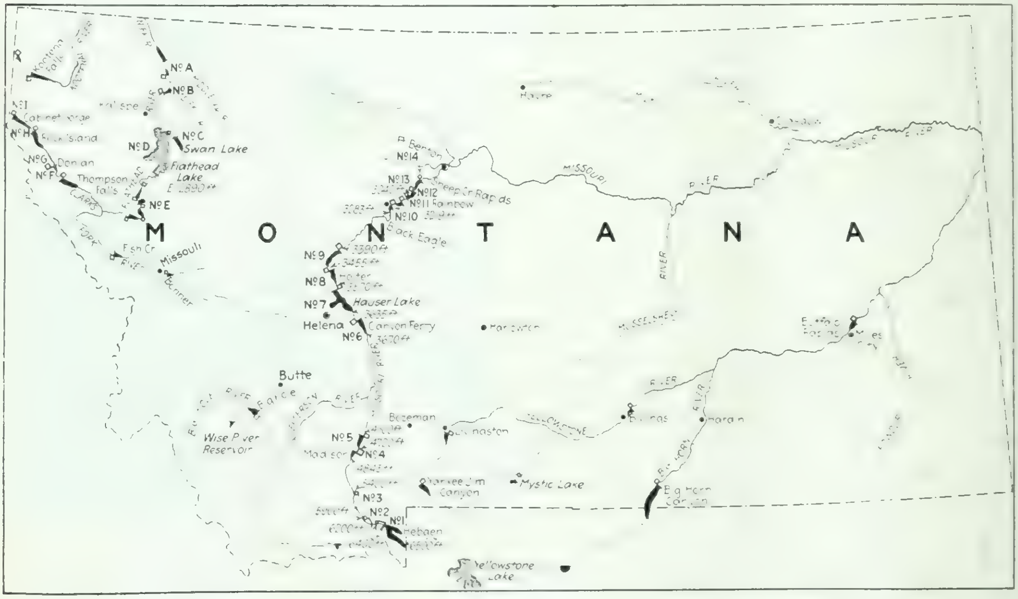
*See p. 1011, May 8, 1920, ELECTRICAL WORLD.

For the purposes of reference, the undeveloped and developed sites along the Madison and Missouri Rivers are numbered beginning below the Hebgen Reservoir. In all cases the power capacity of the site given is the primary power that can be developed considering the Madison and Missouri River plants as in one system. For this reason the figures given in the table under developed water powers may not agree with the actual ratings installed.*

Projects Nos. 1, 2 and 3 are not particularly attractive compared with other undeveloped sites on account of the great length of conduit required for the head obtained, on account of their altitude (which, with the accompanying extreme cold, when the power would be needed most, would cause trouble with any kind of open conduit) and on account of their distance from a market.

Project No. 1, undeveloped, would require a low dam diverting the Madison River shortly below the Hebgen dam, at elevation about 6,400 ft. (1,950 m.) into a tunnel on the north bank of the stream, which would conduct the water for a distance of 6 miles (9.6 km.), returning it to the Madison River at a point where the stream leaves its upper canyon at elevation 6,200 ft. (1,889 m.), where a head of about 170 ft. (5 m.) could be developed. The capacity of this plant should be figured with a flow of about 1,000 sec.-ft. (28.4 cu.m. per second) and a 170-ft. head in estimating the total primary power of projects on the Madison and Missouri Rivers. This will give a capacity of 14,000 hp. Project No. 2, undeveloped, would require a low dam diverting the Madison River below the No. 1 power house, at about elevation 6,200 ft., into a conduit about 7 miles (11 km.) long which could be located on supporting ground and would develop a head of about 250 ft. (76 m.). In estimating the capacity of the system, the flow can be considered 1,000 sec.-ft., as in the case of the No. 1 project, and the head 250 ft., which gives a capacity of 20,000 hp. Project No. 3, undeveloped, would divert the Madison at a point about 9 miles (14 km.) below the No. 2 power house at an elevation of 5,600 ft. (1,706 m.), returning the water seven miles below at elevation 5,400 ft. (1,645 m.). The capacity of the site would be about 12,000 hp.

Projects Nos. 4, 6, 7, 8, 10, 11 and 13 are already developed, although in some cases they are not up to the maximum capacity which could be obtained. As shown in the table for these developments, there is some additional capacity available.



PRINCIPAL DEVELOPED AND UNDEVELOPED WATER-POWER SITES IN MONTANA

Project No. 5, undeveloped, may consist of a dam about 200 ft. (61 m.) high, if proper foundations are found, built about 10 miles (16 km.) below the No. 4 power house, backing water up to an elevation of about 4,720 ft. (1,438 m.) and developing a head between the elevations of 4,500 ft. (1,371 m.) and 4,720 ft. (1,432 m.). It would probably have a short conduit below the dam. A net head of about 215 ft. (65 m.) would be developed. The wheel capacity should be about 2,250 sec.-ft. (64 cu.m. per second), and the power capacity, figuring as heretofore, can be taken as 30,000 hp. This is the last site on the Madison River.

There is an undeveloped site, project No. 9 on the Missouri River between the Holter plant and the developed Great Falls sites, which is about 10 miles (18 km.) up stream from Cascade, Mont. A head of 60 ft. (18 m.) can probably be developed with the maximum elevation of flashing at 3,455 ft. (1,050 m.). The project probably would consist of a dam 50 ft. (15 m.) high above low water with 10 ft. (3 m.) of flashing, which would make considerable storage available. The capacity would be about 17,000 hp.

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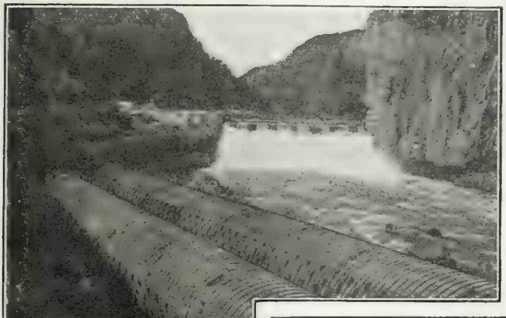
*The developed water powers of this system were covered in the May 8, 1920, issue of the Electrical World.

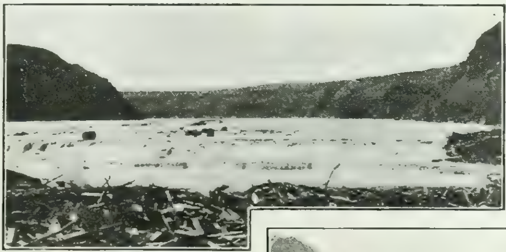
An undeveloped project No. 12 is located midway between the Rainbow and Volta plants. A 60 ft. (18 m.) dam furnishing a 67-ft. (20 m.) head on this site would develop 21,000 hp.

Another undeveloped project No. 14 is located 4½ miles (7 km.) below the Volta plant. A dam 36 ft. (11 m.) high will give a head of 70 ft. (21 m.) at the plant. The capacity would be 22,000 hp.

All of the developed projects belong to the Montana Power Company and are connected by transmission lines operating at 65,000 volts and 110,000 volts. The Montana Power Company has other plants of a capacity less than 10,000 hp. on this system, which have not been mentioned, and a plant at Thompson Falls, on the Clark's Fork, with 40,000 hp. installed, which will be considered later.



The Madison plant of the Montana Power Company, a 12,000-hp. development listed as project No. 4 in the table on page 114. Two wood-stave conduits 7,600 ft. long, one 10 ft. in diameter and the other 12 ft. conduct the water to the forebay. Ten miles below this plant is an undeveloped site for a possible development of 30,000 hp.



A point on the Missouri River below Great Falls where a dam can be built 60 ft. high and 1,000 ft. long which would allow for the development of approximately 30,000 hp.

It is not believed that there are any power projects along the Yellowstone River proper in Montana above the mouth of the Big Horn of a capacity as great as 10,000 hp., unless the Yellowstone Lake in the Yellowstone Park shall be used for storage purposes. A head of 60 ft. (18 m.) could easily be developed at the Yankee Jim Canyon about 15 miles (24 km.) below the point where the stream leaves the park, but since the mean monthly stream flow gets as low as 1,000 sec.-ft. (28.4 cu.m. per second) the capacity of the site would not be over 5,000 hp. The Montana Power Company has a plant with 22 ft. (6 km.) head and about 2,000 hp. capacity at Livingstone and another at Billings with a 20-ft. (6.1-m.) head and about 3,000 hp. capacity. Possibly 10,000 hp. of primary power could be developed at the Buffalo Rapids near Miles City when the storage involved in the Big Horn project is developed. Plans for the development of the Buffalo Rapids project have been made. It is intended to build a dam 13 ft. high above the upper rapids just below Miles City, and to develop a total head of 21 ft. The power will be used primarily for irrigation, and since the peak demand will not occur during the low flow period, it is intended to develop 15,000 hp. There are other rapids along the stream where low head projects similar to the Buffalo Rapids project can be developed. However, it is thought that their primary capacities are not much if any greater than 10,000 hp.

On West Rosebud Creek in the Yellowstone watershed, about 60 miles (96 km.) southwest of Billings, there is a high-head project just below Mystic Lake. The regulated head of 97 sec.-ft. (2.7 cu.m. per second), with an effective head of 1,094 ft. (332 m.), will develop 8,500 hp. This project has been described, even though the capacity is less than 10,000 hp., for the reason that the development is comparatively easy, that it is in a part of the state where power sites are not so plentiful as farther west, and because, with an overdevelopment, the project would lend itself admirably to carrying fluctuations in load occurring in any large system.

The only large power site in eastern Montana is the Big Horn Canyon site on the Big Horn River, about 30 miles (48 km.) above Hardin. The capacity of the project is dependent on the height of dam that it would be practicable to construct in the canyon. Dams as high as 480 ft. (146 m.) have been considered. The foundation and abutments for a high dam appear to be excellent. A 250-ft. (76-m.) dam would develop about 46,000 hp. and a 480-ft. (146-m.) dam about 100,000 hp. of primary power. The latter would be 1,300 ft. (396 m.) long on top and about 160 ft. (48.7 m.) long at the base. This site may play a very important part in railway electrification on account of its location, it being the easternmost site of any size in Montana. It could be used to electrify the Chicago, Milwaukee & St. Paul Railway from Harlowton, Mont., the present eastern terminus of the electrified section, as far east as transmission is feasible, and to electrify the Northern Pacific from some point about Livingston, Mont., as far east as transmission is practicable.

Mystic Lake, on the Yellowstone, offers storage for an 1,100-ft.-head development with a capacity of 8,000 primary horsepower.

As shown in the table, the developments along the Clark's Fork and the Flathead Rivers offer a possibility of developing 578,500 hp., which with the 42,500 hp.

already developed would total 621,000 hp. For reference, the developed and undeveloped power sites on this watershed, which is west of the Continental Divide, have been designated with the letters of the alphabet, proceeding from the Flathead and Clark's Fork and from the mouth of the Flathead. There is only one project of 10,000 hp. capacity on the Clark's Fork above the Flathead. This is the Fish Creek site and will be referred to by name only. The site at Bonner, with an installed rating of 3,200 hp., which supplies Missoula, is developed and is the property of the W. A. Clark Power Company.

Project A would consist of a power dam on the North Fork of the Flathead at a point one-half mile above the mouth of Canyon Creek and a storage dam and reservoir 8 miles (13 km.) above. The dam power would be 145 ft. (44 m.) high above low-water level and 525 ft. (160 m.) long at the top. The capacity would be 30,000 hp. The site for the storage dam is somewhat questionable on account of the foundations. The dam would be 140 ft. (42 m.) high and 1,250 ft. (381 m.) long.

DEVELOPED AND UNDEVELOPED WATERPOWER ON FOUR PRINCIPAL WATER SHEDS

Name	No.	Undeveloped, Hp.	Developed Hp.
		MISSOURI AND MADISON	
	1	14,000	
	2	20,000	
	3	12,000	
Madison	4	4,000	12,000
	5	30,000	
Canyon Ferry	6		12,000
Hauser	7		20,000
Holter	8		31,000
Cascade	9	17,000	
Black Eagle	10		13,000
Rainbow	11		36,000
	12	21,000	
Volta	13		49,000
Sheep Creek	14	22,000	
Total		140,000	173,000
		YELLOWSTONE	
Yankee Jim Canyon		5,000	
Livingston			2,000
Mystic Lake		8,000	
Billings		1,560	1,440
Big Horn Canyon		100,000	
Buffalo Rapids		5,000	
Total		124,560	3,440
		CLARK'S FORK*	
North Fork Flathead	A	30,000	
Coram	B	12,000	
Swan River	C	5,500	2,500
Polson	D	205,000	
Lower Flathead	E	82,000	
Thompson Falls	F	20,000	40,000
Donlan	G	48,000	
Rock Island	H	60,000	
Cabinet	I	92,000	
Fish Creek	J	24,000	
Total		578,500	42,500
		KOOTENAI	
Kootenai Falls		20,000	
[illegible]		11,000	
Total		31,000	

* Calculated on basis of 30 ft. storage in Flathead Lake

The Project B is on the Flathead River near Coram, Mont., about one-fourth of a mile (0.4 km.) below the mouth of South Fork. The Great Northern Railroad runs along the north bank of the Flathead River at the site. It is not known at what depth bedrock could be found at the south abutment or in the stream bed, but if satisfactory foundations were found, it would be feasible to construct a dam 90 ft. (27 m.) high above the low-water level, which would be 700 ft. (213 m.) long on top. The maximum capacity of the site would be about 12,000 hp.

Project C is on the Swan River at Big Fork and includes Swan Lake. The capacity available at this site including storage in Swan Lake is placed at 8,000 hp., of which 2,500 hp. is already developed.

Project D is the most important of the possible developments on either of these two rivers, totaling 205,000 hp. This project involves using Flathead Lake as a storage reservoir and the development of a fall of about 240 ft. (73 m.) in the 10 miles (16 km.) of stream below the lake, probably by means of a 186-ft. (56 m.) dam and a 53-ft. (16 m.) dam or one 50-ft. (15 m.) diverting and storage dam near the lake outlet, a 4-mile (6 km.) tunnel and a second 50-ft. dam. Without storage the minimum capacity of the projects would be 51,000 hp.

What Storage Will Do in Flathead Lake

With storage in Flathead Lake between the mean high and low water marks the capacity would be 113,000 hp., the water being controlled through a vertical distance of 9 ft. (2.7 m.). The area of Flathead Lake is 187 square miles (485 sq. km.), with a long shore line. A dam 30 ft. (9 m.) high above mean low water would about equalize the flow in the stream throughout the ordinary year and would give a capacity of 205,000 hp.

Between the lower power house of Project D and Paradise, Mont., it would probably be feasible to develop as Project E a fall of 175 ft. (53 m.) in four sections, consisting of four dams across the Flathead River. Their combined capacity without storage in Flathead Lake would be 37,000 hp. With storage of 9 ft. (2.7 m.) between mean high and low marks their capacity would be 82,000 hp. With 30 ft. (9 m.) of storage, their capacity would be 150,000 hp.

Project G, undeveloped, is known as the Donlan site. It is located about 6 miles below Thompson Falls. A head of 40 ft. can be developed by means of a dam. The capacity is 20,000 hp. without storage and 48,000 hp. with 30 ft. of storage in Flathead Lake.

On the Clark's Fork River near Noxon, Mont., about 35 miles (56 km.) below Thompson Falls is undeveloped Project H which is known as the Rock Island Gorge. The stream at this point runs over a rock ledge dividing into two channels around a rock island. The abutments are of ledge rock. The channels are 550 ft. and 400 ft. (167 m. and 122 m.) wide at an elevation 50 ft. (15 m.) above the low-water level. The width of the channels at low water level are 250 ft. and 150 ft. (76 m. and 45.7 m). The power house would be located at one end of the dam. A 50-ft. head at this point would develop about 25,000 hp. without storage and 60,000 hp. with 30 ft. (9 m.) of storage in Flathead Lake. The dam at Rock Island would probably develop enough pondage for daily regulation, but no storage.

Railroad Right-of-Way Limits Cabinet Gorge Development

The Cabinet Gorge site on the Clark's Fork River in Montana near the Idaho line is known as Project I and is undeveloped. The precipitous rock walls of the canyon are 115 ft. (35 m.) high above low-water mark. The width of the canyon at the low water elevation is 175 ft. (53 m.), and the width at the top 185 ft. (56 m.). The Northern Pacific Railroad track above the dam site and the tailwater from the Rock Island project would limit the height of dam to about 77 ft. (23 m.) above low water. This head without storage will develop 38,000 primary horsepower. With 30 ft. (9 m.) of storage on Flathead Lake, the primary power developed would be 92,000 hp.

There is a site on the Clark's Fork above the mouth of the Flathead known as the Fish Creek site. It is about 45 miles (72 km.) below Missoula and the nearest large power site to the town. A head of 108 ft. (33 m.) can be developed by a dam which will give a capacity of 24,000 primary horsepower. The stream at the site for the dam is 150 ft. (45 m.) wide and 6 ft. (1.8 m.) deep. The dam will be about 550 ft. (167 m.) long on top.

There are two power sites on the Kootenai River in Montana. The upper one is at Kootenai Falls on the Great Northern Railroad between Libby and Troy. It will consist of a dam above the falls and a power house at the north end of the dam. There appears to be a very good rock foundation. The head developed will be 89 ft. (27 m.). The primary capacity will be about 20,000 hp.

The lower site on the Kootenai is in Montana near the Idaho line. The canyon is 350 ft. (110 m.) wide at an elevation 50 ft. (15 m.) above low water with good rock abutments and apparently good rock foundation. A 50-ft. head would develop 11,000 hp. of primary power.

USES FOR POWER IN THE STATE

If the railroads are excepted, there is very little steam power generated in the state. All the large mining and manufacturing centers are supplied with electrical power, as are nearly all of the flour mills, grain elevators, creameries, etc. When the Montana industries were going in full stride there was a demand for almost the entire supply of developed power. This means that new sites will be developed for any further railroad electrification or for any large industrial project that may be undertaken.

The total extent of railroad lines in the state is about 4,900 miles (7,885 km.), and of this about 400 miles (643 km.) is electrified. The average requirement for the 440 miles (708 km.) of the Chicago, Milwaukee & St. Paul from Harlowton, Mont., to Avery, Idaho, is 20,000 hp. and the maximum 40,000 hp. The maximum requirement is about 91 hp. per mile. The train miles and the grades on this railroad may not be a fair average for the railroads of the state, but in order to estimate roughly the maximum demand likely to occur for railroad purposes, it has been used and gives a total demand of about 450,000 hp. Since this power may ultimately be furnished on a 50 per cent load factor, a primary capacity of 225,000 hp. where the storage is ample, as in the case of the Big Horn and Flathead Lake projects, would be required.

The total length of the main lines of the Great Northern and Northern Pacific railroads in Montana, counting both the Helena and Butte routes as main lines, and of the part of the main line in Montana of the Chicago, Milwaukee & St. Paul which is not electrified is very close to 2,000 miles (3,218 km.). At 91 hp. of installation per mile, it would require an installation of 182,000 hp. to electrify these 2,000 miles. With a 50 per cent load factor and with adequate storage, the primary capacity required would be only 91,000 hp. according to estimates.

However, it seems likely that the power for this electrification can best be supplied from a large power system having a higher load factor than 50 per cent, thus getting a more continuous use of the installation. The present load factor of the system of the Montana Power Company which supplies power for the Chicago, Milwaukee & St. Paul electrification is considerably higher, or about 87 per cent.

Monel Metal Has Definite Magnetic Properties

Investigation Shows Magnetic Characteristics Considerably Less Than Iron—Important Property in Loss of Magnetism at Temperature Near 200 Deg. Fahr.

BY CHARLES W. BURROWS

Magnetic Research Engineer, New York City

DURING recent years an important alloy of nickel and copper, under the name of monel metal, has been developed and has become quite widely used in the industries. This metal has definite magnetic characteristics which are well below those of soft iron, but the critical temperature at which it becomes non-magnetic is very low, near the boiling point of water—a property which should make it of importance for such use as in relays for temperature control equipment. The metal resists corrosion, moreover, and is tough, strong and elastic.

Because of its growing importance in the arts and industry and, furthermore, because of the complete lack of information concerning its magnetic characteristics, it seemed worth while to investigate the magnetic nature of monel metal not only in the cast condition but also as modified by thermal and mechanical treatment. The monel metal used in this investigation was supplied by the International Nickel Company through the courtesy of Dr. Paul Merica. This material is taken from the standard products regularly supplied commercially, and analyses of the samples tested are given in Table I. The samples of monel metal were examined magnetically by placing them in the uniform field of a long magnetizing solenoid and suddenly withdrawing them from this magnetic field. The resulting change in magnetic flux threading the small detector coil which at the beginning surrounded the metal portion of the test bar is indicated by the ballistic deflection of a suitable galvanometer. This quantity added to the strength of the magnetic field as determined by a separate measurement gives the true induction in the specimen.

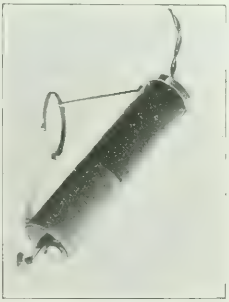


FIG. 1 — ELECTROMAGNET USED IN QUALITATIVE MAGNET TESTS

TABLE I ANALYSES OF THE VARIOUS SAMPLES OF MONEL METAL USED IN THIS INVESTIGATION

			Percentage						
Analysis	Process	Shape	Ni	Cu	Fe	Mn	C	Si	S
P	Hot-rolled	Rod	66.12	28.75	2.68	1.91	0.22	0.29	0.021
Q	Hot-rolled	Sheet	67.12	30.73	1.67	0.22	0.13	0.10	0.026
R	Hot-rolled	Sheet	68.98	29.10	1.60	0.11	0.07	0.10	0.022
S	Hot-rolled	Rod	66.92	29.10	1.70	1.86	0.22	0.17	0.022
T	Cast	Rod	66.18	28.42	2.37	2.10	0.18	0.70	0.038
U*	Cast	Rod	64.50	30.12	2.76	0.87	0.14	0.90	0.062
								*Pb	0.59

Full induction curves for a number of typical samples are shown in Fig. 2, while Fig. 3 has been prepared in order to show the relative magnetic characteristics of monel metal and the usual magnetic materials.

Monel metal, in common with all other magnetic

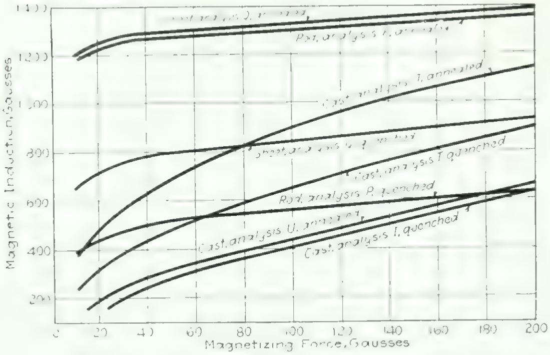


FIG. 2—TYPICAL MAGNETIC DATA FOR VARIOUS CONDITIONS OF MONEL METAL

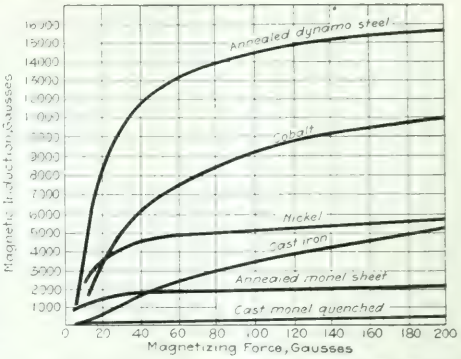


FIG. 3—MAGNETIC CHARACTERISTICS OF MONEL METAL COMPARED WITH OTHER MATERIALS

materials, has a critical temperature below which the material is magnetic and above which it is non-magnetic. This temperature is found by causing the material to pass through a series of ascending and descending temperatures, ending at the temperature at which the magnetic nature changes. In this investigation the critical point was determined by two methods. The preferred method consisted in placing a small slug of the material under test in a beaker of paraffin, at a temperature differing only slightly from the temperature of the paraffin, to pass through the critical temperature. During this operation the slug was repeatedly tested with a small pointed electromagnet and the temperature at which the magnetic change occurs was noted. In the samples tested there was no appreciable difference between the temperature at which the magnetizability of the material disappeared on heating and that at which it reappeared on cooling. The average critical point for a number of sheet and rod samples, hot and cold-rolled, was 203 deg. F. (95 deg. C.).

The other magnetic metals lose their magnetism at considerably higher temperatures. While variations exist between the observations of different persons, the following figures are given as the magnetic critical temperatures of the three common magnetic materials: Nickel, 670 deg. Fahr. (350 deg. C.); iron, 1,440 deg. Fahr. (780 deg. C.); cobalt, 2,000 deg. Fahr. (1,090 deg. C.).

Experiment showed that the heat treatment which will produce the lowest permeability in monel metal consists in heating to a temperature of 1,300 deg. Fahr. (700 deg. C.), cooling slowly down to 350 deg. Fahr. (180 deg. C.), and finally quenching in brine at 16 deg. Fahr. (—9 deg. C.). The highest permeability resulted from furnace annealing at approximately 1,300 deg. Fahr.

TABLE II—CHANGES IN PERMEABILITY PRODUCED BY COLD-WORKING

Magnetizing Force	Change in Permeability
1	100 per cent increase
2.5	17 per cent decrease
5	27 per cent decrease
10	29 per cent decrease
25	28 per cent decrease
50	28 per cent decrease
100	14 per cent decrease
200	12 per cent decrease

The influence of hot-working upon the magnetic properties of monel metal is shown by a comparison of the magnetic results for the cast material with these results for the hot-rolled material. The cast material in the annealing state shows the lowest induction, the annealing hot-rolled sheet shows the highest permeability, and the hot-rolled rods occur at an intermediate position. In general, the effect of hot-working is to increase the magnetic softness of the monel metal, the cast metal being the hardest magnetically and the sheet which has received the maximum of hot-working the softest magnetically.

Cold-working produces changes in the magnetic characteristics of monel metal. For large magnetizing forces the magnetic changes are similar both in nature and in magnitude to the corresponding changes in the magnetic properties of steel. To determine the effect of cold-working, a monel rectangular bar 10 in. (25 cm.) long was hammered while cold until it showed an increase of 2½ per cent. Table II shows the relative change in permeability between the original specimen and the hammered bar.

Most Popular Incandescent Lamps at Present Time

IN THE vacuum-type lamp the 40-watt size is used to the greatest extent, it representing about a quarter of all lamps of this class. The 25-watt is a good second, followed by the 60-watt and 50-watt. A tendency to standardize the last-named size accounts for a very perceptible increase in its use during the last two years. Meanwhile the gas-filled lamps of 75 watts and 100 watts have risen in popularity, while little change is shown in the larger sizes. It now looks as if the two sizes just mentioned would very rapidly drive out the 100-watt and perhaps the 60-watt vacuum lamps. For street-lighting work the vacuum type has virtually disappeared.

In the matter of voltages there is the same tendency toward clustering around a few particular values that appeared in the days of the carbon lamp, though with somewhat less reason. The three voltages most generally used, including three-fourths of the whole number of lamps, are 110, 115 and 120. The use of the last two has grown at the expense of the first within two years.

The lamp committee brought out these facts at the recent N. E. L. A. convention in Chicago.

Public Necessity the Controlling Factor in Homer Case

Priority of Highway Occupation Gives Telephone Company No Greater Rights Except to Protection from Interference When Substantial

THE "Homer inductive interference case," so called, that has been before the Illinois Public Utilities Commission for more than a year past, was the subject of a second supplemental order on June 30, as noted in the ELECTRICAL WORLD for July 9 on page 84, that is of deep interest to the entire industry. The Homer Electric Light & Power Company in 1920 asked for the right to construct a 13,000-volt line along a country road to serve a coal-mining property. The road was already occupied by telephone lines, both local and long-distance. On its being shown that the customer could be served by a line paralleling an adjacent railway, the commission refused the right to construct the line on the highway and the line was accordingly constructed along the railway right-of-way. In the summer of 1920 a number of farmers along the highway petitioned for service and the commission, after hearing the evidence, granted the authority to construct the line. Approximately 7 miles of circuit are already in use along the highway, and the new line will add about 5 miles to the parallel. The present order is the result of a rehearing on request of the telephone companies. The findings affecting the use of the highway are of extreme importance. The order is presented below in an abbreviated form that includes the most important portions, the citations and discussion of the evidence being omitted:

TWO MAIN ISSUES

The main issues in this case are twofold: First—Whether or not a telephone company occupying one side of a highway with its poles and lines can, by reason of its prior occupancy, stand in the way of an electric company which desires to occupy the opposite side of the roadway for the purpose of furnishing a service to the abutting property owners and local consumers different from that which the telephone company is able to provide; or, in other words, does any legal rule of priority of occupancy of a highway as opposed to a junior company extend to a right in the senior company to limit or prevent property owners along the highway, on their petition therefor, from obtaining and enjoying other and different kinds of public utility service which will reasonably serve their convenience and necessity? Second—(a) Whether or not there is substantial interference with commercial telephone service by reason of the existing parallel, and (b) whether or not substantial interference will result from the proposed extension of the existing parallel. . . .

Counsel for the petitioning farmers in his argument contends that farmers and local communities are not users of extreme long-distance telephone service and that service of this character, if of such nature as to be unable to operate in the vicinity of other public utilities, should seek the seclusion of a private right-of-way rather than a public highway. . . .

HIGHWAY PRIORITY

It must also be remembered that the present inter-city and transcontinental use of highways for automobile highway traffic and for long-distance service of any kind is entirely modern; that these highways still retain as fundamental the original idea of a local road; that each such highway furnishes to persons living thereon their sole line of public communication, of ingress and egress to and from their premises, and that for the regulation and protection of the rights of the abutting property owners as to additional burdens on the highway and the right of unobstructed ingress and egress to their property, as well as the preservation intact of the public easement of the right of travel on all the highway, certain well-defined rules have been adopted by our courts and maintained for many years. . . .

The commission in a case of this kind will take into consideration the fact that the abutting property owners along a highway have dedicated the highway to the public use, retaining in themselves the fee of the highway. . . . In cases of this kind the commission is governed largely by the convenience and requirements of the abutting owners.

It is the policy of this state to foster the development of its rural communities, and this commission believes that a public utility which happens to be the earlier occupant of a highway must recognize the fact that the prosperity and growth of the community require the further use of the highways by other utilities, and therefore that all such utilities, both earlier and later occupants of the highways, must so operate and construct their own lines as to prevent unreasonable interference one with the other. . . .

EQUAL HIGHWAY RIGHTS

The law is clear that public utility companies exercising similar franchises, such as companies operating transmission, telephone and telegraph lines, have equal rights in the highways and that priority of occupancy by one company does not give to that company the right to exclude other such companies from occupying the highway. Prior occupancy may perhaps give the prior occupant a right superior in some respects to that of a later comer. This superior right, however, is limited to protection from interference substantial in character. . . .

SUBSTANTIAL INTERFERENCE

We come now to the second proposition presented to this commission for its decision, (a) whether there is substantial interference with commercial telephone service by reason of the existing parallel. This is largely a question of fact. The telephone companies introduced in evidence the results of tests made with a "noise meter," the results of tests made to determine the "telephone interference factor" and the testimony of telephone experts and of two telephone operators. . . .

In this case tests were made on twelve circuits, on nine of which the noise was not in excess of 800 units. The other three circuits on which the noise was found to be severe are phantom circuits. The testimony indicates that reasonably satisfactory service can be rendered over telephone circuits on which the noise units are not in excess of what was found on nine of these circuits. The telephone lines in the section tested are transposed in a standard manner for the elimination of cross talk and mutual unbalances, but have not been transposed since the electric supply line was constructed. . . .

DISADVANTAGES OF LISTENING TESTS

In the development of the telephone industry it has been found that for testing purposes the ear is a relatively crude instrument compared with highly sensitive electrical instruments. Listening tests have the disadvantage that they depend upon the judgment of the listener and upon the condition of the receiving station, and tests on telephone lines to determine interference are possibly not representative, in that the conversations may have been routed over the best or worst circuits. The commission recognizes and appreciates the value of instrument tests in the development of the telephone industry where a comparison of telephonic transmission under various conditions is primarily sought. . . . A determination of whether interference is substantial and whether the service may be considered reasonably commercial may be better determined by conversational tests made at a time when the instruments are generally used and during periods when the conditions affecting both electric and telephone lines are representative and when normal conditions of attenuation and accumulation prevail. . . .

The telephone companies' experts claimed that a telephone interference factor having a value of 173 is unduly high. The record shows, however, that at the present time only meager data are at hand with reference to the importance of telephone interference factor tests. It was admitted by practically all the expert witnesses for both sides that the telephone interference factor is but one of a large number of factors influencing the disturbance in the paralleling telephone circuits. Other factors are voltage of the electric supply line, separation of the conflicting lines, inequality of the capacity of the conductors to ground, residual voltages and current, unbalance of the power circuit, character of harmonics in the inducing circuit, character of the transpositions in the supply and the signal lines, the degree to which they are co-ordinated and the distance of the telephone subscriber from the section paralleled. Extensive reference was made to a paper written by H. S. Osborne, entitled "Review of Work of Sub-Committee of Wave-Shape Standard of the Standards Committee," presented at a meeting of the American Institute of Electrical Engineers on Feb. 20, 1919, a copy of which paper was introduced in evidence. The writer himself does not appear to have given to this factor the importance that was attached to it by the telephone companies' experts in this proceeding. . . .

Must Show Real Handicap to Conversation

This commission will not hold the interference to be substantial unless it is conclusively shown that service is impaired to the extent that the user of the telephone is clearly handicapped in his conversation, or is readily aware of the induction without making a point to listen for the disturbance, or that an unusual amount of repetition is necessary, or that the words of the speaker are made unintelligible. It is not sufficient to prove that noise can be detected by the use of delicate instruments, or that a slight hum can be heard by the tester when a special effort is made to notice it. Neither is it sufficient to state that the telephone service on a particular line may sometimes cause the transmission of unsatisfactory messages. Even on the best telephone circuits service is sometimes unsatisfactory without any pronounced cause. . . .

We now come to the second part of the second proposition, (b). The witnesses for the telephone companies claimed that the construction and operation of the additional proposed parallel from Fairmount to Catlin will result in such inductive interference as to render the telephone lines uncommercial. They base their conclusions upon the alleged interference arising from the existing parallel and upon the theory that interference caused by the proposed parallel by reason of accumulation would be substantial. It is evident that the testimony of these witnesses was largely conjectural. . . . The record shows that good telephone service is being rendered in the cases of many parallels throughout the country where the parallels are longer and where factors tending to induce serious interference are greater than in the present case. Where, as in this case, a parallel is unavoidable, there are shown standard methods in common use for the elimination or substantial reduction of such interference as may exist.

The telephone companies contended that the proper method of furnishing electric light and power service to the petitioning prospective consumers along this highway is by means of a low-voltage distribution line. The application of this method would necessitate in this case the continuance of the existing 13,000-volt line of the power company along the Wabash Railroad, paralleling the highway in question. This would mean a duplication of investment, additional cost of operation and maintenance and a likelihood of impaired electric service. . . .

Franchises Always Subject to Rights of Owner

It is plain that in case of new construction by two utilities on a highway each utility would bear the cost of making the necessary transpositions in its own lines and of installing that character and standard of construction that would render good commercial service. When a public utility obtains a right or franchise to operate upon the highways of the state it takes such right or franchise subject to the rights of the owner of the underlying fee to the public easement of right of travel and to the right of the state to permit the occupancy of such highways for other public purposes.

The record in the instant cause indicates that there may be certain readjustments of the power and telephone lines to permit of the rendition of good commercial telephone service. The record, however, does not indicate the extent of these necessary readjustments or transpositions nor the probable cost to the parties hereto of making such transpositions. The commission, therefore, is not at this time expressing an opinion as to the proper allocation of costs of necessary changes, but in the event that the power and telephone companies cannot come to a satisfactory settlement the commission will take evidence as to the cost of the necessary remedial measures and the proper allocation of the cost thereof between the parties hereto. . . .

Commission's Finding

The commission, having considered all the pleadings herein and all the evidence adduced and the representations and arguments presented, and being fully advised in the premises, finds:

1. That the construction and operation of the proposed additional 5 or 6-mile parallel from Fairmount to Catlin, along the highway commonly known as the "hard road," but on the opposite side thereof from the telephone lines, will not in any substantial degree interfere with the rendering of good commercial telephone service, provided that (a) the existing 13,000-volt, single-phase electric transmission lines are changed to three-phase as specified in the findings hereinafter, (b) the electric transmission line is transposed to co-ordinate with transpositions in the paralleling telephone circuits, (c) the telephone circuits are properly transposed.

2. That a large number of farmers residing along said highway between Fairmount and Catlin have petitioned for, and are entitled to, electric light and power service. and that the most feasible and practical method of furnishing this service is by extending along the highway from Fairmount to Catlin a 13,000-volt transmission line.

Prosperity Requires Electric Service

3. That the growth and prosperity of the farming communities of this state require that such communities be supplied with electric light and power service, as well as with telephone service, and that the future development of rural communities will be seriously impeded if one class of utilities, such as telephone companies, be given a monopoly of the highways to the exclusion of other utilities subsequently seeking to come upon the highway to fulfill an equally important service.

4. That the public would be best served by the construction and operation of a 13,000-volt, three-phase transmission line along the hard road between Fairmount and Catlin and that the public convenience and necessity require the construction and operation by the Homer Electric Light & Power Company of such a line along the said road, such line to be located upon the opposite side of the highway from that at present occupied by the telephone circuits of the Illinois Bell Telephone Company, the American Telephone & Telegraph Company and the Vermilion County Telephone Company.

Must Make Lines Three Phase

5. That the existing single-phase transmission lines of the Homer Electric Light & Power Company extending from Homer to Fairmount and from Fairmount to Jamaica should be made three-phase by said company and properly transposed to co-ordinate with transpositions in the paralleling telephone circuits, and that the proposed electric line between Fairmount and Catlin authorized herein should be transposed to co-ordinate with proposed transpositions in the telephone circuits.

6. That the evidence fully sustains the opinion and order of this commission entered Sept. 28, 1920, and that the said opinion and order should be affirmed except in so far as modified by the terms and conditions that are hereinafter specified.

Interconnection Affords Great Benefits in Italy

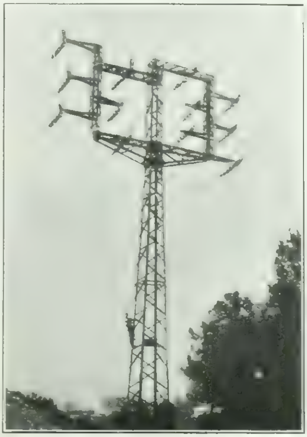
Difference in Seasonal Flow in Mountain Ranges Makes Interconnection Essential—Ornate Architecture of Italian Plants

CO-ORDINATION of water resources for efficient power production was emphasized as a striking feature of hydro-electric development in Italy by Guido Semenza of the Italian electrical mission to the United States at the recent N. E. L. A. convention in Chicago. He pointed out that about 6,000,000 kw. in water power is available in Italy, which has an area of about 111,000 square miles (287,000 sq.km.), or twice the surface of Illinois. There are two main hydro-electric systems, one in the Alps and the other in the Apennines. The former yields a maximum flow of water in summer and the latter in winter. Through interconnection and the construction of storage reservoirs these non-synchronous flows are utilized to the maximum extent, some steam auxiliary plants being installed for supplementary service. The Milan-Lombardi region is served effectively through the use of a storage reservoir of very large capacity supplying water under a head of 900 m. Interchange of energy between the Alps and Apennine plants was brought about by the necessities of the war, and various important interconnections are still incomplete in minor detail.

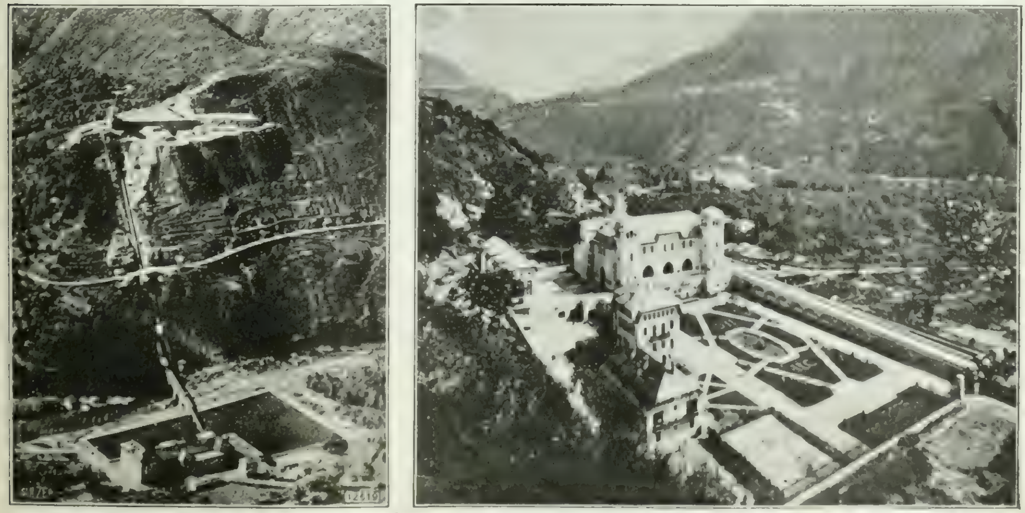
Generally two companies which desire to interchange energy divide the expense of the line, or otherwise they form a separate company to build the line.

Up to the present time, Mr. Semenza said, about 1,200,000 kw. has been developed which could be used all the year around for about fifteen hours per day. Recently there have been constructed many new plants having an aggregate capacity of 550,000 kw., and franchises have already been granted for about 2,000,000 kw. of new power to be developed.

It is considered essential that the architectural style of buildings in Italy be kept up even if they are for hydro-electric purposes, said Mr. Semenza. Formerly, when a castle, a bridge or anything in the nature of a public building was erected artists were called in to design it, and for this reason Italy is full of beautiful structures designed and erected in past generations. It is considered advisable to continue this practice since the cost of doing so does not increase the total expense of the plants more than 1 per cent compared with what it would cost to erect them in a plain style. An interesting plant at Vivarone was described. This plant belongs to the Società Idroelettrica Piemonte ed Elettricità Alta Italia. Here is a case of artificial storage of power. The company had a certain amount of power available during the night which it wanted to store for use during the day. A place was found where there were two lakes with a difference in elevation of 483 ft. (147 m.). On a level with the lower one, Lake Vivarone, a plant was erected and equipped with a set of motor-driven high-pressure pumps which could be used during the night to pump the water from the lower lake to the higher lake. During the day the water thus stored was discharged into the lower lake through waterwheels driving generators. From the technical point of view it



NARROW-BASE TOWERS ARE BEING USED IN ITALY EVEN AT ANGLES FOR ECONOMY



WATER IS PUMPED TO UPPER LAKE AT NIGHT FOR USE DURING THE DAY—NOT ONLY THE DESIGN OF POWER PLANTS BUT THEIR SURROUNDINGS ARE ARTISTIC worked well, but the efficiency of the whole system is very low. The calculated efficiency is 53 per cent, but the real efficiency is not more than 40 per cent.

In Italy electric service companies have the right of eminent domain. Transmission lines can be erected over the straightest and shortest course, arrangements being made for fixing the price of the land so utilized and of all litigations that may arise therefrom. This law is said to work very satisfactorily and has facilitated enormously the distribution of electrical energy.

All the franchises have been limited to sixty years, with the provision that at the end of that period the plant will go back to the state. This would give the impression that state ownership will eventually result, but Mr. Semenza expressed the hope that in the course of the next fifty years people will have recovered from their present notions about state or government ownership of such plants. Load factor was recognized by Mr. Semenza as being very important, but he said it is not such a vital factor when water can be stored. However, an effort is being made to urge the use of energy at a very good load factor by the introduction of electrically equipped kitchens with arrangements for accumulation of heat. Such a kitchen would demand only 1 kw., but over a period of twenty-four hours, and would be available at any time for cooking. Electrical energy is also used to a very considerable extent for heating water for domestic uses, continuous heater being employed. To encourage this application special rates are being offered.

IN ITALY ARTISTIC ARCHITECTURE IS APPLIED TO HYDRO-ELECTRIC PLANTS AS WELL AS ALL PUBLIC BUILDINGS

In Italy the rates are tending toward the plain kilowatt rate. While there have been efforts to introduce special forms which take power factor into consideration, these systems are rather complicated and not accepted with great enthusiasm by customers of central stations. In France the tendency appears to be in that direction, but it is not considered worth while in Italy.

There are some flat rates for distributing energy to workmen's houses where there are perhaps only two or three lamps, but these rates are being discontinued. Some utilities are using the maximum-demand system, and in Mr. Semenza's opinion this system may be very useful if properly applied. That is, the energy consumed should be charged for in kilowatt-hours and the maximum demand in kilovolt-amperes. This would take care of the power-factor question.

Readers' Views and Comments

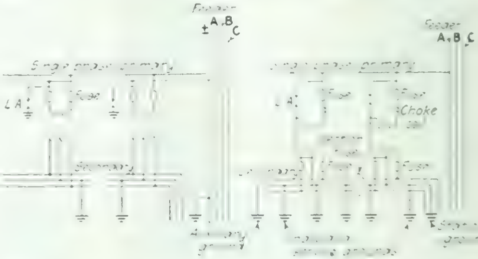
This is a readers' forum. Comments on questions before the electrical industry presenting economic, financial, engineering, or commercial aspects and new or supplementary viewpoints on published articles are cordially invited

Copper Economies in Primary Distribution

To the Editor of the Electrical World:

Sir: In primary distribution the three-phase system is now so generally used that it may be considered standard. However, the majority of companies still stick to the older delta 2,300-volt connection in spite of the fact that by changing to star connection they can still use identically the same apparatus and increase the capacity three times for the same power loss. All that is necessary is a neutral conductor; but, like the secondary neutral this must be thoroughly grounded to avoid serious difficulty due to the shifting of this neutral placing undue voltage strains on equipment. Grounding the neutral at the station only will not work under abnormal operating conditions unless the neutral is very short and of large cross-section. To hold the system successfully to constant potential to earth requires a number of solid high-current-capacity grounds scattered over its length. It is also very important to see that at least one ground is installed near the end of every neutral branch in order that in no case a break in this conductor shall permit it to float and raise the potential on the apparatus connected beyond the break. Where this point receives careful attention the 2,300/4,000-volt star primary system is far more reliable than the delta system and much less costly.

In most systems the power requirements are more or less concentrated, following railroad arteries where trackage is available. The larger portion of the area served is residential in character and can well be served from single-phase sections taken from the main three-phase feeder lines. Where this method is used there is of course no difference in cost between the delta and the star primary system except that less attention need be given to the insulation and protective equipment on the side that connects to the grounded neutral.



FIGS. 1 AND 2 — CAPACITY INCREASED BY THREE-PHASE, FOUR-WIRE SYSTEM; COMMON NEUTRAL PERMITS ELIMINATION OF ONE WIRE

At this time, when more than ever close attention must be given to economies in order to offset increased material costs and interest rates, most careful consideration should be given to what is termed the "common neutral system" by the few companies whose engineers have had the courage and initiative to take advantage of its economical features.

Briefly, this system is based on the very simple fact that if the secondary neutral is permanently and effectively grounded to protect against high-tension crosses of an accidental nature, it can just as well operate safely with a permanent high-tension cross. With the secondary neutral grounded and interconnected there is a grounded conductor parallel to the second grounded conductor used as the primary neutral of the 2,300/4,000-volt four-wire primary system. If these are each properly grounded, as they must be, they in effect become the same wire in so far as potential to earth is concerned. The common neutral system simply combines these two wires physically as they already are combined electrically. An idea of what this means from an economic standpoint can be seen when one considers that the feeder wire required is reduced by one wire out of the four, or 25 per cent. On single-phase distribution it permits of the removal of one of the two wires, as well as the protective equipment on one side of each transformer, or a clear saving of 50 per cent. In addition, the voltage drop over this large aggregate cross-section neutral grid is so low as to be virtually negligible, so that the power loss on the single phase is just about cut in half.

This seems almost like keeping our cake and eating it also, but actual operating experience has proved that all this can be done and more. The system has been operating for about eleven years in the largest city in Canada with a record of not a single accident due to the combining of these two neutrals. Three years' operation in one of our larger Middle Western cities has repeated this absolutely successful experience. Based upon this experience, it can be safely stated that the central stations of today have invested millions and millions of dollars in unnecessary copper erected by engineers who prefer to stick to the beaten path rather than try something just a little different from that in ordinary use.

S. B. HOOD,
Superintendent of Distribution.
Northern States Power Company,
Minneapolis, Minn.

Contact with 33,000-Volt Circuit Did Not Kill Man

To the Editor of the ELECTRICAL WORLD:

SIR: Recently, while examining some high-line oil switches preliminary to overhauling them, Charles Moore, foreman of high-line department of the Texas Light & Power Company, came into contact with a circuit and established a ground through his body. While he was so badly burned that he lost his right hand, he never lost consciousness, despite the fact that the circuit was operating at 33,000 volts. Mr. Moore and an assistant had been standing before the switch box the door of which was off. Mr. Moore, it is thought, swung around to leave and as he did so he caused an arc and was knocked down. The assistant threw himself upon the ground and was unhurt. Witnesses of the accident rushed to the stricken man, expecting to find him dead, but to their amazement he began to talk to them and intelligently directed the first-aid work himself.

The discharge entered his right hand, traveled through his body and passed through his left leg. The concrete flooring on which Mr. Moore was standing at the time clearly showed the outline of Mr. Moore's left foot, having been turned black where current passed out of his body. It is estimated that the minimum voltage which he could have received was 19,000 volts.

Dallas, Tex. W. P. MACKLE.

Change and Development in Sign Lighting

To the Editor of the ELECTRICAL WORLD:

SIR: Users of electric signs have shown such a decided tendency toward higher wattage and increased brilliancy of lamps that it seems advisable to call attention to the new developments and suggest remedies for the troubles that have to be met.

Most important of the new developments in lamps for this service are the 25-watt and 50-watt blue glass type B sign lamps. If they are used to replace 10-watt lamps, it is necessary to find out whether both feeders and circuits are of sufficiently heavy wire to carry the increased load and comply with the fire underwriters' rules. If the wires are much too small, the lamps will burn at a low efficiency and will lose the brilliancy that the change was made to gain.

SHIELD FOR GAS-FILLED LAMPS WHEN USED EXPOSED TO WEATHER IN HORIZONTAL POSITION

Although the glass used in these sign lamps is the same as that used for the daylight type C lamps, the blue sign lamps should not be used for color matching because even approximate daylight will not be produced with this glass except when used on a lamp having considerably higher filament temperature than a vacuum lamp.

The blue B sign lamps are able to withstand all sorts of weather conditions without protection of any kind. The color is permanent, and since the bulbs do not become so hot as those of gas-filled lamps they are not cracked by cold rain. The filaments are coiled in a ring shape and mounted on a short stem. This construction makes a strong lamp and gives high end-on candle power.

Although a great many type C lamps are now used for sign lighting, they were not originally designed for that purpose, and manufacturers do not feel that they can recommend them for it without adequate protection. The metal caps here illustrated for covering the hot spot on the bulb are a great help. This hot spot is directly above the filament when the lamp is burned in a horizontal position, and if not protected the glass is apt to crack when struck by rain or snow.

Some 50-watt white-bulb tungsten-filament lamps have been used to advantage where the chief requirements for the sign are that it should be particularly clear, easily read and free from glare. However, the favorite at the present time is without doubt the 75-watt daylight type C lamp.

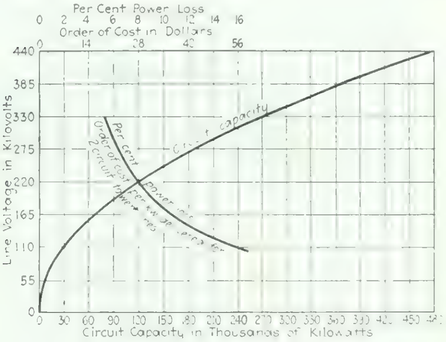
EDWARD B. FOX.
Harrison, N. J.

Station and Operating Practice

A Department Devoted to Problems of Installation,
Operation and Maintenance of Equipment for Economical Generation and
Distribution of Electrical Energy

Economic Study of Transmission at 220,000 Volts

THE economics of transmission at very high voltages are summarized in the accompanying curves, which were shown by J. P. Jollyman at a recent meeting of the San Francisco Section of the American Institute of Electrical Engineers. This figure shows the most important characteristics of 200-mile 60-cycle circuits from an economic standpoint.



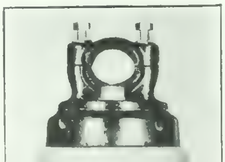
CHARACTERISTICS OF 200-MILE 60-CYCLE CIRCUITS

The maximum capacity of an alternating-current circuit is largely determined by the voltage consumed by the impedance of the circuit. Assuming that the impedance voltage of a circuit is fixed as a certain percentage of the volts delivered, the maximum capacities of 200-mile 60-cycle circuits are found to be proportional to the squares of the circuit voltage. A 55-kv. circuit would deliver 7,500 kw., a 110-kv. circuit 30,000 kw., a 220-kv. circuit 120,000 kw., and a 440-kv. circuit 480,000 kw. Having established the carrying capacities of circuits of different voltage, and having a certain amount of power such as 240,000 kw. to transmit, the next problem is to determine which voltage will be the least expensive to employ. The cost of transmission includes the fixed and operating charges and the value of the lost power. In comparing the efficiency and cost of circuits of different voltages the most economical size of copper for each voltage is determined by an application of Kelvin's law. It will be seen that while the capacity of a 220-kv. circuit is four times as great as that of a 110-kv. circuit, the losses are only half as great and the cost only half as great in the case of two-circuit tower lines. It is apparent that 220 kv. is the more economical voltage to employ in this case.

It might be argued that a higher voltage than 220 kv. would give a still more economical solution, if in fact such a voltage were possible with apparatus now available. However, 330-kv. or 440-kv. circuits have capacities so large in comparison with the developments proposed today that their use does not seem to be warranted even if the possibility of their operation were proved. Another fact to consider in this connection is that the charging kva. is proportional to the square of the voltage and is about one-third the circuit capacity. To operate successfully requires generating units of a size to charge one circuit with one unit. To change the 220-kv. circuit will require a generator of about 40,000-kva. capacity, a 330-kv. circuit would require a 90,000-kva. generator, and a 440-kv. circuit a 160,000-kva. generator. The latter sizes are far beyond anything thus far attempted and exceed the total power to be had from any except a very few developments. With properly distributed synchronous condensers it is believed that 220-kv. transmission can deliver over distances of 400 or even 600 miles with good efficiency and at an expense not prohibitive.

FIELD EDITOR ELECTRICAL WORLD.
San Francisco, Cal.

New Design for 15,000-Volt Bus Support



DUST DOES NOT COLLECT ON THE PORCELAIN

A NEW heavy-duty 15,000-volt bus support will be used in the new station of the Hartford Electric Light Company. The design is unusual in that the porcelain has no corrugations and is finished with a white glaze, giving a surface which will not collect dirt readily and will also make it conspicuous. The porcelain with top and bottom fittings can be used interchangeably to take two-bolt or four-bolt bases and any size of bar or cable clamp. The general appearance of the unit is shown in the accompanying cut and the principal dimensions follow:

Height to center of clamp, in.	7[illegible]
Center to center of base bolts, in.	5½
Height of porcelain, in.	3½
Maximum diameter of porcelain, in.	6[illegible]

Units are required to pass these tests:

Porcelain before assembly, volts	60,000
Assembled units, volts	45,000
Tensile strength of assembled unit in line with the vertical axis, lb.	2,500
Cantilever strength applied at the cable or bar clamp at right angles to the vertical axis, lb.	2,000

The test results show an ample margin of safety.

Stone and Webster, Inc., R. E. ARGERSINGER.
Boston, Mass.

Estimated Cost of Hydro-Electric and Transmission Construction

An ESTIMATE of the cost of building a new hydro-electric plant of 6,000-hp. rating and 66,000-volt lines from this station to other points on its system has been prepared by the New England Power Company.

The estimate is for doing this work during 1921 and 1922. It is based upon the company's extensive experience in hydro-electric plant and line construction in central New England and assumes wooden-pole lines and a generating station operating under a head of about 245 ft. and producing about 25,000,000 kw.-hr. per year. The proposed dam, to be built south of the present Somerset Reservoir, is to be from 30 ft. to 40 ft. high.

The data were compiled in connection with an application which was made recently to the Massachusetts Department of Public Utilities for authority to issue securities.

Boston, Mass. FIELD EDITOR ELECTRICAL WORLD.

COST OF 6,000-HP., 6,600-VOLT HYDRO-ELECTRIC PLANT, OPERATING UNDER 245-FT. HEAD

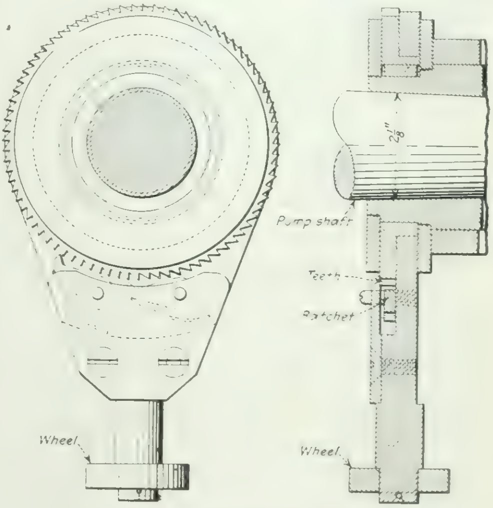
1. Preliminary and General:		
Clearing	$6,000	
Highway changes	4,000	
Construction roads	14,000	
Additional lands	12,000	
		$36.0000
2. Dam:		
Stripping dam site 4,000 cu.yd., at $1.10	4,000	
Dam embankment 60,000 cu.yd., at $1.10	66,000	
		70,000
3. Spillway:		
Excavation, 1,500 cu.yd., at $2	3,000	
Concrete, 2,800 cu.yd., at $25	70,000	
		73,000
4. Outlet:		
Racks, gates and housing	8,000	8,000
5. Conduit:		
Excavation, 50,000 cu.yd., at $2	100,000	
8-in. wood-stave pipe, 21,000 lin.ft., at $21	441,000	
River crossing	20,000	
Trestles, 1,000 lin.ft., at $16.50	16,500	
Vents, 600 lin.ft., at $25	15,000	
Brook intakes, two, at $3,000	6,000	
		598,500
6. Surge Tank:		
Excavation, 1,200 cu.yd., at $2.50	3,000	
Concrete, 120 cu.yd., at $25	3,000	
Steel, 70,000 lb., at 10 cents	7,000	
		13,000
7. Penstock:		
Excavation, 1,000 cu.yd., at $3	3,000	
Concrete cradles, 80 cu.yd., at $25	2,000	
Steel, 235,000 lb., at 9 cents	21,200	
		26,200
8. Power-Station Building:		
Substructure, 4,500 kw., at $4	18,000	
Superstructure, 4,500 kw., at $4	18,000	
		36,000
9. Power-Station Equipment:		
Hydraulic equipment, 4,500 kw., at $18	81,000	
Electrical equipment, 4,500 kw., at $31.50	141,000	
		222,000
10. Sub-total		$1,082,700
11. Engineering and supervision (5 per cent)		54,300
Total		$1,137,000

COST OF 66,000-VOLT, SINGLE-CIRCUIT TRANSMISSION LINES

1. Length 6 miles; No. 2/0 copper; thirty poles per mile:		
Clearing 90-ft. right-of-way	$3,490	
Poles, 180, at $15	2,700	
Power wire, 19,800 ft., at 17 cents	3,366	
Insulators and hardware	7,855	
Pole erection	5,860	
Hauling, stringing wire, etc	3,060	
Telephone wire and materials	1,160	
Installing telephone line	1,095	
Right-of-way	5,244	
Engineering and supervision (5 per cent)	1,691	
Sub-total		$35,521
2. Length 9.5 miles; No. 2/0 copper; fifteen double-pole structures per mile:		
Clearing 125-ft. right-of-way	$8,370	
Poles, 286, at $15	4,290	
Power wire, 62,500 ft., at 17 cents	10,625	
Insulators, cross-arms and sleeves	15,410	
Pole erection	9,640	
Hauling, stringing wire, etc	4,890	
Telephone wire and materials	3,590	
Installing telephone line	1,400	
Right-of-way	8,356	
Engineering and supervision (5 per cent)	3,329	
Sub-total		$69,900
3. Length 21 miles; No. 2/0 copper; fifteen double-pole structures per mile:		
Clearing 125-ft. right-of-way	$18,150	
Poles, 630, at $15	9,450	
Power wire, 137,800 ft., at 17 cents	23,430	
Insulators, cross-arms and sleeves	32,785	
Pole erection	20,890	
Hauling, stringing wire, etc	9,805	
Telephone wire and materials	8,615	
Installing telephone wire	2,275	
Right-of-way	30,050	
Engineering and supervision (5 per cent)	7,770	
Sub-total		$163,220
Total		$268,641

Rotary Plungers on Pumps Reduce Maintenance Costs

A VERY great reduction in the cost of maintaining reciprocating plunger pumps has been made by the use of a device for rotating the rods and plungers of such pumps in plants of a Western company. The plungers of outside-packed pumps often wear unevenly and deep grooves are worn on them. When in this condition it is difficult to keep the packing tight enough to prevent leakage, the wear on the packing is very great, and the power consumed for the operation of the pumps is much larger than it should be. By rotation of the pump rods and plungers the wear on them is evenly distributed over the entire rubbing surface. These parts are kept smooth and polished, and as a result the amount of packing used is very greatly decreased. In addition, the amount of power required for driving the pumps is reduced and the life of the plungers is about doubled.



THIS INEXPENSIVE ATTACHMENT DOUBLES THE LIFE OF PUMP PLUNGERS AND RODS

The device used is a ratchet which causes the pump rods and plungers to rotate a fraction of a turn during each stroke of the pump. The lever of the ratchet is actuated by a small wheel which runs on a camway mounted on the frame of the pump beneath the rod.

FIELD EDITOR ELECTRICAL WORLD.

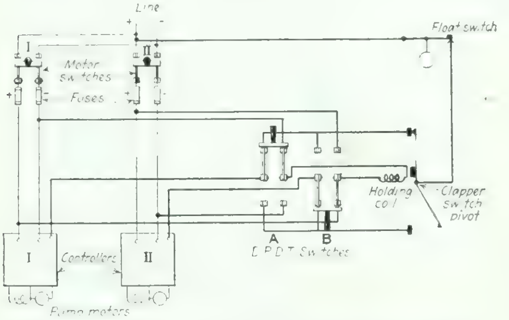
San Francisco, Cal.

Industrial Applications

The Economical Utilization of Electrical Energy
in Mills and Factories, Together with Practical Details of Installation, Control,
Testing and Repair of Equipment Required

House-Pump Control Which Assures Water Supply

WHERE two motor-driven pumps are used for filling the storage tanks of a large building, an automatic system which will cause the second pump to come into operation in case the fuse blows on the line supplying the first one is very desirable. Such a scheme has been developed for installation in a large industrial plant in Brooklyn, N. Y. With this system either pump may be made to carry the load regularly, and on failure of the fuse of the motor driving this pump the other motor will automatically start pumping. Moreover, if desired, the motors can be connected to operate in parallel controlled only by the float switch in the tank.



WHEN A FUSE ON ONE OF THESE MOTORS BLOWS THE OTHER IS AUTOMATICALLY STARTED

The scheme of the connections is shown in the accompanying diagram. The heavy lines represent the wiring for the automatic control feature mentioned. There is a supply line feeding two pumps, No. 1 and No. 2. A line taps off the incoming line ahead of the motor switches and passes to the float switch on the roof. Instead of going directly from the float switch to a controller, it passes through the clapper switch and then through other wiring to the controller. In order for the circuit from the clapper switch to the controller to be complete, one of the double-throw switches, *A* or *B*, must be in the upper position. When *A* is in the upper position, the circuit is complete from the clapper switch to the controller for motor No. 1. When *B* is in the upper position, the circuit from the clapper switch is complete to controller No. 2. With this position of the switches both of the motors are connected in parallel and controlled by the float switch. However, if switch *A* is thrown up and switch *B* down, then motor No. 1 normally does the pumping. If either of the fuses on this motor blows, this takes current off of the holding coil, which releases the clapper switch. The clapper switch falls to the downward position, and this throws energy on the control coil in controller No. 2.

For motor No. 2 to operate normally switch *A* is thrown down and switch *B* upward. Then if a fuse blows on No. 2 the holding coil releases the clapper switch, which falls down and puts energy upon controller No. 1

W. A. HARRIS.

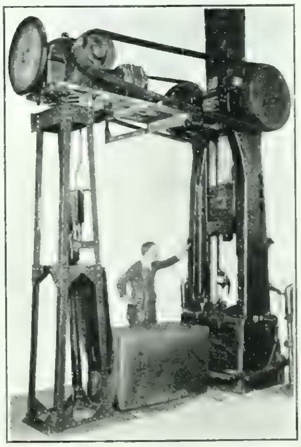
New York, N. Y.

Individual Drive for Drop Hammer Has Advantages

THE application of individual motor drive to machine tools of various sorts has been extended by the General Electric Company to the equipment of several board drop hammers in its Schenectady works. The drive was originally applied, as an experiment, to a 300-lb. hammer and proved so successful that the range has been expanded to include hammers of 600-lb., 1,500-lb. and 2,500-lb. sizes.

The design is the same in all cases, except for variations made necessary by the weight of the hammer. The only basic change since the first ones were installed is the use of induction instead of direct-current motors for the drive. As shown by the illustration, the whole outfit consists of two towers, one composing the hammer mechanism proper and the other serving to support the other end of the platform carrying the motor, gears, etc. The supporting frame is a light structural steel tower, on which are mounted the starting switches for starting the motor.

The operation is very simple. A 15-hp., 800-r.p.m., 40-cycle induction motor is directly coupled to a shaft carrying one loose and one keyed pinion and a flywheel on the extreme end. The flywheel serves to take the initial peak load off the motor when the hammer is drawn up. The keyed pinion engages two beveled gears, which are directly connected to two pulley wheels. The loose pinion simply acts as a spacer on the opposite side of bevel gears. This arrangement of gears causes the two pulleys to revolve in opposite directions, and these are belted to the pulleys on the shafts of the rollers, which when forced together raise the hammer. The gearing is all inclosed and immersed

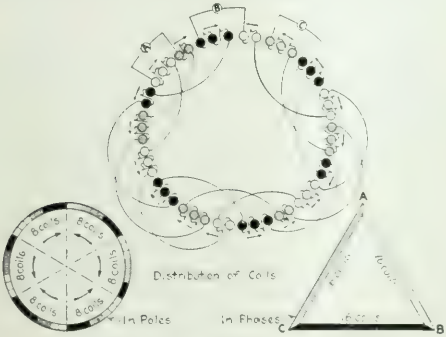


INDIVIDUAL DRIVE ELIMINATES SHAFTS AND BRACING in oil. The total speed reduction through gears and pulleys is eight to one.

Once the motor is started, it runs continuously, operation of the hammer being obtained through a treadle control which separates the rollers and lets the hammer down. The length of the drop is controlled by an adjustable trigger on the hammer frame which comes in contact with a wooden stud on the hammer. The force of the blow is due entirely to gravity. Repeated blows can be obtained automatically by this arrangement, as long as the treadle is depressed.

Simplified Connections and Diagrams of Three-Phase Motors

A SET of simple and clear diagrams for the reconnection of motors by ordinary machinists who were not familiar with the usual style of connections adopted in motor diagrams was desired by the manager of an important manufacturing establishment of Lima, Peru.



VERY SIMPLE DIAGRAM FOR SHOWING MOTOR CONNECTIONS

The work was started having in mind that the diagrams to be prepared must show clearly and faithfully not only the sequence of groups, poles and phases, but also the formation of groups. Starting at the two terminals of each coil, it was proposed to make a detailed and continuous line representation to converge at the three motor terminals. In some cases it became necessary to alter the usual style of connection so as to make practicable the reconnection in the most simple and regular way. The phases were shown differently, the terminals had to be located symmetrically, the top and bottom splicings were drawn separately, and even the coil-to-coil stubs were clearly indicated. Among the diagrams prepared there were some for twelve, ten, eight, six and four poles, using 2,200, 550, 440 and 220 volts both for American and German makes of motors.

The accompanying drawing is a sample of the diagrams made. It belongs to a 5-hp., 1,150-r.p.m., 220-volt, forty-eight-coil, series-delta, three-phase motor. Each of the small circles represents a coil. The different phases are drawn respectively clear, hatched and black. The lines issuing from the small circles represent the terminals and connection ends of the coils, and there is no other explanation accompanying the diagram than the direction to connect the motor in strict accordance with the lines joining the small circles. As the motor requires odd grouping of coils, the distribution of coils in poles and phases is also indicated.

V. M. ARANA,
Lima, Peru. Consulting Electrical Engineer.

Observations on Armature Dipping and Baking

ALTHOUGH a knowledge of varnish, ovens, methods, insulation, ample shop space and a liberal number of spare armatures will permit the most effective method of handling armature dipping and baking, it will be found in the usual run of practice that deviation from constant temperature, constant specific gravity and duration of baking periods will be found to speed up operations without any apparent disadvantages. It is with this viewpoint in mind that the writer desires to present some observations on armature baking as gained during the treatment of several hundred armatures.

There are many good features in armature baking that represent real advantages and that will make themselves felt in operating results. For instance, fixation of the coils in the slots is important. Through shrinkage of insulation or failure of the band wires to exert direct pressure on the coils, the undipped armature will frequently suffer from abrasion of insulation or breaking or loosening of leads. The treated armature, however, is free from such trouble. The sealing of the seam between the end of the commutator and the string or tape band is also another real advantage.

If the treatment puts a hard glazed surface on this band and a hard glazed fillet in the seam, it is, from the standpoint of operating troubles, well worth while. In order to get the glaze desired and to fill the seam thoroughly where the mica V-ring issues from under the commutator wires, the string or tape of which the band is composed should itself be thoroughly dipped and baked before being applied. If this is not done, when the armature is dipped the band will soak up the varnish in the seam and leave it entirely unprotected. As this is an extremely vulnerable part of the commutator, special emphasis should be placed on this point.

The varnish does cement coils in the slots, and this has been construed as an objection to the method by some engineers. However, it has been found that the occasions of reclaiming such armatures by replacing one or more coils are comparatively few. It may be safely said that the reduction in operating troubles amply compensates for the additional labor involved in stripping the coils of an armature when such trouble does occur.

Variations in baking periods of armatures were investigated by taking hourly insulation resistance measurements by means of leads brought out of the oven so that the oven doors would not have to be opened. In this test it was found that the time required to bring the armature to a standard resistance did not depend on the location of the armature with respect to the oven doors. This indicated that the radiation losses at that point were low. The position of the damper or the operation of the ventilating motor seemed to have little or no effect on the time required to obtain the standard resistance. It was found, however, that it did make a considerable difference in time whether the armature was in the upper or the lower tier. Although the temperature in the upper tier was 10 deg. to 15 deg. higher than the lower tier, nevertheless the armatures in the upper tier took a longer baking time to come up to the standard insulation resistance. In order to check this surprising result, the experiment was made several times on the twelve armatures with six in the upper tier and six in the lower, all positions being as nearly as possible the same. The result was found to be always alike.

In order to check the effect of lower baking temperatures, six armatures were baked in a steam-electric thermostatically closed oven, which was maintained at a temperature of 190 deg. Fahr. until all insulation resistance had been raised to 1 megohm or better. The armatures were then transferred to an electric oven, which was maintained at a temperature of 240 deg. Fahr. The insulation resistances immediately after the transfer to the electric oven were virtually the same as those which obtained immediately before removing the armatures from the steam-electric oven. However, after three hours of baking at 240 deg. the deflection increased to a value of 120 volts from the original value, which had been 10 volts at the time of the removal from the lower temperature oven. Tests were made with a 600-volt meter on a 575-volt circuit. It would appear, therefore, that the lower temperatures do not liberate as much moisture to be dispelled.

Bringing all undipped armatures up to a standard insulation resistance before dipping is desirable in that it gives more uniform results in subsequent baking, but it is not necessary if the armatures are to be dipped a second time.

In this plant the following routine has been adopted: Green armatures are baked overnight at an average temperature of 240 deg. Fahr. During the earlier hours of baking, all insulation resistances are found to fall rapidly to a minimum and then rapidly rise to the predecided maximum during the later hours of baking. It is manifest, therefore, that a single reading is not a reliable indication of the condition of insulation, but at least two readings should be taken to determine whether the insulation resistance is rising or falling. If an armature does not show a resistance of 1 megohm or more, it is kept in the oven as long as necessary. As a rule a fourteen-hour bake suffices.

The next procedure is to remove four or five of the green armatures for the first dipping. When these have been dipped they are placed in another oven and baked from three to five hours in preparation for the second dipping. By the time all of the armatures in the first oven have been handled in this way the first armatures placed in the second oven are ready for the second dipping. After completing the second dipping, the armatures are returned to the oven and baked for twelve hours or more. The armatures are then taken out and prepared for shipping. After baking the green armatures according to the indications of the voltmeter, the meter is used no more, but all armatures before being released are subjected to a 2,000-volt test from commutator to shaft. The twelve-hour to fifteen-hour baking of the green armatures, the three-hour to six-hour baking after the first dipping and the twelve to fourteen-hour baking after the second dipping total a maximum baking period of thirty-five hours and a minimum of twenty-seven hours. An armature is never passed under the minimum, and as a rule the minimum is exceeded by several hours, not because it is deemed necessary but because it is more convenient. During the entire baking period the oven damper is open about half way and the ventilating motor is operating. Each electric oven has a heating capacity of 120 amp. at 600 volts, but is operated at half this input. The duration of the baking period is not measurably affected thereby, and the work of the contact-breaking devices is made easier.

Cleaning of cores and spiders of armatures before rewinding makes for the uniformity in time required to bring the insulation resistance of green armatures to a standard value. Further improvement is to be obtained by giving repaired armatures a gasoline bath before baking the first time. The expense, delay in production and amount of gasoline to be handled would, however, be considered prohibitive in the majority of shops. Repaired armatures impregnated with oil and sludge may, after four or five hours of baking, give insulation deflections of from 400 volts to 525 volts out of a possible 600 volts. Subsequent baking frequently reduces the abnormal deflection to a safe value, but in refractory cases the armature is removed from the oven after the baking has had time to loosen the sludge, which is blown out with compressed air. How much this treatment is going to help in any particular instance can usually be foretold from the amount of dirt that the air releases. The relief is likely to be most decided on armatures the commutators of which have radials, as the dirt works through the clearances between the radials and deposits on the rear end of the commutator.

The dipping application referred to really constitutes a "rolling." The armature is supported on trunnions over a tank the lower part of which, containing the varnish, can be raised and lowered. The varnish level is kept such that when the lower part of the tank is raised the full radial depth of the winding is submerged. The armature is slowly turned several times, then permitted to rest several minutes, then slowly turned several times more, the varnish lowered and a draining period of five minutes allowed. While one operator is turning the core another is pouring varnish onto the string band or tape band at the end of the commutator. Special effort is made to give the band all the varnish that it will take. The armature then is lifted by means of an air hoist and let down onto a truck and shoved into the oven.

During the rolling it is necessary to keep the varnish at working consistency as it tends to thicken on account of the evaporation of the solvent. This is done by adding gasoline as required, about 5 gal. of gasoline being used with 15 gal. of varnish. The adding of the gasoline does not impoverish the varnish to the extent suggested by the proportions, because as the armatures are hot the solvent evaporates rapidly while the body of the varnish does not. Indeed, by adding the gasoline in small quantities at frequent intervals and stirring on each occasion the specific gravity of the varnish is maintained practically at prescribed value. The stirring tends to keep in suspension the impurities which the varnish washes out of the armature; therefore, on this account, it is necessary to clean the tank several times during a busy day. E. C. Parham.

Brooklyn, N. Y.

Sparks Between Rotor and Stator May Be Caused by Loose Bars

With induction motors small sparks are sometimes seen between the rotor and stator. These may be due to the copper short-circuiting rings becoming loosened from the slot bars. The only remedy is to solder or weld the rings tightly to the slot bars. If not attended to, the stator winding is liable to become punctured. With a rotor of any size, say 25 hp., the heat for such a repair job must be supplied by a gas flame with air pressure. H. S. Rich.

East Berlin, Conn.

How to Determine if Load Is Too Great for Motor

RECENTLY a case where a motor would not start properly under load came to the writer's attention. When the motor was installed on a chemical-mixing machine it was tried out with the machine empty, under which condition it ran satisfactorily. However, when the machine was heavily loaded it could not be made to start. An attempt was made to correct this trouble by changing to the next higher tap in the auto-transformer, but this was without satisfactory results.

After checking up all connections, line voltage and voltage at motor terminals, a lever was applied to the motor shaft, and by pulling on this lever at 1-ft. radius it was found that a pull of 114 lb. was required to start the machine and the motor to which it was geared. The motor was then moved away from the machine so that the gears were out of mesh. Then the lever was attached securely to the motor shaft and the spring balance was fastened to a stationary point and the starter handle was thrown to the starting position. The motor exerted a pull of 66 lb. at 1-ft. radius on the lever. From these results it was determined that the motor was not sufficiently large for the job. The motor in this case was a 20-hp., 220-volt, 1,160-r.p.m. two-phase machine. When a 40-hp. motor was substituted the machine started satisfactorily under heavy load.

East Orange, N. J. E. R. DEBMAN.

Graphic Study of Current Capacity of Several Wires in Conduit

GRAPHIC studies are presented herewith of the results of tests on current-carrying capacities of wires in conduit conducted by the Commonwealth Edison Company at the request of the Department of Gas and Electricity of Chicago, as set forth by Henry C. Horstmann and Victor H. Tousley in the ELECTRICAL WORLD, May 14, 1921, page 1099.

Plate I shows the copper cross-section necessary to carry different currents in one conduit and shows that for a certain current the total cross-section must be greater when a larger number of small wires is used instead of a small number of large wires.

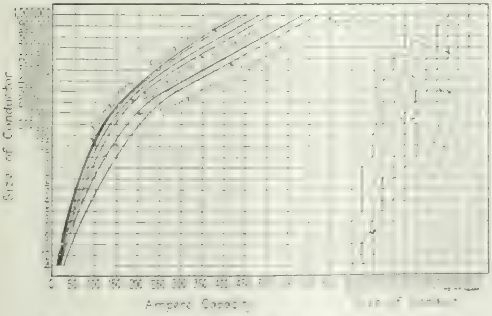


PLATE I—EFFECT OF USING SEVERAL CONDUCTORS IN ONE CONDUIT

National Electrical Code values are shown by circled points. Estimated values are shown by the lines. Wires are calculated to occupy 40 per cent of space in conduit.

The true points of the National Electrical Code curve have been located for the sake of comparison. It may be noted that for large conductors the code allows a greater current than the curves show for conductors in the corresponding conduit, but less current for No. 10 and smaller conductors, four or less in a conduit. The curves show that for a current of 400 amp. two conductors of 600,000 circ.mil may be used in a 3-in. conduit. The code allows 450 amp. for 600,000 circ.mils.

Plate II shows that the code permits of much greater current in all sizes of conductor than the tests seem to indicate should be permitted. For example, from the curves in Plate II it may be seen that with No. 2/0 conductors in a 6-in. conduit the carrying capacity is 75 amp. for each of twenty-nine conductors as determined by the tests. The code, however, allows 150 amp. in No. 2/0 conductor.

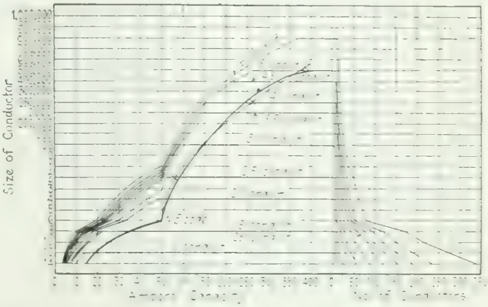


PLATE II—REDUCTION IN CURRENT-CARRYING CAPACITY CAUSED BY USING SEVERAL CONDUCTORS IN ONE CONDUIT

Shows number of conductors which may be placed in different sizes of conduit and current-carrying capacity when so placed. Wires caculated to occupy 40 per cent of space in conduit.

In checking over the tables to develop the curves of the data shown, it was noted that for No. 5 conductor in 2-in. conduit Table I gave 79 amp. and Table II gave eighty-eight wires; it is believed that these values should be 69 and 8, respectively. As a line drawn through all the points in each column could not produce a smooth curve, each curve in Plate I was made smooth by further reducing the carrying capacity at some points by lifting the sags from the curves. D. W. BLAKESLEE,

Jones & Laughlin Steel Co. Electrical Engineer.

Pittsburgh, Pa.

Radiant Heater Employed for Baking Small Coils, Etc.

OCCASIONALLY having a small rewinding job with no way of baking the coils after dipping in insulating varnish, the writer constructed a sheet-iron box, 30 in. square, having a hinged door and lined on the outside with several layers of asbestos sheets and thick cardboard. A 60-watt radiant heater was used for heating the interior, and it was found possible to raise the temperature to 180 deg. Fahr. in several hours. This makes a cheap, serviceable oven with an easily regulated temperature for baking either coils or entire small motors after the rewinding is completed.

The use of the heater for this purpose was first suggested by its use in drying out a 50-hp. motor which had been submerged. This was thoroughly dried out by covering over with an old tarpaulin and for several days maintaining a high temperature underneath with two 600-watt heaters. L. A. TUCKER,

Superintendent.

Municipal Light and Water Commission,
Donaldsville, La.

Central Station Service

A Department Devoted to Commercial Policy
and Management Topics, Including Methods of Increasing the Use
of Electric Light, Power and Heat

Financing Service Extensions on a Profitable Basis

WITH the increased cost of labor and material and the high rate of interest for capital for new construction, said H. A. Doering of the Westchester Lighting Company at the recent commercial meeting of the Empire State Gas and Electric Association, utility companies have been forced to adopt the policy of making service extensions at their own expense only when they are good commercial propositions. Although in the smaller companies an occasional unprofitable extension may not be a vital matter, he pointed out that in a company operating over a large area hundreds of thousands of dollars could be easily invested and expended from which there would be no adequate return for a great many years.

Applicants for service, Mr. Doering continued, may be divided into two classes, desirable and undesirable. They are considered most desirable when the necessary investment is very small, requiring a service, a meter and perhaps the additional expense of changing a transformer or some small part of a secondary system. Applicants that are the least desirable, unless the income promised is very attractive, are those requiring an extension of plant.

If the investment is not warranted, the utility company is justified from a financial viewpoint in declining to make the extension. However, it is not always the best policy to refuse to make an extension; therefore many companies have devised methods of allowing the consumer to help finance the project, thereby enabling the prospective customer to obtain service and the company to furnish it without loss.

When the total cost of making an extension is more than the company should invest and the difference not very great, the amount required of the prospective consumer may be obtained by a direct contribution through mutual agreement, the company assuming its share of the cost and the prospective consumer paying the balance. These methods usually apply to the short extensions. When the cost is very great, a proposition can be submitted whereby the "prospect" does some of the work and contributes toward the cost of the remainder, for which amount he will receive a refund in accordance with future business taken on the extension. This plan applies particularly to developing companies and has worked out very well. Agreements are made whereby the applicant deposits with the utility company a specified sum. A proportion of this sum is refunded at the end of each year for a three-year or four-year period, provided that the revenue to the utility company from this particular customer in any one year is not less than a predetermined amount.

A sufficient return on capital invested will attract additional capital to provide for increased capacity and new extensions. Extensions should therefore be made on a profitable basis in order to maintain the return necessary to attract capital. This demands that those desiring service requiring unprofitable investment should help finance the extension under a plan best adapted for the utility company and the controlling circumstances.

To make the public more willing to do this it must be educated to realize the great value of electric service and that it is obtaining substantial returns in health, comforts and profits by the accrued benefits of the high engineering skill which makes the utility service so valuable to its customers. This is usually not appreciated until some temporary breakdown brings interruption.

"If we can get the people to ask, 'What would we do without this service?' " Mr. Doering said, "we shall have started them thinking in the right direction, and when we can get them to realize that the loss occasioned by unprofitable extensions must naturally be reflected in their purchase price of the service, it seems as if the few individuals particularly interested in a proposed extension would find little sympathy from the general public when these individuals object to doing their just share in financing a service extension."

Selling Stock to the Small Investor in a Consumers' Ownership Campaign

HOW best to reach the small investors—prospective buyers of only one or two shares of stock—frequently presents a puzzling problem in a consumers' ownership campaign. W. S. Webb, manager of the Cadillac (Mich.) district of the Consumers' Power Company, has offered some valuable suggestions for reaching the prospective small stockholder. From his experience he says:

"Our attention, since we commenced the sale of our 7 per cent cumulative preferred stock, has been largely centered on the volume of our sales. This is entirely proper, and the sale of as many shares as possible should continue to be our primary object, but the secondary object of selling to as many individuals as possible should be of almost equal importance. It is perfectly natural that we should think of persons with means as the most probable purchasers of our stock, and our sales records show that by far the greater part of our sales have been for cash. We have also recognized the value of the small sales of one or two shares, because of the fact that 'every little bit helps, but the importance of each sale should not be rated in proportion to the number of shares.

"Every sale means a new partner in the ownership of the company, whether he has purchased one share or one hundred. The sooner we can get even a single share of 'Consumers' into each shop, each office, each neighborhood, each unit of society where people meet and talk, the sooner will the ultimate success of our plans be assured. For every purchaser is going to bring others, and every purchaser of one share on payments is going to be a prospect, already two-thirds 'sold,' for another share as soon as his first is paid up. We are pioneering now, and the road has to be cleared for each sale, but we cannot tell, when we sell one share now, how many shares that sale will lead to in the future.

"In 'talking stock' to people who are obviously 'prospects' for only a share or two, we find that two main considerations must be satisfied before a sale is made. First, of course, the safety of the investment. This is usually already assured in the person's mind except for one idea. We have repeatedly been told in one breath that the party 'would just as soon put his money into the Consumers' Power Company as to put it into the bank' and asked in the next, 'Why is the company so hard up that it needs this money now?' One should not fail to state at the outset of an interview that the proceeds from the sale of our stock are to be used for new construction work, to build new lines, purchase additional equipment or construct new dams, and not for the maintenance or operation of the present property.

"The mention of new power plants and new dams never fails to excite interest in this part of the state at least. The proximity of our Junction Dam, which many Cadillac people watched during its construction, and the general knowledge of the undeveloped resources of the northern rivers make a stronger appeal than descriptions and statistics of our present property. As an illustration of the fact that the company continually needs new capital, it is interesting to state the number of new customers connected during the past year in the home city, with an approximate statement of the necessary investment in meters and services alone.

"The next obstacle to overcome is the question of 'getting my money out if I need it.' Explanation that the company will resell the stock for the owner, and that a bank will usually make a loan of from 60 per cent to 80 per cent of the value of the stock with the certificate as security, is usually satisfactory. It may be added, however, that money in the savings bank is not necessarily available on demand, as it is written into the rules of almost all savings banks that the bank may request ninety days' notice that money is to be withdrawn. This privilege is seldom, if ever, used, but in case of panic it could be exercised. However, we frequently advise right here that a person should not desert the savings bank entirely to buy stock, and that it is not advisable to put one's last cent into the stock. In case of emergency, the money invested in 'Consumers' would be available on short notice, but it would be better to protect the investment by at least a small bank account also.

"A comparison of the return on a time-payment subscription to 'Consumers' preferred with savings bank interest is an illuminating example. Four per cent is the highest interest rate common among savings banks, and interest is usually paid only on what money has been on deposit during the whole of a three-months period or 'quarter.' Deposits made from time to time during a 'quarter' do not commence to draw interest until the next quarter. Partial payments on 'Consumers' draw 7 per cent interest from the time of payment, and a comparative example is given in the table.

"Many banks pay less than 4 per cent on savings accounts, and of course the method of paying interest varies, but this is probably a fair example of the relative return on 'Consumers' and savings bank deposits.

COMPARISON OF SAVINGS-BANK AND "CONSUMERS" INTEREST

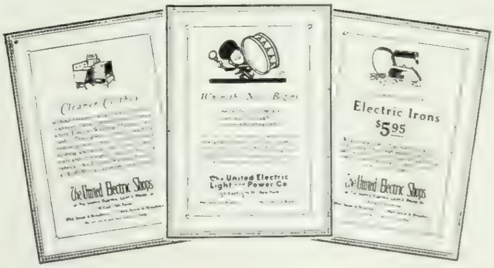
	Deposit in Bank	Interest Credited	Paid on Stock Sales	Interest Credited
Feb. 1	$10.00		$10.00	
Mar. 1	10.00	0	10.00	$0.06
Apr. 1	10.00	0	10.00	0.11
May 1	10.00	0	10.00	0.17
June 1	10.00		10.00	0.23
July 1	10.00	$0.30	10.00	0.29
Aug. 1	10.00	0	10.00	0.35
Sept. 1	10.00	0	10.00	0.41
Oct. 1	15.00	0.60	15.00	0.47
Total	$95.00	$0.90	$95.00	$2.09
Each three months thereafter		0.95		1.75

"Whether a sale of stock is made or not, a talk for that purpose with one of the small consumers of the company is almost sure to be beneficial. In the first place the company is, by the very act of one of its employees making the call, offering to this party an invitation to join as a partner in the business, rather than trying to sell something. Previously, if this was not impossible to the person of small means, the opportunity was, at least, not made so easily available.

"No better opportunity has ever been offered for the company to get closer to its consumers and gain their confidence than through these friendly talks."

New York Company Co-operates in Appliance Advertising

THE United Electric Light & Power Company of New York City is using an interesting method of keeping the contractor-dealers and others in the city in touch with its advertising activities so that they may if they desire co-operate and derive the maximum benefit from the company's publicity. A series of appliance advertisements which is appearing in the New York evening newspapers throughout the summer has been prepared and printed in booklet form. The booklet also contains a schedule of the papers and the date on which each advertisement will be run. A copy of the booklet has been sent in advance to each of the contractor-dealers in the city so that if they wish they can plan their advertising accordingly. Three typical advertisements are shown here.


The United Electric Shops
The United Electric Light & Power Co
Electric Irons
$5.95
The United Electric Shops

TYPICAL CO-OPERATIVE APPLIANCE ADVERTISEMENTS BY THE UNITED ELECTRIC LIGHT & POWER COMPANY

With regard to the company's policy of co-operation with the dealers in appliance sales, Ralph Neumuller, advertising manager, said: "Standard prices are maintained in almost every piece of copy. Where, as in the case of the electric flat-iron, a special sale price of $5.95 for the months of June, July and August is shown, the electrical contractor-dealer has had, through his association, an opportunity to buy and sell such irons co-operatively with us at a satisfactory margin of profit."

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
of the World

Generators, Motors and Transformers

Alternating-Current Motors for High-Speed Elevators.—J. J. MATSON.—For passenger elevators which cover from 175 ft. to 300 ft. (50 m. to 90 m.) per minute and freight elevators which run from 100 ft. to 200 ft. (30 m. to 60 m.) per minute two speeds must be supplied, one of them a very low speed for making accurate landings. Heretofore it has been deemed advisable to supply direct-current adjustable-speed motors and to use a motor-generator set or synchronous converter for changing from alternating to direct current. Now, however, the author says, two-speed alternating-current motors are very satisfactorily adapted to this class of service. These motors have a single winding in the primary and a single high-resistance rotor winding. The motor speed is changed by means of an external pole-changing switch which connects the motor at either speed directly across the line.—*General Electric Review,* June, 1921.

Dynamos with Three Brushes.—M. IGLESIS.—This type of direct-current generator is used extensively for the illumination of trains and automobiles. By simply adding an auxiliary third brush for the excitation to an ordinary shunt-wound generator a fairly constant voltage is obtained within wide speed limits, if a storage battery is kept floating on the line. After describing the characteristics of such dynamos, the author gives the full theory, which, he claims, has never before been developed or published. Simple circle and curve diagrams serve to explain the new theory of such three-brush machines, which utilize the armature reaction and the distortion of the magnetic field. In the last part of the very detailed paper the author describes a few standard makes of such dynamos, gives their characteristic curves and shows their perfect accord with his theory and calculations.—*Bulletin de la Société Française des Electriciens,* Vol. I, No. 2 (1921), page 31.

Generation, Transmission and Distribution

Power Stations of Duquesne Light Company.—J. M. GRAVES.—A full discussion of the design features and operating considerations in connection with the Brunot Island and Colfax power stations.—*Electric Journal,* May, 1921.

Generating System of the West Penn Power Company.—G. G. BELL.—A discussion of engineering features and economies in power-plant design and operation as worked out for the system of the West Penn Power Company.—*Electric Journal,* May, 1921.

Electric Drive and the U. S. S. Tennessee.—H. M. SOUTHGATE.—The maneuvering power of the Tennessee, it is said, was demonstrated during the recent test, when a maximum speed of 21.378 knots was attained. The boat was brought to rest from maximum speed in less than three minutes, and a turning circle, with all propellers operating in one direction and with rudder hard over, was less than 700 yards, or about that of a destroyer. The economy was said to be from 5 to 10 per cent better than the guarantees.—*Electric Journal,* June, 1921.

Automatic Substations for Mining and Industrial Power Loads.—M. A. WHITING and C. E. H. VON SOTHEN.—The supply of mining and industrial loads by automatic substations is urged on economic grounds, and it is claimed that both quality and cost of service are effected advantageously by automatic operation.—*General Electric Review,* June, 1921.

General Arrangement of Propelling Machinery of the U. S. S. Tennessee.—W. E. THAU.—At normal full-load speed of 21 knots the power required is 28,000 hp. The propellers are driven by four direct-connected, two-speed, wound-secondary induction motors, supplied with three-phase power through suitable control equipment at approximately 3,400 volts and 34.6 cycles (full speed) by two 2,075-r.p.m. turbo-generators.—*Electric Journal,* June, 1921.

Traction

Electric Towing of Canalboats.—M. SCHLEICHER.—This paper reviews and criticises the existing methods of moving boats on canals by electric power. The system with a special, slow-moving locomotive running on a track along the canal is used to some extent, but has the disadvantage of being interfered with by boats loading or unloading at plants along the canal. The suggestion has been made to use a small electrically driven mule, running on overhead wires and controlled from the boat. Near industrial plants the mule could run at such a height as to clear any boats. Another system has been advocated using a motor-driven air propeller, installed temporarily on the boat, the motor collecting its current from a pair of trolley wires suspended above the middle of the canal. This system, like the electric mule equipment, is very costly and, besides, the efficiency of an air propeller for such low speeds is very poor. Finally, as the best existing solution, the storage-battery-driven towboat is considered. The author gives an elaborate power and cost estimate, which shows, however, that this system is too costly. He therefore comes to the conclusion that for towing boats along canals the steam engine and the gas motor are as yet superior. He suggests that further research be made to find a reliable and cheaper electrical method. —*Elektrotechnische Zeitschrift,* May 12, 1921.

Important Novelties for Street Railways.—F. HARTMANN.—The author, who is the superintendent of the Vienna street railways, reports experiences with new street-railway material. Iron trolley wires used during the war because of the copper shortage were very unsatisfactory on account of rusting and consequent arcing. The newly introduced carbon-lined-arch current collector used on Viennese trolley cars is satisfactory if used exclusively on the entire system, but gives poor results if used together with aluminum-lined collectors. A lay-out of the overhead wire in zigzag is essential to prevent grooving of the carbon sleeve. Good results were obtained from a novel dust-proof shaft boxing, a section of which is shown. A new model of brake-shoe construction, which permits of the complete use of any shoe, gave excellent results. Recently a peculiar loose-bolt shaft oiler has been installed on some of the motor bearings. For this a very effective and uniform lubrication is claimed.—*Elektrotechnik Maschinenbau*, May 29, 1921.

Main-Road Electrifications in Austria.—C. WALCH.—This article is an abstract of the officially accepted electrification program of the new Austrian Republic, which was definitely passed on July 23, 1920. It is expected to finish the four main branches before the end of 1925. A detailed description of the Austrian main roads which are to be electrified is given, together with a description and sketches of the four types of locomotives, all of them 15,000-volt, 16⅔-cycle alternating-current machines. (For details of these locomotives see also *Electric Railway Journal*, April 2, 1921, page 644).—*Elektrotechnische Zeitschrift*, May 29, 1921.

Installations, Systems and Appliances

Operation of the Surge Arrester.—C. E. BENNETT.—An explanation of the well-known Bennett surge arrester for dissipating transient voltages on transmission systems.—*Ohio Electric Light Association Monthly*, May, 1921.

Underlying Principles of Electrical Ignition.—BENJAMIN F. BAILEY.—A concise development of the theory of ignition both by battery and magneto.—*Journal of Society of Automotive Engineers*, June, 1921.

Government Armor-Plate Factory.—SIDNEY G. KOON.—Some interesting installations of electric furnaces for heavy service are described, together with the operation of 40-ton Heroult electric furnaces.—*Iron Age*, May 26, 1921.

The Minden Pumping Station for the Ems-Weser Canal.—K. STEINNER.—For the operation of the Ems-Weser canal between Hanover and Minden a main and an auxiliary pumping station were erected in 1912-13, taking water from the River Weser. In the main plant are installed four units, each for 120 cu.m. of water per minute and 14-m. lift, driven by 625-kw., 50-cycle, 375-r.p.m., 6,000-volt induction motors. The auxiliary plant has two pumps for 60 cu.m. water per minute, driven by 440-kw. induction motors. The pumps are of the centrifugal type with horizontal shaft and have their intake at both sides, so as to obviate any lateral forces. A special air-pumping apparatus is available to remove the air from the pump casings at starting. The induction motors have wound rotors and are started with resistors in the slip-ring circuit. After attaining full speed the collector rings are short-circuited and the brushes lifted.—*Elektrotechnische Zeitschrift*, May 26, 1921.

Electrochemistry and Batteries

Dielectric Constants of Electrolytic Solutions.—R. T. LATTEY.—A discussion of the divergent view of different observers concerning the change in the dielectric constant produced by dissolving electrolytes in water.—*Philosophical Magazine*, June, 1921.

The Paper Industry.—H. W. ROGERS and E. E. WARNER.—A discussion of the application of motors to the paper industry, which the authors state has jumped to about fourth rank in primary horse-power used. It is said that about 500,000 hp. of electric drive are used.—*General Electric Review*, June, 1921.

Units, Measurements and Instruments

Reactive Volt-Ampere-Hour Meters.—J. W. WEST.—The writer deals with conditions leading up to the demand for these meters and demonstrates mathematically how they serve the purpose.—*Ohio Electric Light Association Monthly*, May, 1921.

Telegraphy, Telephony and Signals

Application of Radio to Navigation Problems.—REAR ADMIRAL W. H. G. BULLARD.—Among the interesting applications of radio in navigation are mentioned the determination of difference in longitude, the sending of weather reports to ships at sea, and the use of the radio direction finder in determining the bearings of a ship at sea. More recent developments have been the use of radio in directing ships through narrow channels by means of a directive pilot cable and the determination of the depth of water. Laboratory tests, it is said, show that the reception of 600 words per minute has been attained by recording photographically.—*Journal of Franklin Institute*, June, 1921.

Reception of Radio Signals by Sense of Taste.—ALFRED N. GOLDSMITH and EDWARD T. DICKEY.—The purpose of this research was to determine the feasibility of reception of radio-telegraphic signals by the sense of taste. Electrodes were made which could be placed against the tongue in such a way as to cause a taste sensation when a source of potential was connected to them. Tests were made, using low-potential direct-current and 60-cycle alternating current, to ascertain the amount of energy and potential necessary for taste reception. The reception of actual signals from an antenna was tried. It was found impossible by using four stages of amplification to obtain taste sensations from all signals the audibility of which was greater than 500 in the detector circuit. The results obtained thus indicate that from an electrical standpoint it is possible to receive radio-telegraphic signals by the sense of taste. When compared to the sense of hearing or even of sight, however, the sense of taste is much inferior as a means for receiving intelligence.—*Proceedings Institute of Radio Engineers*, June, 1921.

Miscellaneous

A Recently Developed Dust Explosion and Fire Hazard.—DAVID J. PRICE.—The improper installation and adequate protection of incandescent lamps and circuits constitute a fire and dust explosion hazard in dusty industries. Methods of preventing such explosions are discussed.—*Circular No. 171, Bureau of Chemistry, U. S. Department of Agriculture*, May, 1921.

Electrical Manufacturing Tendencies in the United States of America.—A. M. RANDOLPH.—The writer refers to standardization of production and research and other tendencies among American manufacturers, which he considers have an important bearing on the possible export of electrical machinery from the United States.—London *Electrician*, May 20, 1921.

Recent Improvements in Steam-Turbine Design.—The products of the English Electric Company are dealt with in this article. This firm, it is said, first introduced the "disk and drum" or hybrid Curtis-Parsons machine, but now favors the pure-impulse type. The machines manufactured by this company are said to range from 100 kw. at 5,000 r.p.m. to 30,000 kw. at 1,500 r.p.m.—London *Engineer*, May 27, 1921.

Scientific and Industrial Research

(Printed in the Third Issue of Each Month)

A Department Devoted to Reports of Investigations Contemplated or Completed, Research Facilities Available, and Suggestions for Co-operative Work.

Conducted by Prof. Vladimir Karapetoff
Cornell University, Ithaca, N. Y.

Research in Progress and Completed

[When investigations which have been completed are, in the opinion of the editors, of wide enough interest to the field we serve, details thereof will be presented in other parts of this paper. Contemplated research or that which appears to have limited appeal will be only briefly reported in this section, but details may be had by communicating with the investigator or institution named in the report. Readers are referred to the department "Digest of Electrical Literature" for investigations reported in other journals. The news and engineering sections should also be followed for research reported before technical societies.]

AMPLIFIER, THERMIONIC, OF VARIABLE AMPLIFICATION RATIO.

A means has been found by which the amplification ratio of a vacuum-tube amplifier may be varied without changing the input impedance of the tube as a whole. Two tubes are used, and the signals amplified by the first are impressed on a variable resistance by inductive action. The input terminals of the second tube are shunted around this variable resistance, so that any desired part of the potential drop across the resistance may be impressed upon them. This gives any desired amplification ratio in the output of the second tube, and the impedance of the whole amplifier to the incoming signals has a substantially constant value.—*Western Electric Company, Ltd., London, England.*

CORONA, WAVE FORM OF.

A study has been completed of the wave form of the discharge of the high-voltage corona and its bearing on the indications of the corona voltmeter. By using a thermionic amplifier for magnifying the indications of the corona voltmeter it has been found possible to use a portable needle instrument and also a loud-speaking telephone as indicators of the first appearance of corona.—*J. B. Whitehead and N. Inouye, Johns Hopkins University, Baltimore, Md.*

IGNITION TEMPERATURE AND SPONTANEOUS IGNITION OF VARIOUS MATERIALS.

Data have been collected on the ignition points and the spontaneous ignition of various important materials used in the principal industries. Among the materials investigated were newspaper stock, motion-picture film and a wool and cotton insulating felt.—*Bureau of Standards, Washington, D. C.*

INDUCTANCE OF CIRCULAR COILS OF RECTANGULAR CROSS-SECTION.

Tables have been prepared which reduce the calculation to the simplest kind of an arithmetical computation. In the preparation of the tables formulas due to Lyle, Dwight and Butterworth have been used, that formula being chosen in each case which gave the best convergence. The tables enable the inductance to be found with an accuracy of better than one part in ten thousand for the ideal case of uniform distribution of the current over the cross-section. The correction for the space occupied by insulation is small in the case of coils of round wire, wound closely in a rectangular cross-section, and unimportant in the case of "honeycomb" coils.—*F. W. Grover, Union College, Schenectady, N. Y.*

INDUCTANCE OF COAXIAL CIRCLES.

New formulas have been derived for calculating the coefficient of inductance of coaxial circles. The method is based on the computation of elliptic integrals, using scales of arithmetic geometrical means. A comparison with the older formulas in use shows a marked advantage of the new method. A complete account of the proposed method has been communicated to the Royal Society of London.—*Louis V. King, McGill University, Montreal, Canada.*

INSULATING MATERIALS, CONDUCTIVITY OF NEAR BREAK-DOWN VOLTAGE.

In a series of tests on the conductivity of insulating materials near the break-down voltage the recording instruments used were protected from injury in case of puncture by placing an insulated hot cathode rectifier in series with the sample being tested, so that the current through the sample could be limited by controlling the temperature of the hot cathode. When with a given applied voltage the current did not reach a constant maximum value upon raising the cathode temperature the voltage had reached the break-down point. Three classes of insulating materials were found, viz., (1) those which obey Ohm's law throughout, (2) those which obey Ohm's law up to near break down, and then the conductivity increases at an accelerated rate, and (3) those for which the conductivity increases over the entire range of voltage at an accelerated rate to break down. Materials in the third general class have the greatest dielectric strength, and those in the first class the least. Results have been obtained for untreated cement paper, paraffined fishpaper and black treated cloth, which are taken as representative respectively of the three classes.—*J. E. Schrader, Research Laboratory, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.*

KENOTRON, STUDY OF.

A theoretical study is being made of the pulsations of direct-current voltage as obtained from a kenotron tube with various methods of connection.—*E. J. Berg, Union College, Schenectady, N. Y.*

LAMP, PROJECTION, FOR MOTION PICTURES.

A new incandescent lamp has been developed for motion-picture projection. The principal distinctive feature is the filament supports, which are arranged to hold the filament loosely so as to allow for varying contraction of the filament and supports when the lamp is turned on and off. The supports are also arranged to prevent the distortion of the filament, and as a result the lamp better maintains its candlepower throughout life.—*N. E. L. A. Lamp Committee.*

LAMP, MILL TYPE.

A new incandescent tungsten lamp has been developed to replace inefficient carbon lamps in places where lamps are subjected to rough treatment. Tests indicate that the new lamp is mechanically about five times as strong as the regular tungsten lamp.—*N. E. L. A. Lamp Committee.*

MAGNETIZATION IN IRON.

An experimental investigation is being carried out on the effect of magnetization upon the atomic structure of iron. Very little work has been done in this field heretofore.—*W. P. Davey, Research Laboratory, General Electric Company, Schenectady, N. Y.*

MERCURY VAPOR, CONTINUOUS SPECTRUM FROM.

Under certain conditions the discharge through mercury vapor gives a green glow which shows the ordinary line spectrum of mercury vapor together with one which is continuous from the red into the ultra-violet, being very prominent in the green. This is the same spectrum as that shown by fluorescent mercury vapor. Two conditions are necessary for obtaining this by an electrical discharge with any considerable brightness—the discharge must pass through hot mercury vapor that is not very far from the point of condensation, and the current density must be small. As the current density is increased the line spectrum becomes more prominent and the continuous spectrum less so.—*C. D. Child, Colgate University, Hamilton, N. Y.*

WHEATSTONE BRIDGE FOR CAPACITY AND INDUCTANCE.

A universal bridge for measuring inductance and capacity with the maximum simplicity, rapidity and accuracy has been designed. The instrument is compact and allows the making of a very large number of standard bridge-method tests.—*Developed by the late C. V. Drysdale, London, England.*

Suggestions for Research

COOLING OF TRANSFORMERS AND ALTERNATORS BY REFRIGERATING MACHINE.

It has been claimed that refrigerating machines may be advantageously used in certain cases for cooling transformers and other electrical machinery. A small refrigerating machine sufficient to care for normal load may be used to care for the maximum power demand by overcooling it. Investigation is desired as to the practibility and resultant economy of such an arrangement. This plan has been successfully tried recently in Europe.

COMMUNICATION CIRCUITS, RESONANT SHUNTS FOR.

The use of resonant shunts, similar to those used on power lines, has been proposed for communication circuits. Such shunts have been used where telegraph service is disturbed by the fundamental frequency of nearby power circuits and have proved successful in telegraph lines paralleling 25-cycle and 60-cycle power systems. Investigation is desired as to their applicability on telephone circuits.—*Inductive Interference Committee, N. E. L. A.*

CURRENT TRANSFORMERS, DIFFERENTIAL.

There is a need for development in the design of current transformers so that one-half of the secondary winding can be reversed, thereby giving a differential transformer.—*Meter Committee, N. E. L. A.*

CURRENT TRANSFORMERS FOR LARGE INSTALLATIONS.

Most current transformers at the present have been designed for station use, and less attention has been paid to types for metering large installations. The demand for this kind of service has increased rapidly during late years, and it is desired that special consideration be given to the requirements for transformers used for this purpose.—*Meter Committee, N. E. L. A.*

ELECTROSTATIC FIELD, MEASUREMENT OF INTENSITY OF BY POLARIZED LIGHT.

It may be possible to measure the intensity of an electric field by observing its effect upon a beam of polarized light passed through a small crystal.—*A. S. Langsdorf, St. Louis, Mo.*

FIRES IN INSULATING OIL FROM ELECTRICAL BREAK-DOWNS.

An investigation is desired upon the effectiveness of the so-called Foamite system for fighting oil fires in electrical apparatus. The system has been employed by various oil companies in fire fighting, but its advantages for oil fires from electrical breakdowns, under the conditions obtaining with transformers, circuit breakers, etc., are yet to be shown. One of the N. E. L. A. committees recommends such research.

GLASS, CONDUCTIVITY OF.

Glass in the liquid state and at comparatively high temperatures is a conductor of electricity. The use of electrically heated glass furnaces may be the solution of a large number of problems connected with the production of certain kinds of glass. There is a need for research in this field, particularly to obtain accurate measurements of the resistance of known glasses, to arrive at the variation of the resistance with the temperature, and to find the effect of variables such as "stones," "bubbles," etc., in the glass.—*F. L. Bishop, University of Pittsburgh.*

MAGNETIC STORMS, EFFECT ON TELEGRAPH AND CABLE LINES.

During certain magnetic disturbances and auroral displays the generated earth currents caused serious interruption on telegraph and cable lines. The general effect of magnetic disturbances is to diminish the intensity of magnetization of the earth's field, in severe cases as much as 10 per cent. Further research in this field is desired.—*L. A. Bauer, Washington, D. C.*

POTENTIAL TRANSFORMER, DESIGN OF.

An improvement is desired in the construction of secondary leads, bushings, etc., in potential transformers so that oil will not siphon up through the leads and leak around the bushings. —*Meter Committee, N. E. L. A.*

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

Col. Kelly Found Europe Watching Our Water-Power Law Operation

COL. WILLIAM KELLY, the chief engineer of the Federal Power Commission, has returned from a visit to England and France, where he conferred with government officials in charge of water-power matters. He found that officials in both France and England were watching with much interest the effect of the recent water-power act on American development. He pointed to the presence of the French Commission in this country as an evidence of the interest France is taking in this subject.

While Col. Kelly found that financial conditions in France are such as to preclude any great amount of hydro-electric development there at this time, he was surprised to find that plans are practically in complete form for a number of important projects. Principal among them is the development of the Rhone which is expected to furnish power for the Paris district and for the electrification of some railroads.

Col. Kelly familiarized himself with the work being done by the British government on the problem of utilizing the tides for power purposes. Considerable work along the same line is being done by the French engineers.

New England Utilities Escape Heavy Storm Damage

WITH the exception of the Edison Electric Illuminating Company of Brockton, Mass., public utilities in New England were fortunate in escaping serious interruptions of service during the unprecedented rain and thunderstorms which swept over the territory centering around Boston at the end of last week. At Brockton the failure of dams unconnected with company operations flooded the basement of the East Bridgewater generating station and cut off the blowers, necessitating reliance upon natural draft. This forced a reduction of load from about 9,000 kw. normal output to about 2,500 kw. Monday morning and a corresponding loss in power load. By Monday night the removal of flood water by pumping had enabled the load to be increased and about 5,000 kw. was taken on Tuesday morning, with every expectation of early resumption of virtually normal load.

The New England Telephone & Telegraph Company suffered a maximum of about 3,000 lines out of commission, due chiefly to the flooding of manholes and to overhead line troubles resulting from high wind. About 6.3 in. of rain fell in less than twenty-four hours. The New England Power Company had little trouble in central New England beyond temporary disturbances due to lightning and the slight flooding of an industrial substation at Fitchburg. The Tenney companies at Malden, Revere and Salem, Mass., escaped serious damage and the Narragansett Electric Lighting Company, Providence, R. I., reports little trouble. The Edison Electric Illuminating Company of Boston sustained some interruption due to lightning and the flooding of manholes, basements, etc., and a short-circuit in the Roxbury district. Taxicabs were commandeered for fuse replacement work and rapid restoration of service was pushed. Street lighting service in Roxbury was cut off for a short time and the Edison-New England power tie line was shut down temporarily. The total physical damage to the system was slight.

Non-Power Dam Proviso to Prevent Water-Power Interference

SO AS NOT to establish a precedent which might interfere with the future use of water for power purposes, the Senate committee on commerce has worked out a proviso which is to be made a part of future authorizations for the construction of dams for non-power purposes. The proviso reads as follows:

> That the consent hereby given shall terminate and be at an end from and after thirty days' notice from the Federal Power Commission, or other authorized agency of the United States, to said company or its successors; that desirable water-power development will be interfered with by the existence of said dam; and any grantee or licensee of the United States proposing to develop a power project at or near said dam shall have authority to remove, submerge, or utilize said dam under such conditions as said commission or other agency may determine, but such conditions shall not include compensation for the removal, submergence, or utilization of said dam if the water level to be maintained in said power project is higher than the level of the crest of said dam.

The proviso was made a part of the bill giving authority to the Trumbull Steel Company to construct a dam across the Mahoning River near Warren, Ohio. With that proviso, no further objection was offered to the measure, and it was passed. The House accepted the amendment. A similar bill authorizing the construction of a dam across the Wabash River at Huntington, Ind., also has been approved by both houses.

Ogden, Utah, Has Model Electrical Home

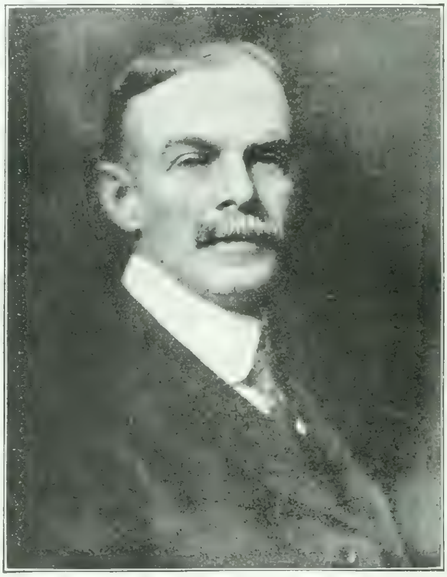
OGDEN'S model electrical home was opened for the first time to the general public on June 18. The visitors found in the home a complete showing of the latest and best methods of installing a modern home-lighting system and a large number of electrical labor-saving devices. From the beautiful light fixtures at the front entrance to the lighting switch at the garage door, in the basement, the electrical equipment is complete.

The companies that have joined in the enterprise are the Lighthouse, Utah Power & Light Company, Redfield Electric Company, Larison Electric Company and Ogden Electric Supply Company. The home was open every afternoon and evening from June 18 to 27 from 2:30 to 9 p.m.

Prof. F. B. Crocker, Father of American Electrical Standards, Dead

PROF. FRANCIS BACON CROCKER, one of the best known of American pioneers in electrical manufacturing, engineering and teaching, died at his home in New York City Saturday evening at the age of sixty years. Prof. Crocker had suffered from an incurable malady almost continuously for many years.

Born in New York on July 4, 1861, he was graduated from the School of Mines at Columbia University in 1882. A year later with Charles G. Curtis he formed the firm of Curtis & Crocker, patent attorneys and patent experts. Much of the spare time during this period was spent in research and resulted in a number of inventions. In 1886 the two partners established the C & C Electric Motor Company, from which he resigned two years later. At that time he joined with Schuyler Skaats Wheeler, with whom he had been associated for some time, in the formation of what is now known as the Crocker-Wheeler Company. The next year he took charge of the newly established department of electrical engineering at Columbia, becoming full professor in 1893. He remained in that work until the discomfort of poor health twenty years later caused him to resign.



FRANCIS BACON CROCKER

Many have been his contributions to the development of the electrical art. With his fellow workers Curtis and Wheeler he created the commercial motor of standard specification. As father of American electrical standards, however, he will probably be best known in the engineering profession. He was chairman of the A.I.E.E. committee which drew up the original standardization rules as well as of the committee which revised them. Besides he was chairman of the conference of insurance and engineering representatives that formulated the National Electrical Code. To him also is credited the choice of the name "henry" as the international unit of inductance.

So long as his health permitted he was very active in the industry. He has held many important offices in the American Institute of Electrical Engineers, of which he was a past-president. He was also president of the Electric Power Club and a past-secretary of the International Electrical Congress. His writings have been numerous and include a two-volume treatise on "Electric Lighting" and one on motors. His latest contribution to electrical literature was on the subject of temperature rating of motors and appeared in ELECTRICAL WORLD April 30, page 977.

Professor Crocker was a man of many friends, to whom the news of his death came as a great shock. His determination to master science rather than let science master him made his life one of constant graciousness. Some of those who knew him for a great many years and worked with him have made the following tributes to his memory.

Advocate of Quality

Prof. Crocker was remarkable for flexibility, adaptability and responsiveness. He was very clear-headed and, as every one knows, intelligent. His judgment was excellent. These qualities led to his opinion in conference being sought by several of our greatest inventors. The position he occupied in this respect is unique and I know of no other man in the world's history who has performed a similar function. He was the partner in invention with, or the collaborator with, in their respective important inventions in different lines, Charles G. Curtis, who got up the C & C motor and the Curtis turbine; Charles S. Bradley, whose numerous inventions parallel those of Tesla; Peter Cooper Hewitt in aviation, and, of course, devices, etc., used by the Crocker-Wheeler Company.

He was a leader in bringing about standardization and was a great believer in simplifying things and in expounding problems in a way that every one could understand. He believed with me that things should not be made to appear complicated or "technical" to the public, but simple, and he had a remarkably clear, concise and at the same time easy and interesting writing style. These two characteristics made him much in demand as a lecturer and writer and made a success of the electrical course which he established at Columbia.

He was fair and impartial and of a judicial turn of mind, being almost able to see the other fellow's side more clearly than his own.

He always and consistently advocated a good quality of work and scientifically correct design.

He, Charles G. Curtis and myself have been associated and in almost constant contact about technical matters for forty years, which I am inclined to think is a longer span of active co-operation than was enjoyed by any of the numerous other teams of electrical men, such as Thomson and Houston; Arnoux and Hochhausen; Sprague, Duncan and Hutchinson; Goulard and Gibbs; Stanley, Kelly and Chesney, etc.

SCHUYLER SKAATS WHEELER.

No Place for Empiricism

Francis Bacon Crocker was a great pioneer in electrical engineering. The history of electrical technology in the United States will be always associated with his name. The Crocker-Curtis motor of 1884 was the foundation of the C & C Motor Company and it was a wonder of efficiency for those days and for the size of the motor. It is the earliest monument to Crocker's life-long faith that empiricism has no place in the art of designing electrical machinery. When he became the technical head of the newly founded department of electrical engineering at Columbia University he became the leader of those men who believed that there is such a thing as the science of electrical engineering which is entirely distinct from every other engineering and from physics and that it has nothing in common with empiricism. It was that belief which inspired Crocker's magnificent work on electrical nomenclature and standardization.

Most of the successful electrical inventors in the United States knew Crocker and sought his advice, and they relied upon the verdict of his unerring judgment. The technical schools of the United States accepted the verdict of his judgment when in the organization of their electrical engineering departments they followed the program first mapped out by him at Columbia.

I have known Crocker for thirty-two years; during twenty-two of these years we were colleagues at Columbia University and saw each other almost every day. He was really my teacher and the only teacher in electrical engineering, and I was never as happy as when Crocker consulted me on pure theory and accepted my opinion. Few mortal men can fill the place once occupied by Crocker. Few professors can captivate the heads and hearts of students as Crocker could, and few were admired as much as Crocker was admired by his students and by his former students. M. I. PUPIN.

Prof. Crocker's death removes one of the outstanding pioneers of the electrical industry. His work and teaching as founder and head of the school of electrical engineering of Columbia University contributed much to the growth and importance of the electrical development of this country.

As the first chairman of the standardization committee of the American Institute of Electrical Engineers, Prof. Crocker's painstaking work earned the lasting gratitude of everyone connected with the electrical industry throughout the world. THOMAS A. EDISON.

I regret very much to learn of the death of Prof. F. B. Crocker. He was one of the early pioneers whose work has left its impress on the art, while his services to the profession in many capacities have been invaluable. Of a most attractive personality he was esteemed by all who knew him. My own friendship with him covers nearly forty years past. ELIHU THOMSON.

Deserves Credit for Standardization

The electrical industry mourns the loss of one of its eminent leaders and educators in the passing away of Prof. F. B. Crocker, one of the pioneer workers in the field of electrical applications. He brought to his activities in the educational field a thorough grasp of the commercial and practical problems of the industry which made the electrical engineering course of Columbia University a model of sound practical teaching. He deserves the greatest credit for initiating the work of standardization in the electrical industry and the original standardization rules of the American Institute of Electrical Engineers formulated under his chairmanship bear the impress of his thoroughly practical and constructive viewpoint. He had a proper appreciation of the difficulties encountered by the pioneer workers in the field and he was deeply interested in having a proper record of the early history and successive stages of progress in the art. He will be mourned by a large circle of friends and co-workers who have in the past few years missed his earnest and interested co-operation. JOHN W. LIEB.

Prof. Crocker has been a force for advancing the sciences and arts associated with electrical engineering. His efforts which resulted in the establishment of the standards committee of the American Institute of Electrical Engineers in 1898, of which distinguished committee he was for many years chairman, has had much influence upon the electrical engineering arts in this country. He has also been of influence in improving international standardization in electrical engineering; the internationalization of electrical and magnetic units was close to his heart. His inventions and writings have also been of service in the development of electrical engineering. All electrical engineers pay tribute to Prof. Crocker and all who know him will pay it not only on account of his ability and service in the profession but also on account of his delightful characteristics as a friend. DUGALD C. JACKSON.

Prof. Crocker's death closes a career of achievement and work faithfully performed by a genius of rare ability. The results of his life work will remain as a permanent benefit to the electrical industry and will be an inspiration to future generations of electrical engineers.

JAMES BURKE.

Will Be Remembered as an Engineer

Prof. Francis B. Crocker laid the foundations of electrical engineering at Columbia; but although he was eminent as a teacher it is especially as an engineer that he will be remembered. He was an unusually gifted designer of electrical machinery. In his chosen fields of study, such as the theory of high-potential direct-current generators and motors and of the automatic regulation of alternating circuits, he had few equals. EDWARD J. NICHOLS.

The death of Francis B. Crocker will be deplored by all who have come in contact with him. For almost a quarter of a century throughout his interest in international standardization I have had the opportunity of meeting him and of appreciating the devotion and enthusiasm which he brought to his task. A high type of gentleman, a man of vision as is evidenced by his early work in connection with the founding of the Crocker-Wheeler Company, and also by his career as a teacher of electrical engineering at Columbia University, Professor Crocker will long be remembered as one of the notable figures among the electrical engineers who have created and shaped the great industry in the promotion of which we all are engaged. B. A. BEHREND.

Brought Practical Point of View to Teaching

In the death of Prof. Crocker our civilization sustains the loss of one who pioneered for a third of a century as university man and engineer. He carried a leading part in the generation which has followed that of gramme and which has taught the world the intelligent and abundant use of dynamos and motors. In developing the university curriculum in electrical engineering he acted with extraordinary energy and wisdom from the beginning. He demonstrated the necessity for the teacher to engage in practice as well as in study. The fundamentals of electrical action were discovered in the university. Professor Crocker showed by his life and example that the university has a corresponding work to do in the development of the great industries that are founded upon such discoveries.

HARRIS J. RYAN.

I greatly regret to learn of Prof. Crocker's death and wish to add my tribute to that of others in recognition of his ability as an educator and his pioneer work in the field of electrical development. BION J. ARNOLD.

His Opinion Widely Sought

The death of Prof. Crocker is the loss of an old friend whose keen and sound judgments were highly valued. He was one of the great figures in the early days of electrical developments who remained conspicuous, beloved and honored to the last. Above all things he was level headed and judicious and his opinions were therefore widely sought and respected. His loss removes one of the finest characters among the pioneers of electrical engineering and is deeply felt by a host of friends old and new. LOUIS BELL.

Prof. Crocker's brilliant work in his design of electric motors, the arc furnace and the chemistry of the primary battery at a time when these were virgin subjects resulted in his selection by Columbia to create its department of electrical engineering, one of the first in the country, and in his selection a few years later for the presidency of the American Institute of Electrical Engineering. He was the principal founder of the whole movement for uniform electrical standards and a large contributor to the progress of dynamo-electric machinery and also largely responsible for the creation of the international electrotechnical commission. His books are clear and constructive, and his engineering judgment always sane and balanced. His principal qualities were characterized by an unusually high sense of honor and loyalty, the electrical art notes the passing of a fertile and constructive pioneer and a large circle mourns a rare teacher and a rare friend.

GANO DUNN.

Electrical Workers' Strike Darkens Chicago Streets

SOME sections of Chicago were dark all the night of July 12 as a result of the strike of city electrical workers which began at 1 p.m. on July 12 and was settled at 10.30 p.m. the same night. The strike was called when the City Council finance committee refused increases to thirty-nine telephone operators, engineers and substation watchmen and granted increases averaging $1 per day to 300 other men on the municipal electrical force. Conferences lasting through the day had failed to prevent the strike. It was not until the chief of police threatened the strikers and their leader with indictments for manslaughter and murder if any crimes or accidents resulted from the lightless streets that the strikers capitulated. The substation supplying the downtown section was cut in and other substations followed until by midnight 60,000 of the 62,000 street lamps were burning. According to the City Council the pay increase demanded is still undecided and will come up for discussion at a later date.

Commonwealth Edison Brings Out Six Million 6s at 6¾ per Cent

TO REIMBURSE capital expenditures the Commonwealth Edison Company has sold to a large underwriting syndicate $6,000,000 of 6 per cent first mortgage gold bonds dated Sept. 1, 1908, and due June 1, 1943. The bonds are being offered to investors at 91½ yielding about 6¾ per cent. All former issues now outstanding bear a 5 per cent interest rate.

The company has 485,000 customers at the present time, having added 59,967 or 14.5 per cent during 1920.

Attleboro Company Reduces Rates

FOLLOWING conferences between the Attleboro (Mass.) Chamber of Commerce and the Attleboro Electric Company a reduction in rates for both lighting and power service has been announced, effective July 1. Lighting service is now billed at 11 cents net per kilowatt-hour instead of 12 cents. The net price of power in the new schedule ranges from 6 cents per kilowatt-hour from zero to 1,000 kw.-hr. to 2.25 cents for 20,000 kw.-hr. and above. Of the sixteen blocks of energy classified in the power rates, twelve were decreased. The four classes increased include the largest users, who now pay about 3 mills per kilowatt-hour more than before. The old schedule ranged from 7.7 cents to 1.925 cents. The minimum charge remains unchanged. In arranging the new schedule it was pointed out by the company that some of the large power business was being done at a loss and at a lower rate than is enjoyed by some of the larger customers of the Narragansett Electric Lighting Company in Providence, R. I., which supplies energy to the Attleboro Company. About $8,000 per year will be saved the customers of the Attleboro Company by the new schedule. Highly complimentary comment has appeared in the Attleboro press regarding the harmonious negotiations which have been conducted by the local trade organization and Edgar Tregoning, superintendent of the Attleboro Company.

Non-Water Power Application Approved

AFTER having heard from the chief of engineers in person as to the application of the Arkansas Hydro-Electric Development Company, the Federal Power Commission at its meeting on July 11 withdrew its objection and voted that the project will not affect the interests of interstate commerce. The project is on the Little Red River in White and Cleburne counties, Arkansas. The company proposes to build a dam near Judsonia to raise the water to a 60-ft. level and to build a second dam near Higden to raise the water level 70 ft., thereby storing some 9,000,000 cu.ft. of water. The chief of engineers held that the Little Red River above Bee Rock, 6 miles below the proposed development, is not navigable. Even below that point it is navigable only by back water from the White River.

Action on the application of the Wisconsin-Minnesota Light & Power Company and on the application of C. E. Loose was deferred until the next meeting of the commission.

The commission approved applications in the following cases:

Project No. 17.—Preliminary permit in favor of Western Tie & Timber Company for power development near Eminence, Shannon County, Mo., in the Current River. The project is rated as being capable of developing 8,000 hp.

Project No. 32.—Preliminary permit in favor of R. W. Hawley for a power development involving 60 hp. on Silver Creek, Eldorado County, Cal.

Project No. 52.—Preliminary permit in favor of the city of Dothan for a development involving 8,000 hp. at Chalkers Bluff, Geneva County, Ala., in the Choctawhatchee River. It was voted to reject the application of the Huston Power Company (Project No. 164) in conflict with the application of the city of Dothan.

Project No. 77.—License in favor of the Snow Water & Power Company for a development involving 15,000 hp. on the South Fork of Eel River in Lake County, Cal.

Project No. 78.—License in favor of the Western States Gas & Electric Company for a development involving the enlargement of an existing project of about 10,000 hp. on the American River in Eldorado County, Cal.

Project No. 166.—License in favor of the McConnellsville-Malta Electric Company covering an existing project involving 210 hp. located at U. S. dam No. 7 in the Muskingum River at Malta, Ohio.

Project Nos. 150, 180 and 181.—License in favor of the Pacific Gas & Electric Company covering transmission lines in Wapavai and Maricopa Counties, Arizona, and in Yuma, Nevada and Placer Counties, Cal.

Project No. 198.—License in favor of the Boston & Montana Milling & Power Company covering a transmission line in Beaver Head County, Mont.

Electrical Page Committee Formed in New England

UNDER the auspices of the New England Geographic Division of the National Electric Light Association an "electric page" committee has been organized with headquarters at Room 623, 149 Tremont Street, Boston. This committee, representing all branches of the industry, has been formed to promote concentrated advertising of electrical products and service in the newspaper press. L. D. Gibbs, Edison Electric Illuminating Company of Boston, is chairman of the committee, the other members being C. A. Andrews, Manchester (N. H.) Traction, Light & Power Company; E. L. Olds, Twin-State Gas & Electric Company, Boston; G. W. Hurn, Haverhill (Mass.) Electric Company; M. F. Falk, Union Electrical Supply Company, Providence, R. I.; L. L. Gaillard, New England Engineering Company, Waterbury, Conn.; W. F. Abely, Western Electric Company, Boston; M. R. Griffeth, General Electric Company, Boston; J. P. Coghlin, Coghlin Electric Company, Worcester, Mass.; William Gould, Gas & Electric Improvement Company, Boston; E. M. Graham, Bangor (Me.) Railway & Electric Company; Frederic Cutts, General Electric Company, New Haven, Conn., and H. S. Knowlton, New England editor ELECTRICAL WORLD, Cambridge, Mass.

Pennsylvania Electric Association to Meet Sept. 7-10

ANNOUNCEMENT is made this week that the Pennsylvania Electric Association will hold its annual convention at Bedford Springs, Pa., Sept. 7-10.

There will be morning and afternoon sessions except on Saturdays, when the final session will be held in the morning. The program opens on Wednesday evening with the reception to the president. On Thursday morning the chief features will be the address of the president, Henry Harris of Wilmerding; the appointment of auditing and nominating committees and a paper on "The Super-power Survey as It May Affect Pennsylvania" by Harold Goodwin, Jr. The afternoon session will be a commercial meeting with a number of interesting reports and papers. The technical session will be held on Friday morning, while the accounting session will be held on the morning of Saturday. A feature of the entertainment will be nightly radio concerts furnished by the Westinghouse Electric & Manufacturing Company of Pittsburgh.

Prominent speakers will address the public policy session on the evening of Friday, Sept. 9.

Kva. Rather Than Kw. Demand Favored as Rate-Making Basis

A STRONG sentiment for the use of the kva. demand in place of the kw. demand on which to base rate schedules was manifest at the meeting of the Ohio Electric Light Association at Cedar Point on Wednesday, when the meter committee report presented by S. C. Henton was discussed. D. J. Angus discussed the two definitions for power factor that the American Institute of Electrical Engineers has had under consideration, pointing out that the first definition took into account the increased investment that would be required as a result of unbalance in the distribution circuits, while the definition that is known as No. 2 and favored as the proper one gives the same results whether the circuits are balanced or not. W. H. Pratt of Lynn, Mass., asserted that there are two conditions involved; one being the condition at the generating station on which the single-phase circuit, unbalanced because of the diversity as between customers, would have little effect, and the condition at the customers' premises because of the effect on the distribution conditions. The definition that seems preferable depended on the condition that was to be covered. R. C. Fryer of Cincinnati also emphasized the same matter and pointed out that the investment required to serve the consumer was one of the vital factors in rate making.

The address of President Hard at the first session of Tuesday afternoon emphasized the importance of the inductive interference and rural distribution problems. He recommended the formation of a committee to study the utility taxation problem. G. S. Merrill, for the illumination committee, laid stress on the necessity of selling light rather than electric light, showing that the day is past when electric light needs to be sold. The problem is now one of selling the proper and efficient use of lighting and educating the customer to the use of the proper amount of light.

Street lighting was discussed by D. L. Gaskill, who presented an analysis of the legal phases of the street lighting situation in Ohio with some suggested forms of specifications, contracts and ordinances. J. C. Martin of Columbus made a strong plea for street lighting rates that would return interest on the property involved in the service.

A review of the court decisions and an argument for the present-day basis of property values was presented in the paper by F. A. Newton of Jackson, Mich., on rate making. In the discussion J. C. Martin of Columbus called attention to the effect of a decision of the Ohio Supreme Court that in its practical effect prevents the inclusion of going value in a property valuation.

Live line maintenance received favorable discussion at the presentation of the report of the transmission and distribution committee, and the discussion also included a plea for standardization of line construction practices. The possibilities in reducing storeroom stocks of material were mentioned in the discussion. The annual banquet was held on Wednesday evening and the session continued over Thursday and Friday.

Secretary Hoover Discusses Our Need of Foreign Trade

"THERE is a feeling of some uneasiness and even of pessimism regarding the future of our foreign trade, in which I do not participate," said Herbert Hoover, Secretary of Commerce, in an address before the National Shoe and Leather Exposition and Style Show in Boston on July 12. Continuing, in part, he said: "Our exports and imports during the last few months have dropped nearly 50 per cent in value from the high water mark of a year ago. Some of this decrease is due to the fall in prices relatively more than volume; some of it to the temporary world depression, and some of it lies deeper.

"The direction of our trade has shifted greatly. During the last year about one-half of our whole foreign trade was with Europe, but of our exports to Europe 80 per cent were foodstuffs and raw material; of our exports to states outside of Europe about 75 per cent were manufactured goods. Europe in turn is our serious competitor in the marketing of our manufactured goods to the rest of the world.

"Another great but uncertain shift in world forces will arise out of Germany. Beyond the reparation payments of about $750,000,000 a year minimum, she must also sell goods abroad in the amounts necessary to buy her imports of food and raw materials. Any calculation based on the pre-war trade of Germany implies an enormous increase—perhaps more than doubling—of her pre-war exports. In view of the export duty and other payments, she must produce these goods for about one-half our production cost in order to take our markets. Such an increase in exports must be manufactured goods, and until the world consumption grows these must be marketed in the displacement of the goods of other industrial nations. We shall certainly feel the effects of this flow of goods that must be produced if she is to make reparation payments. On the other hand, Germany must take more raw materials from us for this purpose. In any event, the crowding in the market of German exports will affect her immediate neighbors more than ourselves.

"While establishing a proper equilibrium of imports and exports, if we would maintain our economic position, we must continue to give credits to buyers of our goods and if we should demand interest or principal on our established loans we would nullify any benefits of such credits.

Sells $500,000 Preferred to Customers in Twenty-two Days

AN EXTREMELY successful customer ownership campaign was completed July 8 by the Adirondack Power & Light Corporation, which sold $500,000 worth of 8 per cent preferred stock in twenty-two working days—with a considerable over-subscription. The issue was sold at low cost, entirely by company employees. Only a small amount of newspaper and direct-by-mail advertising was done. The campaign was under the supervision of Charles S. Ruffner, general manager, and the active direction of Percy H. Whiting.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest

Economy of Loading Coils on Telephone Circuits.—The great saving in telephone operation made possible by the use of loading coils was emphasized during one of the discussions at the Salt Lake City convention of the A. I. E. E., where it was brought out that in New York City alone $25,000,000 in investment and an annual charge of $4,000,000 had been saved by their use.

Electricity Supply in South Africa.—Following the example of Great Britain, steps are to be taken to reorganize and co-ordinate the electricity supply undertakings of South Africa. These include the passing of an act for unifying and modernizing the existing legislation governing the electricity supply in the various states of the South African Union, for the appointing of a controlling authority and for fixing standard voltages and frequencies. It is intended to adopt electric traction on some of the railroads, and a definite line of development to supply power for all purposes is the aim of those behind the movement. Existing electrical installations in South Africa are mainly owned and run by the municipal councils.

Pioneer New York Skyscraper Adopts Central-Station Service.—The Potter Building, at Park Row and Beekman Street, New York City, a twelve-story office structure which in its early days ranked among the skyscrapers, has recently abolished its lighting plant and its hydraulic elevator equipment in favor of New York Edison Company service. As part of the change, says the *Edison Monthly*, the high-pressure steam plant, with its three generators, pumps and other equipment, was moved. The four passenger elevators and the steam-operated sidewalk lift have been re-equipped so that they are now all electrically operated. The space gained by the abolition of the steam plant is now used as a storage vault. Frequent interruptions to the lighting service which had interfered with the tenants' satisfaction under the independent-plant system will now be over.

Water Power in Ireland.—A parliamentary committee which has been considering the water-power resources of Ireland has, according to the London *Electrician*, reported that 500,000 hp. is available continuously in that island and can be economically dveloped. The value of this power is put at £10,000,000 annually and is equivalent to the power generated by the annual consumption of 7,500,000 tons of coal. Detailed investigations which were made of the Lower Bann, the Lower Shannon, the Lower Erne and Liffey show that considerable power is available in these rivers as well as in the high-level lakes in Donegal, Connemara, Kerry and Wicklow. The committee urges that the work of developing Irish water-power sources be begun at once in the interests of fuel saving. Six hydro-electric stations on the Liffey are proposed, from which the power requirements of the Dublin district could be met.

Hydro-Electricity in the Holy Land.—According to a very roseate-hued estimate published in European papers, there is sufficient water power in Palestine for generating 1,000,000 electrical hp. An engineer interested in the plan for setting up a modern Jewish state in that country has recently outlined in the London *Times* a project to erect hydro-electric works for utilizing the water power of the Jordan and to build a dam at the southern end of the Sea of Galilee, where the main generating station would be established. The scheme would be carried out gradually as the demand for lighting and power increased.

West Penn Company Helps Sick and Wounded War Veterans.—By an arrangement with the West Penn Power Company, La Société des Quarante Hommes et Huit Chevaux, Voiture No. 5, Pittsburgh, has obtained an excellent summer camp site, rent free, with facilities for canoeing and bathing, on the Allegheny River near the company's new power plant at Springdale. While nominally for use of members of the society named, the camp will afford free outings to wounded World War veterans and other service men who have become incapacitated through illness and are quartered in hospitals in the Pittsburgh district. Three hundred were entertained on the formal opening day. The camp is complete with commissary, mess tent and sleeping tents.

Will Electricity Abolish the Farmer's Time-Honored Right to Grumble About the Weather?—A writer for the British Electrical Development Association, advocating a more general employment of electricity in farm work, expresses the perhaps overoptimistic view that on a farm completely equipped for electric service ground for the perennial complaints of the agriculturist against the weather would almost disappear, "owing to the fact that work can be done much more quickly in the preparation of the ground and cultivation. Moreover, protection can be afforded during the germinating, growing and maturing periods of the crops which protects them from adverse influences of the extremes of bad weather and conditions. At haymaking time the grass can be mowed in accordance with the original program, and then, if dark, threatening clouds spring up, the cut grass can be dried and made into hay by the aid of electric power, regardless of the absence of warm sunshine. Again, in harvesting, the increase of speed possible by electric methods is very advantageous, coupled with the fact that electrically operated binders can be used to cut even tangled crops."

Spiders, Rats and Vegetable Growths Make Trouble for Electrical Men.—Certain parts of South America, particularly Brazil, are, according to the United States Rubber Company, the habitat of an enormous spider that weaves its web around telephone wires strung on the cross-arms of poles. The web is spanned across several wires. It is heavy and of a thick texture. Until they discovered the source of the trouble the telephone companies were much perplexed when in the late evenings and nights frequent short circuits tied up their lines. When the sun is out the webs are dry and do no harm, but at night when the webs are covered with dew the trouble begins. The only remedy is the constant brushing away of the webs. On board ship trouble results when rats eat away the insulation on the electric wires. To meet the situation one manufacturer of wire mixes rat poison with a rubber compound that is used on the tape wound on the conductors. This scheme is said to be effective. In Porto Rico aërial plants attach themselves to the suspended telephone lines. These plants grow to large proportions and look like festoons hanging from the wires. The growths collect moisture and thus interrupt the service.

Associations and Societies

Engineers in Western Massachusetts Elect Officers.—Officers of the Engineering Society of Western Massachusetts have been elected as follows for the coming year: President, George E. Williamson of Mittineague; vice-presidents, C. B. Wheeler of Pittsfield and Frederic H. Fay of Boston; secretary and treasurer, Winfield E. Holmes of the Samuel M. Green Company, Springfield; directors for two years, George W. Atkinson of Springfield, Fred L. Hunt of Greenfield and F. F. Brand of Pittsfield; directors for one year, Alexis E. Trudo of Chicopee, Harry M. Chase of Holyoke and Edwin Krause of Springfield.

Coming Meetings of Electrical and Other Technical Societies

National Association of Electrical Contractors and Dealers—Buffalo, July 18-22. (For program see issue of April 30, page 1010.)

American Physical Society, Pacific Coast Section—Berkeley, Cal., Aug. 4 and 5.

Michigan Electric Light Association—Ottawa Beach, Mich., Aug. 24-25.

N. E. L. A., New England Division—New London, Conn., Sept. 6-9.

Pennsylvania Electric Association, Bedford Springs, Pa., Sept. 7-10.

N. E. L. A., Great Lakes Division—French Lick Springs, Ind., Sept. 14-16.

Association of Iron and Steel Electrical Engineers—Chicago, Sept. 19-24.

West Virginia - Kentucky Association of Mine, Mechanical and Electrical Engineers—Huntington, W. Va., Sept. 21-23.

Illuminating Engineering Society — Rochester, N. Y., Sept. 26-30.

American Electrochemical Society — Lake Placid Club, N. Y., Sept. 29-Oct. 1.

American Electric Railway Association—Atlantic City, N. J., Oct. 3-7.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities

Segregation of Localities Into Group Units in Fixing Rates.—For the purpose of establishing just and reasonable electric rates for a utility serving several localities by means of transmission lines, localities of similar characteristics and size and served from the plant direct or the primary transmission lines are segregated by the Missouri Public Service Commission from those served by means of spurs from the primary lines, each group being treated as a unit for the purpose of establishing rates.

A Fair Permanent Return, Not a Fluctuating One, the Best.—Commenting on the rates asked for by a utility company which in 1919 and 1920 paid a dividend of 16 per cent on its common stock and for a period of seven years prior to Jan. 1, 1921, paid an average annual dividend of more than 13 per cent, the Public Service Commission of Connecticut observed: "It is a fundamental principle applicable to utility companies that the main reason for their existence is to furnish to the public a necessary service at reasonable rates, and not the accumulation of property and profits at the expense of the public. The financial hazard of a utility company falling upon the investors and the ultimate profits being limited by public regulation, the rate of return for the money honestly and economically invested should be liberal, to compensate for the risk taken, but the rate should not be based upon pyramided investment or inflated value of physical property. It is more important to the utility and to the public that the necessary capital invested and to be invested should be assured a fair permanent return than subject to fluctuating values and uncertain return, and the rate of return should be influenced by the market value of money at the time."

Setting Up a Contingency Reserve.—In a modification of a previous decision affecting the accrued depreciation of the Southern California Edison Company the California Railroad Commission ordered the company to set aside from its net earnings for 1920 a contingency reserve of $550,000, and that the contingency reserve to be hereafter accounted for should be limited to cover the fluctuations of water supply and fuel-oil price. An amount is to be credited to the contingency reserve each year which will represent the saving in fuel oil during the year resulting from the fact that the output from the company's hydro-electric plants during the year has been greater and the output from its steam plants has been less than would have been the case had conditions of water supply available to its hydro-electric plants been at average, together with an amount representing the saving to the company from any decrease below the standard of $2 per barrel at shipping points in the price paid by it for fuel oil consumed during the year. For opposite conditions a corresponding charge will be made against the contingency reserve, and the excess of credits over charges will constitute the fund. In determining the extent to which in any year the output from hydro-electric plants is greater or less by reason of the water supply conditions of that year being greater or less than average, the load of the year under consideration will be applied to the water resources of each of the years for which an adequate record exists, taking into consideration both the hydro-electric installation available during the year under consideration to utilize such water resources and the steam capacities to supply the balance, and the average of such figures will be taken as the output under prevailing water conditions.

Principles Governing Dual Service.—Holding that the test of confiscatory rates in a combined electric and steam-heating utility is whether the particular service sustains itself, and that rates should not be higher in either of two combined services rendered by a public utility than the value of that service to the public standing alone, the Montana Public Service Commission denied the application of the Eastern Montana Light & Power Company for an increase of electric rates at Glendive until such time as a proper segregation and allocation should be made. It said: "While rates may not be so low as to deprive an owner of a fair return on the fair value of his property devoted to the public service, it is a principle of equal dignity and importance, and constantly opposing, or tending to oppose, that rates may not be higher than the value of the service to the public. Here are two utilities operated by one corporation, and doubtless there are consumers of light and power who do not use steam heat and vice versa. Of what value then is the steam heat service to the straight electrical users? Obviously, of no direct value. Would any one suggest that the consumers of steam heat only should should help pay for the electrical energy used by those who demand only the electric service? And yet if it is shown that the steam-heat service is not self-sustaining, but that it is in fact leaning on the electric utility, which is paying a fair return on the combined investment for the two utilities, are not the electric consumers, despite the fact that they never use a pound of steam heat, helping to pay for the heat consumed by those who patronize the steam-heating utility alone? What, then, becomes of the principle that consumers of a public service should not be required to pay more for such service than the sum which it is reasonably worth?"

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies

Oiler Injured in Bus Room, Where He Had No Right to Be, Cannot Recover.—A workman employed as a night oiler of machinery in an electrical power house, whose sole duties were to oil certain engines and pumps in one part of the building, but who without proper cause left his work and entered the bus room, where he was injured by contact with electrical appliances occasioned by his own recklessness or carelessness, cannot recover damages under the workmen's compensation act of Kansas, according to the decision of the Supreme Court of that state in Haas vs. Kansas City Light & Power Company, his injuries not arising out of and in cause of employment. (198 Pac. 174.)*

Powers of Oklahoma Supreme Court in Appeals from Commission Decisions.—In hearing an appeal which was made by the St. Louis-San Francisco Railway Company against rates fixed by the State Corporation Commission of Oklahoma, the Supreme Court of that state, asserting that the order of the commission must be regarded as prima facie just and correct, nevertheless declared it to be the duty of the court to try the case de novo upon the record and evidence introduced before the commission and judicially to determine and fix a new rate if in its opinion the evidence submitted upset the prima facie presumption referred to. (198 Pac. 73.)

Meaning of "Adequate Consideration."—In United States Smelting, Refining & Milling Company vs. Utah Power & Light Company, the Supreme Court of Utah affirmed an order of the Public Utilities Commission of Utah which altered the contract rates for electricity purchased by the plaintiff from the defendant. The smelting company in contesting the commission's order relied on a provision in the public utilities act of Utah to the effect that nothing in the act shall prevent the carrying out of contracts for public utility service previously made and founded upon adequate consideration." The court found that the consideration in the contract at issue was not adequate, declaring that by "adequate consideration" was meant such consideration as, when all the elements which enter into the transaction are considered, would prevent the beneficiary under the contract from receiving a substantial preference or advantage over the public or other utility in the matter of rates or charges for the service rendered. (197 Pac. 902.)

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*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System

Men of the Industry

Changes in Personnel—Responsibilities and Association Appointments of Men Engaged in Professional, Executive, Operating and Commercial Branches of the Industry

R. C. McFadden, who has been appointed district manager of the Southern California Edison Company at Oxnard, Cal., as recently announced in ELECTRICAL WORLD, was born at Placentia, Cal., in 1887. Upon completing his course in electrical engineering at Stanford University in 1910 he was employed by the Tacoma (Wash.) Railway & Power Company, one of the Stone & Webster properties. He remained with the Stone & Webster organization until 1916, when he entered the commercial department of the Pacific Light & Power Corporation of Los Angeles, giving special attention to the development of that company's electric range and water-heater load. Following the consolidation of that company and the Southern California Edison Company in 1917 Mr. McFadden was transferred to Ventura, where his duties were enlarged to include the development of the power load in that territory. During the war he enlisted in the naval service and was discharged with an ensign's commission. On his return he was sent to Long Beach on power-sales work. He was later made acting manager in that district, a position he held up to his appointment as district manager the first of this year.

R. C. MC FADDEN

Fred B. Johnson, who recently retired from the Indiana Public Service Commission, has taken up the practice of utility law.

John J. Caddigan, for the last two years assistant superintendent of the advertising department of the Edison Electric Illuminating Company of Boston, has been appointed an assistant to the general superintendent. Mr. Caddigan has been assigned to the duty of promoting closer co-operation throughout the various branches of the electrical industry in the Boston Edison territory, including active personal contact with central-station jobbing and contractor-dealer interests.

Miss Sarah Mary Sheridan, who was recently elected a vice-president of the Detroit Edison Company, came into the electric light and power industry in the '90s, when the pioneer technical work had been done and commercial development was beginning to take its modern form. For several years she has been sales manager for the Detroit company, which enjoys not only one of the most rapidly growing loads in the country but one of the most diversified as well. Beginning work as the youngest employee in a total list of less than fifty, Miss Sheridan is now an officer of an organization of nearly 5,000, of whom, on the day of her recent promotion, 569 were reporting to her. In her earlier work she learned all the ways and methods of dealing with customers and also learned the personalities and methods—or lack of methods—of customers themselves, individually and in the aggregate. Her opportunity came in 1904, when she was inquiry and record clerk of the small sales organization of the Detroit Edison Company. That organization was even then differentiated into lighting and power divisions, into inquiry and record divisions, and had its competent sales engineers and estimators. The illness of the officer who had charge of sales made it necessary to appoint an acting chief for twelve months in his place, and Miss Sheridan secured the temporary appointment. From the start she showed that she was a natural executive, and that she had exceptional ability to gain and hold the loyalty of her staff, and the good-will and the respect of all her customers. From that time on her success came with opportunity and she grew with a growing concern in a prosperous town. She has always been willing to assume responsibility and has the gift of making quick decisions correctly.

MISS S. M. SHERIDAN

Charles W. Tippy, general manager of the Consumers' Power Company, Jackson, Mich., was recently elected vice-president of the company. Mr. Tippy began to work for utilities when a boy. All of his early experience, however, was in the gas-supply field, and it was not until 1912, when he went to Detroit as assistant to W. M. Eaton in the management of the electric properties of Hodenpyl, Hardy & Company in Michigan, that he became associated with electric light and power service. In 1914 he went to Jackson as general manager of the Consumers Power Company, at the time this company passed from a holding company to an operating company in Michigan. Mr. Tippy was born in Three Oaks, Mich., in 1876 and was graduated in 1899 from Purdue University, where he took the mechanical engineering course.

C. W. TIPPY

F. D. Brown, for eight years manager of the Huron (S. D.) Light & Power Company, has resigned, to open an engineering office in Huron. Mr. Brown will be succeeded by J. A. Ward of Chicago.

Walter A. Shaw, special technical expert, has been engaged by the Board of Public Utility Commissioners, New Jersey, to assist the commission in special rate hearings. Mr. Shaw was formerly connected with the Illinois Public Utility Commission.

M. J. Maxfield has been appointed director of laboratory instruction, department of industrial electrical engineering of Pratt Institute, Brooklyn, N.

Y. Mr. Maxfield was formerly connected with the department of electrical engineering of the Pennsylvania State College.

Charles L. Towne has been appointed resident manager of the department of information of the Georgia Railway & Power Company, Atlanta. This department will be under the direction of Ivy L. Lee.

Ralph D. Ballew has been appointed city manager of Sturgis, Mich., effective May 15. Mr. Ballew was formerly manager of the Grand Rapids branch of the Westinghouse Electric & Manufacturing Company.

Chester M. Clark, formerly head of the corporation department of Stone & Webster, Inc., has been elected treasurer of Arthur D. Little, Inc., chemists, engineers and managers, Cambridge, Mass.

Merton R. Sumner has been appointed chief engineer of Arthur D. Little, Inc., chemists, engineers and managers, Cambridge, Mass. Mr. Sumner was formerly chief engineer of the Fuller Industrial Engineering Corporation.

David C. Rosetahl has been appointed general sales manager of the Robert Findlay Manufacturing Company, Brooklyn, N. Y. Mr. Rosetahl was formerly associated with the B. & K. Manufacturing Company, New Haven, Conn.

Edward R. Knowles, a well-known consulting engineer and fuel expert, has recently become associated with the engineering firm of Murrie & Company, Inc., of New York City. Mr. Knowles will have charge of the company's pulverized-coal and gas-fuel engineering work.

F. E. L. Whitesell, who for several years has been connected with the sales department of the Railway & Industrial Engineering Company of Greensburg, Pa., has been appointed New England representative of the company, with headquarters at 136 Federal Street, Boston. Mr. Whitesell is a graduate of Washington and Jefferson College and during the world war served with the ambulance corps in France.

G. W. Borst, who for the past eight years has been electrical engineer for the Chicago Fuse Manufacturing Company, has resigned and will take a rest until about Sept. 1. His plans from then on have not as yet been definitely formulated. Mr. Borst is an electrical engineering graduate of the Armour Institute of Technology. After receiving his degree, he spent several years with the Westinghouse Electric & Manufacturing Company in the main factory, various branches of the engineering department and on outside erection work. In 1910 he became connected with the Western Electric Company, where he remained for three years, leaving in 1913 to join the Chicago Fuse Manufacturing Company. In the latter position his principal duties were along the lines of fuse development, but his duties also covered work on factory costs, estimating and advertising. He also was active in outlet box standardization.

H. W. Stortz, formerly with the Transportation Engineering Corporation of New York and the Edison Storage Battery Company of Orange, N. J., is now New York district manager of the American Radio & Research Corporation in charge of motor and radio equipment sales, with offices at 21 Park Row.

Maxwell Alpern, president-elect of the Stoker Manufacturers' Association, is vice-president and general manager of the American Engineering Company, Philadelphia. He was born in Alpena, Mich., in 1884 and was graduated in engineering from the University of Michigan in 1906. Mr. Alpern is a specialist in combustion engineering and is the inventor of one of the well-known mechanical stokers.

MAXWELL ALPERN

Allan V. Garratt, formerly chief engineer Lombard Governor Company, and lately consulting engineer hydraulic department Lockwood, Greene & Company, Boston, has established an office at 176 Federal Street, Boston, Mass., for the practice of hydraulic engineering along consulting and advisory lines.

Charles W. McKay, until recently president of McKay & Sherman of Chicago, has become identified with the American Appraisal Company, Milwaukee.

Robert Johnson has recently been appointed district manager of the Oakland (Cal.) office of the Federal Electric Company. Mr. Johnson has had a varied experience in saleswork. For four years he was salesman for the Commonwealth Edison Company of Chicago. The next three years were spent as contract agent for the Milwaukee Electric Railway & Light Company. The next four years were divided evenly between the H. W. Johns-Mansville Company as salesman in Milwaukee and the Utah Power & Light Company as commercial salesman in Salt Lake City. Mr. Johnson left this post to join the Federal Electric Company as its Intermountain representative in 1912. From there he was promoted to his present position.

I. H. Lovett has received the appointment of assistant professor of electrical engineering at the University of Missouri, Rolla, Mo. In 1914 he was graduated in electrical engineering at the Massachusetts Institute of Technology. For five years he was employed in the engineering department of the New England Power Company. Recently he has been an instructor in electrical engineering at the Worcester (Mass.) Polytechnic Institute, which position he leaves to begin his new work.

Eustace C. Soares, now electrical engineer of Ophuls, Hill & McCreery, Inc., has had a varied experience with manufacturing and central-station companies. He was born in Port Royal, Jamaica, British West Indies, Sept. 20, 1889. Coming to America in April, 1908, he entered the employ of an automobile manufacturer, after which he was employed by the Brooklyn Edison Company and the United Electric Light & Power Company in operating capacities. During these years he studied electrical engineering with the American School of Correspondence and at Cooper Union. His next position was with the Crocker-Wheeler Company, where for two and a half years he was in charge of the department which tests all the apparatus manufactured by the company. He also supervised electrical maintenance and for a while had charge of the repair department.

Obituary

John Findley Wallace, chairman of the Chicago Railway Terminal Commission, recently died in Washington, where he was attending Interstate Commerce Commission hearings. Mr. Wallace, who had been engaged in engineering for the past fifty years, for more than ten years directed the activities of Westinghouse, Church, Kerr & Company, which more recently has been merged into the Dwight P. Robinson engineering organization. He became chairman of Westinghouse, Church, Kerr in 1906, and later became president as well.

Achille Fournier, director-general of the French works of Schneider & Company, one of the leading industrial firms of Europe, was killed last month in France when a motor car in which he was riding was struck by an express train. Although only thirty-eight years old, Mr. Fournier had played a leading part in industrial production both under war-time conditions and since the re-establishment of peace. He was especially interested in the development of hydro-electricity and the electrification of railroads in France and contributed to these projects the powerful help of the Schneider works.

Trade and Market Conditions

Business Reviews, Together with Market Letters
from Important Trade Centers, on the Supply, Demand and Prevailing Prices of
Electrical Apparatus and Supplies

$18,560,000 in Electrical Porcelain Made in 1920 in U. S.

THE United States Geological Survey, in its review of the pottery industry in the United States in 1920, shows that the value of pottery produced in the United States in 1920 was $105,700,000, of which $18,560,000 went into porcelain electrical supplies. This figure of porcelain electrical supplies for the year 1919 is estimated by the Geological Survey at $12,190,000, so that the 1920 production is more than $6,000,000 better than that of the year before, or about 52 per cent.

"Notwithstanding the great demand and the large value of the output," says the Survey, "the potters had many handicaps, chief among which were the shortage of fuel, especially in the western districts, and the shortage of materials on account of transportation difficulties, both of which caused considerable loss in production, and it was well toward the middle of the year before anything like normal conditions prevailed in regard to fuel and transportation. The refusal of operatives to work full time and the decrease in output per man were further handicaps which it was impossible to overcome.

"There were no general strikes in the industry, but the few minor ones that occurred were sufficient to cause serious loss in production."

Ohio Manufacturers Reported on Better Working Schedule

MANAGERS of power plants throughout Ohio have noted considerable revival in the activities of manufacturing companies, according to the report of D. L. Gaskill, secretary-treasurer of the Ohio Electric Light Association, who, while in Toledo recently, said, while talking with President Frank R. Coates, of the Toledo Railways & Light Company: "Power plants of the state are a good indicator of business. The load of power that is carried directly measures manufacturing and tells what the heart of business is registering.

"Ohio was hardest hit at Akron, where the power load fell off more than 65 per cent. But even though Akron is a one-industry city it is coming back, and power is being turned on in most of the plants. Other Ohio cities are showing steady gains. I believe it will be at least a year, however, before we are back to a real normal basis again."

Ventilating Equipment Sales Hold Up in Good Volume

ONE of the most active lines of electrical equipment and apparatus just now is that of ventilating, fan and blower equipment. Although sales of the ordinary desk fans were disappointing up to the middle of June, the hot weather of the latter part of that month started a very encouraging movement. Ventilating equipment, though, had been moving well and just now is gaining a good momentum. Certain manufacturers are working their plants at full time, but in several other cases this rate has not been reached and will not be reached, they say, till commercial and industrial building sets in in earnest.

Air conditioning in food-manufacturing establishments, textile, woodworking and many other classes of industries, as well as in power-plant work, is receiving general consideration, and the outlook in that direction is very encouraging. Old plants, too, are being equipped with ventilating systems. Considerable stress is being placed on direct-connected fan and blower sets for ventilating restaurants, garages, dyeing and laundry establishments and for kitchen and furnace use in the home, and special efforts in this direction are getting results.

Some producers are making for stock, and in general shipments can be made at short notice. Hardly over a week is needed to fill an order for manufacturing. Sheet metals, castings, angle iron, etc., are lower in price than they were the first of the year, and some price revisions have consequently been made. Of course, motors and control are lower, besides wiring materials.

Extraordinary Demand for Fans in Minneapolis Center

CONTINUANCE of the hot spell throughout the country has brought new local records in fan sales, an interesting example of which is from the district surrounding Minneapolis and St. Paul. Here the fan season is often as short as ten days but usually divided into three short periods, one early, one in July and one in August. This year the temperature has been in the nineties during the daytime and with only a five to ten-degree drop at night since June 1. Stocks of fans were exhausted two weeks ago and rush orders are now being filled by express from Eastern points. These are in small lots and are promptly exhausted by standing orders.

In the Twin Cities and the surrounding territory two jobbers have already sold more than five thousand fans. In the city of Minneapolis alone about four thousand have been sold. These have come from every available source including jobbers, dealers, hardware stores, plumbing stores and machinery second-hand dealers. It is conservatively estimated after a careful check of the demand that more than ten thousand fans could have been disposed of in that city had the stock been available. Jobbers report that the 9-inch fan is the most popular size when price alone is considered and the 12-inch and 16-inch oscillating under other circumstances.

Weatherproof Wire Sales Making Slight Progress

CENTRAL station extensions are not making very noticeable inroads on jobbers', distributers' and manufacturers' stocks of weather-proof wire. There is some central station buying in the Chicago territory, the southeastern states find sales holding up pretty well on Nos. 6, 8, 10 and 12 and the St. Louis district is finding a slightly increased demand for weather-proof wire in sizes Nos. 6 and 8. There some of the jobbers are buying to keep their stocks on an even level. New England reports show a decided change for the better as the number of building permits and of contracts for wiring old houses is increasing favorably, calling for line extensions. New York territory is not noticeable in its purchasing.

Still there has been considerable residence building in the Northwest, southern California, the Intermountain district, the Southeast, in some parts of the New York territory and in parts of New England, and this should encourage sales of weather-proof for street extensions outside of congested city districts. But electric railway buying and central-station buying as a whole has been so quiet the weatherproof wire mills are running at a rate of about 50 per cent only. Shipments naturally are good and stocks are still too high for mill comfort. With bare copper wire quoted at 15-15.25 cents bare at the mill, up-river fine para rubber at 15½ cents, first latex crepe at 14⅝ cents and spot cotton in New York at 12.70 cents, weatherproof wire can be purchased at a relatively low rate, about a 16½-cent base ruling for No. 6.

Lower Steel Prices Bring Conduit and Other Products Down

FOLLOWING general reductions in the price of steel products that were made recently, lower quotations have resulted on a number of electrical steel products. Effective July 7 the U. S. Steel Corporation reduced the price of standard steel pipe from the discounts shown on its April 13 card as follows: ¼-in. and ⅜-in., 1 point or $2 per ton; ½-in. to 6-in., 2 points or $4 per ton; and 7-in. to 12-in., 3 points or $6 per ton. Effective July 11 a number of the leading manufacturers of electrical conduit also reduced prices by increasing the discount allowed distributers, at the same time advancing the number of their base card by one. The decrease amounted to 9 points on black and galvanized conduit in some instances and 5 points in others. The difference of 4 points is accounted for by earlier price reductions on the part of those who at this time dropped the least, so that base prices are said to be approximately on the same level. Sizable stocks are reported by manufacturers, with keen competition for orders and generally quiet conditions of demand. The new card is No. 47, the discount on ½-in. black in carload lots being 41 per cent and on white 35 per cent.

In line with the drop in the price of base sheets, outlet box quotations have been generally reduced 11 per cent on black and 10 per cent on galvanized. The drop became effective on various dates ranging from June 27 to July 11.

Locknuts and bushings were reduced approximately 29 per cent by manufacturers during the same period as the outlet box price decrease noted above. The discount to jobbers in standard packages was increased 10 points.

Switch box prices are also down, the drop in several instances there becoming effective around the first of the month. The amount of the decrease varied with different manufacturers, ranging from 11 to 35 per cent.

The Straits Settlements as an Electrical Market

EXPORTS of electrical materials and apparatus from the United States to the Straits Settlements during the year 1920 amounted to $283,104. This figure and those in the table below were compiled by the ELECTRICAL WORLD from data received from the Bureau of Foreign and Domestic Commerce. From this table it is interesting to note that exports of batteries and of magnetos, spark plugs, etc., amounted to $111,036, more than one-third of the total electrical exports that year.

STRAITS SETTLEMENTS

	1920 Exports
Batteries	$65,119
Carbons	3,906
Dynamos and generators	26,415
Fans	17,009
Insulated wire and cable	11,516
Interior wiring supplies (including fixtures)	7,397
Metal filament lamps	4,397
Magnetos, spark plugs, etc	45,917
Meters and measuring instruments	4,023
Motors	21,543
Switches and accessories	3,797
All other	72,065
Total	$285,104

Receipts of dynamos and generators came next highest, with motors closely behind. Fans showed relatively high receipts. None of the items of a general electrical nature rate very high in the Straits Settlements, but it is reasonable to believe that there will be an increasing market for electrical materials. Tin, of course, is the well-known products of these Settlements, but spices, rubber, rattan, coffee, gum, sago and copra are also widely exported from there. Consequently a modernizing of these industries should provide a further outlet for electrical supplies. At the same time a large transient trade is handled by the principal ports, which are Singapore, Georgetown and Malacca.

Exports for the first four months of this year have amounted to $90,850, which is virtually one-third of last year's total. This year to date, however, is going at a rate exceeding last year's figures in dynamos and generators, fans, heating and cooking appliances, interior wiring supplies, metal filament lamps and transformers while the other listed items are falling behind.

The *Electrical Times*, London, shows that in the years 1917, 1918 and 1919 the British Malaya drew its electrical supplies from countries as follows:

	1917	1918	1919
United States	£17,293	£9,179	£74,593
United Kingdom	28,569	17,028	50,430
French India			16,643
China	422	7,674	4,651
Australia	796	792	1,074
Italy	1,753	933	857
Japan	8,195	13,806	811
Hongkong	1,231	1,688	592

Switch Box Section A. M. E. S.

IN AN item appearing in these columns of June 25 the ELECTRICAL WORLD was advised that in the formation of the Switch Box Section as part of the Outlet Box Section of the Associated Manufacturers of Electrical Supplies, F. H. Merrill, of the Appleton Electric Company, was chairman. Recent advices, however, show that W. W. Merrill, vice-president of the Chicago Fuse Manufacturing Company, is chairman of the Switch Box Section.

The Metal Market Situation

PRODUCERS of copper still hold for 13 cents a pound delivered, but some of them are reported to have accepted ⅛ cent lower than that for prompt shipment. Small interests have even taken as low as 12.62½ cents for prompt copper though the quoted range is 12.75 to 13 cents for July and August. Further ahead than that there is little interest shown. Domestic demand is as light as ever but there is greater activity in export sales.

To assist in financing the exportation of 500 tons of copper to Italy the War Finance Corporation has agreed to make an advance of $145,000 to an American banking concern. The outside market is dull, for there is little copper held by second hands and prices are slightly higher than producers'.

Zinc shows little change with demand light and prices steady. Inquiries for lead are reported to be good and the market is firm. Sterling exchange has dropped to the extremely low figure of $3.62¾ at present and the price of tin has reacted by falling to 28.37½ cents.

NEW YORK METAL MARKET PRICE

	July 5, 1921	July 12, 1921
Copper	£ s d	£ s d
London, standard spot	72 5 0	72 0 0
	Cents per Pound	Cents per Pound
Prime Lake	13.00	12.87½—13.00
Electrolytic	12.87½—13.00	12.75—13.00
Casting	11.75—11.87½	11.75—11.87½
Wire base	15.00—15.25	15.00—15.25
Lead, trust price	4.40	4.40
Antimony	4.75	4.65
Nickel, ingot	41.00	41.00
Sheet zinc, f. o. b. smelter	10.00	10.00
Zinc, spot	4.85	4.80
Tin	28.87½	28.37½
Aluminum, 98 to 99 per cent	28.00	28.00

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	9.25—9.50	9.50—9.75
Brass, heavy	4.25—4.50	4.25—4.50
Brass, light	3.50—3.75	3.50—3.75
Lead, heavy	3.25—3.50	3.37½—3.50
Zinc, old scrap	2.00—2.25	2.00—2.25

THE WEEK

IN TRADE

Prices When Quoted Are Those Prevailing at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

OF ALL the electrical supply buying this week, fans hold the front stage. Ideal fan weather has prevailed all over the country and movement has been very satisfactory. Trade in general is spotty to quiet. In New England house wiring is good, building permits are increasing and line extensions are more frequent. Fundamental banking conditions are better. Building is a little better in the Metropolitan district too. There is improvement in agricultural outlook in the Southern states, there is more money in circulation and electrical buying is better in agricultural regions.

Chicago is quiet in electrical trade but has some street lighting activity by several municipalities. Building is hesitating still. Further south buying is more cautious than a month ago but there is a fair movement of pole-line materials and accessories. Home building continues on a good volume in the Intermountain district. In the Northwest export trade is reviving; home building is very active in Portland but only fair in Seattle. Northern California is still in the grip of a building strike but the southern part of the state is active. Collections generally show no improvement.

Following steel pipe and sheet reductions at the mills, electrical manufacturers have reduced conduit, outlet boxes, switch boxes and locknuts and bushings.

NEW YORK

Activity in the general electrical market continues on the same quiet plane as heretofore, but the rush with which fans are selling helps to balance dullness in other lines and makes things seem brighter. Industrial demand shows very little if any improvement, it is stated, and there is not much buying on account of building work. Sales to dealers and contractors seem to be about the largest class of business at present.

Collections are getting neither worse nor better but are about holding their own, and the trend among jobbers is still to liquidate rather than to buy. Recently announced reductions in steel quotations have resulted in price decreases on several electrical items including conduit, outlet boxes, locknuts and bushings and switch boxes.

A large building operation involving about $1,500,000 has been started at Jamaica, L. I., which will include store and office buildings, a public market and manufacturing plants. Building contracts for New York State and Northern New Jersey awarded in June amounted to $62,659,000, an increase over May of 8 per cent, which again was 14 per cent ahead of April according to the Dodge reports. Of the June total 54 per cent was for residential work. In the Middle Atlantic States, however, the total June building contracts of $32,136,000 represented a 27 per cent decrease from May.

Locknuts and Bushings.—Manufacturers have generally reduced prices about 28 per cent by increasing the discount allowed on standard packages 10 points.

Outlet Boxes.—Virtually all manufacturers have increased the discount allowed on both black and galvanized boxes by 5 points, making a cut of about 10 per cent.

Switch Boxes.—Prices have been reduced but not uniformly. One manufacturer has made a cut ranging from about 11 to 17 per cent, another from 17 to 26 per cent and a third from 27 to 35 per cent.

Rubber Covered Wire.—Conditions are unchanged; No. 14 single braid holding at $6.50 to $7 per 1,000 ft. in 10,000 ft. lots, with demand poor and stocks good.

Flexible Armored Conductor.—The current market is weak with plenty of material on hand; No. 14, two-wire, double and single-strip is bringing $53 to $55 per 1,000 ft.

Fans.—One or two jobbers still report disappointing sales but the majority are in the midst of an unprecedented rush to fill orders. Ideal fan weather has been experienced and several jobbers have sent in repeat orders. Sixteen-inch and 12-in. oscillators stand out in the buying. Some ceiling fans are moving but not a great lot, while sales of exhaust fans are slow.

Flashlights.—Demand is spotty among different jobbers, though some report a good volume of vacation buying. Renewal sales are only fair. Stocks are well filled with prices steady.

Loom.—In 1,000-ft. lots $\frac{7}{32}$ in. brings $20 to $24.80 and ¼ in. from $24 to $27 per 1,000 ft. Good quantities are on hand but demand is small.

Lamp Cord.—No. 18 cotton twisted brings $12.50 to $14.50 per 1,000 ft. in that quantity and No. 18 cotton parallel from $15 to $17.50, but the good stocks held are not moving.

CHICAGO

The only activity of note in the electrical industry during the past week has been the purchase of materials for ornamental street lighting by several different municipalities. It seems that the only buying power in evidence at present is that of the taxing powers. Purchases in all other lines are limited strictly to routine requirements and the most radical efforts to induce heavy buying on the part of the general public meet with an almost total lack of response.

The building industry remains stagnant as the arbitrator has so far failed to render a decision. All work under way is proceeding, but no new projects are being initiated.

Collections remain as slow as before and no price changes in electrical goods are noted.

Motors.—What little demand there is is limited to small lots for replacement purposes. Although various small concerns are offering motors "new or as good as new" at very low figures, all established lists are firmly held by the larger concerns.

Fractional Motors.—Manufacturers are proceeding on very conservative lines as the consumption by makers of washing machines, vacuum cleaners, etc., is thought to be over 40 per cent of normal. As in the case of larger motors, lists are firmly held, the current price of a ¼-hp., 1,800 r.p.m., alternating-current motor being quoted by one jobber as $28, list.

Fans.—Four weeks of excessive heat with no relief in sight has stimulated the best fan business in three years. Jobbers find it impossible to meet the demand, back orders in some cases running into the thousands. Prices are firm, with the heaviest demand being noted for the 10-in. size.

Exhaust Fans.—The same conditions which are boosting the sale of desk fans are helping distribution of exhaust fans. Demand is notably better than that of a month ago, although supplies are having no difficulty in filling orders. A 24-in. single-phase fan is quoted at $189, list.

Ornamental Street Lighting.—Poor retail business in all sections is causing retailers to strive for "business getters." This is finding expression in numerous requests for information as to the cost of installations and in the actual placing of orders for several lots ranging from 50 to 500 poles. Deliveries are being promised in good time.

Farm Electric Plants.—The summer bids fair to pass with but little business closed. Dealers are wholly unable to accept their full quota and factories are operating on greatly reduced schedules. No price changes are recorded.

Bare and Insulated Copper Wire.—No price changes of moment have been reported and sales are at a minimum. Copper wire, No. 8, bare, remains at 17 cents per lb. in 1,000-lb. lots; rubber-covered, No. 14, is $7 per 1,000 ft. in 10,000-ft. lots; weather-proof, No. 6, triple braid, is 18½ cents per lb. in 1,000-lb. lots.

BOSTON

Trade continues spotty in this district. The principal market for electrical material is the central station and the contractor dealer at the moment. Wiring of unwired houses is fairly active and the demand for line extensions is increasing. Metal industries are quieter than textiles and the woolen industries are operating at 75 per cent of capacity or over. Boot and shoe plants are running at about 50 per cent of capacity. Retail sales, indicated by the department store reports to the Federal Reserve Bank, are holding up finely. Collections are unimproved in the electrical field. Jobbers' stocks are still being liquidated and buying is largely on a hand-to-mouth basis. Building and engineering contracts, however, for the week ended July 5 in New England totaled $6,262,800, a figure equaled only in two of the past twenty-one years, according to the Dodge reports, and comparing with $4,196,900 for the preceding week. Fundamental banking conditions in New England are better. Prices weakened this week about 10 per cent on rigid conduit and on some porcelain material.

Fans.—Last week's extreme weather pulled hard on retail stocks but did not exhaust distributers' supplies of fans. Excellent sales are reported from electric stores.

Wire. — Central-station buying featured last week's weatherproof market, orders aggregating about $350,000 being reported from several of the larger companies. Base price, Monday, 16 cents. Rubber-covered No. 14 wire was selling Monday at $9 per 1,000 ft. in coil lots and from $6.25 to $6.50 per 1,000 ft. in 5,000-ft. lots. Stocks are good.

Porcelain Fittings.—A drop of about 10 per cent on tubes and other fittings except "Nail-it" knobs was announced Monday. The latter sold at $21 per 1,000 in barrel lots and at $18 in three-barrel lots. Some activity is apparent in the insulator market.

Rigid Conduit.—Following a further drop in the price of steel, rigid conduit softened Monday at Boston about 10 per cent. The current price of 1-in. black pipe was approximately $105 per 1,000 ft. and of galvanized about $115 in lots under 5,000 pounds.

Washing Machines.—With good local stocks, distributers are preparing for an active demand a little later in the season. A leading distributer is selling about three carloads per month at present in two makes, but midsummer is a quiet time for the sale of the larger appliances.

Flexible Armored Conductor.—Moderate sales are being handled and about $55 was being charged per 1,000 ft. in lots of 1,000 to 2,500 ft. the first of this week in No. 14 double-strip. Stocks are easily meeting the demand.

Portable Lamps.—A reasonably good season is being enjoyed in such sales. One prominent retailer exceeded his first half 1920 portable sales this year and a still better demand is expected later.

Irons.—These are moving well and vigorous campaigns are yielding good results. Older types at reduced prices are moving exceedingly well.

Meters.—Business is not brisk, but wiring work is absorbing a good many meters from week to week. One active central station added 42 per cent more meters this year to June 30 than for the same part of 1920 in old-house wiring.

ATLANTA

Despite the interference of holidays the first week in July has shown signs of continuing the activities of the prior month, and while the fan business which has been induced by the extraordinary hot weather approximates 60 per cent of the total business, at the same time there is a fairly steady demand for electrical goods in general, particularly in the class of construction material. This class is going mostly to the larger cities and to middle Georgia, where the excellent peach and melon crops have placed considerable amounts of money in circulation. Agricultural reports indicate a good yield in all of middle and south Georgia, particularly in the food crop line, while the cotton is reported as being slightly above the estimate of two weeks ago. This is resulting in a better feeling for the business outlook in the smaller towns this fall.

Panelboards.—One of the larger manufacturers announced a reduction in price of approximately 10 per cent in this line, and stocks are moving fairly satisfactorily. Drop shipments from factory are reported very prompt.

Schedule Material.—On the recent reduction in price contractors and dealers are replenishing depleted stocks and it is expected this line will continues to show activity for another ten days. Sockets, porcelain tubes and Nail-it knobs are moving particularly well. Jobbers' stocks are reported in good condition.

Rigid Conduit.—There is a slight variation noted in price in this line as some manufacturers have made sharper cuts than others. Both black and galvanized in ½-in., ¾-in. and 2-in. sizes are moving very well in less than carload lots, but sales of large quantities are rather slow. Local stocks are from good to heavy.

Tape.—A continued steady demand is reported for black friction, but the demand for varnished cambric is dull. Rubber tape, however, continues to keep pace with the friction. Only fair stocks are reported on hand.

Flexible Armored Conductor.—The brisk movement of the past two weeks has largely disappeared because the price has again risen to $67.50 per 1,000 ft. and contractors are stocked up at a lower figure.

Fuses.—Plug fuses are reported at $3.57 per 100, but this price reduction has not served to stimulate buying, though a slow movement continues. Renewable cartridge fuses are selling well to those custmers who have had experience with them. Stocks of both types are in excellent shape.

Pole Line Hardware.—Despite the excellent prospects and the receipt of large numbers of inquiries, little or no heavy bona fide orders are being placed. Jobbers state, however, that they expect a satisfactory movement of the entire line before Sept. 1.

Farm-Lighting Outfits.—Sales are reported rather spotty, but prospects for purchases from the rural districts in middle and south Georgia are very bright and manufacturers report the placing of a very satisfactory number of sets in this locality during the past two weeks.

ST. LOUIS

The week shows no marked change in general business or in that of the jobbers. Every one is buying more cautiously than a month or so ago and dealers are endeavoring to maintain their stocks at the absolute minimum consistent with the immediate needs.

Except for the seasonal purchasing of appliances such as fans, the most active field appears to be in plant and distribution extensions of municipalities and the smaller utilities. Fairly good movement is found in pole-line materials, distribution transformers, lightning arresters, generators and switchboards. As a rule the orders are not individually large, but a goodly number keep coming in.

The cost of building is being closely watched for its effect upon the electrical industry. Wage agreements in some lines have expired and the contractors are endeavoring to obtain reductions in all lines; the State is investigating the activities of the St. Louis Millmen's Association, the St. Louis Material Dealers' Association and the Lumber Trade Exchange.

The number of unemployed in St. Louis was 0.4 per cent more in June than in May, according to reports of the United States Department of Labor. There has been greater decrease in those employed industrially, but this was offset by the customary exodus to the harvest fields.

Dry Cells.—A good and steady demand continues over the entire territory and stocks are maintained on a normal basis. The regular cell in barrel lots usually sells at $31 per 100 and the igniter at $32, though some cells can be secured at slightly reduced rates.

Linemen's Tools.—It is reported that it is difficult to get satisfactory deliveries of standard makes and that local stocks are very low.

Annunciator Wire.—Movement is very slow and stocks are inclined to be heavy. No. 18 on 1-lb. spools is quoted by one jobber at 43½ cents per lb., one cent is added for duplex and 2 cents for twisted pair.

Outlet Boxes.—A reduction of five points in the discount is reported this week. Representative prices are: 4-in. square box, 15 cents net; 4-in. round, 12½ cents; 3¼-in. round, 10 cents. Movement is inclined to be slow.

Meters.—Fairly good movement prevails in small lot orders. The type I-14, 5-amp., single-phase, is quoted at $9.42 and the type D-6, 25-amp., three-phase, at $40. Stocks may be slightly heavier than the demand warrants.

Lightning Arresters.—Reasonably good sales are being made to the smaller utilities and stocks seem to be in line. A standard type compression arrester is selling at $5.25 each.

Drills and Hammers.—There is very slow movement because of the lack of industrial activity. One jobber reports good interest in a new electric slate drill and an electric screw driver, but the devices have not been on the market long enough to develop sales in quantity.

Ammeters and Voltmeters.—Fairly good call is found for automobile instruments, but the demand for standard portables is practically dead. Switchboard instruments find some opening in plant enlargements of smaller utilities.

SEATTLE—PORTLAND

Outstanding features of the week's activities as reported by both retailers and jobbers in Seattle and the Puget Sound district are a further quieting down of trade, a slower pace in most all industries and continued slow collections. Jobbers' business is affected by depression along industrial lines, while retailers' business is poor because of refusal of the buying public to purchase appliances, etc. However, showing a revival that means prosperity for the state of Washington, foreign flour shipments from the state in June increased 263 per cent as compared with the May record, foreign fir lumber shipments jumped 167 per cent and wheat movement more than 100 per cent. These increases indicate a revival of buying power in foreign markets and a continuance, it is felt, will stimulate business and industrial activity to an enormous extent. Efforts of the commission to bring about a speedy settlement of the strike that closed virtually all of Washington's open-market coal mines nearly four months ago apparently have failed.

Northwestern jobbers in construction materials as a whole assert that there are prospects for a strong late summer and fall building season as there is considerable improvement in material markets and buying is considerably increased. In Seattle during June building permits were issued valued at $920,000 as compared to $1,324,000 during June of last year. Thus far this year there have been permits issued valued at $3,112,000 as compared with $7,909,000 last year for a like period. In Portland home building progressed at the average rate of $861,693 a month for the first six months of the year. This record is practically three times greater than for the corresponding period of last year. A total of 1904 permits have been issued for residences in Portland since the first of the year.

Farm Light Plants.—Because farmers are more or less reluctant about buying at a time when crop yields are uncertain, sale of plants are very few, although inquiries in considerable numbers are being received weekly by jobbers. Still sales efforts and educational programs are being carried on. Stocks of nearly all makes are excellent.

Schedule Materials.—Sales during the past two weeks have been off on account of the midsummer holiday but the letup is considered only temporary.

Fans.—Following a week of warm weather, fan sales of considerable proportions for Puget Sound have been noted. In Spokane and Eastern Washington cities fans have been moving exceptionally well for more than a month. Stocks are good and prices steady.

SAN FRANCISCO

Increasing sales of power companies' securities are reported and 1922 should see some active campaigns in new fields for the sale of the increased power that is now delivered, or almost ready to be delivered, in Northern and Central California. An electric range campaign will be actively under way during the latter part of this year. A committee of bridge experts has considered the terminals and construction of the mammoth bridge across the bay of San Francisco. The structural cost is estimated to be about fifty million dollars. Business interests of the bay cities are reported solidly behind the structure and propose to push energetically its construction.

The building trades strike enters its third month indecisively. More and more skilled workers are being brought from Eastern and Southern points, and even some of the big jobs now have workers of different classes upon them. So far the actual results are small. However, most of the electrical contractors now have a few men at work on the American plan and the situation seems to be working itself out in favor of a victory for the employers.

Fixtures.—Sales of fixtures in northern California are running about 20 per cent less in the country districts than normally and have dropped to a mere trickle in the bay cities because of the strike. Special sales campaigns have been tried for some of the nationally advertised fixtures to stimulate a demand. The southern California demand is excellent and is principally for simple bungalow types.

Heating Devices.—The new Edison and Hotpoint prices announced for July 15 were already in effect on July 1 and all dealers have marked their stocks accordingly. Retail prices on some standard makes of irons are widely divergent and there seems to be a price-cutting campaign on in some makes commonly quoted for $7 each in which they are being offered by competing department stores for as low as $4.50. Toaster and small grill sales are increasing, but hollow-ware sales, after the usual June stimulation, have slumped to a very low ebb.

SALT LAKE CITY—DENVER

Jobbers, in some cases excessively stocked, are taking the initiative in the matter of stimulating consumer demand. They are co-operating in every way possible with dealers in devising and putting over advertising and selling campaigns. Many unusual things are being resorted to to create sales, including actual cooking demonstrations in homes where cooking appliances are potentially in demand. Prospective customers are in the main continuing to sit tight in the belief that prices will materially recede in the not far distant future. Credit has not shown any recent change and collections are about as difficult as ever. There is little money available for expansion in the building field except in the case of homes. Thousands of smaller construction jobs are proceeding at a satisfactory rate, furnishing employment and an outlet for schedule material and lighting fixtures.

The latest crop forecast is highly encouraging. Bankers are showing a disposition to force farmers to liquidate by disposing of last year's crops at prevailing prices. This pressure, if generally applied, will remove a condition of economic stagnation that has helped demoralize business in the Intermountain country. A liberal appropriation for advertising the "electric home" idea was recently voted by the Rocky Mountain Electrical Co-operative League. Central stations are substantially interested in the project along with jobbers and contractor dealers.

Ranges.—The past week has recorded a $15 reduction in the type of three plate range that has been selling regularly at $145. The range demand has been fair during the weeks of June and July.

Electrical Appliances.—The recent 10 per cent reduction on appliances is said to have had a decidedly stimulating effect on sales and dealers are ordering from their jobbers at a more satisfactory rate.

Fans.—The fan season thus far has been disappointing, some sales are recorded on excessively hot days, but the general tone of the market is sluggish.

Manufacturers' Activities

Devoted to the Business Side of Manufacturing, Distribution and Sales, News from Jobbers and Foreign Fields and a Record of New Devices and Trade Literature

"House Wiring Outlook Better," Says Boston Jobber

An encouraging improvement in the sale of wiring supplies is noted by Joseph E. Greene, of Joseph E. Greene, Inc., electrical supply jobber, of Boston, who informed a representative of the ELECTRICAL WORLD this week that house-wiring activities in eastern New England have for some months reflected a demand for electric service that is absorbing a goodly amount of material. This jobber notes a healthy demand for fixtures and portable lamps in connection with wiring improvements in the Northeastern territory. Industrial buying from New England jobbers is at present dull, he said, but considering general business conditions the movement of wiring supplies for residential service has been reasonably vigorous, especially since spring.

H. S. Whiting Doubling Last Year's Fixture Business

H. S. Whiting, president of the H. S. Whiting Company, Inc., New York City, manufacturer of the "Economy" and other commercial lighting units, states that business for the first six months of this year has surpassed the total recorded for the entire year 1920. The company has just recently moved its offices from 104 East Forty-first Street to Room 4839 Grand Central Terminal, and in line with the current volume of business has also increased its sales force. May was the biggest month recorded this year, it is stated, but June shows only a slight falling off. The company has only been in the lighting fixture business about a year and a half, having taken over the lighting fixture department of J. Livingston & Company, electrical contractors, New York City.

Luminous Unit Co. Matures Plans at Summer Conference

The Luminous Unit Company, St. Louis, Mo., held a sales conference at the home office June 27, 28 and 29, at which sales policies proper under present business conditions were discussed. According to Ray V. Owen, sales manager of the company, there was a rearrangement of discounts to jobbers and dealers and plans were matured to make it possible for jobbers to carry smaller stocks. Reports of representatives from various parts of the country indicated a great deal of business in prospect, much of it depending on the resumption of building. It was also disclosed that the greater part of present business is in special lighting units and that the demand for standard units is not holding up in proportion. Mr. Owen said the plant was working at about 40 per cent of normal and that he expected production to increase gradually during the fall.

Western Electric Opens Largest Electrical Warehouse

The new building of the Western Electric Company at 395 Hudson Street, New York City, which was officially opened on July 15, is not only said to be the largest concrete edifice on Manhattan Island but is also the largest combination warehouse, shop and office building occupied by any electrical supply jobber in the country.

CITY BLOCK COVERED BY JOBBING HOME

The building occupies the entire block at Hudson and West Houston Streets, an area of 338 ft. x 200 ft., with a total floor space of 595,000 sq.ft. Several departments of the Western Electric have already moved into their new quarters, but the New York shops and the supply divisions of the Eastern district territory, which includes New York State, New Jersey, Pennsylvania and New England, and of the International Western Electric Company, will not take up their quarters there until everything is completed.

Although most of the building is eleven stories in height, there is a narrow five-story wing on Greenwich Street. Under this one roof will be housed the many departments which for several years have been scattered throughout the city. A special demonstration room is provided for showing latest developments in electrical household devices, farm-lighting equipment, etc. A conference room and restaurant are also provided. Special attention has been given to a conveyor system with automatic push-button control of deflectors for various floors, an overhead conveyor system for stacking conduit, and hoisting equipment and three monorail cranes which are capable of handling 6-ton loads each. Loading and receiving platforms can handle fourteen and twelve trucks respectively at the same time. Included in the power load of the building there are 117 motors in the shops averaging 1 hp. in capacity and ten averaging 23 hp. in capacity.

Increase in Territory and Product for E. G. Bartling

E. G. Bartling, manufacturers' agent, 703 Ford Building, Detroit, announces that Indiana has been added to his territory on all the lines he represents. In addition to the lines noted in the item giving his organization appearing in these columns on May 21, he is handling the product of the Magic Electric Company, New York City, and the Eagle Electric Manufacturing Company, Brooklyn, N. Y.

Hoover Sweeper Awarded Medal at English Health Exhibit

The Hoover Suction Sweeper Company, North Canton, Ohio, announces receipt of a medal emblematic of highest honors at the Royal Sanitary Institute's Health Exhibition in Birmingham, England. The award, it is said, was made in competition with every known make of electric sweeper or vacuum cleaner.

The Royal Sanitary Institute, founded in 1875, has for its purpose the education of the public to the practicability, hygienic and economic value of household utensils and equipment, and the Earl of Plymouth is the president. It is gratifying to note that an American manufacturer received this award.

In passing it might be remarked that no award was made in the line of washing machines.

The Permutit's Water Softening Patent Upheld

In a suit in equity by Permutit Company, 440 Fourth Avenue, New York City, against the Harvey Laundry Company, a user of the apparatus in question, and the Refinite Company, inventor and manufacturer thereof, to enjoin infringements of letters patent No. 1,195,923, Judge Hazel on June 15, in the United States District Court, Western District of New York, handed down a decision in favor of the Permutit Company.

The patent relates to an apparatus for softening water by using a mineral substance of relatively small grains of zeolites or hydrated alumino-silicates and their exchangeable bases. Judge Hazel in the last paragraph of his decision states: "As the claims in suit are found to be valid and to have been infringed by defendants, as contended by the plaintiff, an injunction and accounting is decreed with costs."

The Permutit Company advises that

it will supply complete particulars respecting this litigation to any companies that wish this information.

Medart Pulley Co. Launches New House Organ

The *Dart* is the name of the new house organ of the Medart Patent Pulley Company, St. Louis, Vol. 1, No. 1, of which appeared under date of June, 1921. No. 2 also is out for July. The *Dart* has been conceived to interest power users and men concerned with industrial affairs in the company's lineshafting equipment. The publication states that in 1879 Medart gave to American industry the first steel rim pulley ever built.

Stein & Ellbogen Take M. J. Silberberg Agency

The agency for time and motion study watches and other instruments of precision formerly held by M. J. Silberberg, has been taken over by the Stein & Ellbogen Company, 31 North State Street, Chicago, which will have exclusive control of their distribution. A new instrument of precision has recently come to the front said to combine the advantages of the stop watch and the time-study watch. It will be known as the "split-second time-study watch." For the convenience of its customers the company has established a five-day repair service.

June a Good Month for Electric Furnace Company

The Electric Furnace Company, Alliance, Ohio, reports more orders for its Baily electric furnaces in June than in any single month in the last two years. These orders include standard brass melting units, car furnaces for steel plant purposes, and a special electric enameling equipment. Most of the sales were made to concerns not particularly busy at the present time, but who purchased this equipment with a firm belief that by the time the furnaces were installed and ready for operation business would be such as to justify the present expenditure.

Indications point to an equally good month in July. The foundries are exhibiting a desire to modernize their equipment so as to lower their cost of production and meet competition when business again shall have become normal.

The Automatic Reclosing Circuit Breaker Company, Columbus, Ohio, announces the opening of an office at 110 Hale Street, Charleston, W. Va., with Donald J. Baker as manager.

The Pawling & Harnischfeger Company, Milwaukee, has removed its San Francisco office from the Monadnock Building to 32 Beale Street. At the new location the company maintains a complete service station, warehouse and display rooms for electric cranes and hoists, machine tools and excavating machinery. R. M. Taylor, district manager for the Pacific Coast, has his headquarters at this office.

Harry G. MacLellan, James B. Fitch and **Ernest A. Skinner**, all of Angola, Ind., have organized what is to be known as the Electric Safety Equipment Company. The company will deal in all manner of electrical equipment.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

A mercantile firm in Catania (No. 35,105) desires to purchase spark plugs, magnetos, storage batteries, etc.

An agency is desired by a merchant in Ireland (No. 35,128) for the sale of an iceless ice-cream freezer.

An advertising sign company in England (No. 35,146) desires to purchase electric motors of fractional horsepower (1/20 to 1/50 hp.), universal, voltage 100 to 250; complete with suitable reduction gears, etc.

A merchant in Scotland (No. 35,147) desires to secure an agency and to purchase electrical appliances, electrical household fittings, flashlights and batteries, etc.

A manufacturing firm in Chile (No. 35,142) desires to be placed in communication with manufacturers of electric furnaces for rolling mills. This furnace should be of an approximate capacity of 5 to 7 tons per day of twenty-four hours.

JAMAICA RAILWAY TO BE ELECTRIFIED.—A bill authorizing the Jamaican Government to take over the traction and light system of the city of Kingston, Jamaica, and to equip 127 miles of the National Railway for electrical operation is now being prepared by the Attorney-General for submission to the colonial office. The government proposes to borrow between $6,000,000 and $7,000,000 to carry out the project.

MUNICIPAL ELECTRIC PLANT FOR BARBERTON, SOUTH AFRICA.—Bids have been asked by the Municipal Council of Barberton, Transvaal, South Africa, for machinery and equipment for a municipal electric light plant and distribution system. Specifications call for two electric generating units driven by gas or steam engines.

PROPOSED ELECTRICAL WORK IN SOUTH MANCHURIA, CHINA.—According to the *Electrical Times*, the South Manchuria Railway Company contemplates an expenditure of 2,485,961 yen on electrical work during 1921-1922. The project includes the establishment of an electric experimental station at Darien, the erection of a second power station at Darien, a third at Antung, and also extensions to the Darien electric tramway systems. There is also much other engineering work to be done.

ELECTRIC LAMPS FOR MONTEVIDEO, URUGUAY.—Local authorities in Montevideo, Uruguay, it is reported, are advertising for tenders to be submitted by Sept. 3 for furnishing 59,250 metallic filament lamps, from 10 to 300 cp., 225 volts, required by the State power house. Local representation is necessary.

LAMPS FOR ELECTRIC CAR LIGHTING IN AUSTRALIA.—The Victorian Government Railways Commissioners, Melbourne, Australia, are asking for tenders for furnishing 24,000 metal filament lamps (46 watts, 116 volts) for electric car lighting, 4,000 carbon filament lamps (32 watts, 140 volts), and a 5-hp. electric motor, controller, etc. Tenders for lamps to be submitted by July 27 and for motor, etc., Aug. 3.

SIGNALING APPARATUS FOR AUSTRALIAN RAILWAYS.—Tenders will be received by the Victorian Government Railways Commissioners, Melbourne, Australia, until Aug. 10 for 250 impedance bonds for power signaling (Contract 34,130) and 56 miles of insulated copper wire (Contract 34,131). Tenders will also be received until Aug. 17 for renewals for 3,000 sets of caustic soda primary cells (Contract 34,145). Specifications may be seen at the Department of Overseas Trade, 35 Old Queen Street, London, S. W. 1, England.

New Apparatus and Publications

COILED WIRE CARRIER.—The Baker R & L Company, Cleveland, has developed a device for its storage battery lifting trucks for handling and transporting wire in coils.

ELECTRIC ICE CREAM FREEZER.—A device for connecting a motor to an ice cream freezer is being marketed by Taylor Brothers Churn Company, St. Louis, with motor and freezer if desired.

OVERHEAD TROLLEY SYSTEMS.—The Whiting Corporation, Harvey, Ill., has developed its "short-turn overhead trolley system" for material handling employing short-radius curves, switches, cut-outs, etc.

SUCTION CLEANER.—The Pittsburgh Gage & Supply Company, P. O. Box 1236, Pittsburgh, Pa., has added a new "Gainaday" suction cleaner to its list of household appliances.

LIGHTING PLANT.—The Radiant Manufacturing Company, Sandusky, Ohio, manufacturer of light and power plants, has recently developed a 1¼-kw. water-cooled, 32-volt generating unit, consisting of a gasoline engine, 3½ hp., directly connected to a General Electric generator through flexible coupling.

ELECTRIC DRILL.—An electric drill, known as the "One-Hand-Y Drill' has recently been placed on the market by the Knight Engineering & Sales Company, Los Angeles.

DIRECT-CURRENT MOTORS.—The General Electric Company, Schenectady, N. Y., is distributing bulletin No. 48,121.1A, entitled "Direct-Current Mill-Type Motors, Type MD and MDS," superseding bulletin No. 48,121.1.

GENERATORS.—The Allis-Chalmers Manufacturing Company, Milwaukee, is distributing bulletin No. 1115, superseding bulletin No. 1098, entitled "Alternating-Current Generators," describing its engine-type generator units.

ELECTRIC SPECIALTIES.—The G & W Electric Specialty Company, 7440-52 South Chicago Avenue, Chicago, manufacturer of electrical specialties, has issued catalog 11, containing bulletin No. 211, covering its pot heads and accessories and bulletin 212, describing its underground boxes.

New Incorporations

THE INTERNATIONAL CORPORATION, Quinton, N. J., has been incorporated with a capital of $35,000 to develop electricity. The incroporators are G. Milton Harris, Quinton; Samuel W. Needy and Cornelius J. Benfer, Newark.

THE EVANS LIGHT & ICE COMPANY, Brooksville, Fla., has been incorporated with a capital of $25,000 to construct and operate electric light and power systems. The officers of the company are: W. D. Evans, president; Imo Evans, vice-president, and T. H. Evans, secretary and treasurer.

THE MIDLAND ELECTRIC COMPANY, Webster, S. D., has been incorporated with a capital of $25,000 by C. J. Strike, E. A. Sewall and W. W. Strike.

THE HOOSIER ELECTRIC LIGHT, HEAT & POWER COMPANY, Brewersville, Ind., has been incorporated with a capital of $20,000 by G. M. Robison, C. B. Stearns and E. A. Graves.

THE CROSS PLAINS (TEX.) POWER & LIGHT COMPANY has been incorporated with a capital of $25,000 by S. F. Bond, Taylor Bond and T. C. Cross.

THE NEON LAMP WORKS, New York, N. Y., has been incorporated with a capital of $9,000 to manufacture and deal in arc lamps. The incorporators and D. G. Albert, C. H. Carter and C. G. Katz.

THE GARDNER STORAGE BATTERY COMPANY, New Bedford, Mass., has been incorporated with a capital stock of $100,000 to manufacture storage batteries. The directors of the company are F. W. Gardner, president, Harold Gardner and Walter Gardner, 317 Rivet Street.

THE CAMBIA POWER COMPANY, Sanborn, N. Y., has been incorporated with a capital of $100,000 to generate electricity for light, heat and power. G. G. Mattern, Kenmore, is interested in the company.

THE BANGERT ELECTRIC COMPANY, Jamaica, N. Y., has been incorporated with a capital of [illegible] by W. A. and A. M. Bangert and T. Brieling.

Record of Electrical Patents

Notes on United States Patents

(Issued June 28, 1921)

1,382,620. Wire Clamp; William J. Carley, Culpeper, Va. App. filed Jan. 31, 1920. Trolley.

1,382,622. Program Battery-Charging Device; James W. Bryce, Binghamton, N. Y. App. filed filed Oct. 29, 1918. For time clocks.

1,382,631. Repeater Circuits; Charles S. Demarest, Brooklyn, N. Y. App. filed May 17, 1919. One repeater employed for several circuits.

1,382,664. Trolley Wheel; Otto Moore, Frankfort, Ind. App. filed March 26, 1910. Automatic sliding and rotating trolley.

1,382,738. Amplifying Apparatus; Marius C. A. Latour, Paris, France. App. filed June 8, 1918. Elimination of objectionable noises.

1,382,745. Electrical Rectifier and Pole Changer; Fred Schoenwolf, Chicago, Ill. App. filed Feb. 16, 1917. Automatically rectifies alternating current.

1,382,766. Party-Line Lockout for Telephone Systems; John W. Dorsey, Winnipeg, Manitoba, Canada. App. filed June 20, 1917. Lockout and signaling device.

1,382,781. Attachment for Electric Irons; Adam Hausam, Richmond Heights, Mo. App. filed Aug. 11, 1920. Automatically opening plug.

1,382,786. Rotary Spark Gap; August J. Kloneck, New York, N. Y. App. filed June 3, 1916. High-tension current modified in frequency.

1,382,795. Lightning Arrester; Ralph McNeill, Newark, N. J. App. filed May 4, 1920. Vacuum-tube.

1,382,808. Process of Precipitating Aluminum Compound; Mathias O. Sem, Christiania, Norway. App. filed April 23, 1918. Electrolysis.

1,382,817. Means for Automatically Recording Calls in Telephone Systems; William J. Blair, Melbourne, Victoria, Australia. App. filed April 28, 1917.

1,382,873. Stationary Induction Apparatus; Edward A. Wagner, Fort Wayne, Ind. App. filed Sept. 23, 1919. Transformer clamps.

1,382,877. Means for Frequency Transformers; Ernst F. W. Alexanderson, Schenectady, N. Y. App. filed Oct. 6, 1916. Frequency changer.

1,382,878. Cooling Dynamo-Electric Machines; Ernst F. W. Alexanderson, Schenectady, N. Y. App. filed Nov. 26, 1918. High-frequency alternator.

1,382,891. Telephone System; Bryant D. Campbell, Oakland, Cal. App. filed Feb. 6, 1917. Automatic means for counting coins.

1,382,899. Terminal for Electrolytic Condensers; Charles Le G. Fortescue, Pittsburgh, Pa. App. filed Jan. 16, 1919. Will not corrode.

1,382,905. Cooling Means for Electric Metal-Working Transformers; James H. Gravell, Elkins Park, Pa. App. filed Oct. 4, 1919. Welding transformer.

1,382,912. Insulator; Harry H. Hipwell, Pittsburgh, Pa. App. filed July 22, 1919. For a flashlamp.

1,382,914. Amplifying System; Charles A. Hoxie, Schenectady, N. Y. App. filed May 10, 1920. Electron discharge relays.

1,382,965. High-Tension Rectifying Apparatus; Nicholas V. Fedotoff, Brooklyn, N. Y. App. filed March 22, 1918. Constant direct current obtained.

1,382,968. Protective Device; Henry G. French, Schenectady, N. Y. App. filed Oct. 24, 1919. Relay.

1,382,987. Armature Winding; Jan A. Kuyser, Edgewood, Pa. App. filed April 16, 1913. Means for interconnecting cells.

1,382,988. Motor-Control System; Edwin S. Lammers, Jr., Wilkinsburg, Pa. App. filed Nov. 3, 1917. Rolling mills.

1,383,011. Switch and Contact Mechanism for Electric-Current-Regulating Plugs and Sockets; Antonio Papini, Philadelphia, Pa. App. filed July 8, 1920.

1,383,033. Electric Water Heater; Louis E. Seimbille, Paris, France. App. filed Sept. 24, 1918. Heater combined with faucet.

1,383,034. Electric Water Heater; Louis E. Seimbille, Paris, France. App. filed Sept. 24, 1918. Considerable surface but small volume.

1,383,037. Electric Contact Device; William E. Studstill, Murphy, N. C. App. filed July 13, 1920. Automatic train stops.

1,383,038. Telephone Call-Wire Circuits; John F. Toomey, New York, N. Y. App. filed June 10, 1919.

1,383,081. Method of Control for Electric Motors; Harry E. Dey, Jersey City, N. Y. App. filed Oct. 29, 1918. For electrically driven vehicles.

1,383,098. Consecutive Operation of Two or more Mechanisms; James F. Gill and John N. Chaviara, Liverpool, England. App. filed Feb. 26, 1919. Telegraphic.

1,383,108. Electric Steam Cooker; William S. Hadaway, Jr., New Rochelle, N. Y. App. filed July 26, 1917.

1,383,109. Rang; William S. Hadway, Jr., New Rochelle, N. Y. App. filed Aug. 1, 1917. Steam in conjunction with electric energy.

1,383,158. Trolley; Adam Shultz, Worcester, Mass. App. filed March 18, 1921. For preventing trolley from leaving wire.

1,383,186. Winding Apparatus; Carl A. Brink, Providence, R. I. App. filed July 13, 1918. For winding coils.

1,383,197. Bed Warmer; John R. Fletcher, Dayton, Ohio. App. filed Jan. 16, 1920. Guard for incandescent lamp.

1,383,211. Heat Producing and Distributing Element; Charles E. Johnson and Andrew J. Jorgenson, Vancouver, B. C. App. filed April 28, 1920. Heats circulated air.

1,383,233. Means for Detecting or Measuring Moisture; Charles A. Parsons and Alexander H. Law, Newcastle-Upon-Tyne, England. App. filed July 10, 1918.

1,383,236. Third-Rail Bracket-Clamp Cap; Hugh Rice, Yonkers, N. Y. App. filed No. 10, 1920. For supporting and insulating third-rail.

(Issued July 5, 1921)

1,383,275. Amplifier; Samuel E. Adair, New York, N. Y. App. filed Aug. 14, 1919. Tri-electric device.

1,383,303. Coupling; James T. Honen, Cleveland, Ohio. App. filed March 20, 1919. For connecting circuits.

1,383,361. Energy-Translating Device; William M. White, Milwaukee, Wis. App. filed Sept. 5, 1918. Ventilated brake for rotating parts.

1,383,472. Automatic Telephone Pay Station; George A. Long, Hartford, Conn. App. filed May 25, 1920.

1,383,487. Outlet Box; James J. Rutledge, Pittsburgh, Pa. App. filed April 10, 1919. Has knockouts.

1,383,494. Regulator; Edgar M. Soreng, Milwaukee, Wis. App. filed Aug. 25, 1916. Automatic battery charger.

1,383,534. Automatic Time-Indicating and Signaling Instrument; Charles M. Crook, Chicago, Ill. Automatic control.

1,383,564. Heating Apparatus; Emil Phillipson, New York, N. Y. App. filed May 28, 1920. Combined fan and heater.

1,383,584. Telephone System; Ray S. Wilbur, Lyndhurst, N. J. App. filed Dec. 27, 1918. Arrangement for signaling.

1,383,588. Semi-Automatic Telephone Exchange System; Joseph L. Wright, Cleveland, Ohio. App. filed Oct. 29, 1915.

1,383,670. Heating Apparatus for Use in Oil Wells; James C. Stephens, Norfolk, Va. App. filed July 20, 1920.

1,383,677. Telephone Exchange System; George Thompson, Mount Vernon, N. Y. App. filed Aug. 7, 1919. Circuit arrangement for line switches.

1,383,700. Acoustic Device; Henry C. Egerton, Ridgewood, N. J. App. filed Aug. 14, 1918. Telephone transmitter.

1,383,718. Electrical Connection; Albert C. Grunwald, Chicago, Ill. App. filed Aug. 8, 1919. For outlet box.

1,383,743. Telephone Exchange System; Leon A. Mortimer, New York, N. Y. App. filed Aug. 24, 1918. Toll-line connections.

1,383,777. Heating Apparatus for Use in Oil Wells; James C. Stephens, Norfolk, Va. App. filed July 26, 1920. Electric.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

CLIFTON, ME.—Investigations have been made by the Bangor Electric Company, Bangor, in Clifton with a view of installing an electric lighting system here.

SPRINGFIELD, MASS.—A petition has been presented to the City Council by merchants on Bank Street for the installation of additional electric lamps on that thoroughfare.

NEW BRITAIN, CONN.—The Connecticut Light & Power Company has petitioned the City Council for approval of the method of constructing a 13,000-volt transmission line between Black Rock and Church Street substations.

Middle Atlantic States

ALBANY, N. Y.—The Hires-Turner Glass Company, Thirtieth and Walnut Streets, Philadelphia, Pa., plans to build a one-story power house to be used in connection with its new plant on Tivoli Street, Albany. Estimated to cost about $100,000.

ATTICA, N. Y.—The Genesee Light & Power Company, Batavia, has applied to the Public Service Commission for permission to construct an addition to its electric plant at Attica for extensions in local service.

BINGHAMTON, N. Y.—Negotiations are under way for the extension of the Binghamton Light, Heat & Power Company's transmission system a distance of 27 miles north of Binghamton, covering the towns of Maine, East Union, Glen Aubrey, Whitney Point, Lisle, Killawog and Marathon. The plans provide for the construction of a new substation in the towns where energy will be distributed to the local power company in each village. The cost is estimated at about $70,000. R. L. Peterson is general manager.

DANSVILLE, N. Y.—Work is under way on the development of a hydro-electric plant on Bradner Creek about 2 miles from Dansville to supply power for the village creamery. The plans provide for three dams, the first, which is under construction, will be 28 ft. high, the second, 38 ft. high. Plans for the third dam are not completed. The three dams, it is estimated, will develop about 1,000 hp.

HERKIMER, N. Y.—The Herkimer Municipal Commission has been authorized by the Public Service Commission to build an addition to its municipal electric lighting system.

IONA ISLAND, N. Y.—Bids will be received by the Bureau of Yards and Docks, Navy Department, Washington, D. C., until July 27, specification 4215, for improvements to the power plant at Iona Island. A deposit of $10 is required for plans. For information address the chief of bureau.

JAMAICA, N. Y.—The Ashland Contracting Company, 186 Remsen Street, Brooklyn, recently organized, contemplates the construction of an industrial project on Fulton Street, Jamaica. The plans provide for a central power house, central market building, ice and refrigerating plant and other mechanical buildings. The total cost is estimated at about $1,500,000. Michael H. Wolpert is president.

NEW YORK, N. Y.—The New York Edison Company, it is reported, will soon receive bids for the construction of a two-story substation, 40 ft. x 100 ft., at 214 East Fifty-second Street, to cost about $175,000.

SAG HARBOR, N. Y.—The Village Trustees have appointed a committee to investigate the feasibility of establishing a municipal electric and gas plant in Sag Harbor.

SPRINGVILLE, N. Y.—Bonds to the amount of $90,000 have been voted for the construction of a dam to supply power for the municipal electric light plant.

UTICA, N. Y.—Steps have been taken by merchants on Columbia Street in the downtown business section for the installation of ornamental lamps on that thoroughfare from Genesee Street to State Street.

DUSHORE, PA.—Application has been made by the Sullivan Electric Company to the Public Service Commission for charters for new electric companies to operate as subsidiary organizations at Laceyville, Forkston Township, Meshoppen Borough, Meheopany Township, Washington Township, Windham Township, Powell, Monroeton and vicinity. The application, it is understood, is preliminary to extensive development in these sections.

LEETSDALE, PA.—Tate-Jones & Company, Inc., manufacturers of industrial furnaces, oil heaters, etc., plan to install a centrally-located switchboard and carry its industrial load through one meter instead of two. James H. Knapp, 915 Empire Building, Pittsburgh, is general manager.

PHILADELPHIA, PA.—A recommendation submitted by James F. McLaughlin, chief of electrical bureau, appropriating the sum of $3,900,000 for the installation of a new fire alarm system has been approved by Director Cortelyou of the Department of Public Safety. It is proposed to apportion the appropriation as follows: New buildings and apparatus, $1,500,000; four substations, $100,000 each; equipment, $500,000; cables necessary to place police and fire wires underground, $1,500,000.

PHILADELPHIA, PA.—Plans have been filed by the Pennsylvania Sugar Company, 1037 North Delaware Avenue, for extensions and improvements in the power house at its works to cost about $15,000.

PHILADELPHIA, PA.—Bids will soon be received by the quartermaster, Frankford Arsenal, Philadelphia, for the installation of an electric lighting system in the experimental shop.

PITTSBURGH, PA. — Plans have been filed by the Northside Packing Company for the construction of a one-story power house on Romain Street, Northside.

TOWANDA, PA.—Application has been made by the Towanda Gas & Electric Company to the Public Service Commission for permission to organize two subsidiary companies to be known as the North Towanda Electric Company and the Wysox Electric Company.

WILKES-BARRE, PA.—Steps have been taken by the business men of Wyoming Avenue and Market Street to secure a new lighting system on those streets, replacing the arc lamps now in use with incandescent lamps mounted on standards.

CUMBERLAND, MD.—The City Council has authorized the installation of a new ornamental lighting system on Virginia Avenue.

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing the following: Until July 22, Brooklyn, Schedule 8456—10,000 ft. electric wire; Washington, Schedule 8462—miscellaneous quantity of wire, cable and lamp cord. Until Aug. 5, Mare Island, Schedule 8474—miscellaneous quantity of lamp cord and cable.

WASHINGTON, D. C.—Bids will be received at the office of A. L. Flint, general purchasing officer, Panama Canal, Washington, D. C., until August 1, circular 1453, for furnishing wire and cable, motors, pumps, insulators, voltmeters, switches, reflectors and receptacles.

North Central States

COLUMBUS, OHIO. — Bids will be received by the Board of Education of the City School District of Columbus, Ohio, Ohio National Bank Building, Columbus, until July 25 for electric wiring for the manual training motors at Avondale, Indianola and Roosevelt School buildings in said district. Plans and specifications are on file in the office of Howard Dwight Smith, school architect, 50 East Town Street, Columbus.

PIQUA, OHIO.—The Orr Felt & Blanket Company plans to build a new one-story power house for general mill service. Fretzinger & Sussellman, 1155 Reibold Building, Dayton, are architects.

TOLEDO, OHIO.—The Council has authorized the installation of 72 new lamps on Adams Street and 91 lamps in other parts of the city.

MOUNT STERLING, KY.—The Salt Lick Lumber Company plans to rebuild the power house at its mills, recently destroyed by fire.

KOKOMO, IND.—The Kokomo Steel & Wire Company is contemplating a number of additions and changes in its electrical system, including increasing the load from 400 kva. to 600 kva. and changing the system from 2,200 volts, two phase, 60 cycles, primary and 440 volts, three phase, three wire secondary to 4,000 volts, three phase, four wire, 60 cycles primary and 460 volts, three phase, 60 cycles, three wire secondary. J. E. Frederick is general manager.

BLOOMINGTON, ILL.—The city officials are considering the question of placing underground all wires in the city.

DUQUOIN, ILL.—The Southern Illinois Light & Power Company has been authorized by the Illinois Commerce Commission to erect and operate an electric transmission line from Duquoin to Mount Vernon and Waltonville.

OQUAWKA, ILL.—The Henderson County Public Service Company, Kirkwood, has applied for a franchise to furnish electricity in Oquawka.

PEKIN, ILL.—The Pekin Light, Heat & Power Company has applied to the Illinois Public Utilities Commission for permission to erect a transmission line from the Rockford power house in Pekin to South Pekin.

PEPIN, WIS.—The Wisconsin-Minnesota Light & Power Company is considering extending its line from Nelson to Pepin. An advance loan of from $15,000 to $17,000 would be required from the citizens of Pepin to cover half the cost of construction.

ST. PAUL, MINN.—Twenty buildings at Henry Schroeder's dairy farm on Rice Street, including power plant, farmhouse, barns, etc., were recently destroyed by fire causing a loss of about $100,000.

CORNING, IOWA.—Bonds to the amount of $60,000 have been voted for the construction of a municipal power plant in Corning.

DUBUQUE, IOWA. — A movement has been started by the Travelling Men's Greater Dubuque Club and the Kiwanis Club to secure extensions to the street lighting system in Dubuque.

WINTERSET, IOWA. — Bonds to the amount of $100,000 have been voted for the construction of a new municipal electric light plant.

RAYVILLE, MO.—The City Council has granted the Excelsior Springs Light, Heat & Power Company, a twenty-year franchise for the construction of an electric transmission line to Rayville for light and power purposes. A special election has been called by the Council to vote on a special lighting tax for street lamps.

BRUCE, S. D.—Bonds to the amount of $12,000 have been voted to install an electric lighting system. A 24-hr. service will be established.

Southern States

ATHENS, GA.—Arrangements have been made by the Athens Railway & Electric Company to issue $179,000 in bonds, the proceeds to be used for improvements, etc.

ATLANTA, GA.—Plans have been completed whereby the Morgan Falls plant of the Georgia Railway & Power Company will be changed from 25 cycles to 60 cycles. The plans provide for replacing the water wheels with larger units, rewinding the present 25-cycle alternators and substituting new rotarys for those now in use, changes in transformers, switchboards, etc.

JULIETTE, GA. — The Juliette Milling Company plans to build a hydro-electric generating plant on the Ocmulgee River to cost more than $150,000. Contract has been awarded to the Hardaway Construction Company, Atlanta, for the construction of the impounding dam.

ROCK MART, GA.—The City Council is considering the erection of a transmission line 2½ miles long, to connect with the system of the Georgia Railway & Power Company. The plans provide for the construction of a transformer station and the installation of an electric pump. The cost is estimated at $15,000.

ST. PETERSBURG, FLA. — The Grove Land & Timber Company, Asheville, N. C., has acquired 11,000 acres of land in St. Petersburg and proposes to develop it for live stock purposes. The plans provide for the construction of an electric light plant and waterworks. E. W. Grove is president.

FORT PAYNE, ALA.—A. A. Miller, Chattanooga, Tenn., has acquired the local municipal power plant which will be operated as a private enterprise to furnish local service. Extensive improvements including the installation of new equipment will be made.

VERBENA, ALA.—The Alabama Power Company, Birmingham, has been granted a preliminary permit for the construction of a dam, 74 ft. high and 1,600 ft. long, at Duncan's Riffle on the Coosa River near Verbena. The plans provide for an initial development of 60,000 hp. and an ultimate of 120,000 hp. The project is estimated to cost between $7,000,000 and $8,000,000.

ABBEVILLE, LA.—At an election to be held August 23 the proposal to issue $125,000 in bonds for the construction of an electric light and water plant will be submitted to the voters.

BATON ROUGE, LA.—The Baton Rouge Electric Company plans to extends its transmission lines to Dixie. The cost is estimated at about $200,000. T. L. Small is manager.

OKLAHOMA CITY, OKLA.—The plant of the Curtis-Bentley Woodworking Company, including a three-story structure and a power house, was recently destroyed by fire causing a loss of about $500,000 including machinery. The plant, it is understood, will be rebuilt.

EDGEWOOD, TEX.—A conference was recently held by H. Jalonick and M. P. Ross of Dallas, representatives of the Texas Power & Light Company, and a number of business men of Edgewood to discuss the probability of extending immediately the company's high-tension line from Terrell by way of Edgewood to Tyler. The cost of the line is estimated at about $300,000.

WHITNEY, TEX.—The City Council has authorized an election to be held July 25 to submit to the voters the proposal to issue $15,000 for rebuilding the electric light plant recently destroyed by fire. The town is at present without lighting service.

Pacific and Mountain States

BREMERTON, WASH.—The Council is considering the installation of an electric lighting system on Fifth Street.

SAN DIEGO, CAL.—The San Diego Consolidated Gas & Electric Company has been authorized by the Railroad Commission to make considerable improvements and extensions.

Canada

GALETTA, ONT.—The Carleton County Council has authorized the erection of a transmission line by the Galetta Electric Power & Milling Company to supply energy to a number of farmers and for the Connaught rifle range. The line will extend from Galetta to Carp and from there to the township of March to the county road known as Carp No. 2, then along the March Road to the rifle ranges.

HAMILTON, ONT.—The Dominion Power & Transmission Company, Terminal Station, plans to construct a double-track electric street railway, 3,000 ft., on York Street from Queen to James Street, to cost about $100,000. E. P. Coleman is superintendent and engineer.

TORONTO, ONT.—The Board of Control has authorized the expenditure of $750,000 to enable the Toronto Hydro-Electric Power System to obtain equipment to be used in connection with supplying power for the Transportation Commission.

Miscellaneous

CITY OF MEXICO, MEXICO.—Plans are under way by the Mexican Light & Power Company for the construction of a 40,000-hp. hydro-electric plant to be used in connection with the Necaxa system, and to take care of present and future demands for additional power. The same water that passes through the present power plants, it is understood, will be used. The cost of the plant is estimated at $2,000,000.

PUEBLA, MEXICO.—S. Pearson & Son, Ltd., are considering additions and improvements to its hydro-electric plant near Orizaba and the street railway and lighting plants in Vera Cruz and Tampico. The transmission line which supplies light and power to Puebla from the Orizaba plant will be extended to other cities and industrial centers in this part of Mexico.

Electrical World

New York, Saturday, July 23, 1921

The Appliance that Makes the Greatness of Our Industry

SOMETIMES it is good to think back behind the present scenes and ask what really makes so many wheels go around so fast in this big industry of ours. There is a simple reason.

In the beginning we had but electricity itself, a mystic thing for scientists to putter with. Then a way was found to make this electricity develop light. Then it was turned into a power to drive machinery. Then it was made a source of heat. From that time on to this the industry has grown only as more and more useful things have been devised for electric light and power and heat to do, and more people have been induced to utilize them. And we can only hope for further growth as we increase the number of these applications and their popularity.

It is not the power house or the factory, therefore, that makes this industry what it is, but the lamp, the motor and the heating appliance. It is not the number or the size of generators or transmission systems or the volume of the business done by manufacturers and jobbers. It is the multiplicity of lamps, of motor-driven machines, of industrial ovens and of clothes washers, ranges, grills and cleaners that serve the people of the earth. Here is the measure of our greatness, and no man is thinking straight who does not recognize as vital to us all the problems of increasing the applications of electricity, of making their use more universal, and of maintaining them.

There are many electrical appliances now well standardized and in broad use. There are many others not yet so widely known that will enjoy no less a popularity some day. There are several of these still in the pioneering stage that ere long will rival in their influence and value anything that uses electricity today. In them lie much of the future growth and greatness of the electrical industry. Why is it, then, we ask, that most electrical men remain content to know so little of these appliances and do so little to increase their use?

Surely each one of us should be the leader and the pioneer in things electrical for his own friends and neighborhood. Our homes should be equipped with all the labor-saving and cost-saving devices and as many of the comfort-bringing appliances as we can possibly acquire. We should advocate them. We should personally know how to use them. By our example we should be giving constantly new impulse to the spread of the great idea of "doing it electrically." For after all, it is only for the appliance that the energy is generated.

Charles Otto Lenz

A consulting engineer of wide experience whose work includes the design of some of the best-known plants and systems in the country

IN THE final analysis the backbone of any industry are the men who get things done, for after all it's results that count. In this category belongs C. O. Lenz, consulting engineer, who while specializing in steam power plant construction, hydro-electric development and refrigeration has an experience covering the entire range of a consultant in the generation, transmission and utilization of electrical energy.

Mr. Lenz is a product of New England, having been born at Providence, R. I., in 1868, and graduated at the age of twenty-one from the Massachusetts Institute of Technology. His first three years after graduation were spent in New York in the engineering department of the Edison General Electric Company. In 1892 he went to Chicago, where he became associated with the late Frederick Sargent as assistant engineer for the World's Columbian Exposition, in charge of all power equipment design, construction and installation, except that in Machinery Hall. This association with Mr. Sargent really marked the beginning of Mr. Lenz's consulting work for at the conclusion of the Exposition he joined the Sargent & Lundy engineering organization as first assistant engineer to Mr. Sargent. In this capacity he designed the Harrison Street Station of the then Chicago Edison Company and the first Commonwealth Edison station, besides electric power plants for the Milwaukee Railway Company, Cincinnati Edison Company, United States Electric Company, Washington, D. C.; Union Traction Company of Anderson, Ind., and Toledo Traction Company. In 1900 he resigned to go with J. G. White & Company in New York, where he was assistant engineer in charge of design and construction of plants for the Toledo-Monroe Railway, Colorado Power Company and Imperial Electric Light & Power Company of St. Louis, besides being chief engineer in the design of power plants in Manila, Porto Rico, Rutland, Vt.; La Fontaine, Ind., and Harrisburg, Pa. From 1905 to 1908 he was associated with Sanderson & Porter, where in addition to designing a number of plants he was engineer in charge of the Brooklyn Edison valuation and the valuation for the city of New York of United Electric Light & Power Company and Katonah water power properties.

In 1908 he established a consulting engineering office and during the thirteen years he has been thus engaged he has had a varied experience. His most important work in that connection was the design and construction of the 96 000-hp. development of Tallulah Falls for the Georgia Railway & Power Company, which was placed in operation in 1913. The main substation for supplying Atlanta with a rating of [illegible] kv. was then said to be the world's largest outdoor substation. He also built the Cabin Creek plant of the Virginia Power Company. Mr. Lenz also is a fellow of the A. I. E. E.

No better tribute could be paid to any engineer than that by the late Frederick Sargent, his early guide and constant friend, who once said: "Give it to Lenz and then forget about it. It will be done, and done right."

Electrical World

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Muscle Shoals Again in the Limelight

According to the daily press Henry Ford has made the government an offer for the hydro-electric and nitrate plant at Muscle Shoals, on the Tennessee River in Alabama, when completed. This should give rise to some thought on the part of Southern power companies operating in that district. Last winter when the water power committee of the National Electric Light Association was in session in Washington these companies were anxious to know what the new administration's attitude was toward Muscle Shoals, and the ELECTRICAL WORLD secured for them from Secretary Weeks of the War Department the very definite assurance that if any private corporation would agree to take over the plants he would petition Congress for the money with which to complete them. It was the expectation that the price per kilowatt would approximate the pre-war cost of other Southern hydro-electric developments, and that the difference would be accepted by the government as a war loss. It was also thought that a syndicate could be formed to take over the projects and that the energy would be apportioned among the several power companies having need of it. Whether any decision was ever reached we do not know. What we do know is that the Alabama Power Company has started a new hydro-electric development on the Coosa River, so that if the government completes the Muscle Shoals project and sells it to Henry Ford an interesting situation will develop. Either the output will be used to make steel or automobiles or it will be offered for sale in a market already well served. And thereon will hang a tale. The whole history of the Tennessee River and of Muscle Shoals is interwoven with romance and politics, chiefly the latter, and the final chapter, we are sure, will not be one whit less absorbing and exciting in its details than the other chapters have been during the past decade.

Police Value of Public Street Lighting

The refusal of the City Council finance committee of Chicago to grant pay increases to linemen, repairmen and power house operators employed by the city caused a strike of the employees of the municipal electrical department last week and for a time a section of Chicago's streets remained unlighted. Fortunately the strike was of short duration, but the lesson was none the less effective and ought not to go unheeded, although it undoubtedly will. The late Theodore Roosevelt when he was Police Commissioner in New York City was credited with the statement that one street arc lamp was equivalent to one policeman, and it is generally recognized that light and crime are rarely found together. Hence, any one who willfully darkens the streets endangers public safety and is an enemy to society. We hope that the time will come when strikes on any public utility will be treated as a crime. Nor should there be any occasion for them. All differences should be subject to compulsory arbitration, and within reasonable limits no employee whose presence is absolutely essential to the continuity of the service should be permitted to withdraw until a substitute has been found. This is all in the public interest, and that in the utility business is paramount. It is expedient, moreover, that employees of public utilities be properly looked after and adequately paid. They should be as satisfied in their calling as policemen and firemen; in many respects their work is just as important and just as essential to the public welfare as that of the guardians of the peace and the fire protectors.

The Tariff and the Electrical Industry

When the government of the United States proposes to protect infant industries against foreign competition by means of a tariff we are heart and soul for it; but when it proposes to erect a high wall around full grown and husky industries and sometimes monopolies, we think it is time to protest. We have already protested against a tariff on oil and now we just as emphatically protest against any tariff on copper and aluminum. Producing and exporting more copper than any other country in the world, why should the copper producers need or seek protection? The electrical industry is a large user of copper and also of aluminum, the price of which is fixed by that of copper, and therefore the industry will suffer in a non-competitive copper market. As for aluminum, we have always felt that the price was too high and that there is little or no competition in its manufacture.

The electrical industry also employs large quantities of graphite, carbon and mica, for brushes, electrodes and for insulating purposes. The best grades of mica we must import; but graphite and carbon we produce in abundance. We fancy the difficulty is one of quality rather than quantity, and inasmuch as quality can be secured if sought after, we doubt the wisdom of penalizing our industry, which needs and is willing to purchase the best the market affords. One foreign company already has established an electrode manufacturing plant in this country, and if an oppressive tariff is put on carbon and graphite other foreign companies are sure to establish factories here also. Cheap labor need not be feared. American labor through the wider use of machinery produces far more than European labor and is more enlightened and efficient.

We are the world's greatest user of electricity in industry and yet we do not begin to use half enough. If the country would use more machinery all industry and labor would be better off. We regret to see the proposed tariff on incandescent electric lamps and bulbs, because, while compared with the ordinary oil lamp chimney the incandescent electric lamp is cheap despite the numerous processes it passes through in manufacture, still a little competition would do no harm, and the lamp industry is no longer an infant in arms needing protection. American incandescent lamps are the finest in the world because American research has made them so, and we feel American skill can outmatch anything that Europe or Asia can produce.

Analysis of Distribution Systems Is Essential

TO SOME engineers who are responsible for the operation of distribution systems they have too often appeared so complicated that any effort to analyze and systematize them has seemed a task of such magnitude that it has never been undertaken. However, the general tendency nowadays is toward acquiring a working knowledge of conditions in all fields. Theodore H. Rice's paper reflects this tendency and indicates means of so arranging the information regarding the distribution system that maps and records can be readily made and kept. Any operator with this equipment can proceed to improve or add to a system along definite lines and with good chance of effecting economies, if proper cost analyses are made to substantiate a general policy.

Perhaps the most striking fact is the demand that exists at present for some convenient means of indicating the load conditions on distribution transformers. A device easy to install and reasonably priced that would give warning when a transformer is in danger of overheating because of overload must undoubtedly be produced in the near future. Some device of this nature that can be read from the ground will be especially desirable on overhead construction. Aside from the evident saving in the amount of testing required to insure transformers against dangerous overloads, it is unquestionable that with a dependable device of this nature it will be possible to carry high average peak load on transformers and thereby considerably reduce transformer investment. It is gratifying to find a general desire for economy on distribution lines in the many efforts that are being made to obtain accurate knowledge of conditions on distribution systems.

Calculation of Power for Industrial Heating Is Simple

INDUSTRIAL operators are beginning to understand that electric heating pays at costs now readily attainable just as central stations are just beginning to realize the importance of industrial heating as a steady and paying load. In the current issue Harold Fulwider considers from an intensely practical standpoint the calculation of power required for the ordinary cases of industrial heating, such as japanning ovens, core-baking ovens, and the like. His working out of practical examples brings out very clearly how computations should be made for similar cases. In the case of ordinary oven work, such as japanning, the material baked, together with the truck on which it is placed, must be brought to the baking temperature, which requires a perfectly definite amount of heat, dependent on the specific heat of the material. Furthermore, the vapors driven off from the solvent must be disposed of so that the volume of air to be heated to the working temperature for each charge is definite. Then there is loss from general radiation, loss through the doors when opened for changing the charge or for inspection, and another loss in raising the oven itself to the working temperature at the start. In instances like core baking, where considerable water has to be evaporated, the latent heat of vaporization is not an unimportant item, in the example cited accounting for a full quarter of the total energy. After the foregoing factors have been taken care of there is a certain amount of unclassified radiation and convection losses which depend largely on the particular way in which the oven is used, but these hardly amount to 15 per cent of the total. Speaking generally, the actual efficient work done in an oven engaged on such tasks as Mr. Fulwider considers appears to run between two-thirds and three-quarters of the entire energy input, which is certainly a figure that does vast credit to the electrical method.

Efficiency Versus First Cost

THE purchaser of large power equipment in considering competitive bids always considers the guaranteed efficiencies as well as the first cost. But how many purchasers of moderate-size machines consider efficiency? This question is raised by Miles Walker in a recent number of the *Electrician* (London), who states that the average purchaser, not being able to test the manufacturer's claim for efficiency, is more influenced by the question of first cost, and that manufacturers recognizing this fact are showing an increasing tendency to cut down the amount of material in industrial equipment, thereby lowering the efficiency. The condition is aggravated in the case of many motors by supplying them with fans, which so improves ventilation that a large loss may be carried on a small frame. The fan itself, however, adds considerably to the windage losses.

The question raised is, in effect, whether Kelvin's Law should not be applied to small machines. In the article referred to figures are given of typical cases in which the weight of field copper would have to be increased from two to four times if the most economical size of wire were to be used. On similar grounds the same author makes a plea for the use of silicon iron in motors and generators, showing that the resulting improvement in the usual values of iron losses would effect a saving which is far greater than the added cost of the somewhat heavier machine occasioned by the use of silicon iron.

Mr. Walker seems to make a very good point in his claim that electrical manufacturers are proceeding upon the wrong lines in cutting down the first cost of electrical machines at the expense of efficiency. However, we have not noticed any great tendency in this direction in this country, at least among reliable electrical manufacturers, and trust that they will not display such shortsightedness. The cost of the materials in the average machine is generally a relatively small part of the total cost. If efficiency can be substantially increased at relatively small increase in the total initial cost of the machine, it would seem to be advisable that some concerted effort should be made to induce manufacturers to work in the other direction. The importance of the matter lies not so much in the saving to be effected in the continuous operation of one machine or plant, but in the aggregate power saved within a large community or in the country as a whole.

No Utility Priority for Coal Probable

THE chairman of the Interstate Commerce Commission, in view of the present rail and coal situation, has suggested that all public utility corporations lay by a plentiful store of coal before winter sets in. Secretary Hoover has also intimated that storage at this time is desirable and that inasmuch as proper warning has been given it is hardly likely that companies which find themselves short of coal will be favored by priority orders next winter. Be that as it may, the warning is worth heeding. Of course there is an injustice done utilities, and through them the general public, because utilities must tie up much needed capital in coal not now needed and suffer the loss of deterioration and the expense of rehandling just to accommodate the coal producers and railroads. That is too great a price ordinarily to pay for insurance, and too much to ask in the way of co-operation. If the coal producers and the railroads really want to move coal during dull months they might offer inducements in the shape of lower prices and preferential freight rates. It is unreasonable to expect outsiders to interest themselves in the business of others. Every merchant knows how to make goods move from his shelf, if they can be made to move at all, and the electric light and power companies of the country learned years ago how to attract off-peak business. If the coal producers and the railroads would use plain business sense and not try to force other industries to play their game just because coal is absolutely necessary to the life of the country both would undoubtedly fare better in public estimation. There are other seasonal businesses besides the coal business, and apparently those in charge of such business manage somehow to see to it that the public demand is adequately supplied. Might we suggest that the coal operators and railroad executives at this season consider the straw "Katy" and all that it means? Be it a "Panama" or just an ordinary straw hat, it holds for them a lesson.

Combining Power and Water Supply

NOT a few novelties in hydro-electric development have originated in southern California. One of the most interesting examples which have yet appeared is described in this issue of the ELECTRICAL WORLD. Two years ago the shortage of power in the territory around Los Angeles became so acute that something had to be done at once to relieve it. One remedial measure adopted by the city of Los Angeles was to utilize as quickly and efficiently as possible an available power site on its water supply system. One plant operated from this supply was already in use, but a further opportunity appeared at a point nearer the city where a drop of 515 feet would make available about 30,000 hp. The striking feature of the new installation from the hydraulic standpoint is the use of vertical-shaft turbines instead of impulse wheels, each with a maximum rating of 20,600 hp., and so planned that they have their maximum efficiency at a point near average load and corresponding to an equal division of the total present flow through the two turbines. Although the water supply is provided with a surge tank at the head of the penstocks, it was found desirable to install a pressure regulator worked by a hydraulic governor to offset the effects of violent variations in load. An arrangement is provided whereby there is no risk of unsealing the draft tubes. The regulators may be adjusted to bypass any quantity of water up to the full discharge of the turbines in case of suddenly losing the load. For this purpose they have proved their usefulness, since in a single day not long ago they were called into activity five times.

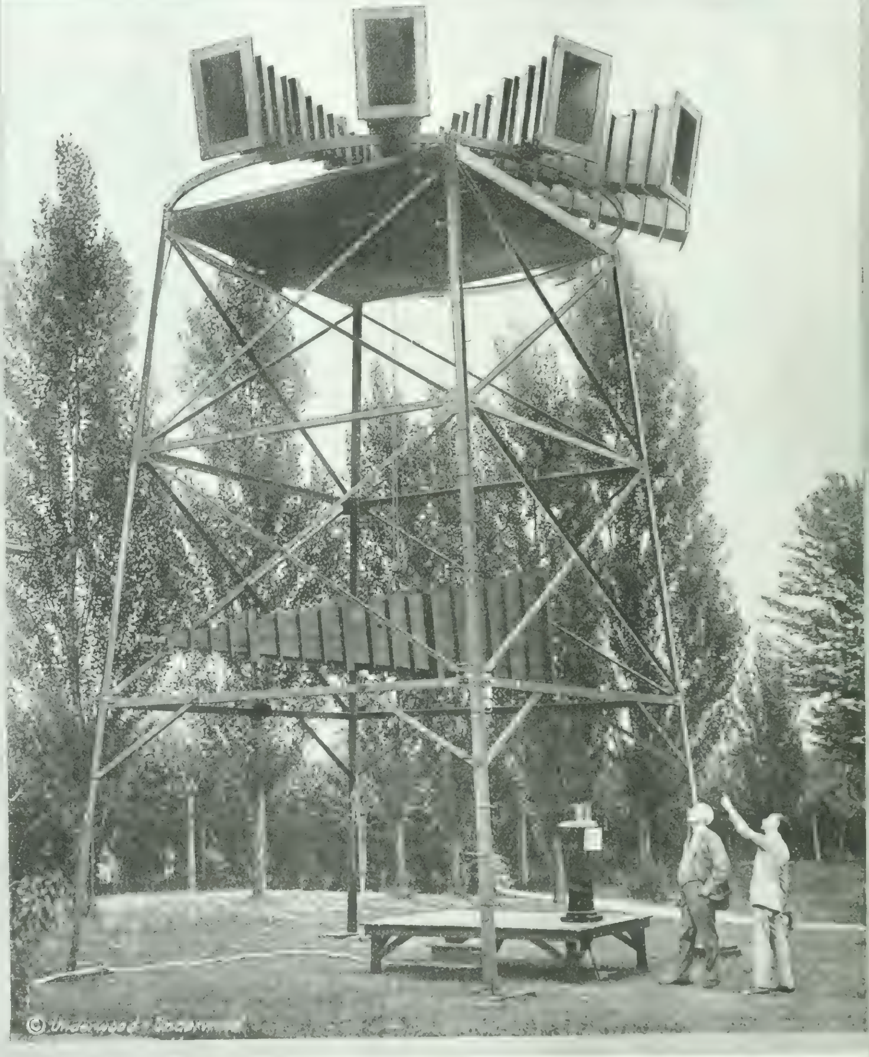
A Park Lighting System that Marks an Advance

SUITABLE ornamental lighting for parks and parkways stands almost by itself as a problem in public lighting. More and more parks are becoming community centers. The ways leading to them carry heavier and heavier traffic, and the situation demands lighting far better than was the case when parks were virtually used only in the daytime. We are glad in our current issue to give an account of the lighting recently installed at Edgewater Park, Cleveland, in which city C. G. Beckwith is the superintendent of lighting. The conditions to be met were in theory simple. It was needful to have fixtures that looked well both by day and night, distributed the light efficiently with minimum glare and gave sufficient illumination on the boulevards as well as in the park proper, while at the same time the equipment had to be simple, reliable and easily maintained. These requirements are not difficult to fulfill today provided that the lighting engineer has the courage of his convictions in breaking away from the bad precedents.

About two years ago the deficiencies of the Cleveland lighting system had become so conspicuous that a change was resolved on, and the present installation, which is an exceptionally good one, was introduced. This latest system consists of 600-cp. gas-filled series lamps carried in lanterns centered 18 feet above the ground and spaced at about 200 feet. The lanterns are of the suspension type, from a bracket arm carried fairly well out and provided with glass panels in bottom and sides. The light is well distributed by the rippled opalescent glass, and the lamp is equipped with a dome refractor and with a curved reflector which keeps the light well down, inasmuch as in parkways no considerable amount of upward light is either necessary or desirable. This well-chosen mounting height gives an admirable distribution of the light, and the lantern equipment has proved singularly easy to clean and keep in order. The lantern itself is suspended by a bayonet joint, and when cleaning is necessary the cleaner need only take the lamp out through the hinged panel at the side, turn the lantern and take it down. The lamps themselves are of the high-amperage type, and there is an individual two-coil transformer in the base of each of the rolled-steel poles. A unique safety device in the form of a lighted bull's-eye is provided on each post to avoid danger to traffic which might arise in case a lamp went out. In each standard there is a colored glass bull's-eye about 6 feet up, behind which is a small lamp in multiple with the main lamp on the transformer circuit. So long as the main lamp is burning the voltage on the signal lamp is so reduced that there is a barely visible glow, but if the main lamp burns out, the signal lamp comes up and makes the presence of the standard particularly prominent.

Altogether it is an installation which marks an advance in the technique of park lighting and furnishes an example which ought to be followed by cities and towns in other parts of the country.

Population of United States Assembled Could Hear One Speaker with This Equipment



A RECORD in projecting speech has been established by the American Telephone & Telegraph Company at an experimental station in the Catskill Mountains where a speaker's voice was made intelligible 38 miles away through the medium of a loud-speaking telephone. The equipment is similar in some respects to that used at recent outdoor addresses to large audiences but has considerably greater amplifying power. It consists chiefly of electrostatic transmitters setting on the pedestal on the speaker's platform, vacuum-tube amplifiers in cascade and the loud-speaking projectors shown on the tower. The single lower projector established the record, the energy amplification being 10^{10}. H. B. Thayer, president, and Colonel J. J. Carty, vice-president of the American Telephone & Telegraph Company, are shown discussing the performance of the equipment.

Ornamental Lighting for Cleveland Parks

Modern System with Gas-Filled Lamps Inclosed in Lanterns of Opalescent Rippled Glass Proves Adequate and Readily Maintained—Rolled-Steel Posts Adopted—Installation Costs per Lamp

By C. G. BECKWITH

Superintendent of Light and Heat, City of Cleveland, Ohio

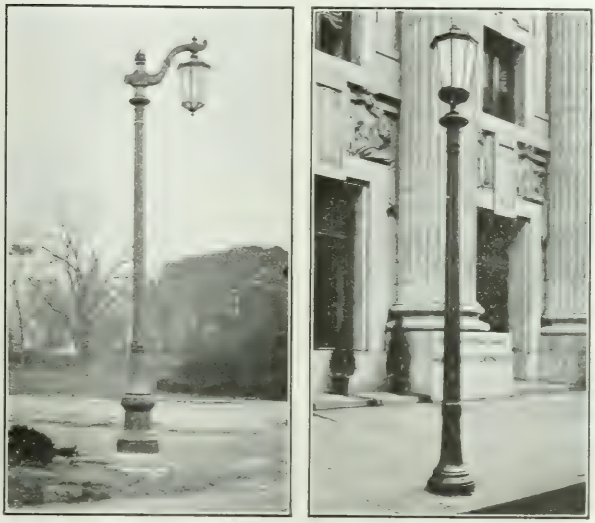


FIG. 1—LANTERN AND POST ADOPTED FOR EDGEWATER PARK, PATTERNED AFTER THE CLEVELAND "WHITE WAY" (RIGHT). MANY PARTS ARE INTERCHANGEABLE

BECAUSE of the more general use of the city parks as community pleasure centers and the ever-increasing motor vehicle traffic, park and boulevard lighting is assuming a new status. The modern system recently installed in Edgewater Park, Cleveland, was, in so far as possible, designed to embody the following boulevard lighting requirements:

1. The standard should be of pleasing appearance both by day and by night.
2. The equipment employed should distribute the light efficiently, and without causing undue brightness in the direction of the eye.
3. The system should be safe, simple, reliable and easily maintained at its original effectiveness.
4. There should be adequate illumination on the boulevards to facilitate the heavy traffic and to reduce the likelihood of traffic accidents and crime.
5. The system should be of such design that it will satisfy and at the same time advance civic pride.

The new installation may be briefly described as being made up of ornamental bracket lantern posts approximately 20½ ft. (6.2 m.) high over all, carrying 600-cp. gas-filled lamps and spaced 200 ft. (60 m.) apart.

During the past ten years three different systems of lighting in Edgewater Park have been discarded as deficient. The original electric lighting system, which employed overhead wiring and 6.6-amp. open carbon arcs mounted on wooden poles and spaced approximately 400 ft. (120 m.) apart, was replaced in 1912, on account of insufficient illumination, by 10-amp. flaming arcs. Owing to the difficulty of insuring proper candlepower maintenance, the flaming arcs were removed at the end of two years' service. It was at this time that the gas-filled tungsten lamp came into prominence, and its easy adaptation to ornamental lighting was at once recognized. An ornamental system consisting of 250-cp. gas-filled lamps spaced about 250 ft. (75 m.) apart was then installed. However, the type of standard used was a converted gas-post only 9 ft. (2.7 m.) in height, and the extremely low mounting of the light source resulted in a poor distribution of light on the drives and undue brightness in the line of vision. Since the lighting effect was not highly satisfactory and since, in addition, some operating difficulties, due chiefly to faults in the underground wiring, had arisen, plans were made about two years ago to replace the old equipment with a complete modern installation. The very satisfactory appearance and illumination effectiveness and the low maintenance cost of the lanterns developed for the Cleveland "white-way"* installation led to the development of a unit adapting the salient features of this lantern for the Edgewater Park system.

Fig. 1 illustrates the similarity between the two units. The top glass section and center portions of the lanterns as well as the steel column and certain castings of the standards are interchangeable, thus reducing the number of stock parts necessary. Both the park and the "white-way" lanterns are glazed with a slightly opalescent rippled crystal glass. This glass was chosen after experiments with several score of different samples had been conducted with the view of obtaining a glass which, without destroying the very efficient distribution of light from the refractor, would break up the light rays sufficiently to avoid glare and give the impression of a lively sparkle. The glass is placed with the smooth face outward and the lantern is constructed as nearly airtight as is possible without excessive expenditure, in order that dust collection shall be retarded.

Experience has indicated an incidental but practical advantage of the lantern structure in that the replacement cost of broken panels is very low. This results not only from the low cost of an individual panel, but also from the circumstance that since the glass is divided into comparatively small sections the chief stresses are carried by the lantern structure, and there is therefore much less tendency for the glass to become broken than in the case of a single globe of comparable size held only by a fitter.

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*See description by Ward Harrison, ELECTRICAL WORLD, Sept. 1, 1917.

In white-way lighting it is desirable to employ some type of globe or lantern which allows sufficient light upward to illuminate the façades of the buildings and relieve the tunnel-like appearance of the street which would otherwise prevail. This desideratum does not obtain in park or boulevard lighting, and therefore the park lantern was designed to have but a small proportion of upward light. Thus, while the "white-way" lantern is equipped with a band refractor and a flat reflector with a comparatively large opening in the reflector for the upward component of light, the park lantern is equipped with a dome refractor and a curved reflector which allows very little light to be transmitted upward.

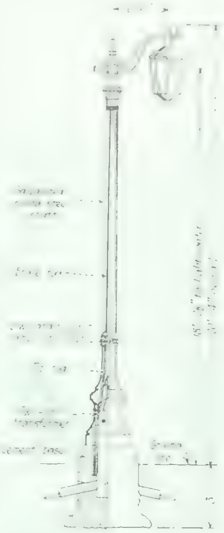


FIG. 2—STEEL SHAFT WILL NOT BREAK READILY AND THE LANTERN GLASS IS READILY REPLACED

Except with levels of illumination corresponding with that provided in the principal business district of Cleveland, where 1,500-cp. lamps are spaced approximately 85 ft. (26 m.) apart and placed opposite each other on both sides of the street, it is necessary to depend for the discernment of objects to a very considerable extent on silhouette and shadow effects. The silhouette may be either against the spot of light beneath a lamp or, particularly in the case of boulevards which have acquired a black polish from heavy continuous traffic, against the mirror-like streaks of light reflected by the gloss of the pavement surface. In order to obtain the maximum benefit from this so-called glint effect and also to obtain a better distribution of light on the street with the minimum of light interference from tree foliage, the park standard was designed to have the lantern suspended from a bracket arm extending over the street. An increased downward candlepower is obtained by placing glass panels in the bottom of the lantern. The candlepower distribution curve is shown in Fig. 3.

The standards employed are of corrugated rolled steel with cast-iron arm, capital, and base, the whole being held together by three tie rods running up through the columns (Fig. 2). This construction of standards was adhered to following the very satisfactory results obtained with the rolled-steel columns in the "white-way" installation. There it was found that damaged standards could be repaired in almost every instance at a comparatively low cost, and that owing to the rigidity of the lantern the glass panels were seldom broken even though the standards were in some accidents bent at right angles.

The park installation to date has about 200 600-cp. gas-filled series lamps which are divided into four circuits. The lantern suspension arms are placed about 20 ft. (6 m.) above the ground, and the standards are spaced approximately 200 ft. (60 m.) apart. In the base of each there is an individual two-coil transformer which eliminates the necessity of film cut-outs and the danger from high-voltage wires and also allows the use of the more efficient high-amperage lamps. The underground cable employed is No. 8 B. & S. two-conductor, with $6/32$ in. x $2/32$ in. (4.8 x 2.1 mm.) paper insulation, jute filling and $\frac{5}{64}$-in. (2-mm.) lead sheath, and is placed in 3½-in. (8.9-cm.) fiber duct 24 in. (60 cm.) underground. The cascade method of control with pole-type transformer is used. Fig. 4 shows in detail how the method was worked out for this specific installation.

There are several rather novel features introduced in the system with the purpose of insuring safety to vehicle drivers and facilitating maintenance of the equipment. Owing to the physical characteristics of the grounds, it was desirable in several places to change the line of units from one side of the boulevard to the other. Where this arrangement is resorted to the cross-over is made obvious by placing the first unit of one line exactly opposite the last unit of the other line on the other side of the drive.

A difficulty in the case of some underground installations is the inconvenience experienced when repair or replacement of a section becomes necessary. In this installation the fiber duct is curved up through the base of each standard as shown in Fig. 2. This arrangement provides easy access to the cable and an outlet from which sections of cable may be drawn from one standard to another.

From previous experience a cleaning schedule was planned for this system whereby at intervals of a month the accumulation of dust and dirt is removed from the glassware by brushing and washing with hot water. In addition to this monthly cleaning the complete lanterns will be taken to the substation at least once each year for an exceedingly thorough scrubbing with a brush and cleaning compound in boiling water, followed by an inspection and overhaul to renew any cracked glass panels or other defective parts. In order to facilitate the removal of the lantern from the bracket a somewhat novel construction was developed in which the wiring and socket are not connected to the lantern but remain a permanent part of the bracket arm. The lantern itself is carried by a bayonet holder.

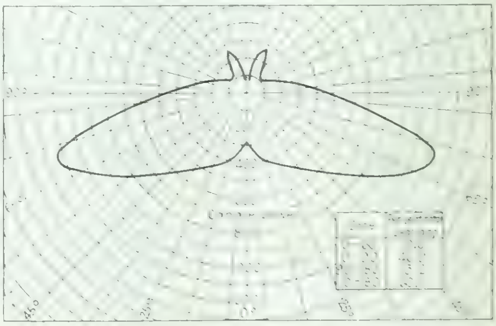


FIG. 3—PARK LANTERN HAS GOOD CANDLEPOWER DISTRIBUTION CURVE

Hence when the lantern is to be removed it is only necessary to take the lamp out through the hinged side-door panel, lift the lantern slightly and turn it, which frees it completely. Even though the lantern can thus be very easily and quickly removed or replaced, the construction of the holder is such that there is no likelihood of a lantern becoming detached by accident or by vibration in the wind.

With a lamp outage there is, of course, an area left in comparative darkness, and in the past it has been a rather common occurrence for the driver of a fast-moving vehicle to collide with a standard which, installed on a curved drive, could not when in darkness readily be distinguished. In order to eliminate the likelihood of these accidents, there is placed in each standard about 6 ft. (1.8 m.) above the ground a bull's-eye with colored glass in which is installed a low-wattage lamp connected in multiple with the 600-cp. lamp off the individual two-coil transformer (Fig. 2). When the large lamp is in operation the signal lamp behind the bull's-eye burns at such a low voltage as to emit only a very faint glow. However, immediately upon the failure of the main lamp the signal lamp, because of the open-circuit rise in voltage on the secondary of the two-coil transformer, is subjected to its normal voltage and the bull's-eye signal shines out brightly.

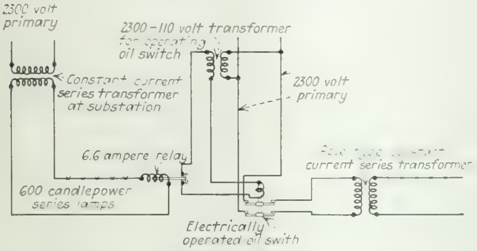

2300 volt primary
2300-110 volt transformer for operating oil switch
Constant current series transformer at substation
2300 volt primary
6.6 ampere relay
Pole type constant current series transformer
600 candlepower series lamps
Electrically operated oil swith

FIG. 4—CASCADE METHOD OF CONTROLLING POLE-TYPE CONSTANT-CURRENT TRANSFORMERS USED AT EDGEWATER PARK

The accompanying table, based on fifty lamps per circuit spaced 200 ft. (60 m.) apart, gives installation cost data per lamp on the park installation, excluding station equipment and high-tension distribution. The material was purchased during the first three months of 1920 and installed during the summer of that year. As there has been a considerable downward trend in prices, it is expected that future additions will be made at a lower cost.

TABLE OF INSTALLATION COSTS PER LAMP

3½-in. fiber duct, at $0.079 per foot	$15 80
Laying duct (trenching, cementing, cable pulling and back-filling), at $0.12½ per foot	25 00
Cable (No. 8 B. & S. two-conductor [illegible] paper with [illegible] lead sheath), at $0.25 per foot	50 00
Cement base in place	22 00
Standard and lantern, glassware and signal lamp	187 23
Erection of standard and lantern	8.58
600-cp. gas-filled 20-amp. lamp (contract $50,000)	3.20
Individual two-coil (6.6 amp. to 20-amp.) transformer	13 54
Pole-type 6.6-amp. constant-current transformer-regulator ($393.75)	7.88
6.6-amp. relay ($40)	0.80
Electrically operated oil switch with inclosed transformer ($110)	2.20
Incidental	1 79
Total	$338 02

Acknowledgment is made to the engineering department of the National Lamp Works, through whose aid in engineering design and laboratory experiments the conception of the Edgewater Park system was made practical.

Modernizing Distribution

Specific Outline of Method for Making a Survey for the Purpose of Redesigning a System of Haphazard Growth

BY THEODORE H. RICE
Engineer Henry L. Doherty Company, New York City

CONSIDERABLY more attention is being given to the question of electric distribution economies than formerly, owing apparently to a realization that a rapid development of these systems from small beginnings has not generally resulted in an economical layout. Excellent possibilities for improvement in operation and economy exist in many communities, and a number of companies have actually started the reconstruction of their systems with the object in view of obtaining the highest efficiency possible and a type of construction that will conform with a definite standard.

So that certain companies might not start such a reconstruction program without first weighing the salient factors that are essential, it has been thought advisable at this time to outline the methods followed in other properties of making a survey of their present distribution systems and planning a future program. From past experience it has been very evident that the cost of making a complete engineering survey of the different distribution systems is negligible compared with the improved efficiency of operation attained.

Although this article is prepared to cover electric distribution systems in cities of 20,000 to 100,000 inhabitants, still the general plan is applicable in larger cities, allowing for slight changes as local conditions may require.

Different methods may be used in gathering the desired information on an existing system, but still the data that are essential for the intelligent planning of a proposed system will be virtually the same regardless of the procedure followed. Therefore an outline of those salient points is given below.

In order to simplify the compilation of the information gathered, it is considered best to cover the survey under four major headings. These divisions with their respective subdivisions follow:

STUDY OF THE PRIMARY LINES

1. Each primary feeder should be traced through its entire length from its source to the point of transformation.
2. A note should be made on the field map wherever the size of conductor changes.
3. Determine whether the feeder is single or polyphase and the class of load connected thereto.
4. Determine whether the circuit feeds to a center of distribution or whether transformers are connected its entire length.
5. Note the location of sectionalizing switches that may be used for interconnecting circuits in case of line trouble or for the isolation of those sections where trouble occurs.
6. Make a load test at each point where the size of conductor changes and from this reading calculate the theoretical voltage drop and power loss for the given distance.
7. At each center of distribution and main branch-off make a voltage test, comparing this with the power plant voltage so as to determine the line drop for a given load.
8. Note class of load connected, whether lighting or power or both.
9. Note whether line is constructed according to standard code.

POINTS TO OBSERVE REGARDING TRANSFORMER LAYOUTS

1. Note exact location of transformer on field map.
2. Check size of transformer with actual load test to determine if it is overrated or underrated.

3. Check voltage rating and ratio of transformer as this is important in giving proper service to the customer.

4. As the core loss and aging of a transformer depend upon the core material, it is quite important to know the serial number of the transformer, from which you can determine the year of manufacture. Almost all transformers manufactured since 1909 are assembled with silicon-steel cores, which are considered non-aging.

5. A load test should be made on every transformer to determine if it is of proper size for the particular load.

6. Where connected three-wire on secondary side, a load test should be made to determine if both coils are balanced.

7. A voltage test should be made at secondary terminals to determine ratio of transformers and also whether customer receives proper voltage.

8. Where voltage conditions are poor, a graphic voltmeter reading should be taken over a period of time.

9. Note the type of primary cut-outs used and whether they are suitable for proper protection.

10. A careful inspection should be made of each transformer to determine the condition and quantity of oil.

11. Note whether transformer is properly installed and the condition of primary taps.

Notes on the Secondary Layout

1. Determine whether transformer secondaries are connected two-wire, three-wire or polyphase.

2. Trace the secondaries throughout their entire length and note the size of conductor.

3. Compare ampere load on secondaries with size of conductor.

4. Note the distance from a transformer of the farthest customer served.

5. Determine whether the secondaries of two or more transformers are banked together.

6. If secondaries are banked, are suitable sectionalizing switches used?

7. Note character of load served.

8. Check transformer secondary voltage with the voltage at the customer's lamp socket to determine if voltage drop is excessive between transformer and lamp.

9. Determine whether secondary neutral is properly grounded, and if so, where.

10. Note type of ground connection used and frequency of connection.

General Observations to Be Made

A few points not included above but which are important and should be carefully noted are:

1. Whether primary and secondary wires are carried on the same cross-arm.

2. A test should be made on each ground wire to determine whether the resistance is excessive for satisfactory operation of lightning arresters and secondary neutral.

3. All lightning arresters should have a careful inspection at least once yearly.

4. Where tree foliage interferes with a line the necessary trimming should be done, preferably in the autumn or winter.

5. Where slack wire is excessive immediate attention should be given to the line.

6. A thorough inspection of all poles and cross-arms should be made at least once yearly.

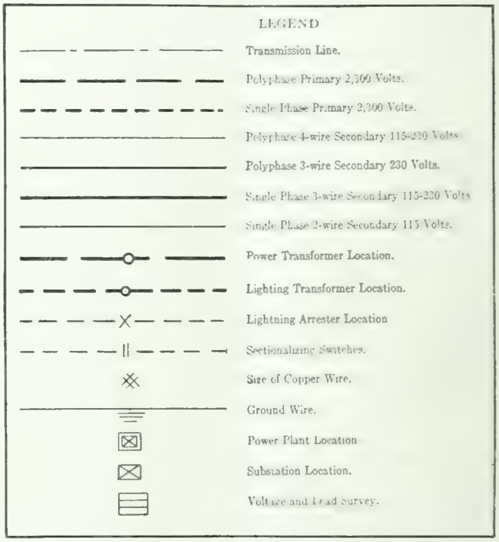
7. An inspection should be made of all service loops.

8. It has been found profitable to maintain a continuous inspection of all meter installations in order to detect possible theft of energy and defective meter and line conditions.

After having made a complete survey of the entire system, it is then advisable to transcribe the field notes as well as to prepare a map to include all the feeders. A good plan in the preparation of this map is to designate the primary and secondary circuits, transformer locations, lightning arresters, primary and secondary sectionalizing switches, ground connection points and the sizes of the several conductors.

To simplify the preparation of this map and still have it legible for the average person, it is suggested that some form of legend be used that will permit future additions or changes to the original tracing without marring its appearance. As it is necessary to change the location of transformers and lightning arresters occasionally, it has been found advantageous to indicate these on the reverse side of the tracing. In this way erasures may be made readily.

After the present distribution system has been reproduced on tracing, then a careful study of the relation between the different feeders should be made to determine whether the circuits are properly laid out to obtain the highest efficiency possible and to serve the community best. In addition to this, a knowledge must be had of the present load conditions, the probable future growth of the town, future power requirements, etc., to plan a reconstruction program intelligently.


LEGEND
Transmission Line.
Polyphase Primary 2,300 Volts.
Single Phase Primary 2,300 Volts.
Polyphase 4-wire Secondary 115-230 Volts
Polyphase 3-wire Secondary 230 Volts.
Single Phase 3-wire Secondary 115-230 Volts
Single Phase 2-wire Secondary 115 Volts.
Power Transformer Location.
Lighting Transformer Location.
Lightning Arrester Location
Sectionalizing Switches.
Size of Copper Wire.
Ground Wire.
Power Plant Location
Substation Location.
Voltage and Load Survey.

SUGGESTED LEGEND FOR DISTRIBUTION SYSTEM DATA

With all this information available, steps then may be taken to lay out a proposed distribution system on tracing cloth in the same manner as the existing circuits. By superimposing one tracing over the other it will be a simple matter to note those sections of line that would need to be newly constructed and those conforming to the proposed plan requiring only regular maintenance to place them in excellent condition.

New construction work should, according to the plan, always conform as closely as possible to the future construction program as formulated. When maintenance work is done consideration should be given to the proposed plan, for in this way it will be only a short time before the entire distribution system will have been rebuilt according to a definite program.

It is important that the service loops and meter installations be in as good condition as the lines; therefore it has been found profitable to make a careful inspection of each service wire direct from the pole to the lamp socket, and then after each day's work is completed the field notes should be checked with the customers' records to determine whether the proper charge is being made the customer. This includes flat-rate customers as well as metered customers.

Electrical Energy from City Water Supply

Station No. 2 on Los Angeles Aqueduct Has Two Vertical Units of 17,500 Kva. Each, Operating Under 515-Ft. Head—Rushed Into Service Three Months After Delivery of Turbines to Help Break Power Shortage

By **D. J. McCORMACK**
Hydraulic Engineer Wellman-Seaver-Morgan Company

IN THE spring of 1919 the power shortage in southern California became so acute that each of the power companies started construction work on that water-power site which required the shortest time for developing. The city of Los Angeles was fortunate in having a 515-ft. (157-m.) head proposition on the aqueduct with possibilities of early completion. There was no need of constructing any dam or long tunnel for diverting the water to the power house. The power could be turned into the transmission lines from the No. 1 plant to Los Angeles, which pass this site. It is in San Francisquito Canyon, about 40 miles (64 km.) from the city, and is called No. 2 plant. The rapid execution of the project with no attendant difficulty in starting up the plant, the unique hydraulic regulation for variable load on the electrical system to prevent interference with the city water supply, and the various provisions for safe operation of the turbines at the high head utilized are noteworthy features.

Water is carried from No. 1 plant by a 6-mile (9.6-km.) tunnel forming part of the aqueduct. A short distance from the end of the tunnel above the power house is the 35-ft. (10.7-m.) diameter surge tank. From this surge tank the water is led through two riveted steel penstocks, 7 ft. (2.1 m.) in diameter and 1,430 ft. (435 m.) long, to the power house at the bottom of the canyon. The water discharges from the turbines into a tunnel 400 ft. (122 m.) long, again entering the aqueduct at the foot of the former cascade.

The power house is built of reinforced concrete of modern architecture, affording ample space for all the hydraulic and electrical equipment. Except for the penstocks and transmission lines, it would not be recognized as a hydro-electric plant, since there is no tailrace or water in sight.

RAPID EXECUTION OF PLANS

At present consumption there is about 600 cu.ft. (16.8 cu.m.) per second of water flowing in the aqueduct, which is capable of developing 30,000 hp. under the head of 515 ft. (157 m.). It was decided to use two vertical units with the maximum efficiency of each turbine occurring at a discharge of 300 sec.-ft. (8.4 cu.m. per second), and an efficiency of at least 80 per cent was required at 440 sec.-ft. (12.3 cu.m. per second). This corresponds to a maximum capacity of 20,600 hp. under 515 ft. head. The generators are rated 17,500 kva. at 0.8 power factor and are of the umbrella type with directly connected exciter and spring-type thrust bearing on top. Later on, when a greater demand for aqueduct water is required by the city, a third unit will be installed, and provision was made in the power house for this.

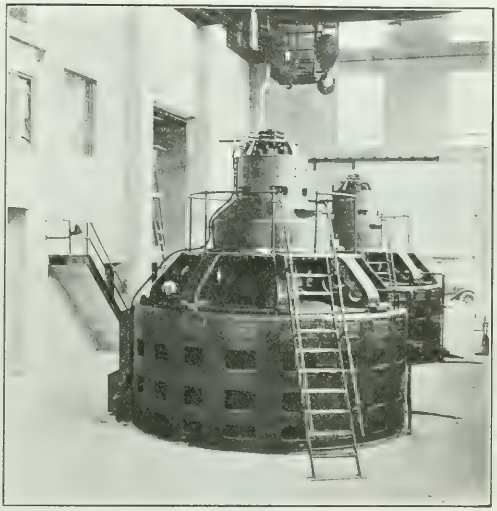
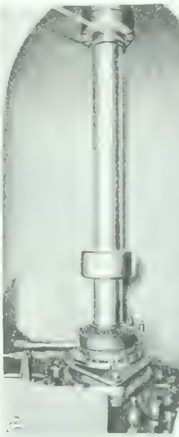


FIG. 1—GENERATORS DEVELOPING POWER FROM AQUEDUCT

Contracts were let early in the spring of 1919 for the two penstocks, and in July awards were made to the Wellman-Seaver-Morgan Company for all of the hydraulic equipment and to the General Electric Company for all of the electrical equipment. The turbines were delivered in March and April, 1920. The first unit was put in operation June 30 and the second Aug. 7. Seven hours after water was admitted to the second unit it was carrying full load, so great was the shortage of power which had been accentuated by an extremely dry winter.

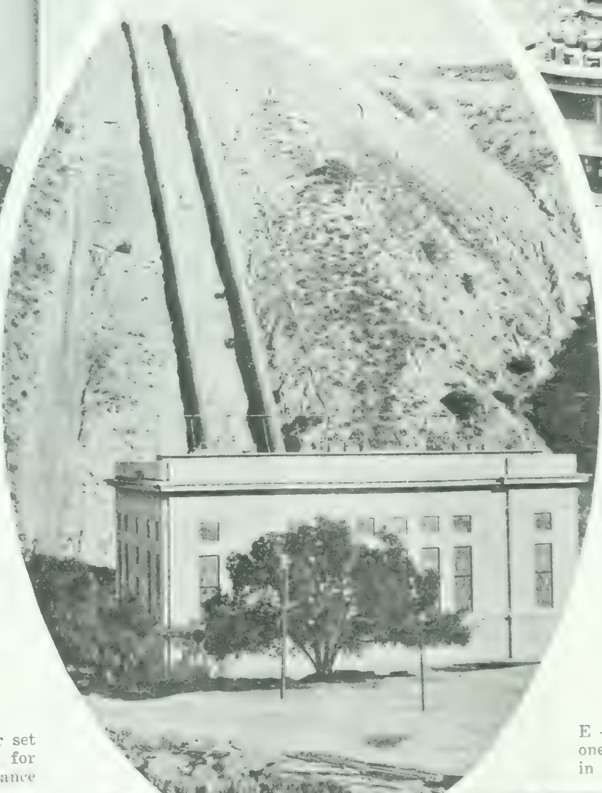
Owing to the high head and large capacity, most of the castings for the turbines, needle valves and pressure regulators were made of steel and subjected to a shop-test pressure of 350 lb. per sq.in. (24.5 kg. per sq.cm.). The hydraulically operated needle valves are 7 ft. (2.1 m.) in entrance diameter and 4 ft. 6 in. (1.37 m.) in discharge diameter. A cast-steel feeder pipe with manhole and separate flange, so that the valve may easily be removed for repairs, connects the needle valve to the cast-steel spiral casing of turbine. The casing is 2 in. (5 cm.) thick, has an entrance diameter of 4 ft. 6 in. (1.37 m.) and is made in four sections. At the down-stream end of casing connections are taken off for the 30-in. (76-cm.) governor-operated pressure regulator, 16-in. (41-cm.) bursting plate and drain valve. The pressure regulator discharges through a cast-steel nozzle into a cast-steel conical-shaped velocity killer which is set in the concrete of the floor below. The discharge then passes out into a separate tunnel built above the tailrace tunnel and joining it further down. This arrangement precludes unsealing the draft tubes when the pressure regulators are called into

Los Angeles City Water Supply Is Utilized to Produce Electrical Energy

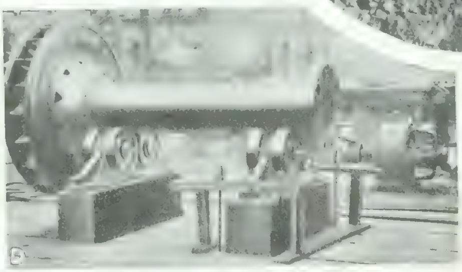


A—Top view of turbine in place in the pit and coupling for generator shaft above

B — Completed turbine erected in the shop before shipment to the station site



D—Turbine runner set up in the shop for test of dynamic balance



E — Spiral casing of one of the turbines in process of erection

C—Concrete structure housing two 20,500-hp. units with room for the addition of another when the water requirements of the city have increased sufficiently. The turbines operate under a head of 515 feet operation. This separate tunnel at its upstream end joins the bypass around the power house, this bypass being necessary to maintain a constant flow of water down the aqueduct in case both units should be shut down. In this emergency the water from No. 1 plant above is turned into the bed of the creek, which runs down the canyon to No. 2 plant.

PRESSURE REGULATOR BYPASSES WATER

Each pressure regulator may be adjusted to pass any quantity up to the full discharge of turbine when the turbine gates are suddenly closed and may be set for governor operation as a water-saving device, closing slowly enough after each sudden rejection of load to prevent setting up another rise in pressure. If desired, it can be set to bypass any quantity of water when the unit is running. It may also be set as a synchronous bypass or water-wasting device, opening to discharge as much water as is rejected through the turbine gates closing, or vice versa, thus maintaining a constant velocity in the penstock. These pressure regulators are operated most of the time with the water-saving feature. They were called into operation five times in one day owing to lightning trouble and short circuits on the line, nearly full load being lost on the unit each time. One short circuit occurred when one of the units was carrying 20,000 hp. Upon dropping this load suddenly the pressure rise was only 6½ lb. (0.45 kg. per sq.cm.).

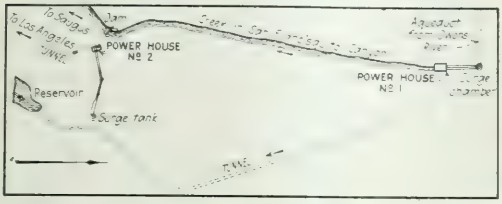


FIG. 2—HOW AQUEDUCT WATER IS PASSED THROUGH THE HYDRO-ELECTRIC STATION

The draft tubes are of the straight conical type lined with steel plate at their upper ends with manholes for inspection of runner. The lower ends of the draft tubes are molded out of concrete. Directly below the downstream wall of the power house a low weir was put in to keep the draft tubes sealed.

The turbine speed ring is made of steel cast in one piece with stationary vanes guiding the water to the gates and acting as a tie across the throat opening of the casing. Both the speed ring and the casing are imbedded in concrete at the bottom of the concrete pedestal which supports the generator.

Forged-steel gates machined all over with integral stems, each having three separately lubricated bearings, are connected at their upper ends by cast-steel levers through cast-iron links to the cast-steel operating rings. The links are the weakest element in the gate mechanism and are designed to break before the elastic limit of any of the other parts is exceeded. Special thrust collars are provided to take up the unbalanced thrust on the ends of the gate stems and to carry the weight of the gates. Two servo-motors bolted to the top of the casing and having a total capacity of 45,000 ft.-lb. (6,210 kg.-m.) are connected by forged steel rods to the operating ring. On account of the gates being balanced at about three-eighths gate opening and having a maximum tendency to open when in the closed position, and on account further of the high head, a special device was designed to hold the gates closed in case the governor pressure should be released. This is particularly desirable when the unit is shut down but still has water in the casing for the purpose of bypassing it through the pressure regulator.

The runners are of special manganese bronze having an exceptionally hard wearing surface and high elastic limit. Forged-steel bands shrunk on the hub and band of the runner form a special seal with the wearing plate on crown plate. A straight running fit at the curb plate and an effective seal at the bottom of the runner band allows a greater pressure to be built up under the band of the runner in order to reduce the load on the generator thrust bearing. Measurements taken during different periods of operation showed only 15 lb. to 23 lb. per square inch (1 kg. to 1.6 kg. per sq.cm.) pressure on the top of the runner. This was counterbalanced by the greater pressure below the band, which varied from 30 lb. to 40 lb. per square inch (2.1 kg. to 2.8 kg. per sq.cm.). A renewable cast-steel liner was also provided at top of draft tube near discharge of runner.

DYNAMIC BALANCING OF RUNNERS

Great care was taken in the shop to balance the runners for dynamic balance on account of the high speed of 428 r.p.m. and the relatively large diameter of the runner, 63½ in. (1.61 m.), for this speed. After truing up the runner together with the shaft in a large lathe and accurately obtaining a static balance, the runner and shaft together were run up to speed on four large rollers having ball bearings. The runner and shaft were belted to a motor. The two rollers next to the runner were free to move in any direction in order not to dampen any tendency to vibrate. By adding or subtracting weight in the proper plane the runner balance was corrected until the instrument which magnified the vibrations ten times showed no movement. The shafts and runners ran perfectly true in the field.

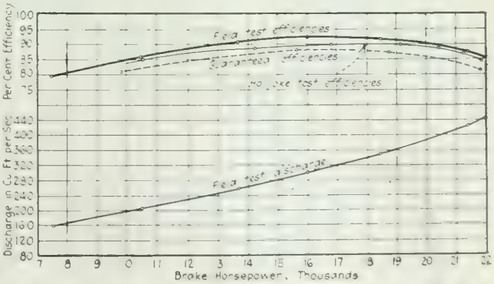


FIG. 3—FIELD TESTS SHOW AN EFFICIENCY ABOVE 90 PER CENT OVER A CONSIDERABLE RANGE OF LOAD

The crown plate is made of cast iron in one piece and supports the operating ring and main shaft bearing. The fact that the water which passes through this plant is used for drinking purposes in Los Angeles precluded the use of an oil bearing, and a lignum-vitæ bearing was decided upon, the water supply to this bearing being taken from the casing. In this supply line are a duplex strainer and a Vaughan current meter with alarm attachment to notify the operator in case the flow is cut off for any reason.

The shaft is 17 in. (43 cm.) in diameter at the bearing and 16½ in. (42 cm.) in diameter for the remainder of its length. It is made in two sections so that the turbine may be dismantled from above and the runner removed without disturbing the generator. A 2-in. (5-cm.) hole is bored through the length of the shaft and flanges forged on the shaft form the couplings. The runner is bolted to one of these flanged couplings.

It was considered better practice not to use any split bronze sleeve on the shaft at the lignum-vitæ bearing. Inspection after eight months' operation showed the bearing surfaces on the shafts to be perfectly polished without a sign of rust. In case the unit is shut down for an extended period, large oil cups on the bearing cover allow oil to be slushed along the shaft.

Four air brakes supported on the arms of the lower generator bearing spider and bearing on the lower surface of the generator rotor are connected by piping to the tops of the governor tanks. The air supplied to the brakes is controlled by an engineer's valve in the control column, which also forms the gage stand and contains the vacuum breaker for the draft tube. To insure accessibility the control column is placed next to the governor on the generator floor. These units are brought from normal speed to rest in five minutes.

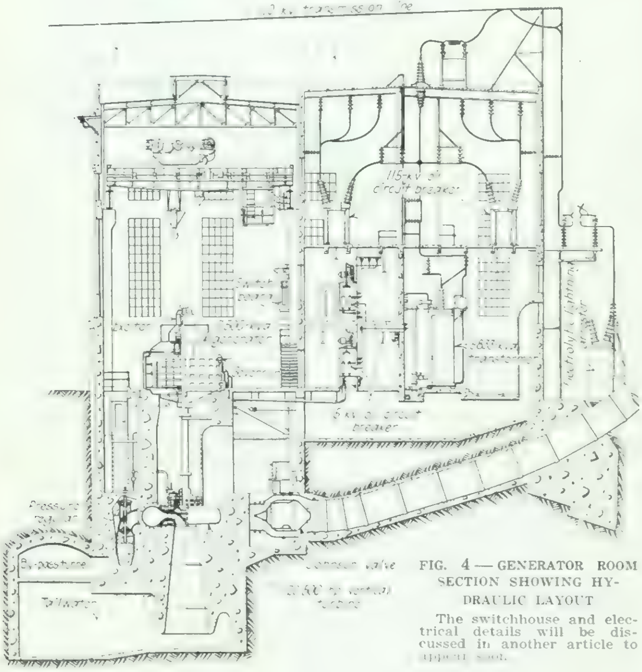


FIG. 4 — GENERATOR ROOM SECTION SHOWING HYDRAULIC LAYOUT

The switchhouse and electrical details will be discussed in another article to appear soon.

The 45,000-ft.-lb. (6,210-kg.-m.) Woodward actuator-type governors are driven by a belt with automatic tightener from the main shaft. An independent hand control consisting of a four-way valve and bypass around the relay valve permits emergency operation of the unit by hand. Under ordinary operation the governors are controlled entirely from the switchboard.

The central pumping system for governors is on the deck beneath the generator floor. Two motor-driven rotary pumps take the oil from a large open-sump tank and discharge into two pressure tanks. Each pump and pressure tank is of sufficient capacity for three units, and they are interconnected to form a duplicate system. It was found that only 145 lb. per square inch (10 kg. per sq.cm.) oil pressure in the governor system was required to operate the gates. The system was designed for 200 lb. (14 kg. per sq.cm.) working pressure. An air compressor replenishes the supply of air in the top of each pressure tank and also serves the brakes.

Plant Takes Load Fluctuations

This plant is very near the center of distribution of the system and therefore serves as the regulating station in the absence of a steam plant. With this purpose in view, a large flywheel effect of 2,000,000 ft. squared-lb. (84,800 m. squared-kg.) was built into each generator rotor. Furthermore, great care was exercised in proportioning the size of the surge tank, penstocks and pressure regulators to allow a minimum time of governor operation. Extremely close regulation is shown by the governors, which have proved very sensitive and dependable.

The sizes and weights of all large sections of equipment were limited on account of the haul of 10 miles (16 km.) from the railroad. An interesting and novel feature of transportation was performed in rolling the second generator rotor and shaft, weighing 100 tons, over the road instead of hauling on a truck. This effected a considerable saving in cost and required less than half the time. Two tractors ahead controlled the direction of rolling and a drag behind aided in rewinding one cable while the other was being unwound.

Conduct of Efficiency Tests

Four months after the turbines had been put into operation, the Bureau of Power and Light of the city of Los Angeles conducted the official tests to determine the efficiency and capacity of the turbines, as well as tests of the pressure regulators and governors. The frictional losses in the penstocks for varying loads were also measured.

A point in the discharge tunnel about 300 ft. (90 m.) from the power house was selected for taking the water measurements. For this purpose the tunnel was calibrated by the engineers of the city water department. A Price current meter was used to calibrate the tunnel. Five separate sets of readings were made to recheck and obtain a very accurate discharge curve of the tunnel. Before and after the readings were taken the Price current meter was calibrated to check its accuracy. The discharge tunnel at this point is 10.2 ft. (3.1 m.) wide. A gage board was placed alongside the tunnel wall at the point where current-meter measurements were taken.

The pressure head was determined by a gage placed on the inlet section of the turbine, and allowance was made for velocity head at this point. The pressure gage was calibrated before and after each test. Measurements of tailwater elevation were taken by a gage board at the side of the tailrace wall near the draft-tube mouth. In the same manner the water level in the surge chamber was read, in order to determine the pipe-line losses. Electrical readings to determine the output were taken by city test meters and checked and rechecked in the testing laboratory.

The unit under test carried a commercial load, and the gates were blocked for each gate opening. The other turbine was shut down and the needle valve closed to prevent any leakage into the tailrace. For this reason the tests could only be run at night. Five readings at three-minute intervals were taken for each gate opening. Ten minutes was allowed between each gate to obtain steady conditions in tailrace tunnel and surge tank.

PART-GATE AND FULL-LOAD EFFICIENCIES ARE HIGH

The accompanying curves show the results of test on unit No. 1 as compared with the guarantees and the results as based on Holyoke test of a 55¼-in. (154-cm.) diameter runner of same design. On account of the head at Holyoke being only 17 ft. (5.2 m.) and the ratio of mechanical losses to hydraulic losses being greater because of the smaller output it is very hard to obtain a representative test there of an extremely high-head low-speed runner. It was expected that the runner would show up much better under a higher head.

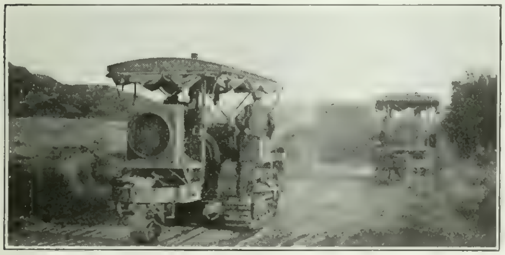


FIG. 5—UNIQUE METHOD OF TRANSPORTATING GENERATOR ROTOR, WEIGHING 100 TONS, OVER 10-MILE ROAD

A more efficient draft tube accounts for part of the increased efficiency. The remainder is attributed to the vertical arrangement, the careful design of all water passages, the conformance to the design and the high class of workmanship. As a remarkable check the tests of both machines showed identically the same results.

Of particular interest is the point of maximum efficiency occurring at the required discharge of 300 sec.-ft. (8.4 cu.m. per second)—73 per cent of full load—and the high part-gate and full-load efficiencies (440 sec.-ft., or 12.3 cu.m. per second).

The complete freedom from trouble in starting up this plant, its continuous and dependable operation under a high load factor, the absence of pitting and wear in the runner or other water passageways and the good all-around results obtained should greatly reassure hydro-electric engineers in the selection of large-capacity vertical units under very high heads.

The success of this undertaking is an indication of what may be done in other localities where water for domestic purposes may be made to perform useful work on its way from mountainous or elevated sources to the consumers

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Watching Transformer Service

Financial Losses Entailed by Excessive Transformer Capacity, Underloading and Overloading—Simple Card-Record System for Small Utility

BY F. W. RANDALL

Assistant to Vice-President and General Manager Rockingham County Light & Power Company, Portsmouth, N. H.

THE central-station manager striving for economy in the operation of his property might well devote more attention to the design of his distribution system. Particularly in the matter of transformer loading and location, there will be serious losses over twenty-four hours of each day arising from excessive investment in transformers, serious energy losses from incorrect loading or rapid deterioration of the transformers due to heat from excessive loading.

It is generally recognized that the majority of distribution systems are not economically laid out. This is not always the fault of original design, but usually is the result of the growth of the system. Extensions are continually being made to serve new groups of consumers, and it is often the case that these extensions are made without giving consideration to the system results as a whole.

UNECONOMICAL CONDITIONS COMMONLY OCCURRING

Considering the transformer system alone in connection with such developments, any or all of the following conditions may exist:

1. Transformers serving single customers. This was the custom when transformers were first used and many of these installations have not been corrected. Experience and tests have proved that one large transformer feeding secondary mains is more economical both in first cost and operating expense.

2. Transformers too large for connected load. This condition may be due to lack of proper consideration of the connected load or to failure to consider the diversity factor of the load. Sometimes the proper size of transformer is not available and the larger size, installed temporarily, remains the permanent installation.

3. Transformers overloaded. Result of connecting new customers to the nearest secondary without any check on existing connected load.

These conditions represent dollars and cents to the smaller as well as to the larger central station, for they involve not alone a question of original investment but a continual core loss, low power factor, poor regulation and in certain cases overheating and short life.

The larger companies, with their great organizations, give more attention to these problems. Engineering and statistical departments are maintained and records of transformer loadings and similar data are kept and followed up. The smaller companies have frequently considered such records of no value and simply as red tape. While the same departments cannot be maintained, it will be a profitable investment, regardless of the size of the company, to have a simple system of transformer records.

A record on 4-in. x 6-in. cards can be used to give all the necessary information. The front of the card gives transformer data as follows: Company number, capacity, make, core loss, makers' number, type, form, cycles, primary and secondary volts, date purchased and price. It also contains a record of the installation, giving location, pole number, circuit number and date installed. The back of the card may be used for listing the customers connected to the transformer, with their approximate loads. These cards may be filed by sizes and by towns, map sections or circuits, according to local conditions. Tabs may be attached to the cards to designate whether the transformer is installed for light, heat or power.

Transformers received from the factory should receive a company number and cards should be made for each. These cards should be filed as stock. When the transformer is drawn from stock and placed in service the record of the installation should be made on the card and the card filed in its proper place. This card record alone will prove very satisfactory. If used in connection with maps of the primary and secondary distribution systems, it will be even more valuable.

Periodic inspection of transformers is advisable to determine quantity and condition of the oil. The record of these tests may be noted on the cards.

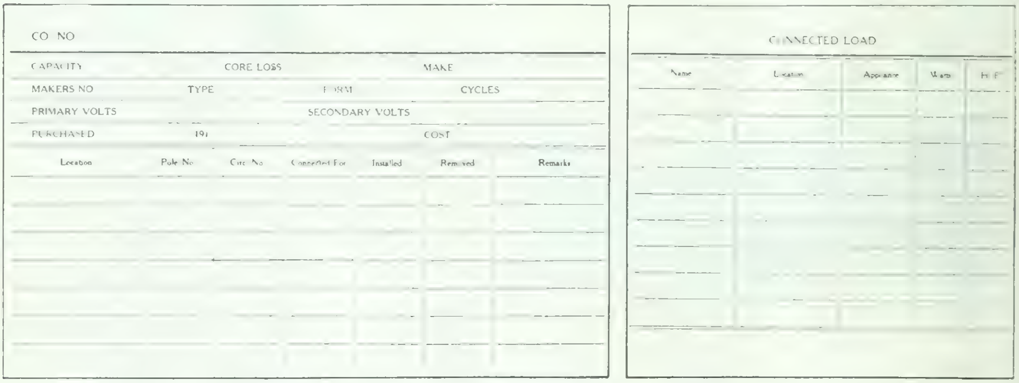
The central-station official may ask concerning some of the specific ways that this record and this attention to the transformer system will pay him dividends.

connected to the existing transformer installation or whether new transformers must be installed. In this way the transformer system can be maintained and extended economically.

In case of trouble reported by a customer it is often of advantage to know the names of other customers on the same transformer. A telephone call to one of the other customers will determine whether the trouble is at the transformer or is confined to the complaining customer's premises.

The card record also justifies its existence for report purposes. In these days of questionnaires, plant inventories and public service commission reports a record of the various sizes of transformers in service, under the various classifications already available, means much even to the smaller companies.

The transformer card record will serve still another purpose for companies having a considerable amount of seasonal business. At beach resorts the energy consumption is confined to three or four months a year. It may not be advisable to remove the entire equipment for the rest of the year, but it will prove profitable to remove the primary plugs, thus cutting the transformer from the line and avoiding the core loss. Reference to the list of customers on transformer cards will indicate which transformers may be cut out, and a notation on the card will serve as a record of the cut-out.



CO NO

CAPACITY CORE LOSS MAKE

MAKERS NO TYPE FORM CYCLES

PRIMARY VOLTS SECONDARY VOLTS

PURCHASED 191 COST

Location	Pole No	Circ No	Connected For	Installed	Removed	Remarks

CONNECTED LOAD

Name	Location	Appliance	Watts	H.P.

A SIMPLE CARD SYSTEM SAVES TRANSFORMER INVESTMENT AND LOSSES

Consider the question of initial investment. Study of the card record will determine whether transformers are larger than necessary and whether some transformers might be eliminated. If the system is equipped with excessive transformer capacity, the correction of this condition will, of course, effect a direct reduction of plant investment.

The question of core loss is of greatest importance, for this is a twenty-four-hour expense and reaches back directly to the coal pile. It is therefore essential to eliminate all unnecessary core loss, and considerable study can be devoted to this subject.

The power factor of most commercial transformers is low at no load, while at normal load the power factor is very good. For this reason it is important to distribute the transformers on the line so that they will carry load enough to keep the power factor high.

Excessive overloading causes increased temperatures, with resulting deterioration and probable shortening of the life of the transformer. Checking of connected loads on transformers will disclose cases of overloading.

In addition to these suggestions of possible economy the card record can be of great service to the line superintendent in giving instructions regarding new services. The record will show whether the new service can be

Seven New England Companies' Output Over 100,000,000 Kw.-Hr.

THERE are seven central generating and distributing companies in New England with an annual output of more than 100,000,000 kw.-hr. These are, in order of output, the New England Power Company, Edison Electric Illuminating Company of Boston, Narragansett Electric Light Company, Turners Falls Power & Electric Company, Connecticut Light & Power Company, New Bedford Gas & Edison Light Company and Hartford Electric Light Company. The output of Connecticut Light & Power Company in 1920 was 145,111,822 kw.-hr., of which 124,454,140 kw.-hr. was generated and 20,657,682 kw.-hr. was purchased. Of the total output, 121,285,281 kw.-hr. was distributed to light and power customers and 23,826,541 was sold to electric railways. The peak load for 1920 was 33,392 kw.-hr., occurring on Oct. 12.

Requirements for Industrial Heating

How to Determine Power Required for Ovens and Energy Consumption per Unit of Product—Typical Calculations for Japanning and Core-Baking Ovens—Selection of Ventilating Equipment

By HAROLD FULWIDER*
Industrial Heating Engineer General Electric Company

WITH the rapidly increasing use of electric ovens for industrial heating purposes the need frequently arises for calculating the probable connected load and energy consumption to handle a process by the electric method. The heat required may be considered in parts as follows: (1) The heat of absorption necessary to raise the temperature of the trucks, conveyors, carriers, oven walls, etc., from room temperature to oven temperature; (2) the heat required to raise the temperature of the fresh air necessary for ventilation, and (3) the radiation loss.

In order to show how the heating requirements may be translated in electrical units a typical problem may be considered.

Problem.—Required to find the energy consumption and connected load for a japanning oven baking at 450 deg. Fahr. for forty-five minutes. Weight of charge, 1,000 lb.; weight of truck, 300 lb.; room temperature, 50 deg. Fahr.; walls of 4-in. Nonpareil pressure block; outside surface of oven in square feet, 232.

CALCULATION OF HEAT FOR ABSORPTION

The following is a simple formula which may be used for the calculation of absorption by the oven load:

Heat of absorption (kw.-hr.) = $(W \times S \times T) \div 3{,}412$, where

W = weight of charge and truck in pounds,
S = specific heat of material baked (average specific heat of iron from 0 deg. to 500 deg. Fahr. = 0.12),
T = temperature rise, deg. Fahr. 3,412 = B.t.u. in kw.-hr.

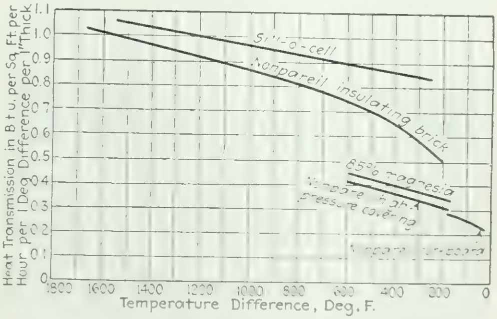
From the information on the oven under consideration, it may be seen that the weight of the material, including charge and truck, is 1,000 plus 300, or 1,300 lb. iron. The temperature rise equals 450 deg. Fahr. — 50 deg. Fahr. (room temperature) = 400 deg. Fahr. Therefore:

$$\text{Absorption} = (1{,}300 \times 0.12 \times 400) \div 3{,}412 = 18.3 \text{ kw.-hr.}$$

One of the most important points about the correct operation of a japanning oven is its ventilation. This is so because proper ventilation renders an oven immune from fire or explosions and insures safe operation. By proper ventilation is meant that amount of air which passing through an oven insures safe operation and at the same time gives sufficient drying and oxidizing atmosphere for the japan being baked.

It must be borne in mind that explosive vapors are driven off in the japanning process and also that the fire and explosive hazard can be eliminated by baking in a neutral oven atmosphere. Since thinners used in japan volatilize readily in air at room temperature, safety and best baking conditions demand that the work be allowed to hang after coating with japan at least twenty minutes before it is subject to baking heat. A good way to allow for a twenty-minute drip is to provide an intermediate loaded truck between the material being dipped and the one being baked.

Assuming that the proper drip has occurred, experience shows that a ventilation of about 1,200 cu.ft. of air per gallon of japan is a safe value (this is equivalent to 1,500 cu.ft. of air per gallon of solvent). Baking in three-fourths to one-hour, most of the solvent is driven off in the first fifteen minutes of the bake, which means that ventilation must be supplied at the rate of 4 × 1,200 = 4,800 cu.ft. per hour per gallon of japan. Since two-thirds of the solvent vapors are heavier than air, at least two-thirds of the ventilation should be from the bottom of the oven.



HEAT LOSS THROUGH VARIOUS INSULATING MATERIALS FOR OVEN WALLS

The following is a formula which may be used for the calculation of ventilation:

$$\text{Ventilation} = (V \times W \times S \times T) \div 3{,}412 = \text{kilowatt-hours per charge,}$$

where

V = total volume of air required per charge,
W = weight of 1 cu.ft. of air at 50 deg. Fahr. (0.08 lb. approximately),
S = average specific heat of air (23 approximately),
T = temperature increase (450 deg. Fahr. — 50 deg. Fahr. = 400 deg. Fahr.).

From the data sheet, 1.25 gal. of japan is used per charge, which will give $V = 4{,}800 \times 1.25 = 6{,}000$ cu.ft. per hour. Substituting:

$$\text{Ventilation} = (6{,}000 \times 0.08 \times 0.23 \times 400) \div 3{,}412 = 13 \text{ kw.-hr. per hour.}$$

It is found that the average oven should be ventilated to the extent of ten to twenty complete changes of air per hour.

Curves showing the heat insulating qualities of various insulating materials for various temperature differences have been made, with the results shown in the figure. These results are expressed in heat transmission in B.t.u. per square foot per hour per 1 deg. difference per 1 in. thickness. From these curves it will be noted that "Nonpareil" high-pressure covering has a very low heat transmission value with ordinary temperature differences such as are met in ordinary practice, an average value being 0.4 B.t.u. per square foot per hour per 1 deg. difference between the oven temperature and room temperature per 1 in. thickness; but to provide for losses due to the metal which must necessarily project through the wall 1.0 B.t.u. has been found to be correct.

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*Presented at the industrial electric heating conference, Boston, under the auspices of the Power Sales Bureau, New England Division, N. E. L. A.

RADIATION LOSS

The following is the formula which is used for the calculation of radiation or heat transmission through oven walls:

$$\text{Radiation} = (K \times T \times A) \div 3{,}412 = \text{kilowatt-hours per hour,}$$

where

K = radiation constant for the wall in question,
T = difference between oven temperature and room temperature (450 deg. Fahr. — 50 deg. Fahr. = 400 deg. Fahr.),
A = total outside surface of oven in square feet.

From the data sheet the oven walls are constructed of 4-in. "Nonpareil" high-pressure block, which will give the value of K equal to $1.0 \div 4 = 0.25$ B.t.u. per square foot per hour per 1 deg. difference, since the heat transmission varies inversely with the thickness of the wall in almost direct proportion.

CONTINUOUS-CONVEYOR JAPANNING OVEN WITH 180 KW. CONNECTED CAPACITY

The total outside wall surface equals 232 sq.ft. Substituting:

$$\text{Radiation} = (0.25 \times 400 \times 232) \div 3{,}412 = 6.8 \text{ kilowatt-hours per hour.}$$

DOOR LOSS IN TERMS OF RADIATION LOSS

This loss depends primarily upon the cross-section and length of the through metal involved, factors not easily obtained in practice. This loss can be approximated with a fair degree of accuracy by empirical means. While this loss is entirely independent of radiation, it will have probable values in poorly insulated, well mechanically constructed ovens of the box type and of moderate size ranging from 50 per cent of the radiation loss up to 100 per cent of this value for small ovens, while in well-insulated ovens ("Nonpareil" high-pressure block or its equivalent) this loss will probably be from 100 to 150 per cent of the radiation loss. As the oven under consideration is of moderate size and well insulated, we have assumed a door loss value equal to that of radiation loss, namely, 6.8 kw.-hr. per hour.

The following table contains the values obtained above. Each of the above formulas is expressed in kilowatt-hours or kilowatts installed to do the work in one hour, in the first column below; if this work is to be done in forty-five minutes instead of one hour, the kilowatts installed is given in the second column:

	Kw. Rate of Input for One Hour Bake	Kw. Rate of Input for 45 Minutes' Bake
Absorption	18.3	24.4
Ventilation	13.0	13.0
Radiation	6.8	6.8
Door loss, estimated	6.8	6.8
Total	44.9	51.0

For the forty-five-minute bake the theoretical power consumption in kilowatt-hours is $18.3 + \frac{3}{4}(13 + 6.8 + 6.8) = 38.25$ kw.-hr. This consumption in forty-five minutes requires a theoretical installation of 51.0 kw. It will be obvious, however, that more than 51.0 kw. is required to produce the proper results, for the following reasons: No provision has been made for heating the walls and interior oven constructed during the first charge, nor for the drop in temperature when the doors are opened, because this loss varies greatly with the oven-operating cycle. It depends on the length of time the doors are opened with the corresponding drop in temperature, factors which are so variable that a calculation of this loss would be useless. In every case, in order to secure best results, the material should reach baking temperature before the end of the baking period, which would require a greater demand than that calculated.

The radiation is calculated for a perfect oven, which has not yet been attained by oven manufacturers.

The correct amount of energy to add to the calculated theoretical value is based largely on the knowledge of existing ovens and a careful survey of the oven in question. It is impossible to give a rule that can be followed in every case, but our experience has been that about 15 per cent should be added in every case to the calculated value. The oven in question should have, therefore, 55 kw. to 60 kw. installed, depending upon the heater selected; *i.e.*, the number of heaters required to give balanced heat conditions in the oven with balanced electric circuits.

SELECTION OF VENTILATING EQUIPMENT

The outgoing air from an oven takes with it great quantities of volatile gases which are liable to condense in the ventilating system exterior to the oven. Great care must be taken to see that the ventilating system is kept properly cleaned.

On account of the importance of always getting proper ventilation, it has been decided to recommend a positive ventilation with a motor-driven blower rather than depend on the uncertain ventilation of natural draught.

Under the heading of ventilation, it will be remembered that it is recommended that one-third of the ventilation be taken from the top and two-thirds from the bottom of the oven. As already seen, there will be required a ventilation of 6,000 cu.ft. per hour, and this will require a motor-driven blower with a capacity of at least this amount.

The thermal efficiency of the electric oven is the ratio of the output to the input, in which the output is the theoretical value of absorption and the input the actual power consumption. The theoretical working efficiency of the oven in question in kilowatt-hours is, therefore:

$$18.3 \div 38.25 = 47.8 \text{ per cent.}$$

This efficiency will result in a baking of

$$1{,}000 \div 38.25 = 26.1 \text{ lb. of japanned material per kilowatt-hour.}$$

In the same way a core-baking problem may be worked out to show how factors such as moisture are taken care of.

Problem.—It is required to determine the energy requirements of an electric core-baking oven baking an 800-lb. charge of core and sand in forty-five minutes; 8 per cent moisture in sand at beginning of bake; 2 per cent moisture in sand at completion of bake; total iron in racks and trucks, 1,050 lb.; 258 sq.ft. outside oven surface.

Substituting in the formula used in the previous problem, with $W = 800$ lb. sand, $S =$ specific heat of sand (0.194), $T = 450$ deg. Fahr. — 50 deg. Fahr. = 400 deg. Fahr.:

$$\text{Absorption sand} = (800 \times 0.194 \times 400) \div 3{,}412 = 18.2 \text{ kw.-hr.}$$

From the information given there is present $0.08 \times 800 = 64$ lb. water, and as the finished core should not contain more than 2 per cent moisture there must be evaporated $0.06 \times 800 = 48$ lb. water.

Approximately 1,200 B.t.u. is required to evaporate a pound of water; hence:

$$\text{Absorption of water} = (1{,}200 \times 48) \div 3{,}412 = 16.9 \text{ kw.-hr.}$$

From the information blank there is present $750 + 300 = 1{,}050$ lb. iron. Therefore:

$$\text{Absorption of iron} = (1{,}050 \times 0.12 \times 400) \div 3{,}412 = 14.7 \text{ kw.-hr.}$$

The ventilation for a core-baking oven should be such that it will keep the oven from smoking, and it is found that about four changes of air per hour are all that is required. This will give a total ventilation of 1,080 cu.ft. per hour, or, substituting in the ventilation formula, there will be found:

$$\text{Ventilation} = (1{,}080 \times 0.08 \times 0.23 \times 400) \div 3{,}412 = 2.3 \text{ kw.-hr. per hour.}$$

The remarks on radiation also apply to this oven, and, substituting in the formula given for a total surface of 258 sq.ft. for the oven in question, there results:

$$\text{Radiation} = (0.25 \times 400 \times 258) \div 3{,}412 = 7.5 \text{ kw.-hr. per hour.}$$

The following table contains the values obtained above:

	Kw. Rate of Input for One Hour's Bake	Kw. Rate of Input for 45 Minutes' Bake
Absorption sand	18.2	24.3
Absorption iron	14.7	19.6
Absorption water	16.9	22.5
Radiation	7.5	7.5
Ventilation	2.3	2.3
Door loss, estimated	7.5	7.5
Total	67.1	83.7

For the forty-five-minute bake the theoretical power consumption in kilowatt-hours is $18.2 + 14.7 + 16.9 + \frac{3}{4}(7.5 + 2.3 + 7.5) = 62.7$ kw.-hr. This consumption will require a theoretical installation of 83.7 kw. We would actually install between 90 kw. and 95 kw., depending on the heater selected.

Too much emphasis cannot be placed on the use of core plates of the least possible weight. Each 100 lb. saving in weight of plates will result in a saving of

$$(100 \times 0.12 \times 400) \div 3{,}412 = 1.4 \text{ kw.-hr. per bake.}$$

As the ventilation of a core-baking oven of this type is not important and as the oven is to be ventilated with only a sufficient amount of air to remove the smoke, natural draught will be sufficient. In this oven the ventilation should approximate 20 cu.ft. per minute.

Since the theoretical absorption of the cores is $18.2 + 16.9 = 35.1$ kw.-hr. and the theoretical oven consumption per bake is 62.7 kw.-hr., the theoretical working efficiency of the oven is, therefore, 35.1 kw.-hr. ÷ 62.7 kw.-hr. = 56 per cent. This efficiency will result in the baking of 800 ÷ 62.7 or 12.8 lb. of cores per kilowatt-hour.

Generating Costs in Stations of Medium Size

Southern Station Burning Mexican Fuel Oil Averages 1.37 Cents per Kilowatt-Hour—Another Station with River Washery Coal Averages 1.24

BY M. J. IDAIL
Engineer with Francis R. Weller, Washington, D. C.

DURING recent years of rapidly shifting prices, scarcity and high cost of fuel and difficult labor problems not much information has been forthcoming regarding the cost of generating electrical energy. In the belief, therefore, that engineers and managers in small central-station systems may find generating cost data useful in checking their own costs, tables are offered giving the operating data and costs of two steam-power plants of medium capacity. Plant No. 1 is located in one of the Middle Atlantic States, and plant No. 2 is in the Southern section of the country. Both of these plants are in medium-size communities and pay about the wage scale obtaining in the average plant of the size. These plants are well managed, and every effort is made to operate them as economically as the equipment and conditions permit. The values given in the tables are, with the exception of the peak loads, averages for three-month periods.

The fuel burned in station No. 1 is river "washery" coal (fine particles of anthracite coal). This coal contains about 12,000 B.t.u. and is reasonably free from dirt. The coal has to bear no freight charge to the plant, and during the period covered by the tabulation it cost the company about $2.50 per long ton, delivered. The coal burned during the last part of 1920 was not so good a grade as that used earlier in the year.

TABLE I—GENERATING COSTS OF STATION NO. 1, BURNING RIVER "WASHERY" COAL

	Oct.-Dec., 1919	Jan.-Mar., 1920	April-June, 1920	July-Sept., 1920	Oct.-Dec., 1920
Peak load, kw.	860	740	760	720	800
Monthly output, kw.-hr.	263,200	247,900	279,300	250,400	276,000
Load factor, per cent	52	55	55	53	54
Lb. coal per kw.-hr.	6.0	5.5	5.6	5.1	5.3
Operating cost per kw.-hr.:					
Superintendence and wages	0.56	0.60	0.47	0.54	0.46
Fuel	0.73	0.66	0.65	0.60	0.56
Water	0.01	0.02	0.02	0.02	0.01
Lubricant	0.01	0.01	0.01	0.01	0.01
Station supplies and expenses	0.02	0.01	0.02	0.01	0.02
Maintenance cost per kw.-hr.:					
Buildings			0.03		
Steam	0.02	0.02	0.01	0.07	0.01
Electric	......				
Total generating cost, cents per kw.-hr.	1.35	1.32	1.21	1.25	1.07

The load on this plant is a combination industrial and lighting load of very good power factor. Throughout the period covered by the table the load was carried on the 937-kva. unit. This unit has a barometric condenser which develops a vacuum of 27.5 in. to 28.0 in. (698 mm. to 711 mm.), referred to a 30-in. (760-mm.) column. Prior to April, 1920, steam was supplied from one of the hand-fired boilers, the coal being at that time handled by means of a small industrial car. In April, 1920, the stokered boiler was put in operation, along with a scraper elevator and overhead-bunker coal-handling system and a steam-jet ash conveyor.

Comparing the six months' operation after the installation of the new boiler-room equipment with the previous six months' operation, the percentage reductions in operating costs are as follows:

	Per Cent
Cost per kilowatt-hour	7.0
Superintendence and wages	13.0
Fuel	10.0
Total generating cost	8.0

In this case it is felt that the steam-jet ash conveyor is responsible for the fact that the new equipment does not show a considerably greater reduction than the above in operating cost. The economy of the new installation seems to be on the increase. The total generating cost for December, 1920, was 0.98 cent per kilowatt-hour.

The load on station No. 2 is a very pronounced seasonal load, consisting of lighting and small motors. The months of heaviest load are January, February and March. It is necessary to operate three units over the peaks. Because of warm condensing water it is not possible to maintain a vacuum in excess of 27.2 in. (691 mm.). Mexican fuel oil is burned under the boilers with natural draft.

It will be noted that the fuel equivalent is kept around an average of 3.75 lb. (1.7 kg.) of coal per kilowatt-hour. During the latter part of 1918 this average equivalent reached a value as high as 5 lb. (2.3 kg.). With practically the same equipment it was possible, by means of careful instruction and constant direction of the firemen, to reduce the fuel equivalent from 5 lb. to 3.75 lb. For the month of December, 1919, it was 3.2 lb. (1.5 kg.). It may also be noted that as the winter load passed the boilers grew dirty and the pounds of coal increased.

TABLE II—GENERATING COSTS FOR STATION NO. 2, BURNING MEXICAN FUEL OIL

	Jan.-March, 1919	April-June, 1919	July-Sept., 1919	Oct.-Dec., 1919	Jan.-Mar., 1920	April-June, 1920	July-Aug., 1920
Peak load, kw	2,185	1,3[illegible]	1,140	1,[illegible]20	2,580	1,[illegible]	1,275
Monthly output, kw.-hr.	567,400	386,100	359,000	491,300	758,000	572,600	452,800
Load factor, per cent	34	40	59	64	62	64	63
Oil per kw.-hr., gal.:	.37	.35	.36	.33	.35	.31	.31
Equivalent coal per kw.-hr., lb.	4.[illegible]	3.6	3.8	3.3	3.7	3.7	3.5
Operating cost per kw.-hr., cents:							
Superintendence and wages	0.21	0.28	0.29	0.24	0.14	0.23	0.2[illegible]
Fuel	0.89	0.82	0.91	0.77	0.88	1.05	0.97
Water	0.02	0.01					
Lubricants	0.02	0.04	0.04	0.03	0.04	0.02	0.01
Station supplies and expenses	0.02	0.02	[illegible]	0.02	0.02	0.01	0.02
Maintenance cost per kw.-hr.:							
Boiler	0.03			0.01	0.03	0.01	0.02
Steam	0.12	0.15	0.1[illegible]	0.07	0.16	0.33	0.03
Electric			0.01	0.01	0.06	0.13	0.02
Miscellaneous	0.03	0.01					
Total generating and maintenance cost per kw.-hr.	1.3[illegible]	1.33	1.39	1.15	1.33	1.78	1.32

The total generating cost is made high by the excessive and out-of-proportion maintenance charge to steam equipment. This maintenance charge is very largely made up by the maintenance of the two engine-driven units, much piston and cylinder trouble having been experienced.

In determining the coal equivalent of the oil burned the actual B.t.u. content of the total oil burned is converted into terms of pounds of 13,000 B.t.u. coal. The weight and B.t.u. content of the oil has varied somewhat. During the early part of 1919 average values were 7.6 lb. per gallon and 18,500 B.t.u. per pound.

During the period covered by the tabulation fuel oil was purchased at approximately $1.13 per barrel of 42 gal. (159 l.) delivered. With average B.t.u. content and combustion efficiencies, coal would have to be purchased at approximately $4.60 per ton, delivered, in order to equal the fuel costs given in the table. Since the period mentioned oil has increased in price to $2.25 per barrel, delivered.

NATURE OF BOILERS AND GENERATING EQUIPMENT IN STATIONS FOR WHICH COSTS ARE GIVEN

Station	Boiler Equipment	Generating Equipment
No. 1	Three 410-hp. Keeler boilers, operating at 200-lb. pressure and 100 deg. Fahr. superheat; one with hand-fired furnace and other with Coxe chain grate	One 937-kva. General Electric turbo-generator and one 500-kw. Westinghouse [illegible] rated at 2,300 volts.
No. 2	Three 335-hp. Erie City boilers; one 400-hp. and one 500-hp. Heine boiler, all operating at 200-lb. pressure and 100 deg. Fahr. superheat.	One 1,250-kva General Electric turbo-generator and two 880-kva. engine-driven generators, all rated at 2,300 volts.

Generator of 22,000 Kva. Rating for Western Company

One of the largest horizontal waterwheel-driven generators ever built has recently been completed for the Great Western Power Company of California. It is a three-phase, 60-cycle machine rated at 22,200 kva., 0.9 power factor, 11,000 volts, 171 r.p.m. There will be two units of this type in the Great Meadow plant on Feather River.

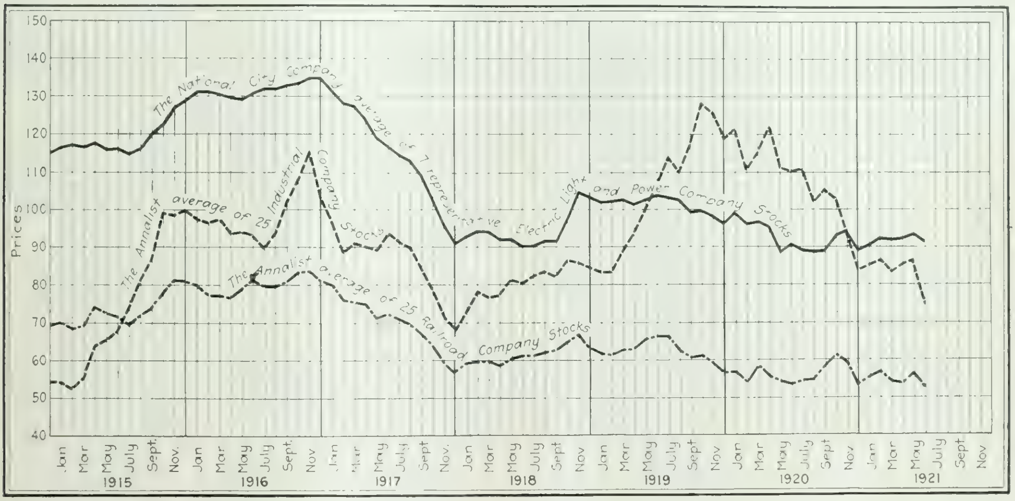
The fact that it was built to operate on a 165,000-volt transmission line, the highest operating voltage to be reached so far in this country, caused some interesting features to be incorporated in its construction. It was designed with special reference to line-charging requirements so that with full-load armature current the transmission-line voltage will not build up to over 80 per cent of the normal voltage. Silicon steel was used in the construction of the armature to minimize core loss. Tests made at the factory on the generator show that it has 97.25 per cent efficiency at full load and unusually high efficiencies at partial loads. These are 95 per cent at half load and 93 per cent at quarter load. All efficiencies were at 0.9 power factor.

The rotor consists of four separate wheels made into a single spider with rim dovetailed to receive the poles. The machine is inclosed for ventilation, having air inlets on each side consisting of ducts coming from underneath. The heated air is expelled into the room. Some of the dimensions are as follows: Total height over all, 21 ft. (6.5 m.); distance over the end shields, about 7 ft. (2.1 m.); distance from the floor line to the top of the machine, 13 ft. (4 m.). The total net weight is 334,000 lb. (151,500 kg.). The machine was built by the General Electric Company and is the largest ever built by that company.

Stability of Electric Light and Power Securities

Average Price of Common Stocks Little Affected by Present Business Depression—Industrials Show Wide Fluctuations

ONE of the essentials of a good security is that it's value shall not be materially affected by conditions existing in other industries. Our industrial and financial structure, however, is so interwoven that absolute immunity from outside effects is impossible; but when an industry such as for instance the electric light and power industry has become part and parcel of our national life, its earnings, both gross and net, fluctuate but little from year to year. Any general industrial or business depression, while it may be reflected in gross returns, does not affect income as adversely as it does the income of some other but less essential primary industries.



AVERAGE PRICES OF ELECTRIC LIGHT AND POWER, INDUSTRIAL AND RAILROAD STOCKS FOR THE PAST SIX AND ONE-HALF YEARS

Through the courtesy of the National City Company we are able to show a chart of the average prices of the common stocks of seven representative electric light and power companies by months for the past six and one-half years. To the diagram have been added curves showing the average prices of twenty-five industrial and an equal number of railroad stocks. The electric light and power stocks represented are of companies doing a purely electric lighting and power business. Companies engaged in more than one utility activity have not been included in the tabulation.

In order that the curves shall be comparable the values plotted have been obtained by averaging the high and low sales of each of the stocks which have occurred during each month.

It will be noticed that the greatest fluctuation in the case of the seven electric stocks for the period of six and a half years was from 89 to 135, a range of 46 points, as compared with a low of the industrial stock of 53 and a high of 128, giving a range of 75 points. The railroad stocks fluctuated from 53 to 84, a range of 31 points. It is, of course, evident that the electric stocks have been more stable than the industrial stocks, and practically as stable as the railroad stocks. There is, however, a noticeable downward trend since January, 1913, which became more or less concentrated during the year 1917. This may be accounted for almost entirely by, first, the increasing return demanded for capital, and the resulting fall in value of securities upon which a return is more or less fixed; and, secondly, by the adverse sentimental effect of the present traction situation, rather than any weakness or falling off in the earnings and business of electric light and power companies themselves. Had the electric companies been able to adjust their rate schedules quickly to meet higher operating costs, as is possible in most other primary industries, it is very probable that this downward trend would have been less acute.

If that portion of the curves prior to January, 1918, is eliminated from consideration, the stability of the electric stocks is quite marked, as compared with the curves of industrials, and is found to be within 1 point of the extreme movements experienced by the older and more mature railroad stocks. During this period of three and one-half years the average maximum fluctuation of the electric stocks was 15 points, as compared with 14 points for the railroads, whereas the average of the industrial stocks ranged between 75 and 128, or a total range of 53 points.

It is plainly evident from the curves that electric light and power stocks are much more stable than those of industrial companies. Such a condition is of course to be expected as the earnings of electric companies, both gross and net, per dollar invested, fluctuate but little from year to year, whereas the income of many industrial companies goes from one extreme to another, depending on the general business condition of the country. It is also probable that as the interest rate demanded by the investing public decreases the selling price of electric light and power stocks will rise, and may even exceed the level attained at the close of 1916. The curves indicate that stocks of electric light and power companies have attained an enviable position in the financial world.

Readers' Views and Comments

This is a readers' forum. Comments on questions before the electrical industry presenting economic, financial, engineering or commercial aspects and new or supplementary viewpoints on published articles are cordially invited

Outdoor Meter Installation

To the Editor of the ELECTRICAL WORLD:

SIR: I note in the July issue of the ELECTRICAL WORLD, on page 3, that you advise it is far easier to install a meter on the porch or in some such place where it may be read without the reader meeting the customer at all. There is no question but this practice of back porch installation eliminates a great deal of annoyance and trouble due to customers being away and the inability of the meter reader to secure the meter record. It does, however, present other problems; that is, rapid deterioration of the meter, temperature error, parts of the meter and rotating standards exposed to the weather on periodic tests.

It is my understanding that all of the leading meter manufacturers have objected to the installation of meters that are any way exposed to atmospheric conditions.

The writer some time ago made a personal investigation of several hundred meters that had been installed on back porches for a period of four or five years and found conditions within the meter which caused this company to abandon such practice. I believe that I am correct in stating that at least one commission prohibits the use of meters on back porches. It is possible that where climatic conditions are ideal the installation of meters on back porches would be satisfactory. Our experience and the experience of other companies with which I am familiar shows that this method of installing meters greatly increases the maintenance.

Hodenpyl, Hardy & Company, G. C. LANGDELL.
Jackson, Mich.

Loose Talk on Welding Should Be Stopped

To the Editor of the ELECTRICAL WORLD:

SIR: For the good of the electrical industry some means should be found to eliminate the tremendous amount of loose talk on the subject of electric welding which is at the present and has been for some time prevalent. A great deal of this is the result of ignorance. Part of it is the result of self-seeking by manufacturers or their representatives. I am not, however, referring to the usual line of sales "patter," which is harmless because it is immediately discounted by the prospective buyer.

Arc welding is a wonderful advance in the application of electricity. It has certain limiting characteristics which any one acquainted with the art knows. This fact should be recognized and explained to the prospective user for his own protection, for the protection of the people who buy his product and for the protection of the good name of the electrical industry.

There are at the present time hundreds of proper appliances for arc welding where the process will be very difficult to introduce because some uninformed or misleading enthusiast has made claims which he could not back up and which resulted in disgust on the part of a prospective user. There are some types of machines on the market which are not suitable for arc welding except in certain cases. There are certain jobs of welding which can be done perhaps under certain conditions but in general cannot be done. Add to this fact an ignorant salesman desirous to make a sale at any cost and short-sighted propaganda from his company, and the resulting combination may do immeasurable damage to other manufacturers who are honestly trying to advance the art, to say nothing of the harm done to prospective customers.

I appreciate that this unfortunate condition cannot be rectified in any other way than by proper propaganda. Unless each manufacturer of arc-welding equipment takes it upon himself to see that the claims made by his salesmen or his representatives are the truth, the whole truth and nothing but the truth, present conditions will continue and the sales of all manufacturers of welding equipment will suffer. J. F. LINCOLN,
Lincoln Electric Company, Vice-President.
Cleveland, Ohio.

Would Be World Record

To the Editor of the ELECTRICAL WORLD:

SIR: In the May 14 issue of the ELECTRICAL WORLD, on page 1126, the height of the Ebro Irrigation & Power Company's dam was given as 804 ft. If this were correct, the height would be a world's record. Inasmuch as P. L. Griffith, who was superintendent of electrical construction on the work referred to, differs from you on this point, perhaps some of his comments may be of interest.

He writes: "This must refer to the Camarara development, on which I was superintendent of electrical construction. All my data are in New York, but the following information I believe will be close enough: Development located in the province of Lerida, on the Noguera Pallaresa River; height of dam, approximately 100 m. above riverbed; head on turbines, maximum, 92 m. Two units are now installed of 18,500 hp. each. The ultimate installation will consist of five similar units, total 92,500 hp. Storage reservoir is about 16 km. long.

The four developments of the Ebro Irrigation & Power Company include:

Plant	Capacity, Hp.	Head, (M.)	Units	
			Installed	Ultimate
(1) Pobla.	4,599	30	Three horizontal	3
(2) Seros	56,000	49	Four vertical	5
(3) Tremp	40,000	68	Four horizontal	4
(4) Camarara	37,000	92	Two vertical	5

We are passing this information along for your records without further comment, but can in no way vouch for the authenticity of the above quoted figures.

Electric Bond & Share Co., W. W. BROWER,
New York. Statistical Department.

[The information presented in the May 14 issue of the ELECTRICAL WORLD was not obtained directly but through a news source. Since that time one of our correspondents has sent us data which we have reason to believe are more authentic. He informs us that the dam is on the Noguera Pallaresa River and is approximately 295 ft. high. Two out of five ultimate units are in operation, being rated at 11,250 kw. or 14,060 kva., 50 cycles. The ultimate installation will be rated at 70,000 kw. or 87,500 kva. as the machines have been able to carry considerable overload. These figures agree very closely with those given in Mr. Brower's letter.—EDITOR.]

Japanese Law Governing Electrical Operation

To the Editor of the ELECTRICAL WORLD:

SIR: In the May 14 issue of the ELECTRICAL WORLD an article by the writer appeared relating to the procedure of applying for licenses and developing water power in Japan. Possibly some features of the law applying to electrical structures and the operation of public utility corporations in that country may also be of interest. Extracts from the law which deal with these points follow:

VII.—A person engaged in an electric industry [generation, transmission or distribution] may enter the land of another person when it is found necessary to do so for the purpose of making surveys or for the construction of works required in that industry. In cases where it becomes necessary to enter the property of another person approval shall first be secured from the administrative authorities and notice given to the mayor, or the village head man, who shall issue a warrant and have it communicated to the occupant of the land. A person engaged in an electric industry may also obtain admission to the land or buildings of another person in which electric structures have been erected, provided that it is necessary to repair or inspect said electric structures. However, during the period between sunset and sunrise he shall not enter a home or other building in opposition to the wishes of the occupant, except in case of emergency.

VIII.—In case it becomes necessary for a person engaged in an electric industry to cut down trees, bamboos or other plants offering obstacles to the erection of electric structures or to the maintenance thereof, and in case permission of the owner cannot be secured, then the person engaged in the electric industry may cut down or transplant said trees, bamboos or other plants with the permission of the administrative authorities, the fact having previously been reported to the owner. In a case of emergency the person engaged in an electric enterprise may forthwith cut down or transplant said trees, bamboos or other plants, disregarding the foregoing provisions, but the fact shall be reported without delay to the administrative authorities.

IX.—When it becomes necessary for a person engaged in an electric industry to construct an electric line above or underneath ground which has been set aside for public use, such as parks, bridges, ditches, roads, etc., said person may do so with the permission of the superintendent of the property concerned, provided that the construction of such work does not interfere with the utility of said property. For this privilege rent must be paid, as required by the superintendent of the property. If the superintendent or local administrative authorities refuse to grant such permission to the person engaged in an electric industry, or if the rent stipulated by the superintendent is found unreasonable, then said person may apply to the proper minister, who may issue the necessary permit and determine the rate of rent.

X.—A person engaged in an electric industry may construct, if necessary, an electric line above or underneath the ground of another person and may erect on the ground of another the structures supporting the electric wires, provided that no other similar structures are already in existence and also that such construction work does not interfere with the original use of the property by the owner. In case a person engaged in an electric industry intends to use the land of another person in accordance with the foregoing provisions but cannot secure the permission of the owner or occupants of said property, he may commence the work after prescribing the area of property required, provided permission of the local governor shall have first been received. In such cases the fact must be reported to the owner or occupant at least five days prior to the erection of the electric structures.

XI.—In case it becomes necessary to make an alteration in the use of land on or near which an electric line has been constructed in accordance with the provisions of the foregoing article, then the owner or occupant of said land may require the person engaged in the electric industry to remove the electric line or to make such alterations in the electric line as may be necessary to permit the owner or occupant of the property to make the contemplated changes in the use of his land. The cost of the removal of or the alterations to the electric line shall be borne by the person engaged in the electric business, except that it shall be borne by the owner or occupant of the property if the latter fails without proper reason to make the contemplated changes to his property after the removal of or alterations to the electric line have been completed.

XII.—When a person engaged in electric industry enters property of another by virtue of his rights under Articles VII, VIII and X, he shall indemnify the owner or occupant of the property for any loss or damage resulting. The amount of indemnity shall be fixed by the administrative authorities who have granted permission to enter the property. If the owner or occupant of the property is dissatisfied with the decision of the administrative authorities, he may apply to the law court within three months from the date on which such information was received by him. The administrative authorities may require the person engaged in the electric industry to make a deposit, or to give a bond in sufficient amount to cover any possible damages to the property on which electric structures are to be erected.

CHARLES B. HAWLEY.

450 Munsey Building, Washington, D. C.

Electric Resistance of Creosoted Poles

To the Editor of the ELECTRICAL WORLD:

SIR: Believing that there exists in the minds of many linemen a prejudice, based on unnecessary fear, against the use of creosoted poles on lines carrying high-potential or extra-high-potential circuits, and believing also that the use of such poles may aid greatly in solving the pole problem—annually becoming more difficult on account of increasing scarcity of cedar—in 1919 I made inquiry of various managers over the South as to the extent of their use of these poles and as to the difficulties and results they had met.

This inquiry developed great difference of opinion, and further search failed to bring conclusive evidence, especially in regard to the real danger to linemen. I then appealed to the United States Forest Products Laboratory, Madison, Wis., and to the Bureau of Standards, Washington, asking that an investigation be made and its results embodied in a government report on the subject. The replies from these bodies stated that lack of funds prevented taking up the investigation. I found one creosoting company which offered to pay part of the expense of such a government investigation, but no others were found to co-operate. The matter rested here until the recent receipt of a letter from the Forest Products Laboratory asking whether I had been able to get any further information and, if so, that the results be forwarded to the laboratory.

Creosoted poles would be particularly advantageous on street lines carrying 2,300-volt circuits. An authoritative report, such as one by the government, on the resistance of such creosoted poles and the actual degree of danger and inconvenience involved in their use is highly desirable, and I ask if you will not co-operate in urging the government to undertake the investigation.

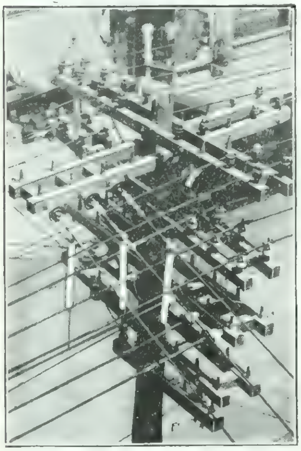
Monroe, La. WALTER G. KIRKPATRICK.

Station and Operating Practice

A Department Devoted to Problems of Installation,
Operation and Maintenance of Equipment for Economical Generation and
Distribution of Electrical Energy

Strengthening a Dead-Ended Circuit

A METHOD of overhead-line construction superseding the old plan of anchoring a dead-ended circuit on pin-type insulators is shown in the accompanying photograph taken on the system of the United Illuminating Company, Bridgeport, Conn. From the pole shown a three-phase, 2,300-volt, 300-hp. circuit is taken off at approximately right angles to the main line to feed the factory of the Bryant Electric Company. The main feed is a No. 4 0 circuit dead-ended on Locke No. 3039 strain insulators bolted through a double cross-arm with guy hooks on the further end and a guy wire to the adjacent pole. The right-angled branch is also dead-ended on strain insulators at the double cross-arm next to the top arm, and the branch is tapped into the main feed through vertical porcelain tubes 2 in. in diameter and 24 in. long. This method costs slightly more to install, according to F. W. Brierly, superintendent of the company, but gives much more satisfactory service. With the older scheme of dead-ending on pins it was found that a No. 4/0 line would cause pin tilting and cross-arm breakage in a short time after installation.



CIRCUITS DEAD-END ON STRAIN INSULATORS

Boston, Mass. FIELD EDITOR ELECTRICAL WORLD.

Economy of 250-Ft. Spans for Rural Lines

THAT some type of construction less expensive than that standardized for urban work is necessary to make farm lines an economic possibility was pointed out in the preliminary report of the committee on rural lines of the Empire State Gas and Electric Association, presented by E. H. Shepard. It is essential that there be no sacrifice of a reasonable factor of safety, that the construction involve a minimum amount of maintenance since it is relatively difficult to reach and that easily obtainable materials be used. It is advantageous to use the same voltage for rural as for urban circuits where practicable, as transformers, insulators and other accessories are thus interchangeable. If it is necessary to use a higher voltage, the choice will depend upon an analysis of the individual case in which the load, the distance and the cost of wire, insulators, transformers, fuses and lightning arresters must all be considered.

On rural lines it will generally be found necessary to string only two or three primary wires of comparatively small size. It is, therefore, possible, so far as the poles are concerned, to increase the span length very materially while keeping the same factor of safety usual in urban construction. It is believed that a span of 250 ft. offers a number of advantages. It may be used for primary line extensions with class B or C poles without sacrifice of the required factor of safety. Using 30-ft. poles and suitable conductors, the necessary clearance to ground can be obtained, and if increased business makes additional wires necessary, such a line can be changed to 125-ft. spans by setting the intervening poles. With 250-ft. construction it is desirable to shorten spans and double-arm poles at sharp corners, and dead ending and guying should be done in a thorough manner.

With the long-span construction it is necessary to use a conductor having a higher elastic limit than the No. 6 copper in common use. There are four materials which have the necessary strength—steel, copper-clad steel and hard or medium-drawn copper wire and steel-cored aluminum cable. Except in cases where the line current is very small and the distance short, the first two materials are unsatisfactory because of their low conductivity, and for general service on long-span rural lines the choice appears to rest between medium-drawn copper wire and steel-cored aluminum cable. There is usually no important price differential between these materials when purchasing wire of equal conductivity.

COST OF ONE MILE OF 2,300-VOLT SINGLE-PHASE LINE, AS OF JUNE, 1921

	—125-Ft. Spans— No. Items	Cost	—250-Ft. Spans— No. Items	Cost
30-ft. 6-in. top Western cedar poles, butt-treated	43	$447 20		
30-ft. class C Western cedar poles, butt-treated			23	$276 00
Four-pin fir cross-arms with pins and braces	45	45 00	27	27 00
⅝-in x 10-in. galvanized machine bolts	41	4 92	19	2 38
¾-in. x 14-in. galvanized machine bolts	2	[illegible] 31	4	0 62
⅝-in. x 14-in. galvanized double-arm bolts	4	0 65	8	1 30
⅜-in. x 4-in. lag bolts	45	1 35	27	0 81
6-ft. guy anchors	2	7 12	2	7 12
[illegible] galvanized steel cable, ft.	100	[illegible]	40	4 00
Three-bolt guy clamps	4	[illegible] 96	8	1 92
Strain insulators	2	0 82	6	2 46
Porcelain insulators	90	40 50	54	24 30
No. 6 copper wire, ft.	11,[illegible]	221 00		
No. 4 [illegible] aluminum [illegible]			10,800 ft	212 00
No. 6 [illegible]			2,000	
Miscellaneous [illegible]		[illegible]		10 00
Labor and [illegible]				
[illegible] poles		48 [illegible]		32 [illegible]
Setting poles		23[illegible] [illegible]		1[illegible]8 [illegible]
[illegible]		[illegible]2 [illegible]		40 00
[illegible]		22 [illegible]		[illegible]
Guying		12 00		1[illegible] [illegible]
Stringing wire		11[illegible] 00		1[illegible] 00
Supervision		48 45		34 20
Total labor and material		$1,313 78		$946 11
Overhead expense at 15 per cent		197 07		141 92
Total cost		$1,510 85		$1,088 03
Saving on 250-ft. span				422 82

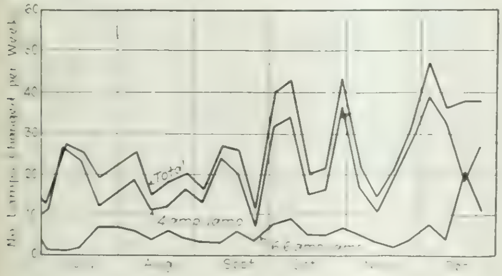
The steel-cored aluminum requires somewhat more care than copper in installation, and the junk value of the copper is proportionately higher than that of steel-cored aluminum. The steel-cored aluminum is, however, much stronger than hard or medium-drawn copper of the same conductivity and is, therefore, better adapted to small sizes for stringing long spans on low supports.

The sag that is recommended for No. 4 aluminum cables steel-reinforced is 52 in. for a 250-ft. span at a temperature of 60 deg. Using 30-ft. poles, clearance to ground at the center of the span will then be about 20 ft. 3 in. Standard N. E. L. A. cross-arms with 1-in. locust pins are suitable for the construction proposed. The use of four-pin cross-arms for two-wire lines or six-pin arms for three-wire or four-wire lines is suggested to obtain ample separation of conductors. Standard galvanized line hardware should be used. The saving to be effected by the proposed construction will vary with different companies, being dependent principally on the material used and the cost of labor. The accompanying tabulation shows the cost of one mile of single-phase, 2,300-volt line of standard construction and one mile of long-span construction on a reasonably straight road, free from trees and when no conflict will be encountered with the construction of other utility companies. It is assumed that both lines are dead-ended at each end. FIELD EDITOR ELECTRICAL WORLD.

New York, N. Y.

Curves Used to Show How Arc Lamps Are Standing Service

IN ORDER to keep track of the condition of arc lamps the distribution department of the Worcester (Mass.) Electric Light Company employs curves showing the number of lamps which are replaced each week. An increase in the number of arc lamps taken out in any week as shown by these curves leads to the conclusion that the arc lamps were not put in proper shape before being installed on the line or that they were handled carelessly by the trimmers. There are two of these curves showing respectively the withdrawals of the ornamental lamp in the special white-way service and the withdrawals for the ordinary street lamps. George M. Hardy, superintendent of the company, is responsible for the development of these curves.



NUMBER OF ARC LAMPS CHANGED FOR REPAIRS OR OTHER PURPOSES SHOWN WEEKLY BY THIS CURVE

Similar curves to this are used for many purposes by this company. Some of them have already been published in ELECTRICAL WORLD and more will be published in subsequent issues.

Boston, Mass. FIELD EDITOR ELECTRICAL WORLD.

Filing More Than 26,000 Charts on an Open Wall Rack

A CHART rack with a capacity of 26,300 circular record sheets of 10-in. diameter is in service in the offices of the generating department of the Edison Electric Illuminating Company of Boston. The rack holds charts from boiler-room and turbine-room instruments. It is constructed of soft-pine strips, shellacked and fastened together with light screws. Recesses about ⅛ in. deep are cut in the strips where they cross one another to insure a solid structure. The strips are ¼ in. thick by 1½ in. wide and are run 12 in. apart on centers between horizontal rows. The rack is divided into three sections each 4 ft. long, and each of these sections is attached by picture hooks to the molding of the office, the lower portion also being screwed into the wainscoting. The charts, which have holes ½ in. in diameter, are hung on brass coat hooks, of which there are seventy-two fastened to the strips as shown in the accompanying photograph. These hooks cost about $8, but were found superior to inclined wooden pins, off which currents of air would sometimes blow the charts. Each hook will carry 365 charts in order, and thus the exact conditions at any boiler or turbine equipped with recorders can be determined immediately for any time within a year's run without the usual trouble of unearthing such records from stacked-up piles. The cost of rack complete was about $25. R. E. DILLON,

Assistant Superintendent Generating Department.
Edison Electric Illuminating Company,
Boston, Mass.

COAT HOOKS KEEP THE CHARTS FROM BEING BLOWN AWAY

Holder for Wire Meter Seals

A RECEPTACLE for wire seals in the meter shop usually presents a sad spectacle. The use of a large test clip for holding the seals is convenient, keeping the seals off the floor and in one bunch and allowing one to be taken without disturbing the rest. It is good for one seal or fifty at a time. The terminal screw on the clip is removed and a wood screw used to fasten the clip rigidly to the end of the test bench. Two flat metal hooks prevent side swing. D. A. MCNULTY.

Waterbury, Conn.

Industrial Applications

The Economical Utilization of Electrical Energy
in Mills and Factories, Together with Practical Details of Installation, Control,
Testing and Repair of Equipment Required

Electric Drive for Small Rock Crusher and Pulverizer

THE proper size of motor to install on a small rock crusher and pulverizer and whether a gasoline engine should be used in preference to motor drive were questions which had to be settled recently for a large fertilizer company. To handle the output of a newly acquired quarry this company purchased a rock crusher rated at 1½ tons per hour and a pulverizer of the same rating. The manufacturers of the machines recommended that a 5-hp. motor be used to operate the pulverizer and a 6-hp. motor to run the crusher, making a total of 11 hp. A motor salesman recommended individual operation with a 5-hp., 1,800-r.p.m. motor and a 7½-hp., 900-r.p.m. motor. This, of course, would give satisfactory operation, but, on the other hand, would have entailed a rather high minimum or service charge.

The matter finally came to the engineering department of a public utility. An inspection of the two machines showed the following characteristics: The pulverizer operated at 1,400 r.p.m. and having a heavy rotating hammer required a rather high torque to get it up to speed. However, when it was running at full speed the kinetic energy stored up in the revolving pulverizer would aid materially in starting the crusher, and it required considerably less power to keep it in motion than to start it. The pulverizer was equipped with only a tight pulley. The crusher operated at 300 r.p.m. and was equipped with tight and loose pulleys. With this condition the full power of the motor could be utilized for starting the pulverizer, and when this was brought up to speed the crusher could be thrown in and the motor would receive help from the pulverizer in starting it. The engineer accordingly recommended that a 7½-hp., three-phase, 1,800-r.p.m. motor be employed to drive both machines from a counter shaft. The utility company had two phases and a neutral of its three-phase system running past the place, and with this small installation it had agreed to make a "V" connection with the two phases and the neutral rather than insist on the prospective customer paying the expense of carrying the third phase of the system 2,000 ft. to reach his premises. The minimum or service charge for this size motor was approximately $4.50 per month.

A comparison of the cost for a gasoline engine installation was made. The figures were as follows:

Price paid for motor and starting [illegible]	$150 00
Cost of suspending motor from ceiling	6 00
Total	$156 00
Price asked for the 15-hp. [illegible]	$285 00
Cost of installing on concrete foundation (estimated)	20 00
Total	$305 00

The difference between cost of gasoline engine and motor installation was $149, and assuming that the installation was not used at all, it would have required thirty-three months for the service charge to dissipate the difference in first cost. Therefore the manufacturer chose the motor drive. The installation was accordingly made, and a test showed that the installation operated satisfactorily and the motor furnished plenty of power for starting and running as the accompanying table shows. The power required was calculated from wattmeter measurements of the input multiplied by the efficiency of the motor.

POWER REQUIRED IN SMALL ROCK CRUSHER AND PULVERIZER INSTALLATION

Both machines rated at 1½ tons of limestone per hour

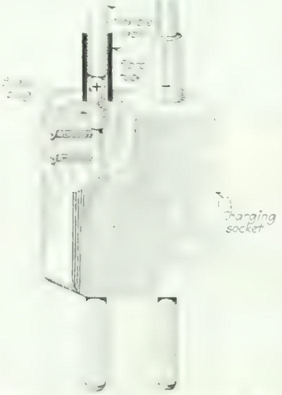
Operation	Power Required, Hp.
Starting pulverizer	6
Driving pulverizer light	2.2
Starting crusher (pulverizer running)	6.5
Driving pulverizer and crusher light	4.15
Driving pulverizer and crusher at full load	6.8

Instances like this are continually coming up which show the value accruing to both the utility and the prospective consumer of competent engineering advice.

Cincinnati, Ohio. A. G. DRURY.

Connectors for Truck-Charging Sockets Save Wires

WHEN charging batteries on industrial trucks a large manufacturing company in the East formerly experienced frequent trouble due to the breaking and short-circuiting of the leads on the charging plugs. The leads must of necessity be stranded to give flexibility, but if the strands are screwed into the plug directly, they soon break and cause a short circuit. By making brass plugs as shown in the drawing to fit in the charging plugs, and soldering in the wire, putting over this a fiber tube, all danger from strands short-circuiting is removed. This was done not only on the charging plugs but also on the plug on the car which fits into the charging socket and is connected to the motor on the truck. Since making this change no trouble has been experienced with leads breaking off and short-circuiting.



BRASS PLUG TAKES PRESSURE OF SCREWS INSTEAD OF STRANDED WIRE

EUSTACE C. SOARES,
Electrical Engineer.
Ophuls, Hill & McCreery,
New York, N. Y.

Lighting a Structural-Steel Plant

FOR lighting the Gage Structural Steel Company's plant at Chicago an illumination design has been worked out which might be applied to other plants of the same general characteristics. This plant starts work at 7 o'clock in the morning and continues until 6 o'clock in the evening. The energy is 60-cycle alternating current, and voltage remains fairly constant at 115 volts.

LIGHTING REQUIRES 0.7 WATT PER SQUARE FOOT

The room which is illustrated in the accompanying photograph has a width of 64 ft., a length of 200 ft. and a height of 30 ft. The walls and the ceiling are both of a dark color.

The lighting installation consists of twenty 500-watt gas-filled lamps hung at a height of 21 ft. above the floor in deep-bowl enameled-steel reflectors. The energy required is 0.7 watt per square foot of floor surface. The equivalent burning hours per month are approximately 75, and the estimated consumption per month is approximately 750 kw.-hr. As the power and light are both on the same meter, the energy consumption could not be measured accurately and the figure given is an estimate. FIELD EDITOR ELECTRICAL WORLD.

Chicago, Ill.

Motor Troubles Which Show Up as Heating

OVERHEATING of any part of a motor indicates that some trouble is present which must be removed. If there is a full load carried, the frame will probably be quite warm, and with an overload the insulation is likely to smell as if burned owing to the heat carbonizing the cotton braid and shellac. The quickest remedy in such a case is to reduce the load or shut down the motor for a test. If an ammeter is connected in the line, the load is easily determined. A thermometer test, with the bulb imbedded in cotton, will show whether the heat is excessive or not.

Excessive heat may be caused by the armature or rotor striking the poles or stator. In such a case renew the bearing sleeves. Not more than three months should elapse without trying a steel gage between the rotor and the stator of induction motors to determine the clearance, as this may save an untimely shutdown.

When the heat comes from the bearings this is usually due to mechanical friction, such as poor lubrication or a bent shaft, and not to electrical defects. If the heat is from an overload, the fuses may melt repeatedly or the relays may open.

Heat on the commutator of a direct-current motor may be due to heavy friction of the brushes or to flashing over continuously. If the former trouble is found, loosen up on the tension springs. For the latter perhaps shifting the brush rocker arm will eliminate flashing and reduce the heating. H. S. RICH.

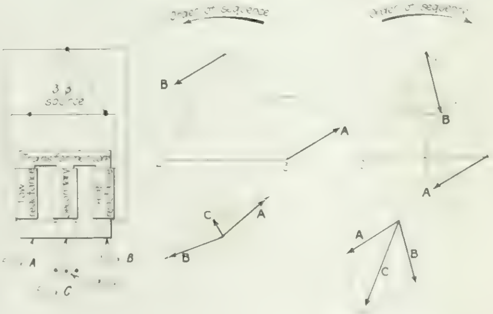
East Berlin, Conn.

Testing for Phase Sequence in Three-Phase Circuits

IN THE interesting article by Prof. F. A. Kartak on "Testing for Phase Rotation in Three-Phase Circuits" which appeared in the ELECTRICAL WORLD for April 23, 1921, four methods of determining phase rotation are classified. A method devised by the writer and which differs materially from the four mentioned in the article will possibly be of interest to those who have to make tests of this nature. This method requires a small polyphase transformer core having two primary windings, one on each of the outside legs, a secondary winding on the common leg and a lamp in the secondary circuit.

The ratio of resistance to reactance in one of the primary coils is made greater than the corresponding ratio in the other primary coil. The flux in the core of the former coil will therefore lag the emf. impressed on that coil by an angle smaller than that by which the flux in the core of the latter coil lags the emf. impressed on that coil. Therefore the resultant flux in the common leg will have a value which is of different magnitude according to the phase rotation of the source, and it follows that the lamp connected in the secondary circuit will have a different brightness.

The electrical connections of the transformer used in this method are shown in the drawing, as are the approximate phase relations of the polyphase emfs. and transformer fluxes for opposite orders of rotation. Vectors 1—2, 2—3 and 3—1 represent the three emfs. of a polyphase circuit. *A* represents the approximate phase of the flux in the core surrounded by the highly reactive coil. *B* represents the approximate phase of the flux in the core surrounded by the coil of lower reactance. *A* lags the corresponding emf. 3—1 by nearly 90 deg. *B* lags emf. 1—2 by about 45 deg. *C* is the resultant flux in the third or common leg.



TRANSFORMER FOR DETERMINING PHASE SEQUENCE OF A THREE-PHASE CIRCUIT

The effect on the resultant flux caused by different orders of rotation is shown by the two sets of diagrams. The current in the secondary circuit naturally reacts upon the component fluxes so that their lags and magnitudes will not be identical in the two orders. There is no difficulty, however, in so proportioning the windings as to secure the effect desired.

A convenient assembly of the apparatus, including a quick reversing switch, occupies a box 6¼ in. x 4¼ in. x 2½ in. and weighs 3 lb., thus being readily carried in a meterman's kit. HENRY J. BLAKESLEE.

States Company,
Hartford, Conn.

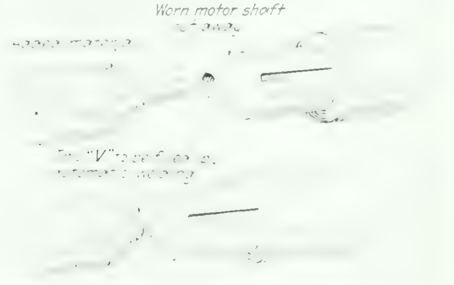
Motor Shaft Repaired by Auto-Welder Without Removing Winding

A METHOD used for welding ends on motor shafts by means of a steam hammer without removing the motor winding is described on page 830 of the April 9 issue of the ELECTRICAL WORLD. This operation is very easily accomplished by means of the automatic electric arc welder. The end of the armature shaft is tapered to a point and a short drill hole made at the center. The extra material is machined with a taper and with a corresponding projection to line up the two pieces of steel. The projection on the second piece fits into the hole in the shaft end. The shaft is then mounted in a lathe and material is deposited in the groove, thoroughly uniting the two sections. After the groove is filled up the metal may be machined to any desired shape.

In some cases the pulley or gear is not damaged so severely, and it is possible to salvage the shaft by merely building it up without removing any metal. The entire armature and shaft are mounted in the lathe. This application is of considerable value in salvaging street-railway motor shafts where the pinion seat is often damaged, but can be reclaimed by building up the surface above the original size and machining to the proper dimensions.

Owing to the fact that the heat is utilized so efficiently in the electric arc, it is localized at the point where the welding is being done, and the windings need not be removed in any case from the core, nor need the core or commutator be removed from the shaft. This process has been used on shafts from ¾ in. in diameter up to 26 in. in diameter. H. L. UNLAND,

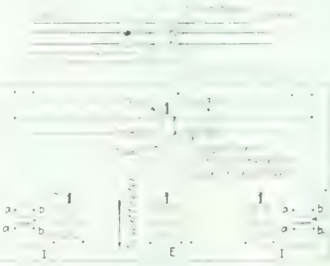
Power and Mining Engineering Department.
General Electric Company,
Schenectady, N. Y.



WORN MOTOR SHAFT PREPARED FOR BUILDING UP BY AUTOMATIC WELDING

Board for Making Quick Connections When Testing Motors

IN CONNECTING instruments for making a test on motors in an industrial plant, speed in making connections is in most cases a very important factor, and full fuse protection is equally important, because such tests are often made when motors show signs of overload, which means that fuses are needed, and also because of the fact that there are in most cases exposed connections on the wattmeter or current transformers which might cause short circuits. A board which allows quick connection and still has full fuse protection has been developed by the writer. The secondary current connections and the voltage connections are made at one side of the board and are similar to those used on another board described by the writer in the ELECTRICAL WORLD for Sept. 20, 1919, page 658. Each of these sections contains a double-pole, double-throw switch which may be used for checking connections or making power-factor calculations, or reversing leads if desired. In the center of the board is a short-circuiting switch which shunts the current around the current transformers while the motor is being started. This switch is open when readings are taken.



MOTOR NEED BE SHUT DOWN ONLY A SHORT TIME WHILE CONNECTING TEST BOARD INTO CIRCUIT

Connected to the line and to the short-circuiting switch are copper bars, to which are fastened fuse clips of proper size and spacing to take fuses rated at 30-, 60-, 100-amp. The proper-sized fuses are put into these clips, and then connection is made with the motor leads at the motor fuses. In making these connections the writer keeps on hand two blown fuses of every size to be found in the plant, and these fuses are provided with short leads which are connected to the board (as shown in the drawing). The current is then passed around the motor fuse clips to the board and back to the motor line.

When inserting the board in the motor circuit the motor is shut down until the fuses are removed and inserted in the clips on the board. The blown fuses are inserted in place of the regular motor fuses. The short-circuiting switch is closed and the motor is started. A test clip is provided for making a connection to the third wire in the motor circuit, and this connection is disregarded until the motor has been started. This saves some of the time of shutdown.

This particular board, which is 30 in. x 19½ in. in size, has leads 10 ft. long. The motors to be tested range from 1 hp. to 25 hp. and operate on a 440-volt, three-phase circuit. When it is desired to test a motor which is too small to warrant the use of current transformers, the primary leads may be connected directly to the instrument by attaching a to a_1 and b to b_1.

Bullard Machine Tool Company, A. H. PLATT,
Bridgeport, Conn. Chief Electrician.

Central Station Service

A Department Devoted to Commercial Policy
and Management Topics, Including Methods of Increasing the Use
of Electric Light, Power and Heat

Personal Contact Makes for Better Public Relations

IN THE report of the public policy committee of the Pacific Coast Division of the National Electric Light Association, of which John A. Britton, vice-president of the Pacific Gas & Electric Company, is chairman, the views of the various power company executives on the Pacific Coast were set forth. Pointing out the necessity for better public relations, the report said: "It is too often the fault of large organizations that the man who, some distance from the head office, is compelled to come into contact with the people and to represent by act and deed the corporation itself is not educated in the policies of the company nor given sufficient authority to speak for and represent the corporation which is served. Thus his position is minimized and of necessity the reputation of the company must suffer. It would seem as if in these days, when an agitated public has a rather critical view of public service corporations and what their activities mean in the development of the particular section which they serve, the company should have as representatives in those sections men who through an intimate knowledge of the company would be able to speak authoritatively upon all questions. The one danger confronting large organizations is the fact that the personal touch of those who have authority to speak is lacking, and it would seem advisable in many cases to try the experiment of having each particular district appeal to the public served in that district as the home company. By such action much misapprehension of the activities of the head office would be cleared away."

Functions and Organization of the Utility Commercial Department

THAT the commercial department should bear the same relation to the public utility company that the selling force does to a manufacturing plant was the contention of W. J. Reagan, commercial manager of the Utica (N. Y.) Gas & Electric Company, in a paper presented before the Commercial Section meeting of the Empire State Gas and Electrical Association held in Cooperstown on June 24. A good commercial department, he said, means more and better pleased customers and the additional load means better operating costs. Discussing the functions, cost, value, organization and methods of this department, Mr. Reagan said:

"In the smaller towns, those of 5,000 or less population, where twenty-four-hour service is available, the problem of promotion of business is essentially different. The community grows but little; the moving-in of a new family marks an epoch; the population has a large proportion of farmers who have moved into town to spend their last years, and the small merchants do a hand-to-mouth business.

"A solicitor, as such, is economically impracticable and unnecessary in a small community. All of the company's employees act as solicitors. The meter reader inquires at each home if the service is satisfactory, leaves a flatiron on thirty days' free trial, suggests a washing machine and hands the mistress a pamphlet descriptive of sewing-machine motors, ironing machines, electrical ranges, toasters, heaters and various other appliances. The bookkeeper tells his grocer, while purchasing merchandise, about the coffee grinder, or to the butcher he explains some late lamp or fixture or suggests a meat chopper. The soliciting is simplicity itself. Every one knows the other fellow's business and talks about his neighbor. The field will never be saturated, for the reason that new time-saving and labor-saving devices are constantly making their appearance.

"The maintenance by the utility of a good stock of lamps and standard appliances, prompt response to trouble calls, generosity in the matter of repairs, wiring on a deferred, small-payment plan, fair treatment and unfailing courtesy—all of these factors contribute to making a market, although every available house and store may be using electric light.

"*Wiring Old Houses.*—Revenue from new lighting consumers on existing lines will net a higher return, capital invested considered, than any other class of business. The utility company can determine a fair price for the installation of the wiring and call upon the contractor to do the work for this price. The advantage of financing house wiring contracts through local banking institutions, instead of the utility, is more manifest nowadays than formerly, in view of the existing necessity for the conservation of capital.

"The utility company should maintain special solicitors for the work, each having a separate district. Co-operative newspaper advertising can be used, the utility paying one-half and the participating contractors the balance of the cost. Solicitors are paid on the combined salary and commission basis. The costs of the advertising and soliciting will approximate $5 for each contract closed.

"*Highway Lighting.*—A potential source of revenue exists in the development of adequate lighting systems for state or town highways. Hours of operation may be controlled through time switches or circuit interconnection. Excessive investment for construction in rural line extensions can sometimes be justified when additional revenue can be secured from highway lighting. Records show that accidents are fewer on highways that are well lighted.

"*Rural Extensions.*—Unceasing and persistent inquiry on the part of farmers and others who are some distance from the terminus of the utility's lines indicates that a definite policy for handling this business must be worked out. Surely the new customer cannot be served at a loss to the utility and the deficit transferred to the existing customers. The utility, therefore, must be willing to serve these prospective customers.

However, an emphatic and direct statement to the customer that 'It must be on a self-sustaining basis' and that he must finance the undertaking is absolutely necessary.

"A definite formula, taking into consideration construction cost, gross earnings and operating ratio, can be worked out in each instance. Placed in the hands of the commercial department, replies can be made to each specific customer, thereby obviating the usual criticism on the part of the applicant of lack of attention to his justifiable inquiry.

"*Service to Existing Customers.*—Utilities should establish themselves as a source of authoritative information and direction among consumers. Let it be known that within the organization there are trained men who can go to the source of any trouble that may be experienced with the operation of electrical apparatus. The utility maintains a complement of expensive and accurate instruments for research. The service is gratis. In the instance of disputed bills, annoying experiences with motors, etc., this advice from the utility would be heartily welcome. Nothing could be more productive in the interest of mutual satisfaction and a substantial foundation for good will. Well-regulated companies find that 15 to 25 per cent of the total cost of the commercial department is accounted for in furnishing this service to the existing customer.

"If the utility goes into merchandising, it must do so on a business basis, with profit to itself and without competition with the supply dealers. It has been stated that the entire industry is not organized on a basis to carry on a merchandising business. The subject is worthy of considerable thought. Either the utility must organize, educate and assist the local dealers to attain the best results or, as an alternative, it must drop its ultra-conservatism and dignity and adopt red-blooded merchandising methods such as the best organized department or other retail stores employ.

"*Repair Service for Appliances.*—It is desirable that the utility maintain a repair service for socket appliances. In many communities it is estimated that only 25 per cent of the appliances that have been sold are in service. Unsatisfactory repair service and high cost of repairs are the contributing causes. If the utility establishes a service wherein the only charge made is for the elements or materials furnished, labor being free, the result will be immediate action on the part of the consumer. The actual cost compared with the good will of the consumer and the attendant use of additional electricity is negligible. The free service given should not be confined to appliances sold by the utility. It should be extended also to devices sold by dealers. The opportunity to learn of devices that cause serious trouble, those that are without merit or are defective, and to learn of dealers who do not give reasonable service or whose methods are questionable, is of inestimable value to the utility.

"*Advertising Expenditures.*—Department stores of recognized standing do not plan to spend more than 2 per cent of the gross receipts per year for advertising. Businesses that are building up must spend as high as 5 per cent. Merchandisers of 'class' and distinction spend 7 per cent. Dealers in electrical appliances are in the latter class. However, they are favored because of the manufacturers' advertising, and the ratio is consequently less.

"If contractors will intelligently apply only 1 per cent of their annual gross receipts to advertising, they can take advantage of every form of co-operative help to the fullest extent and put themselves in the strongest possible position.

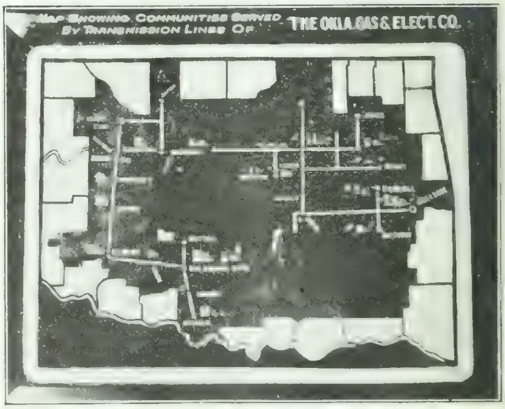
"*Cost of New Business.*—Expenditures for commercial purposes have been roundly discussed by utility executives. No definite ratio has been established. Some companies are limited as to growth and expansion by local conditions, and in these instances a more conservative policy must be adopted.

"However, there is a definite relation between new-business costs and attendant revenue. Reports of well-managed and long-established companies show a ratio of increase in revenue to commercial department costs with some measure of consistency. Excepting special conditions, it may be stated that in general the increase in revenue should be about four times the cost of obtaining it.

"Assuming that operating expenses, taxes and fixed charges together amount to approximately 75 per cent of the earnings, the remaining 25 per cent may be spent in securing the business. This assertion demonstrates the general principles that a utility can afford to spend its prospective first year's new-business profits to secure the business. This appropriation includes compensation of the commercial department for all effort devoted to service for existing customers. A division of the commercial department budget should be 60 per cent to 65 per cent for salaries of the sales organization, the balance to be expended in advertising."

Electrically Lighted Map to Show Extent of Service

THE Oklahoma Gas & Electric Company is exhibiting in its windows in Oklahoma City and other Oklahoma municipalities served by it a large map illustrating pictorially and geographically the cities, towns, villages and agricultural and oil districts served by the company throughout the state. The sign is electrically lighted for display purposes at night and is a patented affair consisting of a galvanized-iron screen, filled with a composition of which the ingredients are kept secret, shellacked and varnished, with the painting superimposed. It is almost transparent, and the electric lights in the box behind the screen give a brilliant and artistic effect to the painting.



MAP ILLUMINATED SHOWING TERRITORY SERVED

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
of the World

Generators, Motors, Transformers

Polyphase Series Motors with Brush-Shifting.—F. ERNSTEIN.—General equations are derived for this type of motor, and a circle diagram is developed, from which the usual electric characteristics may be deducted. It is shown which influence the efficiency of the feeding transformer has, and that it is possible to increase the power factor of the motor by improving the efficiency of that transformer. The magnetizing current of the transformer changes the plain series characteristic of such a motor toward the compound type and limits the run-away speed at no-load.—*Revue Générale de l'Electricité*, June 4, 1921.

Lamps and Lighting

Electricity for Steam Locomotive Headlights.—A. H. CANDEE.—The requirements of the Interstate Commerce Commission for locomotive headlights are set down and several types of equipment are discussed to show how they meet these requirements.—*Railway Electrical Engineer*, June, 1921.

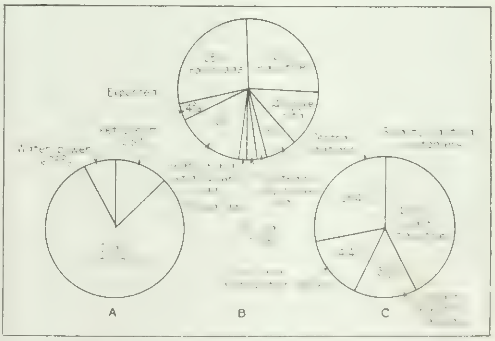
Generation, Transmission and Distribution

Large Hydro-Electric Plants—Tröllhattan Plant in Sweden (1).—A. TETRAL.—The Swedish government owns all water rights on the river Gota between the lake Wenern and the sea coast. The totally available water varies from 320 to 900 cu.m. per second, under a greatest head of 44 m. The present power plant utilizes 250 cu.m. of water per second, developing 80,000 hp. By certain regulations of the lake an ultimate power of 200,000 hp. may be obtained. At present the power house contains fourteen three-phase generators, each driven by a horizontal shaft, double runner, 10,000-hp. turbine at a speed of 187.5 r.p.m. At times of highest water level a head of 30½ m. is available, and the wheels deliver 12,500 hp. The generators are wound for 10,000 volts and give 9,000 kw. at .08 power factor. The machines stand a test voltage of 20,000 volts for fifteen minutes. Under full load a temperature rise of not exceeding 45 deg. C. above ambient air has been guaranteed by the manufacturers (Allmanna Swenska). The regulation of the high voltage is noteworthy, as it is controlled by a booster dynamo, mounted on the shaft of each main generator. The exciter delivers 220 volts and the boosters, which are in series with the excitation buses, give a variable voltage of between plus 110 to minus 220 volts, so that an exciting voltage of from zero to 330 is available. The huge generators have an outside diameter of 7¼ m., a rotor diameter of 4¾ m. and weigh complete about 200 tons. The rotor represents a weight of 60 tons, giving a kinetic energy $\frac{1}{2}MV^2$ of 3.6 million kilogram-meters. A novel ventilating system has been employed, taking air from outside and directing it through the generators. The heated air is used for heating the power plant in winter and is discharged in summer. Three direct-current exciter sets, each driven by a 500-hp. turbine, deliver 220 volts. They are capable of 25 per cent overload. A storage battery of 4,800 amp.-hr. has been installed for emergency.—*L'Electricien*, June 6, 1921.

Survey of Store and Window Lighting.—It is said that a very large percentage of Toronto stores would rank as "bad or medium" according to illumination experts who made a survey in that city.—*Electrical News*, Toronto, June 1, 1921.

Steel Mill Power Factor and the Central Station.—A. K. BUSHMAN and A. L. LEMON.—The author shows that in steel mills the effect of large low-speed main-roll motors is to give a very low power factor at intermittent periods. This is disadvantageous to both the central station and the steel-mill equipment, and automatically controlled synchronous condensers are suggested to remedy both the low power-factor and possible change of voltage.—*General Electric Review*, June, 1921.

Industrial Power Loads.—D. B. RUSHMORE and R. F. EMERSON.—Some data are given showing the approximate amount of coal, water power and petroleum available, with an analysis indicating how this is used in the industries. A discussion of the various load cycles of typical electrically driven machines used in the industries is included.—*General Electric Review*, June, 1921.



DISTRIBUTION OF ENERGY USED IN THE INDUSTRIES

(a) Relative magnitude of the three sources of power on a fuel basis. (b) Distribution of yearly coal production (c) Distribution of central-station power.

Use of Powdered Fuel Under Steam Boilers.—HARLOW D. SAVAGE.—Commercial installations in power plants are described, together with operating results, tests and comparative costs. Slagging problems are also dealt with.—*Iron Age*, June 2, 1921.

Electrically Heated Steam Boilers.—ERIC A. LOF.—Attention is called to the possibility of the electric boiler where hydro-electric energy is comparatively cheap and combustible fuel correspondingly scarce. An example is given of an installation in a large paper mill in Sweden where the electric boiler installation consists of seven 2,000-kw. boilers operating at a potential of 10,000 volts and a steam pressure of 10 atmospheres. In this instance there was a saving of the expense of seventeen firemen and all personnel, tonnage and rolling stock otherwise required for the transport reloading and discharging of coal and ashes, amounting to about 65 tons a day. An example is worked out to show that electrical energy should not cost more than about 0.085 cents per kilowatt-hour for ordinary cost of fuel, in order to make this installation economical. Electric boilers using resistance units and also electrodes with which the water itself is the resistor are described by the author.—*General Electric Review*, June, 1921.

Diesel Engines for Driving Generators.—C. S. Darling.—The author considers construction, operation, maintenance and other problems.—*Beama* (British Electrical and Allied Manufacturers' Association), June, 1921.

Traction

Trackless Trolley Tested at Schenectady.—Tests were recently conducted at Schenectady of a trackless trolley bus built by the General Electric Company for the Virginia Railway & Power Company. The tests were held to be successful. This bus has a seating capacity equivalent to a one-man safety car.—*Electric Railway Journal*, June 18, 1921.

Railway Electrification in Europe.—J. V. Dobson and F. E. Wynne.—The authors have set down and elaborated thirty-four points of difference between European practice in electric railways and American.—*Electric Railway Journal*, June 11, 1921.

Trackless Trolley Buses.—E. Findeis.—Electrically driven buses connect Vienna with a 2-km. distant suburb, running on pneumatic tires without tracks, fed from a double trolley line, on which rolls a small contact-making carriage, connected with a flexible cable to the car. The length of this cable can be varied, as its end is wound around a take-up drum. Approaching cars have to stop when passing each other, exchange their cables and proceed again. The cars are driven by two motors, built into the rear wheels. They are multipolar, slow-speed, direct-current, 550-volt motors, transmitting their power directly without any gears. The buses accommodate twenty-four passengers, but have carried as many as forty. The empty cars weigh 3.2 tons. The road is very hilly, with a maximum of 8.4 per cent grades. The current consumption is on the average 0.6 kw.-hr. per car kilometer. The line has been in satisfactory operation for thirteen years, a total of 661,000 km. has been covered and over two and a half millions of passengers carried. The cars have suffered badly during the war, as it was necessary to run with wooden tires on account of the rubber shortage.—*Elektrotechnische und Maschinenbau*, May 29, 1921.

Installations, Systems and Appliances

Electrical Exposition at Essen, 1921.—The article is a very well-illustrated account of the more important exhibits of the annual show and comprises short descriptions of, for example, cable connectors, adjustable droplights, hot-air fans, heating pads, general heating apparatus, small motors, alternating-current, direct-current rectifiers (electron tubes type), X-ray apparatus, high-voltage switches (35 kv.), automatic chain-welding machines, motor-operated clamshell buckets, radio apparatus, one-piece stretch-metal poles, etc.—*Elektrotechnische Zeitschrift*, May 26, 1921.

The Control Equipment for the Propelling Machinery of the U. S. S. Tennessee.—M. Cornelius.—Emphasis is placed upon reliability, ruggedness and space occupied in the design of this equipment.—*Electric Journal*, June, 1921.

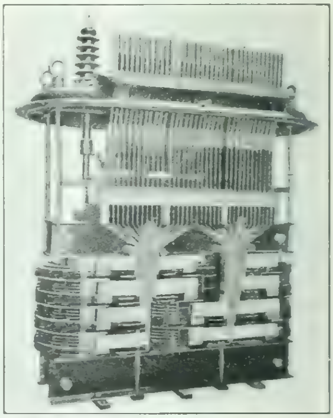
Motor Drive in the Woodworking Industry.—F. H. Penney and E. L. Bamforth.—It is said that fortunately woodworking machinery commonly demands high-speed motors so that small and inexpensive motors may be applied. Various woodworking machines are described showing the applications of motors as many as nine for one machine.—*General Electric Review*, June, 1921.

The Distributed Capacity of Inductance Coils.—G. Breit.—A general formula is derived for calculation of effective capacity of a coil. The formula is applied to the short single-layer solenoid and experimental verification is given by direct measurement.—*Physical Review*, June, 1921.

Development of Atomic Theory.—Andrew Norman Meldrum.—A review of the literature on this subject giving the author's interpretation.—*Publication of Bombay (India) University*, 1921.

Electrochemistry and Batteries

Electrochemical Industries.—John A. Seede.—An interesting summary is given of the cost of electric power in the electrochemical production of various materials employing both electrolytic and electrothermic processes. Conversion and transforming apparatus required for this heavy-current service are also described.—*General Electric Review*, June, 1921.



TRANSFORMER FOR HEAVY CURRENT SERVICE

Units, Measurements and Instruments

The Wagner "Earth Connection" in Practice.—G. E. Moore.—It is said to be quite possible for the electrostatic capacity of a bridge to earth to cause perceptible errors in precision measurements. The type of "earth connection" described is said to insure that the test-bridge remains at earth potential.—*London Electrician*, June 17, 1921.

Directional Measurements with the R. A. F. System.—J. Hollingworth.—The author describes recent designs of direction finding apparatus and discusses accuracy.—*Radio Review*, London, June, 1921.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

Crude Petroleum and Fuel Oil Go on Free List

CONSIDERABLE interest is manifested by the electric light and power industry in the action this week of the House of Representatives in over-ruling its committee on ways and means in the matter of a duty on crude petroleum and fuel oil, transferring these items to the free list. A tax of 25 cents a barrel on fuel oil had been proposed.

Quite a few power companies, and especially those on the West Coast, depend almost entirely on oil for fuel and the heavy duty was viewed with considerable alarm. One of the eastern utilities, the Narragansett Electric Lighting Company, uses 900,000 barrels of oil a year. This would mean $225,000 a year additional cost. The power companies argue that if such a duty goes through it must necessarily mean higher rates for oil-burning companies.

Water Supply Reasonably Good in New England

NOTWITHSTANDING the protracted drought which extended through the greater part of June, New England hydro-electric plants are enjoying a fairly good supply of water, especially when considered in relation to existing loads. The Central Maine Power Company, operating plants on the Kennebec and Androscoggin Rivers and tributaries, reported to the ELECTRICAL WORLD on Monday that water conditions in that territory are exceptionally good considering the recent dry period. None of the present load is being carried by steam, and surplus water power is still available. An excellent business, exceeding last year in the first five months comparison, is being handled. The Cumberland County Power & Light Company, Portland, Me., has sufficient water available for the present load and is running no steam plant service, although the prospects are poor for the next two months. There is no shortage of water power on the Androscoggin River at Rumford, Me., and the Rumford Falls Power Company is handling its entire load by hydro-electric energy. Threatened shortages of water in Vermont appear to have been relieved by recent rains.

The New Engalnd Power Company, operating through central New England, and deriving water power from the Connecticut and Deerfield Rivers, reports 40 to 50 per cent steam service during the first half of July, which is rather better than average conditions with this large system. The Turners Falls (Mass.) Power & Electric Company, operating stations in the Connecticut Valley in the Greenfield district, is finding no unusual shortage of water power. The Connecticut Light & Power Company, Waterbury, Conn., is operating about half steam and half water. Last month the water power utilized was about 55 per cent of the average June supply, and this month conditions have improved.

The Burlington (Vt.) Light & Power Company is carrying full load with water power. The Bangor (Me.) Railway & Electric Company, operating plants on the Penobscot and Union Rivers with no steam reserve, is suffering from a prolonged drought, but is carrying its load by the utmost conservation of water and is drawing slightly on storage.

Practicability of Ground Return Circuits Involved in Illinois Case

GROUND return circuits represent the most feasible and economical practice for rural telephone lines, was the testimony of a witness in a case involving inductive interference before the Illinois Commerce Commission on July 13. Locally the case has become known as the Lena case because it concerns the Lena (Ill.) Electric Light & Power Company and some local independent telephone companies. The hearing was held on motion of the commission. Some alleged deficiencies in the construction of both the power and telephone circuits are involved. The case had been postponed several times, it is understood, to permit some of the alleged defects to be cured, and it had been expected that it would be settled without a formal hearing.

The hearing that was finally held on July 13 seems to indicate that the case will be contested on the practicability of ground return telephone circuits and from indications has the possibility of becoming as important as the Homer case. An array of experts, many of whom were concerned with the Homer case, were on hand to watch the proceedings, though they took no active part. The case will come up for further hearing at a later date.

Electrical Industry Must Lead in Return to Prosperity, Says Bump

THE electrical industry must lead in the return to a better feeling and a condition of prosperity in the business world, was the declaration of M. R. Bump, president of the National Electric Light Association, at Cedar Point on Wednesday of last week. If some industry can take the lead all others will follow, and Mr. Bump believes that because the electrical industry has not had to face as serious deflation problems as other industries it is in a position to become the leader that is so urgently needed. That the association headquarters was designed to be the mouthpiece and not the dictator of the central station industry was the view of the activities of the headquarters force that Mr. Bump brought to the Ohio meeting.

Unless the industries concerned can find the right solution of the inductive interference problem some one else will, was the warning that President-elect McClellan of the American Institute of Electrical Engineers gave in discussion of the situation in Ohio, where a joint committee representing all interests has been formed to draw rules governing both crossings and inductive interference. The Ohio Legislature passed a law at its last session that requires such rules to be promulgated by the utilities commission within six months, and the speaker took the occasion to point out that the situation would reveal the attitude of the utilities toward the law. Rules that will permit progress in giving service to the public are essential and the danger that lies in too hasty standardization and inflexible rules drawn before the problem is really known were called to the attention of the members. S. B. Grace, for the American Telephone & Telegraph Company, said that it must be realized that both industries had to exist and give service not only in the present degree but in a constantly increasing degree. The real solution was indicated as lying in the ability of those interested to get together while plans for contemplated work were yet in the paper stage. The theory of minimum cost to the public of both services was favored by the speaker as a basis for determining what should be done in solving the difficulties. Mr. Grace promised the Ohio people all the information that they asked for regarding the telephone system for use in the study that the joint committee in Ohio is making.

Resolute facing of the problem and the finding of a way of giving service as an alternative of being forced into it by legislative or commission action was urged on the Ohio utilities by D. L. Gaskill in discussing the report of the farm service committee, an abstract of which will be found elsewhere in this issue. An average revenue of $28.40 per year with an average monthly consumption of 14.5 kw.-hr. per month was given by Mr. Gaskill for an analysis of the accounts of one hundred rural consumers on the system of the Greenville Electric Light & Power Company.

The officers elected for the coming year are: President, W. A. Wolls, Columbus; vice-president, E. L. Franklin, Warren; secretary-treasurer, D. L. Gaskill, Greenville.

Sales Managers' Association Meets at Association Island

THE annual convention of the Sales Managers' Association was held on Monday, Tuesday and Wednesday of this week at Association Island, Henderson Harbor, N. Y., with thirty members in attendance, representing the electric light and power companies of Atlanta, Baltimore, Boston, Brooklyn, Chicago, Cincinnati, Cleveland, Detroit, Long Island City, Newark, New York, Philadelphia and Washington. The following program was presented: "Changes in Developments in Electric Sales Quality," R. S. Hale, Boston; "Selling Appliances," E. W. Lloyd, Chicago; "Wiring Old Residences in Cincinnati," F. D. Heed; "Analysis of Electric Conception of Residential Customers," C. A. Barton, Long Island City; "Proper Functions of the Sales Department of a Central Station in Securing Good Public Relations with Its Customers," T. I. Jones, Brooklyn; "Selling Company Securities to Customers," E. W. Lloyd; "Electrical Development Campaign in Cleveland," G. E. Miller; "Some Further Facts and Information in Connection with B 1 Secondary Rates," L. R. Wallace, Boston; "Financing Electric Line Extensions by Customers," R. R. Young, Newark, N. J.; "Large Power Installations," J. D. Noyes, Detroit; "Electric Ice Making and Refrigeration," F. Ennis, New York; and "Actual Experience with Electric Welding," H. T. Luscomb, New York. According to tradition the meetings were held in executive session.

The new executive committee is as follows: R. R. Young, Newark, N. J., chairman; L. R. Wallis, Boston, and H. K. Mohr, Philadelphia.

Celebrate Twentieth Anniversary of Founding of Contractors' Association

MERCHANDISING of electrical appliances still absorbs the attention of electrical contractors and dealers, although there is a tendency on the part of some contractors to give up the sale of appliances and devote their energies exclusively to the contracting business. Although not very general, such a sentiment was manifested at the twenty-first annual convention of the National Association of Electrical Contractors and Dealers at Buffalo this week. It was at the meetings of the national executive committee on Monday and Tuesday that matters of vital importance to the association membership were discussed. These had to do with wiring, cost accounting, cost data, code rules, standard symbols, labor, etc.

The convention also marking the twentieth anniversary of the founding of the association at Buffalo, cognizance was taken of the occasion during the week. Certainly the association, which now possesses 2,320 members, has reason for pride in its record.

Charles L. Eidlitz, the first president of the association, recounted its accomplishments since its inception and all charter members had commemorative badges pinned on them. Past-President W. Creighton Peet was presented with the past-president's emblem and W. L. Goodwin, who received an ovation, was given an illuminated resolution in book form signed by the officers and members of the association in appreciation of the work he has performed for the contractor-dealers of the country.

An admirable address on the business situation was made by Samuel B. Botsford of Buffalo at the opening session. Alfred E. Martin, a banker of South Bend, Ind., spoke on financing the contractor-dealer, emphasizing the need of sufficient capital and knowledge of costs on the part of the contractor in addition to familiarity with the details of his business. He commented on the high cost of selling appliances which needed demonstration and suggested that much of this might be eliminated.

Speaking to the theme of capitalizing your opportunities, W. L. Goodwin made one of his characteristic addresses outlining methods of improving the condition of the contractor-dealer as a merchant and preaching the doctrine of co-operation. He reported that a company has recently been formed to finance contractor-dealers handling certain lines of goods and selling them on the partial-payment plan. The plans of the Society for Electrical Development were also expounded.

One of the most interesting reports presented at the convention was made by the Council on Industrial Relations, headed by L. K. Comstock and J. P. Noonan, president of the International Brotherhood of Electrical Workers. In translating into action the principles adopted at the Milwaukee convention two years ago approximately 100 cases have thus far been acted on by the council with favorable results. Out of the experience gained it was recommended that electrical contractors withdraw from building trade employers' associations and that local unions sever their connection with building trade councils and that separate and distinct contracts be made for electrical work.

In the estimation of the council the open shop movement has yet to prove its virtues under the newer interpretation of justice by the bigger and broader minds in industry. To avoid misapprehension as to the functions of the council, Mr. Comstock told what it was and what it was not. He characterized it as an agency for promoting harmony, good will and co-operation and said it was not an organization possessing mandatory powers. It sought a peaceful settlement of industrial disputes and not unionization of employees where unions do not exist, or to establish a national wage, or to protect the rights of labor unions or of contractors. Its purpose is to remove the cause of disputes and to do justice between employer and employee so that both may work in perfect tune and accord. Up to the time of going to press no action was taken on the report, which aroused considerable discussion.

Utilities Urged to Make Provisions for Winter Coal Stock

IN ORDER to avoid the unpleasant circumstances that might arise should there be a shortage of coal cars this winter the Interstate Commerce Commission and the Secretary of Commerce have written letters urging the utilities to make arrangements for their winter's coal supply and for adequate reserves. The I. C. C., through Chairman Edgar E. Clark, while appreciating the impracticability of putting into storage an entire winter's supply, suggests the "accumulation now while transportation is easy and cars are idle of a reasonable reserve supply which will help out greatly if and when the pinch comes."

J. W. Lieb, chairman of the joint fuel committee representing the national public utility associations, has brought the letters of Chairman Clark and Secretary Hoover to the attention of the utilities and urges them "to proceed at once to make contracts covering their requirements and replenish their fuel reserves as soon as practicable."

Secretary Hoover's letter and Mr. Lieb's reply are given in full:

MR. J. W. LIEB,
Chairman, General Committee,
Three National Public Utilities Associations,
Edison Building,
New York City.

DEAR SIR:

I would like to call the attention of your association to the bituminous coal outlook. There is every indication that there has been an undue slackness in the purchase of coal which may accumulate to large demands in the autumn. I am convinced that due to the general depression the price of bituminous coal at the mines is not too high at the present time. This is, I think, proved by the fact that numbers of operating coal companies are making no profit whatever. If there should be a recovery of business activities in the autumn, taken in conjunction with the large increase in the percentage of disabled cars (from 5 per cent to 16 per cent during the past six months) and the inability of the railways to finance their maintenance there are possibilities of development of a most serious situation as regards coal movement.

I cannot but feel that the Interstate Commerce Commission in the face of warnings it has sent out in this connection would not be disposed to give any priority in such an event. It seems to me, therefore, to be obvious that the public utilities companies, both in their own interests and the protection of the public, should make early provision for stocks of coal sufficient to carry them over a critical period.

Yours faithfully,
(Signed) HERBERT HOOVER.

HON. HERBERT HOOVER,
Secretary, Department of Commerce,
Washington, D. C.

SIR:

I beg to acknowledge receipt of your letter of July 8 in which you call the attention of the national public utility associations represented by this committee to the early provision by the member companies of these associations of an adequate reserve fuel supply to protect them against the uncertainties of fall and winter deliveries.

We appreciate the timely suggestions contained in your letter and we are glad to lend our hearty co-operation to any efforts in the direction of safeguarding the supply of fuel to public utilities so as to protect the public against the possibility of interference with the continuity of the services which they render.

To this end we have urged that public utility companies if they have not already done so to proceed at once to make contracts covering their requirements and replenish their fuel reserves as soon as practicable.

We are sending a copy of your letter to our affiliated organizations—the National Electric Light Association, the American Gas Association and the American Electric Railway Association—with a request that they send a copy to each member company asking them to give immediate attention to the valued suggestions contained in your letter and co-operate in every possible way so as to avoid congestion of demand and delivery during the early fall and winter.

We deeply appreciate the kind interest which you have taken in calling the attention of public utility companies to this important matter.

Yours very truly,
(Signed) J. W. LIEB,
Chairman Joint Fuel Committee Representing the
National Public Utility Associations.

Italian Commission Returns Home Next Week

AFTER a stay in this country of three months, during which time they visited all of the larger cities and more important electrifications, members of the Italian Commission on Railway and Industrial Electrification will return to Italy on Wednesday of next week on the steamer *Paris*. The commission carries back with it a vivid impression of eagerness on the part of American electrical men to hear of Italian progress and to help the commission secure all the information it desired on American practice. Both the National Electric Light Association and the American Institute of Electrical Engineers took advantage of the opportunity to listen to Prof. Guido Semenza, chairman of the commission, tell of Italian hydro-electric development. Accompanying Professor Semenza on the commission were Prof. C. G. Ponti, who has already returned to Italy; Marquis Ferdinando Cusani and Col. Cesare Scarelli.

Members of the commission were guests of the ELECTRICAL WORLD and *Electric Railway Journal* at lunch at the Engineers' Club, New York, on Monday. Professor Semenza in speaking of Italy's water-powers said that 1,200,000 kw. is now developed, 500,000 kw. is in the construction stage, while plans have been completed and franchises secured for 2,000,000 kw. additional. Work will go forward as soon as proper financial arrangements can be made.

New Thousand-Lamp Street Lighting System for Lima, Ohio

WORK is going ahead on a new street lighting system for Lima, Ohio, to cost $130,000. One thousand standards with 1,000-cp. lamps will be used. The system was designed by G. H. Gamper of Columbus and is being installed by the Northern Electric Company, also of Columbus.

White Way Installation at Oklahoma City Completed

A WHITE WAY lighting system has been installed in the downtown section of Oklahoma City, the first in the city, and plans are under way to enlarge the system so that the entire business section will be included by June, 1922. The present system was put in operation on June 25.

The installation consists of single-light pressed-steel standards with a maximum height of 15 ft. 11 in. The source of light is 14½ in. in diameter with a 112½-in. shaft. Each pole is equipped with auto-transformer for 6.6-amp. circuit and 600-cp., 20-amp. incandescent lamp. Each standard is equipped with a disconnecting pothead and the entire system is supplied with a 20-kw. constant current transformer.

Utilities Should Maintain, but Not Invest in, Rural Lines

RECOMMENDING that no central station invest capital in the construction of rural lines, the Ohio committee on farm service nevertheless recommends that the power companies should maintain the lines when built to obviate the danger of improper maintenance due to the lack of ability of the farmers' organizations to command the necessary skilled help and also because such organizations are usually so faulty that they will not function when repairs are needed to keep the lines even in safe condition. The report was presented before the recent convention of the Ohio Electric Light Association at Cedar Point.

In the construction of the lines the committee recommends that nothing less than 25-ft. 6-in. top poles be used in all cases and recommends No. 6 bare copper wire and stranded conductors at railroad or main telephone line crossings. The committee calls attention to the items of excess cost in this service and says that the number of customers in Ohio rarely averages over five per mile. The cost of the distribution lines is placed at $700 to $1,000 per mile for the labor and material without any engineering or overhead costs. A standard of 6,600 volts for the service is recommended, the report noting that while many 2,300-volt lines are in service, the growing demand will call for lines too long to be successfully handled on the lower voltage.

A rate consisting of a fixed charge covering the excess cost of service plus an energy charge is recommended as fairer than one built up on a large minimum charge. An energy rate with steps downward from the maximum is suggested to encourage the use of ranges and appliances. Transformer and line losses should be charged for at the cost of current at the transformer. Maintenance should be charged for at the rate of 3 per cent per annum if the transformers are maintained by the customer or at 5 per cent if maintained by the company. The extra cost of reading meters is placed at 5 cents per month per customer.

Any method of wholesaling current to farm companies or groups of individuals is strongly condemned. The customers contributing to the cost of the original line should be protected by some plan that will make the later comers bear their share of the cost of the original line, though it is recommended that a time limit of five years be placed on such payments. This figure is used as it is felt it is long enough to prevent the slackers from holding out to get the service for nothing and yet will not prove a serious accounting nuisance to the utilities.

Simplified Rate Schedule for Indianapolis

THE Merchants Heat & Light Company of Indianapolis expects soon to file with the public service commission a simplified schedule of rates, which, according to Charles O'Brien Murphy, vice-president of the company, will mean generally lower rates. The new list of schedules, comprising four different classifications, which are expected to displace the dozen or more various rate schedules in effect, will be filed in compliance with an order of the commission made about a year ago, and will be subject to its approval.

Mr. Murphy classed the new schedules as residence, commercial light and power, optional light and power, and primary power. The maximum residence schedule rate will, if approved by the commission, be 7½ cents per kilowatt-hour. The new commercial light and power schedule rate, he said, will be practically the same as the present "B rate," ranging from 4 to 2 cents per kilowatt-hour.

The third schedule, to be known as the "optional light and power" schedule, Mr. Murphy said, would be figured according to the option of the consumer in selecting a basis of computation, and the new rate charge could, at the consumer's option, be made on a basis of either a total power rate or a total light rate. The fourth schedule, to be known as a "primary power" schedule rate, Mr. Murphy said, would be computed on a basis of two lower steps in energy than supplied at present and would establish rates as low as 1.5 and 2.2 cents.

Senate Gets Metric System Bill

A BILL providing for the compulsory use of the metric system, after a period of ten years, was introduced in the Senate on July 18 by Senator Ladd of North Dakota. The bill is identical with that introduced in the House on April 11 by Representative Britten of Illinois. In connection with the introduction of the bill, Senator Ladd sets forth nine reasons for the use of the system as follows: The 103,000 petitions on file with the Department of Commerce, the petitions of various state legislatures, reporting intention of agricultural group of Senators to support metric legislation, the action of directors of the Chamber of Commerce of the United States in appointing a special metric system committee, indorsements by more than 100 national organizations, the use of the system by most countries, enactment of a metric law by Japan, indorsement by several specified companies, and the fact that certain concerns are manufacturing entirely on a metric basis.

Seven Million Rochester Gas & Electric Issue to Yield 7.35 per Cent

AN ISSUE of $7,000,000 Rochester (N. Y.) Gas & Electric Corporation twenty-five-year 7 per cent bonds are being offered at 96 to yield 7.35 per cent. Proceeds are to be used to take up maturing issues, to provide funds for 80 per cent of cash cost and fair value of improvements, extensions and additions and for other purposes.

Massachusetts Commission Empowered to Regulate Depreciation

AS a result of recommendations of the Massachusetts Department of Public Utilities to the last Legislature, a new law has gone into operation (Ch. 268, Acts of 1921) which places the making of provision for depreciation under the regulative authority of the commission. Gas, electric lighting and most of the electric railways of the state will henceforth be required to set aside depreciation allowances prescribed by the board when, in passing upon rates or security issues, the commission determines that the provision for depreciation has been inadequate. Such moneys set apart from earnings at the order of the board must be kept as a separate fund, and may not, without the further order of the commission, be used for any other purpose than for renewals other than ordinary repairs, or for extensions, reconstructions and enlargements of and additions to plant. The commission is required to prescribe in its order such requirements relative to the creation and maintenance of this fund and its use as may be deemed advisable by the board. To a representative of the ELECTRICAL WORLD Chairman Attwill of the commission said that the law is probably the most satisfactory thus far secured in Massachusetts from the regulatory standpoint, as it empowers the commission to act on behalf of the conservative financial administration of utilities, rendering speculative activities through improper dividend declarations difficult.

Ford and Others Interested in Buying Muscle Shoals Plant

THE Secretary of Commerce revealed on Monday that Henry Ford is not the only private interest considering the Muscle Shoals power proposition. Secretary Hoover stated that various chemical and power companies were considering the matter and indicating an active interest in it.

The Henry Ford proposition, and this has been confirmed at the Department of Commerce, is as follows: Mr. Ford offers to lease for 100 years the Wilson dam and the near-by No. 3 dam, along with the electrical installation, when the project is completed. It is estimated that an additional $28,000,000 must be expended for the completion of the dam. On that sum Mr. Ford proposes to pay interest at the rate of 6 per cent, and to amortize not only this sum but the entire cost of both dams over a period of 100 years. In addition he offers $5,000,000 for the outright purchase of nitrate plant No. 2, its auxiliary steam plant, the land necessary to the operation and other appurtenances. He agrees to operate the nitrate plant for the production of fertilizers and to make the necessary conversion of the plant. He agrees also to maintain the plant so that it may be converted promptly for the manufacture of explosives in case of war. The plant is to be kept up to date. He agrees also to limit the profits of the fertilizer plant to 8 per cent.

Mr. Ford expects to use a part of the power not needed for the nitrate plant for some of his own manufacturing enterprises and in addition it is assumed that he will undertake to find buyers for the surplus power. The Secretary of Commerce authorized the following statement in regard to Mr. Ford's proposal:

"The acceptance of the offer is matter for decision by Congress and that body will no doubt be greatly guided by Secretary Weeks' views in the matter. Mr. Ford has made a genuine proposal. It shows courage to agree to pay out $5,000,000; to spend further sums upon large works and besides to take an annual obligation for about $1,500,000 for 100 years and to agree to maintain a nitrate plant in reserve for the government for that period. Whatever may be the result, Mr. Ford's offer does prove what the public associations have contended—that the completion of this project has a commercial value."

Need Not Advertise Water-Power Applications Until Data Are Complete

THE chief counsel of the Federal Power Commission has ruled, and the commission has approved the ruling, that it is not necessary under the water-power act to advertise applications for licenses or preliminary permits pending the completion of the necessary data, where the applicant has a priority under section 23 of the act.

A. A. E. Directors Meet

FOURTEEN of the sixteen directors of the American Association of Engineers attended the board meeting in Chicago on June 24-25, when plans for the coming year were discussed. Those present were: Top row from left to right—Directors: Charles A. Finley, Pittsburgh; L. E. Ayres, Ann Arbor; W. C. Bolin, Chicago; G. M. Butler, Tucson; E. F. Ayres, Boise; B. A. Bertenshaw, Cincinnati.

Middle row—Directors: W. L. Benham, Kansas City; Morris Bien, Washington; Frederic Bass, Minneapolis; W. E. Vogelback (proxy for Garrison Babcock, Everett, Wash.), Chicago.

Lower row—W. R. McKeen, director, Omaha; Henry W. Clauson, treasurer, Chicago; C. E. Drayer, secretary, Chicago; H. O. Garman, president, Indianapolis; A. N. Johnson, first vice-president, College Park, Md.; A. S. Morris, second vice-president, Chicago.

Florida Company Lowers Rates.—The Daytona (Fla.) Public Service Corporation has put into effect a 1-cent reduction for electric service, as specified in the terms of its franchise granted in 1918, when a clause was inserted providing for a reduction on July 1 of this year. The old rate was 13 cents net. The new rate will be 12 cents per kilowatt-hour net.

Electrification of Oil Fields.—As significant of the possibilities of electric service in the oil fields it is reported that the Drumright division of the Oklahoma Gas & Electric Company now furnishes power for pumping fifteen wells for the Prairie Oil & Gas Company, fifty wells for the Shaffer Oil Refining Company and also furnishes power for the operation of one casing head gasoline plant for the Aurelius Thomas Gasoline Company and one for the Shaffer Oil & Refining Company. The Drumright division has also in immediate prospect power for pumping 100 wells in territory adjacent to its present lines and a number of other casing head gasoline plants.

Receiver Asked for Arkansas Utility.—Suit has been filed in the United States District Court at Little Rock, asking for the appointment of a receiver for the Arkansas Light & Power Company, a corporation operating public utilities in a score or more cities and towns of Arkansas. The company also operates the Citizens Ice & Public Utilities Company of Junction City, Ark. The suit was filed by the Morgan Company of Delaware, a foreign corporation controlled by S. R. Morgan of Little Rock, and the Bank of Fordyce, as trustee. The petition recites that the Junction City company defaulted in payment of $39,140 in bonds and interest held by the Morgan Company, and that the Arkansas Light & Power Company guaranteed payment of the bonds when sold.

Cooking by Magnetic Induction to Be Shown at Chicago Pageant.—George B. Foster of the Commonwealth Edison Company, who is in charge of the electrical industry exhibit at the Chicago Pageant of Progress, has made arrangements with C. H. Thorardson, president of the Thorardson Electric Company, to exhibit a table which cooks foods by magnetic induction. While the device in reality is only a simple application of electrical fundamentals, it is expected that it will prove very interesting to the visitors to the exhibit and will impress on them more strongly than commoner exhibits the scope and usefulness of electricity. The table top contains a number of coils which set up a strong magnetic field about the table. When a cooking vessel of cast aluminum or some other metal of low permeance is brought into the field it heats up quickly and the food it contains is cooked. The table top does not become hot, however, it being possible to keep it covered with cracked ice during the process of cooking, and on this fact depends the interest it is expected to arouse.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Rocky Mountain League Aids Home Builders.—A free advisory service for prospective home builders has been established by the Rocky Mountain Electrical Co-operative League. In this way home builders are assured of expert service in the matter of wiring, fixtures and proper location of outlets.

Connecticut Central Station Changes Name.—The Bristol & Plainville (Conn.) Tramway Company, one of the properties managed by Charles H. Tenney & Company, Boston, Mass., has changed its name to the Bristol & Plainville Electric Company by an act of the Legislature. The headquarters offices are at Bristol.

Central Station and Transmission Line Maps to Be Printed Separately by Geological Survey.—As a result of the reductions made in the appropriations for the U. S. Geological Survey, the plates showing transmission lines and central stations cannot be printed as a part of future water supply papers as had been intended. These plates will be prepared, however, but as separate sheets and as sales publications.

N. E. L. A. Overhead and Prime Movers Reports to Be Published.—By authority of the national executive committee of the National Electric Light Association copies of the overhead systems committee report and of the prime movers committee report, which were presented at the Chicago convention, will be published by the association and made available to members. The price to members of the overhead systems committee report will be $2 and of the prime movers committee report will be $3.50 per copy. Non-members will be able to purchase copies of these reports at a price of $4 and $7 respectively.

St. Louis Still Has $400,000 to Spend on Street Lighting. — Almost $600,000 has been spent so far by the Department of Public Utilities of St. Louis in the manufacture and installation of the new electric street lamps, which have been placed during the last year in every city park and on various isolated streets, according to a statement from Director of Public Utilities Hooke. The report shows that 3,800 concrete lampposts have been manufactured by the city and that of this number about 3,424 poles have been installed with full lighting equipment. The cost for the new electric lighting system is being defrayed from the $1,000,000 "Electric Street Lighting Item" in the recent municipal bond issue. There still remains about $400,000 to be used for further electrification of the St. Louis street lighting system.

Southern Power Authorized to Raise Rates.—Authority to increase its power rates around 20 per cent has been granted the Southern Power Company by the North Carolina Corporation Commission.

Spectacular Lighting for New York Electrical Week.—A number of spectacular lighting effects are planned for the New York Electrical Show, which opens in the 71st Regiment Armory on Sept. 28. Illuminating engineers are now working on plans to flood the tall tower of the armory with light, but just what system of illumination will be used has not yet been decided. It will probably combine certain features of outline illumination such as was used during the Hudson-Fulton celebration; the jewel effects which were developed for the Panama-Pacific Exposition and flood-lighting. A battery of searchlights visible from all parts of the city will top the display. The illumination inside the armory will also be quite different from that customarily employed. The big girders will be hidden by a canvas sky, which will also eliminate the lighting fixtures. Concealed searchlights will throw powerful beams against this sky, and the reflected rays will flood the armory with brilliant illumination.

Associations and Societies

International Association of Municipal Electricians.—The twenty-sixth annual convention will be held at Colorado Springs, Col., Sept. 6 to 10. Clarence R. George, Houston, Tex., is secretary.

Portland Section, A. I. E. E.—At the annual meeting the following officers were elected for the 1921-22 season: Chairman, W. C. Heston; secretary, D. W. Proebstel; executive committee, R. R. Robley and J. E. Yates.

Southeastern Section, N. E. L. A.—The executive committee meeting of the Southeastern Section, National Electric Light Association, was held in Atlanta on July 8. Signal Mountain Inn, Chattanooga, Tenn., was selected as the next convention meeting place and Oct. 18, 19 and 20 was fixed as the date.

Coming Meetings of Electrical and Other Technical Societies

American Physical Society, Pacific Coast Section—Berkeley, Cal., Aug. 4 and 5.

Michigan Electric Light Association—Ottawa Beach, Mich., Aug. 24-25.

N. E. L. A., New England Division—New London, Conn., Sept. 6-9.

Pennsylvania Electric Association—Bedford Springs, Pa., Sept. 7-10.

N. E. L. A., Great Lakes Division—French Lick Springs, Sept. 14-16.

Association of Iron and Steel Electrical Engineers—Chicago, Sept. 19-24.

West Virginia-Kentucky Association of Mine, Mechanical and Electrical Engineers—Huntington, W. Va., Sept. 20-23.

Illuminating Engineering Society—Rochester, N. Y., Sept. 26-30.

American Electrochemical Society — Lake Placid Club, N. Y., Sept. 29-Oct. 1.

American Electric Railway Association — Atlantic City, N. J., Oct. 3-7.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities

Arriving at Fair Value.—In determining for rate-making purposes the fair value of the Virginia Railway & Power Company, whose territory covers the greater part of tidewater Virginia, including the state's three largest cities, the Virginia State Corporation Commission took the value as of 1914, deducted therefrom approximately what the plant additions in 1914-20 would have represented had they been in place in 1914, added to this the overhead construction cost and then the actual expenditures in 1914-20 for additions to the plant and deducted from this amount the accrued depreciation. A return of 8.18 per cent on the value thus determined was allowed.

North Dakota Commission on Police Power.—The Board of Railroad Commissioners of North Dakota recently made this exposition of police power and contract obligations: "Section 16 of our [state] constitution provides that no law impairing the obligations of contracts shall ever be passed. If the utility act violates this prohibition, it must be void to that extent. But a franchise granted by a city to a utility is an inviolable contract only in so far as the city has power to enter into it, and if the city's power is hedged about with limitations, then the contracts it enters into must also be subject to these limitations. Section 134 of the same constitution provides that the exercise of the police power of the state shall never be abridged. In other words, the state cannot by any statute conferring power upon municipalities deprive itself of those prerogatives known as police powers."

Why Public Utilities Cannot Be Asked to Operate Without Due Profit.—Answering the contention that public utilities should be forced to bear part of the burden resulting from reduced profits that has fallen on industry in general, the California Railroad Commission said in the course of its decision on gas rates to be charged by the Pacific Gas & Electric Company: "The company was not allowed to increase its rate of profit during the war period, but was only allowed sufficient return to maintain approximately its former earnings and continue to render adequate service. The records show that applicant's net profits from its gas business have not increased during the period of high prices, when it is conceded that extra profits were made by industries in general. The utility, being restricted to but a fair and reasonable return during such a period, must, when a change in such conditions occurs reducing the profits in other lines of endeavor, be maintained upon a reasonable basis, as otherwise proper and adequate service cannot be rendered."

Fixing Utility Rates on Basis Proportioned Upon Cost of Oil.—In fixing gas rates for the San Francisco and northern California district the California Railroad Commission established a ratio between the cost of crude oil and the price of gas. This ratio is fixed at from 2 to 3 cents, according to the district, per 1,000 cu.ft. of gas for each variation of 10 cents a barrel in the price of oil. In the Los Angeles district the ratio was fixed at 1 cent per 1,000 cu.ft. for the same variation.

Spencer's 17-Cent Electric Rate Unchanged by Commission Finding.—No present change need be made in the rate of the Spencer (Mass.) Gas Company for electric service, according to a finding of the Massachusetts Department of Public Utilities on June 24. Customers petitioned the board for a reduction in both gas and electric rates and the case was dismissed without prejudice pending the establishment of a new schedule which may embody a service charge. The pre-war maximum rate for electricity was raised from 15 to 17 cents per kilowatt-hour in 1918. The commission found that the company has been maintaining good electric service and that reported interruptions were due to causes beyond the company's lines or else were associated with necessary maintenance of the distribution system.

Cost of Rural Electric Service.—The increase of rates for rural service, the Wisconsin Railroad Commission held in passing upon an application from the Wisconsin Valley Electric Company, "is quite different from authorizing a necessary increase in urban rates. In this case the consumer has made substantial payments for the right to receive service under specified conditions, and ordinarily such refunds as he receives only reimburse him to a slight extent for his expenditure. The business is usually only a very small part of the total business of the utility, and a prohibitive rate on account of an ill-advised extension would result in practical confiscation of the amounts paid toward construction cost." But, the commission adds: "Rural communities must be served, and utilities cannot be expected to take on business which obviously results in a loss. It therefore appears that even though it is necessary to give some consideration to existing agreements, at least during the normal life of the construction paid for by the consumer, this should not prevent a utility from filing and applying rules for future business which will enable rural applicants for service who are willing and able to pay an adequate rate to obtain such service. The resulting temporary discrimination in rates between consumers on old and new extensions is, in our opinion, not an unreasonable discrimination provided the loss to the utility is not shifted to any other portion of its business."

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies

Power Plant Owned by Steam Railroad Not "Used in Its Ordinary Business."—The New Hampshire Supreme Court has found that an electric power plant at Portsmouth owned and operated by the Boston & Maine Railroad is not "property used by a railroad in its ordinary business" and consequently is subject to appraisement and taxation by the city authorities. (112 At. 394.)*

Liability for Bursting of Dam.—In an action by two counties against the owner of a dam which burst and destroyed a bridge (Supervisor and Commissioners of Pickens County, S. C., vs. Jenning), the Supreme Court of North Carolina found that if defendant's negligence co-operated with an unprecedented rainstorm to produce the injury, defendant would be liable if together the two causes were the proximate cause of the damage or if the defendant's negligence alone was the proximate cause. (107 S. E. 312.)

The Human Element in Valuation.—In a decision ordering the Pacific Gas & Electric Company to pay back to its gas customers more than $2,000,000 charged by it in excess of the tariff fixed by the city of San Francisco, the federal district court made these observations on valuation: "The valuation of a plant of this kind is largely a matter of guesswork. Unlike cotton, wheat and other commodities that are bought and sold daily in the market and have an established value, gas plants are seldom sold, and if one should be sold, the selling price offers a poor criterion by which to fix the value of another where the surrounding circumstances may be entirely different. Noted engineers will differ, and differ widely, as to the value of such plants. The difference between the engineers who come before this court so highly commended by the master and by counsel is measured by millions and not by thousands. A difference of 10 per cent in the appraisement or valuation should be accepted as a matter of course rather than as a matter of surprise. The courts have no monopoly in the privilege of appraising or guessing. They must accord the same rights and the same privileges to the Board of Supervisors, and the mere fact that they may differ from the board in their conclusions does not necessarily establish the charge of confiscating property or denying to the citizen the equal protection of the laws."

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*The left hand numbers refer to the volume and the right hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel—Responsibilities and Association Appointments of Men Engaged in Professional, Executive, Operating and Commercial Branches of the Industry

A. Hardgrave, re-elected president of the Southwestern Geographic Division of the National Electric Light Association at the Hot Springs meeting, is in charge of the Middle West Utilities properties in the Southwest, with headquarters at Dallas. The Southwestern Division has reached a more complete state of organization than most of the other divisions, due in no small part to Mr. Hardgraves' energy and ability to organize. Mr. Hardgraves has been connected with the Insull interests since 1913 in various capacities and since 1917 has been in charge of the Southwestern properties.

A. HARDGRAVE

A. F. Zacher has resigned as district manager of the Buffalo office of the Economy Fuse & Manufacturing Company.

William M. Eader, Frederick, Md., has been appointed engineer in charge of the municipal electric plant and system.

Harvey Keys has resigned as supervisor of the Electric Shops of the Commonwealth Edison Company, Chicago, to become vice-president and general manager of the Equitable Sales Company of Pittsburgh. Mr. Keys had been with the Commonwealth Edison Company eleven years.

H. H. Porter, of whose accomplishments a biographical appreciation appeared in the July 16 issue of ELECTRICAL WORLD, formed with E. N. Sanderson the engineering firm of Sanderson & Porter not in 1906, as was erroneously stated, but ten years earlier, in 1896.

John H. Lloyd has entered the employ of the government of Panama as electrical engineer of the Department of Public Works.

Robert M. Nesbitt has been appointed assistant chief of the electrical department of the Philadelphia Fire Underwriters' Association. He will be associated with Washington Devereux, chief of the department and well known in electrical circles.

Stanley S. Green, who was graduated from the class of 1918 of Purdue University, has been appointed sales manager of the Esterline Meter Company of Indianapolis, Ind. Since March 3, 1920, Mr. Green has been executive secretary of the Purdue Union and active in the raising of $1,000,000 for a new building. Before that he was associated with the Westinghouse Electric & Manufacturing Company, Pittsburgh.

Louis T. Klauder, who recently resigned from the Philadelphia Rapid Transit Company as construction engineer to enter the consulting engineering field, was graduated from the Williamson School in 1901 and from the Drexel Institute in mechanical and electrical engineering in 1908. Mr. Klauder entered the engineering department of the Pennsylvania Iron Works Company in 1901, later resigning to become associated with the Philadelphia Rapid Transit Company in 1905. With the latter company he occupied in turn positions of draftsman, chief draftsman, assistant engineer and construction engineer in charge of plant design and construction. From the last-named position he has just retired in order to devote his entire time to consulting work.

Gustav Clingwald has recently been appointed assistant superintendent of generation of the Southern California Edison Company and will have charge of a number of that company's hydroelectric stations. Mr. Clingwald entered the employ of the Almanna Svenska Elektriska Bolaget of Sweden in 1896. After two years there he was employed by the L. M. Frickson Telephone Company in Stockholm, and later, in 1901, by the De Laval Company in Stockholm. In 1904 he moved to California and was employed by the Southern California Edison Company on construction work. The next year he became assistant station chief of the Kern River No. 1 station, where he remained for nearly ten years, at which time he was promoted to the position of chief of the Mill Creek No. 3 station. In 1919 he was made chief operator of the hydro-electric stations, of which he has recently been placed in charge as assistant superintendent of generation. Mr. Clingwald has a number of inventions to his credit, among which are a long-distance water-level indicator and an automatic water control for use with semi-automatic generating stations.

T. D. Crocker, assistant general manager of the Northern States Power Company, was for the second time reelected president of the North Central Division of the National Electric Light Association at the recent Duluth meeting. The re-election is a tribute to the fine spirit of co-operation that Mr. Crocker is able to instill into the organizations for which he is responsible. The work of the North Central Division for the past year culminated in an unusually enthusiastic and informative convention, due to his ability in securing the enthusiastic co-operation of all members of the association. Mr. Crocker is a graduate of the State University of Ohio and previous to his connection with the Northern States Power Company was associated with the Milwaukee (Wis.) Electric Railway & Light Company and the Lincoln Electric Company, Cleveland, Ohio.

T. D. CROCKER

Obituary

Gabriel C. Lippmann of the University of Paris and winner of the Nobel prize for physics in 1908 died on board the steamship *France* last week on his way back from the United States. Professor Lippmann was a member of the French commission, headed by Marshal Fayolle, which visited Canada to express France's appreciation of the war service of Canada, and later stopped in this country. He was a world-renowned student of electrophysics and electric measurements. Among his better known works is his principle for the conservation of electricity.

Trade and Market Conditions

Business Reviews, Together with Market Letters from Important Trade Centers, on the Supply, Demand and Prevailing Prices of Electrical Apparatus and Supplies

Price Reduction of 10 per Cent Applied to Motors

A GENERAL reduction in prices of motors of 10 per cent was made by manufacturers during the week end of July 9 to 12, and some further changes have just been announced as of July 19. The change affected direct-current motors and polyphase alternating-current motors and motor starting and control apparatus, but did not touch fractional horsepower motors. Single-phase motors of certain manufacturers were also included in the list, but this type was not general. Synchronous motors have been excepted from the cut. This is the second motor price cut this year, the previous one of 10 per cent having taken place early in February.

In addition one prominent manufacturer reports a 10 per cent reduction on transformers of 500-kva. capacity and above and 5 per cent on certain textile motors. Another prominent manufacturer has taken 10 per cent off all direct-current generators and motor-generators.

There seems to be a little better feeling about motor business and from several sources manufacturers find the demand picking up. Inquiries are very heavy in some quarters and more of these are being turned into orders. These orders, however, are small in volume. In fact, motor salesmen and estimators are spending more time than usual on quotations, but the gratifying part of this is that these are breaking a little better. Stocks are good in manufacturers' and distributers' and local district warehouses and virtually all standard sizes and types can be shipped in quick time.

Electrical Material Production for 1919, 1914 and 1909

A PRELIMINARY statement of the 1920 census of manufactures with reference to the manufacturing of electrical machinery and apparatus has been issued by the Bureau of the Census, Department of Commerce. This report is confined to establishments engaged primarily in the manufacture of all kinds of electrical machinery and apparatus during the year 1919.

The figures are based upon the returns from 1,404 establishments, with products valued at $993,280,000. In addition, electrical machinery and apparatus to the value of $21,093,000 were produced as subsidiary products by seventy-nine establishments in other lines of manufacture, making a total value of $1,014,373,000. At the census of 1914 there were 1,030 establishments with products valued at $335,170,000 and ninety-one establishments with subsidiary electrical machinery and apparatus to the value of $24,262,000, a total of $335,170,000. At the census of 1909 there were 142 establishments with subsidiary electrical machinery and apparatus to the value of $18,728,916; total number of establishments is not given, but value is $240,037,479.

There is, however, a considerable production of such commodities by establishments engaged primarily in other lines of manufacture and the general statistics for them are included with those for other branches of industry. In the attached table pertaining to products the total production is given, including that made as a subsidiary product in establishments classed under other industries.

The comparative statistics for 1919, 1914 and 1909 are summarized in the following statement. The figures for 1919 are preliminary and subject to such changes and corrections as may be necessary upon a further examination of the original reports.

The statistics given for the years 1914 and 1909 do not include porcelain electrical supplies manufactured in the clay-working industries, reported by the United States Geological Survey, to the value of $4,130,270 for 1914, nor the value of 10,461,843 dozen globes and 70,211 gross of battery jars accredited to the glass industry.

ELECTRICAL MACHINERY AND APPARATUS—COMPARATIVE SUMMARY FOR 1919, 1914 AND 1909

	1919	1914	1909
Number of establishments	1,483	1,121	
Value of products (1)	$1,014,373,000	$359,432,000	$240,037,479
Generating apparatus and parts:			
Direct current	13,142,000(2)	......	......
Alternating current	13,127,000(2)	....	....
Small dynamos	29,704,000(2)	23,233,000	17,231,804
Self-contained lighting outfits	24,079,000(2)	....	......
Parts and supplies	6,214,000(2)	....	....
Transformers and feeder potential regulators	31,691,000	13,120,000	8,801,019
Rheostats, controllers and resistances	21,542,000	9,543,000	(7) 2,674,963
Generator voltage regulators	262,000	245,000	(8) ....
Motors (not including starters or controllers)	116,898,000	44,176,000	32,087,482
Electric locomotives	8,161,000	3,721,000	(8) ....
Batteries, storage, dry and liquid	92,506,000	23,402,000	10,612,470
Carbons, lighting, furnace and brushes	13,292,000	3,603,000	1,934,864
Arc lamps, carbon and luminous	607,000	742,000	1,706,959
Searchlights, projectors and focusing lamps	4,342,000	2,082,000	935,874
Incandescent lamps, tungsten, carbon and other	59,372,000	17,350,000	15,714,809
Rectifying apparatus	1,965,000	148,000	(8) ......
Telegraph apparatus, intelligence, police and radio	12,816,000	2,248,000	1,957,432
Telephone apparatus	46,340,000	22,816,000	14,259,357
Apparatus and devices, industrial and household	54,998,000	4,049,000	1,954,112
Electric measuring instruments	19,322,000	8,786,000	7,800,010
Magneto-ignition apparatus, generators, spark plugs and coils	47,389,000	22,261,000	6,092,343
Miscellaneous electrical machinery, apparatus and supplies:			
Switchboards, panelboards and cut-out cabinets for light and power	17,736,000	8,989,000	5,971,804
Railway switches, signals and attachments	4,467,000	6,394,000	5,377,843
Circuit breakers (oil, carbon and air)	4,370,000(3)	....	...
Fuses, cut-outs and fuse plugs	7,895,000	1,757,000	1,001,719
Insulators	6,504,000(3)	....	....
Sockets, receptacles, bases and attachment plugs	15,636 000	5,513,000	4,521,729
Wiring supplies (current carrier)	6,858,000(4)	....	....
Lightning arresters, choke coils, reactors and other protective devices	2,353,000	1,189,000	940,171
Insulated wire and cables	84,217,000	69,506,000	51,624,737
Pole line hardware	9,379,000(5)	....	......
Circuit fittings, not elsewhere provided for	4,908,000	2,068,000	1,080,287
Conduits, underground and interior	19,267,000	4,875,000	5,098,264
Electric lighting fixtures of all kinds	2,718,000	3,384,000	(9) 2,200,668
Annunciators and push buttons	710,000	264,000	235,567
Electric clocks and time mechanisms	1,798,000	411,000	352,513
Bells, buzzers and signal gongs	3,616,000(6)		.
Therapeutic apparatus	5,482,000	2,653,000	1,107,858
X-ray tubes	3,389,000(3)	..	. .
All other electrical machinery and apparatus	74,898,000	27,276,000	18,995,176
All other products	89,643,000	23,628,000	17,765,645
Amount received for custom work and repairing	30,760,000(3)		.

(1) Includes electrical machinery and apparatus valued at $21,093,000 reported as subsidiary products by seventy-nine establishments engaged primarily in other industries in 1919, compared with $24,262,000 by ninety-one establishments in 1914 and with $18,728,916 by 142 establishments in 1909.

(2) Included with dynamos in 1914 and 1909.

(3) Included with all other electrical machinery in 1914 and 1909.

(4) Included with electric light fixtures in 1914 and 1909.

(5) Included with circuit fittings in 1914 and 1909.

(6) Included with annunciators in 1914 and 1909.

(7) Rheostats and resistances only.

(8) Figures not available.

(9) Not including fixtures made by establishments engaged primarily in the manufacture of gas and electric fixtures.

In comparing statistics at the different censuses allowance should be made, says the report, particularly in the case of some of the less distinctive products, for changes in the schedule of inquiry used, and for the fact that it is possible that all manufacturers did not classify their products in the same way. It is highly probable that many articles specifically called for were not reported separately and are included in the item "all other electrical machinery, apparatus and supplies."

Present Conduit Prices Same as Those in January, 1917

WITH the announcement last week of lower base pipe drops and the resulting downward price revisions in electrical conduit, the conduit manufacturers are again on a price basis the same as that which went into effect on Jan. 2, 1917. The card generally in effect now is No. 47, dated July 11, carrying a discount of 41 per cent on ½-in. black and 35 per cent on ½-in. white conduit in carload quantities.

Electrical conduit went on the Pittsburgh basing plan with card No. 1 in August of 1913, and according to the cards of a representative manufacturer the low point in price was reached in October, 1914, when ½-in. black carried a discount of 73 per cent and white 69 per cent in carloads. The discounts gradually diminished from that time until they touched a low spot of 21 and 15 respectively in May, 1917, at which time conduit prices from the manufacturer were the highest. The price gradually decreased until March, 1919—30 per cent on ½-in. black and 24 per cent on white—returned 3 points in February, 1920, and decreased again in steps, starting January, 1921, to the present level.

There have been three price decreases this year for a total of 14 points on the ½-in. size in carloads.

Industrial building work generally is at a relatively low level throughout the country and consequently the demand for conduit is low. Still reports are received this week which show a fairly satisfactory demand for ½-in. black pipe in St. Louis, a little more activity in demand for galvanized from textile mills in the Southeast, a steady demand for ½-in. black in Chicago and a slightly better demand for small sizes of pipe from certain jobbers in New York. It cannot be expected that any prominent demand will be experienced, however, until there is more activity in commercial and industrial building than there is at present. But pipe prices are on a level now comparable to that effective January, 1917.

Porcelain Insulator Prices Reduced from 5 to 10 per Cent

EFFECTIVE July 15 and 18 in different instances several manufacturers of high-tension porcelain insulators have announced lower prices. On suspension types the cut amounts to 5 per cent, while on all others it is 10 per cent. Included in this drop are some of the insulator hardware items. Standard wiring porcelain was also reduced, in a representative instance, the discount being increased 8⅓ points, except on short tubes where it was 3⅓ points.

This is the second price decrease to be made on high-tension insulators. The first, amounting to 10 per cent, occurred during the last half of February but it did not cover single-part pin-type insulators. Demand shows considerable falling off since the first of the year, it is stated. At the present time, though there is a fair number of orders being received from central stations, they are small in size and both the foreign and domestic markets shape up as quiet. Electric railways up to the present time have taken little or no interest in the market.

Production is still at full capacity throughout the industry, however, but as deliveries are being made faster than orders are received, it is a question just how long this will hold true. One of the large producers, for instance, has enough business on hand to keep going full time for two months, though it is admitted there is not a whole lot in sight after that time. Deliveries have been steadily improving and now range from about four to six weeks on suspension types and four to eight weeks on pin-type insulators, depending upon the voltage. No stock has yet been accumulated on the high-tension types, but on low and medium voltages there has been some accumulation of stocks.

Pole Line Hardware Prices Show Cut of 2½ to 7½ per Cent

PRICES on pole-line hardware are again down. This time the cut ranges from about 2½ to 7½ per cent in a number of instances, and was made on varying dates from the first to the fifteenth of July. Lower costs on steel are said to be responsible for this latest drop. At least three other general price reductions have been reported in the galvanized line hardware field since the first of the year, and in some instances four decreases. The first cut of 5 to 15 per cent was made in late December and early January, the second of 5 to 7½ per cent occurred on Feb. 15, and the third reduction, amounting to 7½ to 10 per cent, was effective on April 11. Early in June at least one manufacturer and a manufacturer's distributer made a fourth decrease of 5 per cent, so that with this latest drop prices are well down. Demand has just recently started to show a slight improvement, it is reported, though factory stocks are still quite large.

A representative distributer's prices on various items per 100, f.o.b. Chicago, are as follows: Carriage bolts, ⅜ in. x 4½ in., $1.93; crossarm braces, 1¼ in. x ¼ in. x 28 in., $13.19; lag screws, ½ in. x 4 in., $3.33, and machine bolts, ⅝ in. x 12 in., $8.95.

The Metal Market Situation

THE present position of the copper market is not very encouraging. Prices have receded about ¼ cent per pound in the major market on all positions and from ⅛ to ⅜ cent in the outside market within the past week. Domestic demand is no better and export sales are lacking. Despite the fact that forty-two out of fifty large copper producing companies are not operating right now, surplus stocks are still too large to afford much comfort. Large producers are not pressing to sell, however, and are unwilling to shade 12.75 cents per pound delivered for July and August or 12⅞ cents for third quarter delivery. Small producers will sell these positions at 12½ and 12⅝ cents delivered. Bare copper wire base has declined to 14.25-14.75 cents.

In a special study on the German copper market made by *Engineering and Mining Journal* it seems that Germany has lately been the chief support to export copper trade. And Germany pays cash for copper purchased in the United States, while France and England, the two next important users of United States copper, and other countries have been and are still able to take advantage of the liberal credit terms advanced by the Copper Export Association. With official peace declarations consummated it is possible Germany too will seek credit extensions.

The Aluminum Company reduced its prices 3½ cents per pound on July 15. Lead holds its own and shapes up better as to demand than other non-ferrous metals. Demand for zinc is dull and the current output small. Prices have receded a fraction of a cent. Tin is down still further and the cheapness of this metal is attracting some inquiries. The scrap metals market as a whole shows little improvement. Heavy copper scrap, for which there is a fairly good demand, shows a slight increase, while brass holds its own.

NEW YORK METAL MARKET PRICE

	July 12, 1921	July 19, 1921
Copper	£ s d	£ s d
London, standard spot	72 0 0	70 2 6
	Cents per Pound	Cents per Pound
Prime Lake	12.87½—13.00	12.75
Electrolytic	12.75—13.00	12.50—12.75
Casting	11.75—11.87½	11.75
Wire base	15.00—15.25	14.25—14.75
Lead, trust price	4.40	4.40
Antimony	4.65	4.65
Nickel, ingot	41.00	41.00
Sheet zinc, f.o.b. smelter	10.00	10.00
Zinc, spot	4.80	4.70—4.75
Tin	28.37½	27.00
Aluminum, 98 to 99 per cent	28.00	24.50

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	9.50—9.75	9.50—10.00
Brass, heavy	4.25—4.50	4.25—4.50
Brass, light	3.50—3.75	3.50—3.75
Lead, heavy	3.37½—3.50	3.25—3.37½
Zinc, old scrap	2.00—2.25	2.00—2.25

THE WEEK
IN TRADE

Prices When Quoted Are Those Prevailing at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

FANS still continue the chief item of activity in the electrical supply line, although in the Southeast, St. Louis and Chicago territories pipe shows fair activity. General supply business, however, is only holding its own. Here and there is noted a little action on various items, but these are strictly localized. Collections remain unchanged.

Lower prices are ruling this week on motors and control equipment, wiring and high-tension porcelain, pipe and line hardware. Lower prices on schedule material and heating appliances have helped sales in Portland and Intermountain territories.

In the Southeast refrigeration is active and the fruit crops are very good; St. Louis is going through an electrician's strike; building is proceeding well in Chicago, although no settlement of the labor dispute has been made; textiles are quite strong in New England and metal trades slow; crop conditions are better in the Intermountain and Northwest districts.

NEW YORK

Business drags along on the same level with little if any improvement. Fans are active, but that is about all. Residence building in sections such as Long Island is aiding conduit to move with some jobbers, but this is not general. Cuts on heating appliances have not stimulated demand. The armored-conductor market is in a deplorable condition, with prices cut right and left. Panel boxes are down about 10 per cent—another item to feel the effect of the steel price drop. Standard wiring porcelain is also lower by nearly the same amount. Collections show no change.

Industrials within the past two weeks have shown increased signs of life. Business placed by the latter is no larger individually, but there is an increase in the number of orders received, which is regarded as a very hopeful sign. One of the large manufacturers of motors reports that resale orders on behalf of both fractional horsepower sizes for drink mixers, vacuum cleaners, etc., and larger motors going into power machinery are picking up slightly.

Panel Boxes.—Though in at least one instance a price decrease of 10 per cent will not officially be made until July 25, other manufacturers are at the present time quoting prices down to this extent following the recent steel cut. The reduction from peak quotations amounts to 40 to 50 per cent. Manufacturers report a light demand with good stocks.

Conduit.—Prices in 2,500-ft. lots are as follows: black, ½-in., $57.80 to $62.02; ¾-in., $74.70 to $80.63; 1-in., $107 to $115.96; galvanized, same sizes, $62.90 to $66.87; $81.55 to $87.19; $117 to $125.65. Stocks are good but despite the report of some jobbers that sales are better for residence building in outlying sections, general demand is light.

Flexible Armored Conductor.—The market is in a weak condition with prices shot to pieces. As low as $48.50 per 1,000 ft. in that quantity is quoted on No. 14, two-wire, double-strip by a large jobber this week, and some prices are even lower.

Tape.—Demand for friction is fair with a price in 100-lb. lots of 33 to 42 cents per lb. Sales of rubber are slightly less with a prevailing price of 33½ to 44 cents. Stocks of both kinds are good.

Rubber-Covered Wire.—Sales are light, with more than adequate stocks held. No. 14 single-braid, 10,000-ft. lots, brings $6.50 to $6.77 per 1,000 ft.

Porcelain.—General price decreases were made by manufacturers on standard wiring porcelain early last week. The drop ranged from about 4 to 10 per cent. Jobbers are quoting 60 per cent discount in barrel lots but demand is light.

Fuses.—In standard package quantities N. E. C. non-renewable 30-amp. fuses bring 7 to 10½ cents each net, and plug fuses from $3.38 to $4 per 100. A standard 30-amp. renewable fuse sells for 26 cents each with a contract and 30 cents without a contract. The supply is plentiful and stocks are moving fairly well.

Sockets.—On pull sockets listing at 60 cents each, keys at 33 cents and keyless at 30 cents, jobbers quote 24 and 25 per cent discount in standard packages. Jobbers' stocks are well supplied but the demand is spotty though better than before the recent price drop.

Fans.—Sales have dropped slightly as the weather has not quite held up its hot pace, but the general demand is good. The best sellers are 16-in., 12-in., and 9-in. oscillators.

Heating Appliances.—The general report is that recent price decreases have stimulated little if any business though some jobbers report a fair demand for 6-lb. irons. Two well-known makes now list for $6.95 and $7 each, a drop of about a dollar, and take 30 per cent discount in quantities up to six.

CHICAGO

Despite the unsettled labor controversy the initiation of new building in Chicago is proceeding at a lively pace. The ten-year average of permits issued is $1,620,000 per week. During the eight weeks before the selection of an arbitrator new permits were down to an average of $600,000 per week, but immediately thereafter they jumped and since then have averaged $1,750,000 per week. When it is considered that very little industrial work is included in this current total and that it is made up almost exclusively of small residence and apartment jobs it can be seen that whenever the break for prosperity does occur there should be an immense amount of construction work.

Current transactions in the electrical trade, except in hot weather goods and for the above construction, are limited to routine requirements. Price changes are negligible and when they do occur they seem to have no effect on trade, as buying is done only when an actual need exists. Collections remain slow, but no new features have developed which would cause any alarm.

Bare Copper Wire.—Except for filling seasonal replacement needs trading is absent and the price remains unchanged. Most purchases are for relatively small lots and quotations thereon are firmly held. On large quantities prices are open to negotiation. Quoted price remains 16½ cents per lb. on No. 8 in 1,000-lb. lots.

Rubber Covered Wire.—Under light demand thirty-day stocks are being maintained by most handlers. Current quotation for No. 14 in 10,000-ft. lots is $7 per 1,000 ft.

Flexible Armored Conductor.—Price remains $57.50 per 1,000 ft. for No. 14 two-wire, double-strip. There is a steady demand of small volume for this material for current building operations. Stocks are normal and a shortage is possible should consumption increase rapidly.

Black Conduit.—A steady demand continues for black pipe, particularly in the ½-in. size, which is quoted at $59 per 1,000 ft. in 1,000-lb. lots.

Fans.—Demand continues excellent as the heat continues of real summer variety. Retailers and jobbers alike are unable to supply the demand, which is heaviest for household sizes. The 12-in. fan is the one most wanted, although large quantities of 6 and 8-in. are finding distribution.

Heating Appliances.—Summer demand is excellent and the current habit of maintaining low stocks has resulted in much back ordering. Prices are firm, with but little complaint heard of their being too high. Sales run to the smaller and lower-priced items.

Washing Machines.—This trade seems to have fallen off to a certain extent, probably largely due to reduced sales effort during the vacation season, as no reports are heard of campaigns failing.

BOSTON

Trade shows no marked improvement as yet, but underlying conditions continue in the main to strengthen. Business in Maine is holding up remarkably well and in textile centers many mills are operating well up toward their capacity. Metal-working industries are very dull. A gradual increase in the number of building construction jobs being handled can be seen in some quarters of New England, although the total of contracts for building and engineering construction placed in the week ended July 12 in this section was only $1,569,500. Prices softened considerably during the past week, with reductions in motor and control equipment, pole-line hardware, porcelain tubes, unglazed cleats and rigid conduit. Jobbers are buying from hand to mouth and retailers are moving cautiously in replenishing stocks. Collections are very closely watched, but underlying financial conditions tend to improve slowly.

Motors.—Prices on a number of leading makes of motor and control apparatus were reduced about 10 per cent during the past week. It is easy to secure prompt shipments on virtually all standard lines at present. Buying is still very spasmodic, but small power users are never out of the market, and the demand for quotations is diversified and distinctly encouraging.

Flexible Armored Conductor.—Slow movement is reported. No. 14 single-strip sold Monday from $50 to $55 per 1,000 ft., depending on size of orders. In 1,000-ft. lots the $55 figure obtains quite generally.

Porcelain Fittings.—Easier prices on some material of this class are in effect. Nail-it knobs now sell at $19 per 1,000 in barrel lots. Unglazed cleats are down to $16.25 per 1,000 in barrel lots from about $24, and 3-in. x $\frac{5}{16}$-in. tubes are now $7.05 per 1,000 in barrel lots. Some small-scale buying of these materials is under way and shipments are good.

Fans.—Last week an active movement of fans took place in Boston, although distributers' stocks were not cleaned out by any means.

Non-Metallic Flexible Conduit.—This material is more active than most other wiring supplies. Stocks are ample and the $\frac{7}{32}$-in. size is selling around $22 per 1,000 ft. in 1,000-ft. lots.

Wire.—Rubber-covered wire is in moderate demand. No. 14 is selling from $6.25 to $6.50 per 1,000 ft. in lots of 5,000 ft. and under, with considerable instability on the sale of larger quantities. Weatherproof wire, on a 15-cent base, is moving slowly. Bare wire is in very light demand, with a 14½-cent base quoted. Central-station buying while not heavy is fairly good considering the conservatism followed in regard to extensions.

Flashlamps.—Trade is brisk, largely owing to seasonal movement and to energetic marketing methods. New designs are appealing to the trade.

Line Hardware.—Reductions of the order of 10 per cent occurred within the past week. The market is rather dull, but piecemeal line construction is absorbing some of this material.

Small Socket Appliances. — Well-distributed orders, including a good many "repeats," are being received from small dealers in this territory.

Washing Machines.—Prices on a leading make have been marked down 10 to 15 per cent. A fair volume of business continues to be handled. Ironers of the same make are also easier.

ATLANTA

Jobbers report a steady but still decreased demand for lines of electrical material with a rather bright outlook for increased activity in the electrical building material lines, induced by increased home building and prospective industrial plant construction. Increased activity is to be noted in certain manufacturing lines, particularly in the construction of raw water ice plants, a number of those already in operation making additions, and an unusual number of serious inquiries being received for new plants and change-over of old ones from steam drive to electric. Reports from south and middle Georgia indicate that very much improved conditions are immediately ahead, because the peach and melon crops now being marketed are the best on record and are bringing excellent prices. As a result money is much easier and jobbing firms are expecting payment of long-outstanding accounts as well as a general resumption of activities in this section. The attitude of the national government regarding farm loans, particularly the announcement that Federal Reserve Banks would discount paper secured by cotton, is having a more encouraging effect on the rural districts. Still further indication of improved conditions is reflected in the government report of employment, the increase in Atlanta being 16.7 per cent over that of May. This condition exists to a smaller extent in other industrial centers in this section, though labor is in excess of the demand in the agricultural districts, particularly in Arkansas, Louisiana, Oklahoma and Texas.

Rigid Conduit.—With prices down 10 to 15 per cent there appears to be more activity in the demand, mostly from textile mills having uncompleted work and new jobs just starting. The demand in this section for black is weak as all the large contractors are endeavoring to standardize on galvanized.

Pole Line Hardware.—A price weakening has shown in this material for the past two months and has been subject to several reductions and the market has not stabilized so far. The demand is very poor and no improvement is expected until small central stations begin to build their primary lines to outlying residential districts, which are now beginning to grow rapidly, because of the boom in residential construction now under way.

Schedule Material.—Residential construction in the Southeast at this time calls for knob and tube work and allied material and therefore the demand for this material is fairly good.

Sewing Machines.—Dealers were overstocked and reduced the price, which stimulated sales. This is evidenced by a decrease of inventories and certain reorders from factory.

Two-Way Plugs.—The demand has been very good, due to national advertising campaigns and concentrated efforts on the part of dealers to merchandise this line. A price reduction of from 10 to 15 per cent is to be noted.

Lighting Fixtures.—The demand for the less expensive residential type has been excellent of late and all dealers are looking forward to a continued demand as the building season advances, and as the money situation eases up it is expected that builders will gradually go in for higher priced material.

ST. LOUIS

Conservatism to a high degree marks business activity in this territory. Very little change in the situation could be noted last week. Some improvement in buying is observed in the South due to the ability of the farmers to move cotton and other products to better advantage, but in the immediate vicinity of St. Louis business is very quiet. A large producer of automobiles has reduced production from a 40 per cent to a 20 per cent basis and operations on the higher basis had prevailed for but two or three months. While the purchasing of electrical goods by the industrials is extremely quiet slight improvement in the movement of appliances can be noted, particularly in fans and washing machines, the extremely warm weather causing the former and lowered retail prices the latter.

Electrical workers in St. Louis and East St. Louis went on a strike July 14 to retain the $1.25 per hour wage, which is that being paid the majority of the building trades. Efforts are being made, however, to get all the trades to enter into an agreement with the Building Industries Association whereby the same wage will be paid to all and all contracts will be for the same term, the wage being such as will encourage building. In the meantime very little construction work is being done and that is almost entirely for residential purposes.

Fans.—An exceptionally heavy demand for fans of all kinds developed last week, with the result that several dealers' stocks of the popular sizes were exhausted and at least one jobber's stock. The 10-in. and 12-in. oscillator has the heaviest call. Indications are that a good fan business will continue for the next four weeks at least.

Washing Machines.—The local distributer of one well-known machine has temporarily reduced the list price from $160 to $109. Special campaigns are being conducted and as a result the movement of this machine has been materially improved. The reason for the reduction, it is reported, is to liquidate stocks.

Conduit.—With a reduction of 9 points in the discount of all kinds and sizes there is a fairly satisfactory demand for ½-in. black, but the larger sizes have but little call because of lack of industrial work. Some jobbers' stocks are about in line, others are slightly heavy, particularly in the larger sizes.

Ranges.—There is hardly any movement and interest is practically nil. It seems to be considered that this is not an opportune time to engage in campaign tactics.

Flat Irons.—Slightly improved retail demand is reported as a result of the recent price reductions. A few of the jobbers report substantially improved business.

Lighting Fixtures.—A large manufacturer and distributer of semi-indirect fixtures reports that the demand is about 50 per cent of normal and prevails particularly with clubs, churches, schools, etc. The plant is operating with about 75 per cent of its regular force. Prices are being fairly firmly maintained.

Domestic Refrigerators.—One distributer reports considerable interest in machines for residence purposes in St. Louis and immediate territory. Sales this year have been larger than last and the field is comparatively undeveloped. However, the general shortage of money has held up a number of sales. The price has recently been reduced from $595 to $395, installed in St. Louis. Delivery can be made from local stock.

SAN FRANCISCO

The building trades strike situation in San Francisco and Bay City has been much clarified during the past week by the action of the Oakland unions which voted in favor of resuming work at the new rate of $9.25 per day for electricians and of working on open shop jobs. Until San Francisco unions take similar action nearly all big building jobs in San Francisco will be tied up. So far an inadequate number of skilled workers have been sent here for the many jobs awaiting them, particularly in the case of the electricians. The value of building permits issued in the principal California cities during the month of June, 1921, is as follows: San Francisco, $950,965; Los Angeles, $6,269,546; Oakland, $1,486,412; San Diego, $799,944. The value of building permits issued during the corresponding month for 1920 was as follows: San Francisco, $1,949,692; Los Angeles, $6,610,681; Oakland, $1,050,642; San Diego, $204,935.

Flashlights.—For several months sales of flashlight materials have been excellent, due not only to seasonable sales to camping parties but also to clever window displays and increased sales efforts. Of course the principal sales are of battery renewals, but the introduction of new flashlights has considerably boosted the dealers' sales of cases.

Bells and Buzzers.—The new price on 3-in. iron box bells, class C, is 50 cents each in 100 lots, a large decrease from the former price. There is a 12 per cent higher price in package lots of ten, in which quantity most of the sales are being made.

Radiators.—The new prices on Majestic radiators for the 1921-22 season provide for the same discounts, grading from 30 per cent in single lots to 30-10 per cent in fifty lots, but the list prices are decreased a dollar or so, the new list on the best selling size being $12.50 each instead of $13.50. Dealers in general are inclined to postpone the placing of their orders for several months.

Ironers.—The demand for ironers has reached a sudden halt and efforts to improve it have resulted in a demoralized market. On some makes the lists are fairly steady, but on some of the older ironers sharp decreases have occurred in the retail price, with considerable variation from town to town.

SALT LAKE CITY—DENVER

The recent price reduction in electrical merchandise announced by manufacturers has created a flurry of demand among consumers, particularly for appliances. As a result retailers, generally unprepared, have made a run on jobbers that has strained their stock resources to the limit. To meet the exigency there is considerable interchange of stocks in lines that are plentiful. The sudden demand has clearly demonstrated that here price is the outstanding consideration with the buying public. Quality and service appeals are comparatively unimportant at the present time. Jobbers and dealers are hopeful that the improvement in the market is a foreshadowing of a return to normal conditions. There is already a better tendency to stock among jobbers and dealers alike.

The easing of the money market noted in the East has not yet become a tendency in the West and bankers are still ultra-conservative in granting loans. The lack of credit is pinching farmers particularly; in one or two cases states are coming to the rescue, co-operating with private financial concerns in granting urgent loans. The system, it is believed, will provide the necessary relief. The old tendency to hold crops for better prices is no longer manifest. The present yield forecast is highly encouraging in the Intermountain west. A revival of the mining industry, especially in copper, is looked for within the next twelve months. Building operations are proceeding at a fair rate, notwithstanding generally unsettled conditions.

Cooking Appliances.—There has been a noticeable pick-up in the demand in the last two weeks. The hot wave is partly responsible for this, but reduced prices are considered the main cause.

Bake Ovens.—The demand is steady, though the volume is not large. The market is limited to bakeries, hotels, hospitals, etc., and several orders for extra large sizes have been filled lately.

SEATTLE—PORTLAND

In Seattle and Puget Sound cities a generally quiet condition in trade and industry prevails, with retail business more active than wholesale and jobbing lines. With mills and logging camps operating with full crews and with prospective early railroad buying forecasted, the passing of the most prolonged period of extreme depression ever known to the west coast lumber industry bids fair to be accomplished. Manufacturers in Puget Sound and Portland districts report business still quiet. There are spasmodic reports indicating improvement and others of a more depressing nature, but the net result seems to be practically the same volume as for the past two months. Credits and collections in both districts show but little change and stocks, particularly in Seattle, are in excellent shape, with replacements easy to obtain. Jobbers in Seattle as well as Portland report business a trifle improved since the Fourth.

There appears to be a greater demand for standard package material and a tendency to demand carton packed goods. Portland dealers report the recent drop in prices on practically all schedule material, ranges and heating devices has aided in stimulating business somewhat, the greatest activity being noted in the sales of washing machines, stocks of which are in fine shape. This decrease in prices has not noticeably affected sales in the Puget Sound district. There is a considerable amount of contract work being taken on at the present time, but practically all of it is on a very narrow margin.

Grain crop reports emanating from the inland empire district and eastern Oregon are excellent and farmers have already contracted for a large portion of their crops. Generally speaking, throughout the district there is a surplus of common labor and cuts in wages are prevalent.

Electric Fixtures.—So far this year the fixture business in Seattle compares favorably with that of last year, especially as regards the moderate-priced residential type. Commercial fixtures have not moved particularly well.

Vacuum Cleaners.—Some improvement is noted, attributed largely to the warm weather and to the continual effort at publicity on the part of dealers with the easy terms of payment offered.

Manufacturers' Activities

Devoted to the Business Side of Manufacturing, Distribution and Sales, News from Jobbers and Foreign Fields and a Record of New Devices and Trade Literature

Refractories Association Makes Public Production Charts

In following Secretary Hoover's suggestion that trade associations should give to the public any production statistics they have heretofore compiled exclusively for their own membership circulation, one of the first associations to adopt this suggestion is the Refractories Manufacturers' Association, F. W. Donahoe, 840 Oliver Building, Pittsburgh, secretary, which has made up charts taking in figures for the entire refractories industry.

These charts show production, shipments, stock on hand and unfilled orders of certain refractories from January, 1919, to June, 1921, and indicate very clearly the condition of the steel industry in the last two and one-half years, an industry which accounts for more than 90 per cent of the fire clay and silica brick production every year.

New Catalog of R. Thomas Facilitates Export Business

The R. Thomas & Sons Company, East Liverpool, Ohio, manufacturer of porcelain insulators, etc., has just issued a new catalog entitled "Standard Electrical Porcelain," which includes several interesting features. For the convenience of foreign customers the dimensions of the various products are given in both inches and millimeters, a code word is listed for each item and the export as well as the domestic shipping weight is stated. Although these details are already a part of the company's catalog on high-tension insulators it is the first time that they have appeared in the publication devoted to standard porcelain.

Holabird to Distribute Weber Devices on Pacific Coast

Arrangements have been made by the Weber Electric Company, Schenectady, N. Y., with the Holabird Electrical Company to act as its sales representative on the Pacific Coast. H. A. Sayles, secretary of the Holabird Electrical Company, under the general direction of R. D. Holabird, will have charge of the Weber products. The offices of the Holabird company are in the Hobart Building, 582 Market Street, San Francisco, and 451 East Third Street, Los Angeles. A complete stock of Weber wiring devices will be carried in the Holabird warehouse in San Francisco, and a carload is now in transit from the factory at Schenectady. A comprehensive illustrated catalog of the complete line of Weber products is now on the press and will be ready for distribution during September.

Enlarged Production for Maker of Condensers

John E. Fast, Oak Park, Ill., manufacturer of electric condensers, has announced that the capacity of his plant has recently been enlarged and that he will be able to supply condensers on order in the future. At present the plant is turning out small telephone, violet ray machine and automobile ignition condensers. Mr. Fast was formerly with the American Telephone & Telegraph Company in Chicago.

Kuhlman Electric Company to Enlarge Plant

Plans are under consideration by the Kuhlman Electric Company, Bay City, Mich., manufacturers of transformers, for extensions to its plant. Under normal conditions the company is crowded for room and it is now planning to erect an addition providing about 5,000 additional square feet of manufacturing floor space.

Anchor Lite Appliance Company Moves to Larger Quarters

The Anchor Lite Appliance Company, Pittsburgh, Pa., manufacturer and distributer of electrical supplies and lighting fixtures, announces that it is now established in its new quarters at 420 Wood Street, where it occupies a four-story and basement building, approximately 10,000 sq.ft. of floor space. The company is doing everything possible to give twelve-hour service and thinks that as soon as it gets things in order it will be possible to get out all orders in one day's time. The company began business on a small scale in a two-story building at 25 Strawberry Way, less than a year ago. It makes a specialty of wholesale distribution to contractors and dealers and does not cater to the retail end of the electrical business, and in the little retail business that is done advises that the full retail price is maintained. The officers are: A. S. Goldstein, president; S. J. Goldberg, treasurer, and M. Kimball, secretary.

French Electrical Manufacturer Discontinues New York Office

The Compagnie Générale d'Electricité, Paris, France, which has maintained a purchasing office at 50 Church Street, New York City, for the past four years, has decided to discontinue this office on account of present business conditions. H. S. Foley, who has been the company's representative at that address since the office was first opened, will continue to occupy the same premises and will conduct a general electrical export business.

Aluminum Conductor Business Picking Up Well

Aluminum Company of America Has 71,000 Miles of Conductor in Use, 78 per Cent in United States

The aluminum conductor business of the Aluminum Company of America, Pittsburgh, has been picking up better and better each month of this year so that it is expected new stranding machines will have to be added. One feature of the orders seems to be the rather quick shipments asked. Export business is good, a recent order of note being for 2,000,000 lb. of aluminum conductor for the Morwell Brown-Coal Power Scheme in Australia. The Melbourne coal fields are about 100 miles from Melbourne City.

Seven hundred miles of standard 336,400-circ.mil aluminum cable steel reinforced, which was sold to the government of the Victoria Electricity Commissioners, will be used on a double circuit three-phase high-tension line operating at 132,000 volts, 50 cycles. The cable will be suspended from suspension insulators attached to steel towers placed 1,056 ft. apart.

Up to June of this year there were about 71,000 miles of aluminum conductor in service which has been manufactured by the Aluminum Company of America and its affiliated interest, the Northern Aluminum Company, Ltd., Toronto, Canada. Of this quantity of aluminum conductor, approximately 50 per cent is composed of aluminum cable, steel reinforced. Of this total amount 78 per cent is in service in the United States, 15 per cent in Canada, 2.3 per cent in Europe, 2.2 per cent in South America and 2.5 per cent in other parts of the world.

Piedmont Electric Establishes Branch in Greensboro

The Piedmont Electric Company, which has been in business for nineteen years, maintaining headquarters in Asheville, N. C., is establishing a branch in Greensboro, N. C., which will soon be ready for business. Up to this time the company has been covering out of Asheville all of North and South Carolina with the exception of that portion directly on the coast. Increase of business in eastern North Carolina has made necessary a warehouse and branch office in Greensboro. The branch office in Greensboro will be at 335 South Davis Street and will be in charge of Frank B. Bibb as local manager. B. C. Banks, who has for several years been with the company in charge of the eastern territory, will continue in this capacity but will work directly in connection with the Greensboro warehouse. This branch, with the advantage of the reduction in freight rates to Carolina points which has just been established, will enable the company to distribute to territory contingent to Greensboro at a saving to the consumer on transportation.

New Manufacturers' Agency Established at Columbus

S. E. Ringgold, formerly general sales manager of the Moock Electric Supply Company, Canton, Ohio, has established an office in the Ferris Building, Room 502, Columbus, Ohio, and is now covering all of Ohio, western Pennsylvania, and all of western Virginia, representing the following manufacturers: The Fernando C. Mesa Company, Irvington, N. J.; the Federal Porcelain Company, Carey, Ohio; the William Wurdack Company, St. Louis (switchboxes); the Saylor Electric & Manufacturing Company, Wheeling, W. Va., and the Magic Electric Company, New York City. He contemplates taking on two or three more lines, probably rubber-covered wire, conduit, and flexible-armored conductor.

Industrial Cost Association Conference Successful

With the overshadowing interest of cost problems in the manufacturing world of today, the conference of the Industrial Cost Association at East Aurora, N. Y., the last of May, carried particular significance. The association was incorporated only last January by plant executives who desire to standardize manufacturing cost methods, and the progress made toward the solution of many important cost problems at the conference was considered by those attending to be very satisfactory.

The greatest interest was manifested in the topic "Should Abnormal Burden Be Included in Current Monthly Cost?" More than fifty speakers gave their views on this subject and a vote showed a sentiment of three to two in the negative. "Current Influences on Cost Problems," "Current Problems in Expense Distribution," "Uniform Cost Systems," "Human Element in Costs" and "Standardization of Cost Terminology" were discussed. Addison Boren, Yale & Towne Manufacturing Company, was named chairman of a committee to write a lexicon of cost terminology.

As an outcome, the conference agreed that complete uniform cost systems, adaptable to all factories alike, cannot be devised, and also that the best cost system is one which is developed from the factory end by employees. Boston, Bridgeport, Philadelphia, Rochester, Buffalo, South Bend, Cleveland, Cincinnati, Milwaukee and St. Louis have asked for local sections.

On the resignation of M. F. Simmons, General Electric Company, as president of the Industrial Cost Association, J. W. Stannard, American Autoparts Company, was elected president. Mr. Simmons remains a national director. A. A. Alles, Jr., People's Bank Building, Pittsburgh, is secretary-treasurer.

Mica Insulator Meets in Annual Convention

The annual sales convention of the Mica Insulator Company, with representatives from New York, Cleveland, Cincinnati and Chicago, was held at the company works, Schenectady, N. Y., lasting the entire week of June 20. Among those present who have been connected with mica insulation since early days were E. C. Wood, vice-president of the company, and C. W. Jefferson, one of the pioneers in the commercial use of mica insulation material in the electrical industry. The great progress which has been made by the mica insulation industry during the past thirty years was well illustrated in the company's eighteen-building plant. Of particular interest was a flexible, oiled cotton tube, a recent development to withstand high temperature.

MICA INSULATOR MEN LOOK FOR BRIGHT FUTURE

The convention was marked with great enthusiasm throughout and the consensus of opinion was that the future outlook for the mica insulation industry was very bright.

New Building Started in New York for Dodge Manufacturing Company

The Dodge Manufacturing Company, Mishawaka, Ind., the sales organization of which is the Dodge Sales & Engineering Company, has virtually completed excavation for its new $1,000,000 building in New York City. This will occupy 165 ft. on West Broadway, 50 ft. on Murray Street and 75 ft. on Park Place. It is laid out for twelve stories at this time but foundations and construction will be sufficient to take care of an additional four stories. Further building plans are being completed as rapidly as possible.

The basement and part of the first three floors will be used by the Dodge Sales & Engineering Company for warehouse and for "Dodge service," both domestic and export, while the remainder of the building will be leased. Occupancy is expected by May 1, 1922.

The company finds an increasing number of inquiries for machinery and engineering service, and at the same time it is closing more of these inquiries than it has been doing in the past few months. This is particularly true in the New York and New England territories and in Canada.

Receiver Appointed for National Conduit and Cable

Judge Knox in the United States District Court on July 15 appointed Clarence G. Galston receiver in equity of the National Conduit & Cable Company, Hastings-on-Hudson, N. Y. Suit was brought by a large holder of stocks and bonds of the company after several months of endeavor to straighten out the company's affairs.

Since the early months of this year a committee of the stockholders, a committee of the bondholders and a committee of the company have tried to work out a financing plan but the support of a majority of the stockholders could not be received and the receivership became necessary.

J. R. Crawford, general sales manager of the Union Carbide Sales Company, New York City, has been appointed general sales manager of the National Carbon Company, Inc., Cleveland, succeeding N. C. Catabish, who takes up other duties with the company.

American Di-Electrics, Ltd., announces change in address of E. A. Thornwell, its Atlanta, Ga., distributer to Candler Building.

The Clary-Cummings Battery Company, Columbus, S. C., manufacturer of storage batteries, contemplates increasing its capital stock from $10,000 to $20,000. The company would like to receive catalogs from manufacturers of battery boxes, plates, lead parts, separators, rubber jars and lead-coated bronze terminals, etc.

Foreign Trade Notes

FRENCH POWER PLANT BUDGET EXPENDITURES.—In the French budget of 1921, recently published in the *Journal Officiel*, the amount of 7,473,450 francs is apportioned for power plants.

HYDRO ELECTRIC DEVELOPMENT IN SWITZERLAND.—According to a report of a special survey by the Swiss Bureau of Hydrography recently published the total available water power of the country is estimated at 2,173,238 hp., or an average of about 52.62 hp. for each square kilometer of Swiss territory. The report further shows that about 25 per cent of the available water power of the country is already being utilized, there being installations of 6,860 plants, having 3,170 turbines and 4,903 wheels, developing 526,098 hp. Of the 526,000 hp. already developed more than 50 per cent (312,000 hp.) is utilized by electric power plants, followed by the chemical industry, utilizing 112,000 hp. The federal state, the several cantons and various communes control about 400 plants.

ITALIAN CONCERN TAKEN OVER BY THE GENERAL ELECTRIC COMPANY.—According to *Il Messagero* the electrical manufacturing firm of Società Electrotecnica Galileo Ferraris of Milan, Italy, has been taken over by an American for the General Electric Company. Before the war the Galileo Ferraris concern was known as the Thomson-Houston Company.

GERMAN ENGINEERS TO DISCONTINUE USE OF SUBSTITUTE METALS.—According to the *Electrical Review*, London, the Union of German Electrical Engineers (V.D.E.) has decided to discontinue as from Oct. 1 the use of substitute metals (iron, zinc, etc.) because they are unprofitable. The government, however, is considering a scheme for maintaining such substitutes, particularly aluminum.

GERMAN INTEREST IN SPANISH ELECTRICAL COMPANY.—At a recent meeting of the Compania Hispano-Americana de Electricidad, Madrid, Spain, says the *Electrical Review*, London, they have elected to the board of directors four Germans who are prominent in banking and electrical manufacturing companies. This action is interesting in view of the fact that last summer the South American operation of the German Transmarine Electricity Company, Berlin, was transferred to the Compania Hispano-Americana de Electricidad. It would seem from this that a continuation of German influence in central station and traction operations in South America was being effected.

A. E. G. ENDEAVORING TO RECOVER GERMAN EXPORT MARKET.—Before the war the A. E. G. exported 40 per cent of its total production and it is the company's determination to recover, if possible, this lost export business. It has been proposed to re-establish the export organization; a lot of this has been maintained in America and the East, but everything has been destroyed in the allied countries. Having regard to the situation of gold currency, Dr. Rathenau observed that it certainly sounded absurd to build up the export organization in mark currency. This absurdity, however, did not actually exist as the question substantially concerned the possibility of supplying goods made in Germany to other countries on credit. As to the siutation of business, Dr. Ratheneau said the company's orders on hand were satisfactory in number but were not so uniform as in former years. Large machines were in great demand at present and the orders for them would insure work for a long time to come.

GOOD REPORTS OF BRITISH ELECTRICAL MANUFACTURERS.—The reports of several electrical manufacturing companies for 1920, recently issued, according to the *Electrician*, have shown very good results considering the adverse conditions prevailing. In all cases there is an increase in the gross and net profits, the dividends are either maintained at the old rate or increased. The Brush Electrical Engineering Company in its report shows a net profit of £191,096, against £148,685, and is again paying 15 per cent on an increased capital, besides devoting the usual sum to pay off the 6 per cent second prior lien debentures, adding £53,377 to the general reserve and increasing the balance forward from £85,568 to £143,268. The Metropolitan-Vickers Electrical Company reports an increase of £81,555 in the gross profit and of £83,231 in the net profit. After devoting £100,000 to reserve, £35,000 to special depreciation and increasing the carry-over, the directors are able to raise the dividend on the ordinary shares from 8 to 12½ per cent. The orders received during 1920 were in value about 80 per cent greater than those in 1919, while the orders completed were in value about 50 per cent greater. Johnson & Phillips also announce an increase in profits from £90,000 to £98,400, and the ordinary dividend is maintained at 12½ per cent, but on a larger capital.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

A merchant in Italy (No. 35,179) desires to secure an agency for the sale of electrical appliances, etc., for industrial purposes.

A commission merchant from Japan (No. 35,189) who is in the United States, desires to purchase an ice plant ammonia compressor, ice plant motor, vacuum cleaners, railway supplies and equipment, etc.

POSSIBLE DEMAND FOR ELECTRIC SUPPLIES IN PALESTINE.—In a recent report on trade matters in Damascus, Palestine, it is stated that among electric goods most likely to find a sale in Damascus would be electric light fittings and shades.

ELECTRIC LIGHTING SYSTEM FOR MOULMEIN, BOMBAY. — Proposals are asked by the Municipal Committee of Moulmein for the installation of an electric lighting system in the town.

TENDERS ASKED FOR PORCELAIN INSULATORS.—Tenders will be received by the New Zealand Public Works Department, Government Buildings, Wellington, New Zealand, until Aug. 9 for suspension type porcelain insulators to carry 110,000-volt 50-cycle transmission lines in connection with the Waikato electric power scheme. Specifications may be seen at the Department of Overseas Trade, 35 Old Queen Street (Room 59) Westminster, S. W., 1, London.

ELECTRIC PLANT FOR BULAWAYO, RHODESIA, SOUTH AFRICA. — Tenders are invited by the municipality of Bulawayo, Rhodesia, South Africa, for material and equipment for an electric light and power plant, including two sets of gas producing plants, gas engines, three-phase generators (300 kw.); alternative steam plant, main switchboard, switchgear, distribution houses and transformer houses, insulators, hard-drawn bare copper wire, three-core cable, insulated cable, etc. Specifications and form of tender may be obtained on payment of deposit of £3 3s., from Davis & Soper, Ltd., 54 St. Mary Ave., London, E. C., 3, who will receive tenders until Aug. 3.

New Apparatus and Publications

ELECTRIC WATER HEATING. — The Electric Boiler Corporation, 475 Main Street, Cambridge 39, Mass., manufacturer of the "Electric Boilerette," has issued data sheet No. 6, containing information on electric water heating.

EXPANSION JOINT. — The Griscom-Russell Company, 90 West Street, New York City, has recently placed on the market its low-pressure expansion joint known as the G-R type "C."

RADIO RECEIVER. — "Aeriola Jr." is the title of a leaflet issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., describing its new radio receiver unit.

EXCAVATOR CRANE.—Bulletin 6-X describes the Pawling & Harnischfeger Company, Milwaukee, newly developed No. 206 excavator-crane which can be used in coal and ash handling and with a lifting magnet.

STORAGE BATTERY TESTER.—The "Startometer" has been developed by the Shire Electrical Products Company, Marquette Building, Detroit, for measuring storage-battery output under load. A folder is issued on this instrument.

BELT CONVEYORS. — The Link-Belt Company, 910 South Michigan Avenue, Chicago, has issued a new book, No. 215, on belt conveyors in which it describes the "Uniroll" and "Multiroll" idlers. The company has also issued a new steel chain data book, No. 475.

REFRIGERATION.—The Automatic Refrigeration Company, Hartford Conn., has issued a booklet entitled "Automatic Refrigeration" in which it describes its different methods of automatic refrigeration.

WATER-COOLING APPARATUS.—The Binks Spray Equipment Company, 3114 Carroll Avenue, Chicago is distributing a small circular describing its "Spra-Rite" cooling pond equipment for steam and ammonia condensers.

BALANCE COILS AND AUTO TRANSFORMERS.—The Sorgel Electric Company, 138 West Street, Milwaukee, is distributing a bulletin describing its air-cooled balancing coils and auto transformers.

ELECTRIC LIFT TRUCK.—Bulletin No. 5, issued by the Cowan Truck Company, Holyoke, Mass., describes the "Cowan" electric self-loading truck which it has recently placed on the market.

ASH HANDLING EQUIPMENT.—Conveyors Corporation of America, 326 West Madison Street Chicago, has issued a booklet "Proof of the Pudding" containing letters from users of its ash handling equipment.

HOUSEHOLD UTILITY MOTOR.—Reynolds Electric Company, 2650 West Congress Street, Chicago, has developed an improved "Reco" household utility motor for kitchen work. A circular has been issued on this.

BATTERY IGNITION. — The American Bosch Magneto Corporation, Springfield, Mass., has developed a new compensating battery ignition system described in its July *Bosch News*.

DRILL STAND.—The Independent Pneumatic Tool Company, Chicago, has put on the market the "Thor" electric drill stand for converting portable electric drills to drill presses.

New Incorporations

THE CLARION DISTRICT HYDRO-ELECTRIC COMPANY, Wilmington, Del., has been chartered under the laws of the State of Delaware with a capital of $2,000,000 to generate and distribute electricity. The incorporators are M. M. Lucey, V. P. Lacey and L. S. Dorsey.

THE LANE SIGNAL ACCESSORIES, Sayre, Pa., has been incorporated under the laws of the State of Delaware by William H. Lane, Harry S. Fish and Raymond L. Gebhardt, Sayre, Pa. The company is capitalized at $500,000. and proposes to manufacture electrical equipment and signal devices.

THE MARQUETTE ELECTRIC COMPANY, 222 West Austin Avenue, Chicago, Ill., has been incorporated by Harold B. Harvey, Harry I. Kirk and Samuel Hohman. The company is capitalized at $200,000, and proposes to manufacture electrical appliances, etc.

THE M. & M. ELECTRIC COMPANY, Louisville, Ky., has been incorporated with a capital of $15,000 by John McG. Miller, Joseph Muir and A. M. Marrett, all of Louisville.

THE GRAYWYN, INC., 220 North Holiday Street, Baltimore, Md., has been incorporated by Jack Albert, Lee Silver and Joseph Silverman. The company is capitalized at $10,000 to manufacture and deal in electrical equipment and appliances.

THE DISTRIBUTORS ELECTRIC COMPANY, Canistee, N. Y., has been incorporated by J. N. Anderson, H. and T. C Cobb. The company is capitalized at $20,000, and proposes to manufacture electrical equipment.

THE CON-DEN-RIT RADIANT LOG COMPANY, Elizabeth, N. J., has been incorporated with a capital of $100,000 to manufacture electric heating and lighting equipment. The incorporators are James P. Conroy, Orange, Charles C. Denton and Albert F. Reithemeyer, Elizabeth.

THE W. E. GROFF COMPANY, Easton, Pa., has filed notice of organization to manufacture and deal in electrical products. The incorporators are W. E. Groff, John Stead and Harvey Herstein. The company is capitalized at $25,000.

THE AUBURN-WOODBURN ELECTRIC COMPANY, Auburn Ky., has been organized with a capital of $30,000 by J. Guthrie Coke, R. L. Stevenson and R. W. Wilson. The company will purchase electricity from the Kentucky Public Service Company, Bowling Green.

THE CONTINENTAL ELECTRIC COMPANY, LTD., has been formed to manufacture and sell Royal electric cleaners in Canada. The new organization has its headquarters at 507-511 King Street East, Toronto, Ontario.

THE HYDRO APPLIANCES, LTD., recently incorporated with a capital stock of $200,000, has purchased the former plant of the Dominion Canners, Ltd., Port Robinson, Ontario, which it will equip for the manufacture of an electric washer and ironing machine and other electrical appliances.

THE AMERICAN GENERATOR COMPANY, Poseyville Ind., has been incorporated by E. D. Fletchall, O. E. Caudell and Valentine Bender, Poseyville. The company is capitalized at $100,000 and proposes to manufacture electric equipment for lighting, heating and cooking.

THE ABOTT ELECTRIC & SUPPLY COMPANY, Buffalo N. Y., has been incorporated with a capital of $10,000 to manufacture electrical appliances and to engage in electrical contracting. William F. Burket, 61 Englewood Avenue, is interested in the company.

THE ELECTRICAL SPECIALTY MANUFACTURING COMPANY, 51 Beaufort Street Providence, R. I., has been organized to manufacture electrical equipment. W. B. and L. J. Hopkins are interested in it.

THE IDEAL ELECTRIC DUMBWAITER COMPANY, Buffalo, N. Y., has been incorporated with a capital of $50,000 to manufacture electrically-operated dumbwaiters and other lift equipment. The incorporators are G. A. Irwin, J. D. Hillery and J. A. Wechter. The company is represented by Sullivan, Bagley & Wechter, Chamber of Commerce Building.

THE ECONOMY ELECTRICAL MANUFACTURING COMPANY, New Haven, Conn., has been incorporated by A. I. Lapides, S. D. Pardoll and S. Jacobson, 1 Lawrence Street. The company is capitalized at $25,000 and proposes to manufacture electrical equipment.

Record of Electrical Patents

Notes on United States Patents

(Issued July 5, 1921)

1,383,750. ALTERNATING-CURRENT SIGNALING SYSTEM; Ralzemond D. Parker and Baxter P. Hamilton, Brooklyn, N. Y. App. filed June 26, 1918. Same circuit for several messages.

1,383,756. AUTOMATIC SWITCHING APPARATUS FOR TELEPHONE EXCHANGE SYSTEMS; John N. Reynolds, Greenwich, Conn. App. filed Aug. 1, 1917. Two electromagnets used in operation.

1,383,764. SOCKET FOR ELECTRIC-LIGHT GLOBES; John A. Sargent, Normanby, Taranaki, New Zealand. App. filed June 13, 1919. No spring contacts.

1,383,789. TELEPHONE EXCHANGE SYSTEM; Roy D. Conway, Chatham, N. J. App. filed Aug. 24, 1918. Manual connected to automatic exchange.

1,383,796. TROLLEY HARP EXTENSION; Walter F. Freeman, Springfield, Mass. App. filed March 5, 1921. Cushion support for wheel.

1,383,797. TROLLEY SHOE; Walter F. Freeman, Springfield, Mass. App. filed April 15, 1921. Scraper for removing snow.

1,383,799. ELECTRICAL REGULATING DEVICE; Edgar W. Gent, New York, N. Y. App. filed May 1, 1920. Rheostats, etc.

1,383,802. SIGNALING DEVICE; Charles L. Goodrum, New York, N. Y. App. filed May 14, 1917. Machine switching telephone.

1,383,804. TELEPHONE EXCHANGE SYSTEM; John A. Hall, Bayside, N. Y. App. filed Nov. 19, 1918. Substation apparatus.

1,383,805. PARTY-LINE METERING SYSTEM TELEPHONE EXCHANGES; John A. Hall, Bayside, N. Y. App. filed Nov. 19, 1919. For party lines.

1,383,807. POWER MODULATION FOR RADIO-TRANSMISSION; Raymond A. Heising, East Orange, N. J. App. filed Sept. 21, 1915. High-frequency.

1,383,845. STORAGE-BATTERY CONNECTOR; William H. Palmer, Jr., Wyncote, Pa. App. filed March 28, 1917. For automobiles.

1,383,879. OUTLET BOX; George C. Thomas, Jr., Elizabeth, N. J. App. filed Nov. 21, 1919. Wall of outlet utilized as seating surface.

1,383,949. ELECTRIC STOVE; John A. Howard, Sr., West New Brighton, N. Y. App. filed July 3, 1920. Percolator.

1,384,014. METHOD AND APPARATUS FOR SIGNALING AND OTHERWISE UTILIZING RADIANT IMPULSES; Reginald A. Fessenden, Brookline, Mass. App. filed Jan. 14, 1918. Submarine detector and signal.

1,384,017. ELECTRIC LANTERN; John Haack, Portland, Ore. App. filed May 10, 1920. Electric cell easily accessible.

1,384,028. FUSE PLUG; Ernest H. Baxter, Chicago, Ill. App. filed Aug. 5, 1916. Refillable.

(Issued July 12, 1921)

1,384,067. WEATHERPROOF ELECTRIC HEATER; Lee P. Hynes, Albany, N. Y. App. filed May 8, 1920. High heat without deterioration.

1,384,101. SERVICE-BRACKET FOR TELEPHONE-RECEIVERS; Sidney C. Sladden, New York, N. Y. App. filed July 31, 1919. Holds receiver to ear.

1,384,108. MEANS FOR GENERATING ELECTRICAL OSCILLATIONS; Roy A. Weagant, Roselle Park, N. J. App. filed April 9, 1914. By gaseous conducting medium.

1,384,143. X-RAY APPARATUS; William Meyer, Chicago, Ill. App. filed May 29, 1918. Improved transmission tower.

1,384,144. X-RAY APPARATUS; William Meyer, Chicago, Ill. App. filed May 31, 1918. Improved generator cabinet.

1,384,177. MAGNETIC PULLEY; John P. Bethke, Milwaukee, Wis. App. filed Aug. 23, 1918. Air cooled.

1,384,182. ROOM-CALLING SYSTEM FOR HOTELS; Oreste Conti, Viareggio, Italy. App. filed Jan. 20, 1920. Automatic call system.

1,384,214. INSULATOR; Richard Sands, Osawatomie, Kan. App. filed Sept. 18, 1919. No tie wires needed.

1,384,256. MOTOR; Annie L. Harrell, Seattle, Wash. App. filed June 7, 1920. For small appliances.

1,384,295. ELECTRIC REPRODUCER FOR PHONOGRAPHS; Henri Armagnat and Pierre Frely, Paris, France. App. filed May 19, 1919.

1,384,352. ELECTRIC WINDING DEVICE; Fritz Sauter, Basel, Switzerland. App. filed Dec. 13, 1919. For clockworks.

1,384,396. TELEGRAPH SYSTEM; Benjamin F. Merritt, East Orange, N. J. App. filed Oct. 10, 1917. Multiple distribution of messages.

1,384,398. SIGNALING SYSTEM; Louis A. Mortimer, New York, N. Y. App. filed July 12, 1917. Non-interfering.

1,384,418. TROLLEY; Christian Aalborg, Wilkinsburg, Pa. App. filed April 18, 1917. Contact pressure may be materially changed.

1,384,439. ELECTRODE HOLDER FOR ARC WELDING; Otto H. Eschholz, Wilkinsburg, Pa. App. filed Nov. 24, 1919. For overhead welding.

1,384,458. ADJUSTABLE TROLLEY-WHEEL FORK; David M. Fowler, Terre Haute, Ind. App. filed Aug. 28, 1920. Will automatically hold wheel on wire.

1,384,464. DRIVING AND CONTROLLING MECHANISM FOR POWER-OPERATED MACHINES; Martin Hemler, Elizabeth, N. J. App. filed May 28, 1918. For sewing machines, etc.

1,384,467. BANDAGE; John G. Homan, Steubenville, Ohio. App. filed Jan. 27, 1920. Electrically heated.

1,384,479. TIME-CONTROLLED ADVERTISING DEVICE; Thomas J. Mosure, Niles, Ohio. App. filed Nov. 29, 1919. Projects pictures on screen in rotation.

1,384,491. CONNECTOR; Karl A. Simmon, Edgewood Park, Pa. App. filed June 13, 1917. Train-line connectors.

1,384,495. SYSTEM OF CONTROL; Norman W. Storer, Pittsburgh, Pa. App. filed Oct. 17, 1918. Electric railway motors.

1,384,499. METHOD OF AND APPARATUS FOR REFINING METALS; Samuel A. Tucker, New York, N. Y. App. filed May 7, 1920. Electrolytic.

1,384,504. CHANGE-SPEED GEAR; Gillis von Zweigbergk, St. Annes on Sea, England. App. filed July 23, 1918. Electric control.

1,384,523. WIRELESS SIGNALING APPARATUS; Athelstan A. Hall, London, England. App. filed Nov. 1, 1919. Without usual aerials.

1,384,579. AUTOMATIC TRANSMISSION-CONTROLLING MEANS; John T. Toomey, New York, N. Y. App. filed Oct. 16, 1917. Telephone repeater circuits.

1,384,587. MANUFACTURE OF COMPOSITION CORES; Harry T. Bellamy, Oak Park, Ill. App. filed Sept. 29, 1919. For electrical windings.

1,384,636. FLASHLIGHT; Arthur C. Sachse, Detroit, Mich. App. filed Sept. 2, 1920. No battery.

1,384,658. OCCULTING LIGHT; Henri L. M. J. Benard, Paris, France. App. filed April 3, 1919. Long-distance luminous signals.

1,384,660. ELECTRIC HEATING PLATE; Michael Gorritzen, Stavanger, Norway. App. filed Nov. 10, 1920. Separate plates which may be heated independently.

1,384,683. PROCESS FOR AMALGAMATING METALS; Ransom H. Stevens, Los Angeles, Cal. App. filed Aug. 29, 1918.

1,384,716. ELECTRIC THERAPEUTIC APPARATUS; Louis F. Bogia, Philadelphia, Pa. App. filed July 15, 1920. To generate ozone.

1,384,719. ELECTRIC WATER HEATER; Clarence C. Herbert, Lincoln, Neb. App. filed Aug. 8, 1919. To heat water in any vessel.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

LYNN, MASS.—Steps have been taken in West Lynn to raise the sum of $6,000 to secure an ornamental lighting system from Market Square to McDonough Square. T. A. Garafano, City Councilor, is member of the committee in charge.

MILFORD, MASS. — The residents on Cedar Street have petitioned the Selectmen to have the electric light service extended to their part of the town. The Milford Electric Light & Power Company supplies electric service in Milford.

NEW BEDFORD, MASS. — The City Council has authorized changing the lighting system in Russell Street to be connected with the underground conduits which are being laid in Russell Street from Achushnet Avenue to County Street. This is part of the mile-a-year underground work that the New Bedford Gas & Edison Light Company is doing.

ANSONIA, CONN.—Bids have been received by the Ansonia O. & C. Company, it is reported, for the construction of a two-story addition to its plant, 75 ft. x 250 ft., to cost about $125,000. The plans provide for a power house.

Middle Atlantic States

ALBANY, N. Y. — Bids have been received for the installation of eight electrically operated pumps in the city filtration plant.

BUFFALO, N. Y.—A hearing will be held by the State Water Power Commission in Albany, July 27, regarding the joint applications of the lower Niagara River Power & Development Company, the Niagara Gorge Power Company and the Niagara Gorge Railroad Company for development projects on the lower Niagara River. The Federal Power Commission has already approved the plan to divert water for power development in the lower river between the cantilever bridge and Devil's Hole.

GREENPORT, N. Y.—At a special election held recently the proposition to issue

$34,000 in bonds for improvements to the electric light plant was defeated for the second time.

MIDDLETOWN, N. Y.—Bids will be received by the State Hospital Commission, Capitol, Albany, until Aug. 3, for construction, heating, sanitary and electric work, additional accommodations for chronic patients (east group), etc., at the Middletown State Homeopathic Hospital, Middletown. Drawings, specifications and blank forms of proposals may be consulted at the Middletown Hospital at the New York office of the Department of Architecture, Room 618, Hall of Records Building and at the department of Architecture, Capitol, Albany.

NORTH GREECE, N. Y.—Work has been started on the extension of the power lines of the Rochester Gas & Electric Corporation through North Greece, a distance of 6 miles.

PHELPS, N. Y.—Extensions of the electric and gas service to residents of Clifton and Mary Streets is under consideration. The Empire Gas & Electric Company supplies electric service in Phelps.

VENICE, N. Y.—The Poplar Ridge Lighting Company has applied to the Public Service Commission for permission to construct an electric light plant in the town of Venice.

WYNANTSKILL, N. Y. — The Town Board of North Greenbush has entered into contract with the Wynantskill Hydro-Electric Company for the installation of an electric street-lighting system in Wynantskill. The plans provide for lamps along the main street from the Albia Station to the Pawling Sanatorium, and also on the streets in the "hill section" of the village.

GLOUCESTER, N. J.—Bids will be received by the Council of Gloucester, N. J., until Aug. 4, for improvements to the municipal water supply system. The project includes the following items: Contract 1—Construction of a 30 ft dia. x 125 ft. high steel standpipe. Contract 2—Pumping station, exclusive of equipment, and concrete settling basin, Section "A"; standpipe foundation, Section "B." Contract 3—Mechanical and electrical equipment, consisting of six motor-driven centrifugal pumps, switchboard, electric wiring and auxiliaries, Section "A"; furnishing and erecting all inside and outside station piping, Section "B"; Venturi meter, Section "C." Contract 4—one 150-kw. oil engine driven generating set. Contract 5—Two or more artesian wells. Plans and specifications are on file and may be seen at City Hall, Gloucester and at the office of Remington & Vosbury, engineers, 601 Market Street, Camden, N. J.

PHILADELPHIA, PA.—The Logan Baking Company contemplates the construction of a new three-story and basement plant, 50 ft. x 125 ft. The plans include a one-story power plant. T. Frank Miller, 1012 Walnut Street, is architect.

YORK, PA.—Eleven electric companies including the Glen Rock Light, Heat & Power Company, Hopewell Township Light, Heat & Power Company, New Salem Light & Power Company, North Codorus Light & Power Company, Seven Valleys Light & Power Company, Codorus Township Light & Power Company, Shrewsbury Light & Power Company Springfield Township Light & Power Company, Loganville Light & Power Company and the Jefferson Light & Power Company have applied to the Public Service Commission for permission to consolidate under the name of the Glen Rock Light, Heat & Power Company.

DOVER, DEL.—Bonds to the amount of $30,000 have been sold, the proceeds to be used for improvements to the municipal electric light and water plant.

CAMBRIDGE, MD. — The plant of the Cambridge Ice Company and the power plant and pumping house of the Dorchester Water Company, it is reported, were recently destroyed by fire. The loss is estimated at about $70,000.

SOUTH HILL, VA.—The town has authorized the issue of $150,000 in electric light, water and sewer bonds.

North Central States

DETROIT, MICH. — Contract has been awarded to the Hazleton-Clark Company for the construction of a brick and steel power house to be built at Clark and Wabash Avenues for the Timken-Detroit Axle Company.

ECORSE, MICH. — The Hinkley Motors Corporation, 3240 West Fort Boulevard, Detroit, is having plans prepared for the construction of a one-story factory and also [illegible] ft. x 84 ft. and a one-story power house, 52 ft. x 60 ft. on Cicotte Avenue, Ecorse. A. Kahn, 1000 Marquette Building, Detroit is architect.

CLEVELAND, OHIO.—Bids, it is understood, are being received by H. C. Bishop & Company, architects, Guardian Building for the construction of a one-story power plant, 40 ft. x 75 ft. on Cedar Avenue, for Telling-Belle-Vernon Company. The cost is estimated at $50,000.

CLEVELAND, OHIO.—The City Council has authorized the Cleveland Railway Company to construct and operate a single-track street railroad on St. Clair Avenue from Nottingham Road, the present terminus of the St. Clair Avenue line, to the present city limits west of East 200th Street.

MARIETTA, OHIO.—An election will be held in August to submit to the voters a proposal to issue $500,000 in bonds for the construction of a hydro-electric plant in Lowell. H. Gamper, New First National Building, Columbus, is engineer.

NEW PHILADELPHIA, OHIO. — The City Council has instructed City Engineer Arnold to prepare plans and estimates for the installation of three electrically operated pumps with a daily capacity of 750,000 gal. at the muncipal waterworks pumping station to replace steam pumps now in use.

MUNCIE, IND. — The City Council has directed the Electric Light Committee to make investigations regarding the extension of the ornamental lighting system southward on Walnut Street as far as Twelfth Street.

CHICAGO, ILL.—Plans have been prepared by C. H. Shepard, consulting engineer, for the installation of a lighting system in the Woodlawn district, to cost about $50,000. O. S. Turner, care of McKey & Poague, is chairman of the street-lighting committee, Woodlawn Business Men's Association.

FREEBURG, ILL.—The lowest bid submitted for rebuilding the municipal electric light plant was $37,000. As only $25,000 has been voted for the work the plans will have to be changed or additional bonds voted.

STERLING, ILL.—The City Council has authorized the installation of seventy-nine additional lamps in the business district of the city.

KIMBALLTON, IOWA. — The electric light plant has been sold to the town of Kimballton for $12,000, contingent upon the approval of the voters to issue $20,000 to purchase and improve the plant.

MILWAUKEE, WIS.—Preliminary plans are being prepared by E. Brielmaier & Sons engineer, 432 Broadway, for the construction of a power plant at Marquette University, 1115 Grand Avenue.

BRASHEAR, MO.—The city officials are considering the erection of a transmission line.

SIKESTON, MO. — The Missouri Public Utilities Company is considering rebuilding its local power plant recently destroyed by fire.

SPRINGFIELD, MO. — The Springfield Gas & Electric Company will install twenty-five additional incandescent street-lamps in the city.

JAMESTOWN, N. D.—The State Railroad Commissioners are considering the erection of a high-tension transmission line to supply electricity to towns near Jamestown on the main line and branches of the Northern Pacific Railroad and also on the Soo and the Great Northern and Midland Continental, and also to farmers in the vicinity.

ORLEANS, NEB.—The city of Orleans has authorized an issue of $50,000 in electric light bonds.

Southern States

DUNN CENTER, N. C.—The plant of the Farmers Elevator & Light Company was recently destroyed by fire. The town at present is without street-lighting service.

DURHAM, N. C. — Extensions to the lighting system on Chapel Hill and Mangum Streets are under consideration. Electrical energy is supplied by the Durham Traction Company.

ELK CITY, N. C.—The City has issued electric light bonds to the amount of $25,000.

COLUMBUS, GA.—The city officials are considering the installation of a lighting system on Triangle Street.

LEXINGTON, GA.—Work is under way on the installation of an electric lighting system in Lexington.

LAKE BUTLER, FLA.—The Council is considering the issue of $10,000 in electric light bonds.

BRISTOL, TENN.—The power plant of the Bristol Gas & Electric Company was recently damaged by fire causing a loss of about $10,000.

FORT PAYNE, ALA.—A contract has been entered into between the Fort Payne Water Company and the Fort Wayne Light & Power Company, whereby the latter company is to operate the pumping machinery of the water company by electricity.

SANATORIUM, MISS.—The State Bond Improvement Commission, Jackson, Miss., will receive bids until Aug. 8 for the construction of a number of buildings at the Tuberculosis Sanatorium, including nurses' home, white infirmary, negro infirmary service building, recreation building, power house and laundry building. Plans and specification may be obtained on application to Bem Price, architect, Jefferson County Bank Building, Birmingham, Ala.

FAYETTEVILLE, ARK.—The plant of the West Fork Light & Power Company was recently destroyed by fire, and the citizens of West Fork and Winslow have appealed to the Fayetteville Gas & Electric Company to erect a transmission line to furnish electricity from the local plant to these two cities.

ALEXANDRIA, LA. — Bids will be received at the office of the supervising architect Treasury Department, Washington, D. C., until July 29 for furnishing wiring material in the United States public building at Alexandria, La.

SAND SPRINGS, OKLA.—H. S. Shaner contemplates the construction of a hydro-electric plant for what is to be known as the Missouri Interurban Railroad and which will cover a distance of 200 miles. The cost is estimated at $4,000,000.

TAFT, TEX.—Plans have been completed by the Taft Packing Company for the construction of a two-story fertilizer plant, 65 ft. x 115 ft. and a power house. H. S. Green, 415 Euclid Avenue, San Antonio, is architect.

Pacific and Mountain States

KELSO, WASH.—The Lewis River Hydro-Electric Power Company of Vancouver has filed application covering four power projects on the North Fork of the Lewis River above Kerns, Cowlitz County.

PORTLAND, ORE.—The Alaskan-American Paper Corporation of New York, it is reported, has applied for power rights on Orchard Lake, and plans to erect pulp and paper mills there.

PORTLAND ORE.—The Portland Railway, Light & Power Company has filed application with the state engineer for the storage of 100,000 acre-ft. of water from the Clackamas River and 600 sec.-ft. from the same stream. It is proposed to store the water in a large reservoir and divert it by means of two canals into the Oak Fork of the Clackamas River and develop approximately 58,600 hp. The cost of the project is estimated at about $3,000,000.

FRESNO, CAL.—The San Joaquin Light & Power Corporation has been granted a permit by the Federal Power Commission to construct a diversion dam and tunnel 8 miles to the proposed King River power house, diversion dam in Roaring River and tunnel 2½ miles to power house, and a diversion dam in Rubbs Creek.

SANTA BARBARA, CAL.—The installation of ornamental lamp standards on East Carillo Street between Stata and Anacapa Streets is under consideration.

TAFT, CAL.—The installation of an ornamental lighting system in Taft is under consideration. E. M. Lynch, Los Angeles, is engineer.

BROADUS, MONT.—The city officials are considering the installation of an electric lighting plant in Broadus.

Canada

BAGOTVILLE, QUE. — The Municipal Council is considering the construction of a hydro-electric plant to cost about $30,000. L. P. Chayer is secretary.

Electrical World

New York, Saturday, July 30, 1921

This Public That We Talk About—Another View

ONE of the most troublesome words in the dictionary at the present time is the little word public. We use it in our business, but we fail literally to interpret it—most of us do—and so it keeps continually developing misunderstanding and distress.

The word public really means *all the people,* but the average man doesn't think of it that way. "Public" to him means *the rest of the people* but not himself. Therefore, he looks upon and thinks about the public as *other* people. Yet he inconsistently expects these other people to think his kind of thoughts, to talk his language and to do his way. And when they act some other way—as, of course, at times they do and always will—he is surprised and hurt. He is discouraged. But the trouble really is that he has never looked to see what kind of people this public is composed of.

In the United States today — to take one aspect of it—there are 23,050,446 men, women and children, making up more than one-fifth of our great public, who think, talk and reason in another tongue. Why, in the city of New York alone, where one-twentieth of our entire population lives, there are no less than forty-eight foreign language newspapers. There are four Arabian, four Czechoslovak, one French, three German, two Greek, two Hungarian, five Italian, five Jewish, four Jugoslavic, one Lithuanian, one Spanish, one Ukranian, three Polish and three Russian dailies and two Chinese, one Danish, one Japanese, one Norwegian, one Swedish, one Rumanian, and two Finnish weeklies. The man who thinks of the New York public, therefore, must have in his mind not only the varying characters, the changing moods, the diverse interests and purposes of all the people—rich, poor, educated, ignorant, good and bad—that at least speak our own language. He must think, too, of these other men and women whose whole background is unknown to him.

"New York is different," of course, but in this it is typical. For the public is ever the same, an infinitely varied mass of human people each with his own ideas, his own desires, his own limited experience, his own aims and his own manner of both thinking and believing. No utility man, no business man of any kind, therefore, can expect this public to measure rightly and sympathetically his own ideas and purposes, unless he makes them clear enough before the world for every kind of folk to see and understand.

Harris Joseph Ryan

A pioneer in electrical engineering, an educator and a scientist whose researches in high-tension insulation have been one of the contributing factors to the attainment of commercial 220,000-volt power transmission

THE pioneer spirit in science as elsewhere is born of that type of mind to which all attainment is but a challenge to further exploration. Never was this more true than of Prof. H. J. Ryan, setter of many landmarks in electrical history since 1888. The latest of these achievements is his research contributions to the solution of the insulator problem for 220,000-volt transmission. Much of Professor Ryan's early research was the direct result of the demands made on him by teaching. He has been in university work since 1889. He labored always to give his students the material with which to go further and to solve the inevitable problems that arose in those early days of electrical study. The year 1889, when he presented a paper on transformers before the American Institute of Electrical Engineers, marked a dramatic turning point in his career. This work started a new era in electrical design, and Professor Ryan was acclaimed with an enthusiasm that lifted him into the limelight of international fame. The paper was widely translated and reprinted, being reproduced even in Russia.

Only a few years later some experiments conducted in the Rocky Mountains resulted in an announcement by transmission engineers that 40,000 volts was the limit for transmission and that it was useless to endeavor to go beyond it. Doubting the truth of this, Professor Ryan definitely set himself to study higher voltages. For years his studies continued both in America and England, and they resulted in another Institute paper. This paper, "The Conductivity of the Atmosphere at High Voltages," presented in 1904, established the laws of corona formation and definitely removed the 40,000-volt limit.

Previous to this Professor Ryan had made another important contribution to electrical progress in his studies of direct-current machines, which led to the development of pole-face windings and commutating poles; but since 1904 he has concentrated his attention on high-voltage transmission problems. Other papers of special note relate to the insulating qualities of air and transformer oil, the use of the cathode-ray power cyclograph for studying high-voltage phenomena, the cathode-ray alternating-current indicator, electrical characteristics of the suspension insulator, sphere-gap discharges at high frequencies, electrical porcelain, the distribution of electrical stresses in transmission-line insulators, and co-authorship of a textbook on electrical machinery. During the war Professor Ryan co-operated with the National Research Council and was made director of the Pasadena (Cal.) supersonics laboratory in developing anti-submarine equipment. Further biographical details are on page 239.

Professor Ryan is universally esteemed alike by his acquaintances and his students. His teaching and his research work have always gone hand in hand, and it is difficult to say which has borne the greater fruit.

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The Friend-Winning Power of Thoughtful Service—An Example

FRIENDS can be made in many ways by any central-station company that is willing to take the profitable trouble. Good service makes friends. Good manners make friends. A good spirit of community interest and responsibility, properly expressed, makes friends. But there are other ways, more seldom thought of, less expected, and therefore more heartily appreciated and approved. An Iowa central-station company—to instance a case in point—has just installed a wireless receiving apparatus on its own building. One of its engineers has learned to operate it. And now each day this company receives by wireless the daily market quotations and market news letter which are sent out by radio from the Department of Agriculture in Washington. This information is then posted in abstract on the window of the company's salesroom. Fully typewritten, it is also placed on a file available to any one who calls. The necessary blanks are supplied without charge by the Bureau of Markets. It is a little gratuitous service that is extremely popular, for this company serves a very active farming section.

This thoughtfulness on the part of the electrical utility occasions little trouble, costs almost nothing and is worth a great deal. For it is a tangible evidence of friendliness that promotes good will and wins new friends.

The Billion-Dollar Output of 1919

THE Bureau of the Census has compiled a preliminary statement of the electrical manufacturing industry for 1919. It records an output valued at over $1,000,000,000, or a growth of approximately 183 per cent over 1914. This is an excellent showing, exceeding the percentage growth of all other large established industries of the same age with the exception of the iron and steel industry. Motors top the list in value, taking the place formerly occupied by insulated wires and cables. This is directly attributable to the wider electrification of industries during and after the war and to the decreasing price of copper wire and cable. Batteries, chiefly storage, come second, followed by generating apparatus and wire and cable. When one considers that there are more storage batteries used today in the automobile industry than in the electrical industry, the increasing value of storage batteries is explainable. Naturally industrial and household electrical devices show a phenomenal growth in the five-year period, increasing from $4,000,000 in 1914 to $55,000,000 in 1919. In the race for place the incandescent lamp also scores heavily, jumped from $17,000,000 in 1914 to $59,000,000 in 1919 and exceeding in value telegraph and telephone apparatus combined—which speaks well for the lamp industry. It is a matter of pride that the output of electrical apparatus and supplies increased in value over 322 per cent during the decade 1909-1919. During the same decade the output of electric light and power companies increased in value from approximately $200,000,000 to $773,650,000, or 286 per cent, indicating the lesser returns earned by regulated monopolies. Of course, the value of the product is no index of the quantity produced and it is certain, owing to higher prices, that the quantity of goods produced by electrical manufacturers did not increase in the same ratio. On the other hand, the percentage increase of output of the electric light and power industry exceeded the percentage increase of income.

The Mortality of Electrical Contractor-Dealers

THERE is a familiar biblical saying to the effect that "many are called but few are chosen." Its application is very broad and its fulfillment only too true. When gold was discovered in California there was a mad rush to the coveted region. Not all those who braved the dangers and suffered the privations of the "forty-niners" were rewarded, however, and many returned sadder but wiser men. The trouble was, not that gold did not exist in California, but that many who sought it were not properly equipped for the job or were unsuccessful in locating the precious nuggets. A similar fate has overtaken some electrical contractors who engaged in the sale of electrical appliances, and here again the fault is not that appliances are not being bought, but that the electrical contractor is not always a merchant. He may know all that is to be known about wiring and yet be blissfully ignorant of the first principles of merchandising. It is no shock, therefore, to learn that the mortality among contractor-dealers is growing. Every business has had a similar record, but we are not aware of any enterprising man who was deterred from engaging in business for that reason or of any industry that stopped on that account. Fitness is just as great a prerequisite as ever in business, and those who are unsuited for the task must in the nature of things drop out.

A Few Missing Electric Cooking Utensils

IN DISCUSSING from time to time the appliance field, already of great importance and likely to be of greater, we have hinted at some of the failures of existing appliances fully to meet the domestic situation. We are going here, in a spirit of co-operation, to mention a few appliances which are lacking or at least are not to be found easily in the open market. If any appliance manufacturer is actually making any of them but keeping his light hid under a bushel, it is up to him to remove the bushel and meet the wants of many consumers.

Certain utensils have been admirably developed and the experience of central-station-company men shows that these particular items are the ones most prominent in the demand for appliances—for instance, the flatiron, the coffee percolator, the toaster and the modest water heater for boiling eggs or furnishing shaving water. All these have been worked out to a point where they are in large demand and have thoroughly proved their usefulness and durability. It is perfectly easy, too, as everybody knows, to obtain, at a price, electric ranges which are pretty good imitations in appearance and functions of the coal and gas ranges of the last generation. A small general utility kettle, however, does not appear on the shelves of the ordinary appliance dealer—a kettle with a perfectly smooth interior which can be readily cleansed and so designed and covered as to utilize its electric heat efficiently. If there is such a thing, will the maker please explain why the ordinary user of central-station energy cannot immediately find it? Again, when will somebody put out a small double boiler for cooking cereals and the like, also perfectly smooth inside for ready cleaning and well heat-insulated? Such a device need not be inefficient and certainly would be convenient as a self-contained bit of cooking apparatus. Item 3: When will some maker put out a plate warmer of the portable variety that can keep a meal hot, taking not more than 50 watts to 100 watts at the outside? Item 4: When will somebody provide an electric fireless cooker that will brown a loaf as well as the ordinary gas-heated fireless cooker? The man who devised the soapstone slugs which store the equivalent of 0.5 kw.-hr. apiece converted the fireless cooker from a sort of imitation of the late Edward Atkinson's Aladdin oven into an exceedingly useful cooking appliance. All the electric fireless cookers which we have seen fail in the one particular of furnishing at need a little concentrated heat placed where it will do the most good.

These are some of the missing links in the evolution of a proper electric cooking system that will tend greatly to the convenience of the public and add thousands and thousands of kilowatt-hours to the central-station loads. If such appliances are to take the place which they deserve, they must be readily obtainable in the open market and reasonably cheap. Once furnished, they will meet a warm welcome from supply stations and their many consumers.

An Interconnection of Increasing Value

SUCCESSFUL interconnections must be built upon a solid economic and engineering foundation in order to increase in usefulness year by year. Without competent preliminary analysis of the possibilities it easily may be impossible for skillful operation to enable the investors in the lines and equipment to realize a profit. Certainly much credit for engineering foresight is due to those who conceived and developed the notable interconnection between the Tenney properties in the northern Boston suburban area, the broader scheme of which, with the results attained from four years' operation, is described elsewhere in this issue by F. C. Sargent. It is gratifying to learn that by this interconnection about 10,000 gross tons of coal is being saved annually and that, in addition to operating economies, the Malden and Revere companies have been spared extra plant investment exceeding $1,600,000 by the development of this efficient and extremely tangible central-station *entente cordiale*. Reserve capacity otherwise essential at individual stations has been lessened in ratio to peak loads; the tie-in has been extended to the Boston Edison system, which in turn is connected with the New England Power Company lines, and a fine co-ordination of production and distribution has been attained.

Load gravitates by economic law to the more efficient plants in interconnections, and so the tendency in this case is for the Salem station to become more and more important in the expansion of business in the district served by these Tenney properties. Nevertheless, the provision made for oil burning at the Malden and Revere stations adds to the flexibility of the tie-in, further safeguarding the service and reducing stand-by losses. At least one famous municipal plant in the district has succumbed to the more efficient supply secured through the tie line. The project has been handled from the start to enable sure returns to be made upon the outlay necessary, and there is every indication that this installation will furnish useful service for a long period. Considerable interest among central-station men exists as to plant economies under interconnection, and the results already attained at Salem and the immediate prospect of their betterment in terms of fuel consumption per kilowatt-hour when improvements now under way are completed are creating friendly rivalry in Massachusetts operating circles. A better example of a clean-cut, soundly planned and intelligently administered interconnection would be hard to cite.

Why Rush Inductive Interference Rules?

HASTY action in the adoption of construction rules seems to be gaining ground. Ohio is the latest to fall into line, with a law that originally called for the adoption of rules within sixty days from the date the law went into effect, but which was later changed to six months. So far as the matter of overhead crossings is affected the limit is not serious, but the inclusion of inductive interference is particularly unfortunate at this time. The rules must be in force long before the co-operative work between the National Electric Light Association and the American Telephone & Telegraph Company can possibly be fully developed, not to say completed. There will undoubtedly be a desire on the part of some interests to utilize the Calfornia rules as the basis for action in Ohio in the same manner that they have been used in other states. The effect will be still further to establish these rules by force of use rather than by merit and tend to prevent the consideration of the as yet untouched and important phases that must be studied before the real solution can be reached. Ohio cannot afford to adopt any but the simplest and most general rules on this subject at the present time. The National Electrical Safety Code can be used for the basis of the crossing rules without fear of establishing harmful precedents, but the same cannot be said of any body of rules that have yet been drawn to cover inductive interference.

So many moves in the state legislatures or commissions looking to the adoption of rules including inductive interference are occurring and so many cases are coming before public utility commissions in which the most vital points are being raised that the observer is inclined to wonder if there is not an undue and unwarranted effort being made to rush the adoption of rules in a large portion of the states before a full study of all angles of the question can be completed. It is to be hoped that this is not the case, but the fact that so much activity is occurring at an important time in the history of the co-operative study cannot be charged to the desire of the commissions for work to do. Most commissions at the present time are none too flush of funds and are not taking up work for which there is not an active demand from some quarter.

Semi-Automatic Operation Offers Opportunities for Small Hydro Plants

THE conversion of small hydro-electric generating stations to semi-automatic operation offers one of the most attractive savings in operating costs which can be made with this class of station. There is a distinct difference between semi-automatic and full-automatic operation, and the former as well as the latter may be again subdivided into local and remote control. A very satisfactory form of semi-automatic operation consists in remote control from a nearby plant. This greatly simplifies the installation and places the operation of the semi-automatic station more or less under the control of the operators in the distant station.

In the conversion of such a station the most logical approach to the problem is to determine exactly the operations which are performed by the operator and then duplicate these and improve on them by means of the mechanism installed. For example, in the article printed elsewhere in this issue describing the semi-automatic station of the Southern California Edison Company one requirement to be met was that of regulating the height of the water in the forebay. This function is performed in exactly the way it would be done manually, that is, the flow of the water through the station is increased a small amount at intervals, rather than by an attempt to pass through the entire range in one movement.

In general the stations whose conversion to semi-automatic operation is most feasible are those which are used mainly for the production of kilowatt-hours in a system in which such stations do not predominate in capacity and where therefore the complete shutting down of one or more units would not materially affect the total generating capacity of the entire system.

In order to make the conversion of these plants attractive the cost must be kept down to the very minimum. With ordinary diligence and ingenuity the entire cost of rebuilding a two-unit or three-unit small hydro-electric generating station should be easily less than the saving in the first year's operation. With four or five units the saving would not be proportionately so great as the number of operators would generally be the same as with fewer units and the cost of the installation greater.

One important factor must be kept in mind when considering such conversion. That is that the stations should operate as long and as continuously as possible until trouble occurs. Upon the occurrence of trouble the defective generator line or station is to be shut down and remain shut down until it can be started manually. This holds true because such troubles as are not taken care of by the automatic devices are of a nature which will require repairs and consequently the visits of maintenance men.

Measuring the Resistance of Transformer Grounds

AS A GENERAL rule an electric circuit requires to be either insulated or grounded. When it is insulated it ought to be well insulated, and when it is grounded it ought to be thoroughly grounded. An exception presents itself in the case of three-phase transmission systems with grounded neutrals, where it is sometimes desirable to ground through a definite resistance, but such an exception only tends to prove the rule. A particular case in point is that of low-tension three-wire alternating-current distribution systems which call for permanent neutral grounding in order to protect them against accidental crossing with the high-tension supply circuit. Such ground connections may occasionally become defective by accidental rupture or by corrosion. Regular inspection is therefore desirable. The imperfection in the ground connection is apt to develop at points which are relatively inaccessible or which are concealed from view. For this reason a periodical electric test of the resistance in the ground connection gives a convenient assurance that no derangement has taken place.

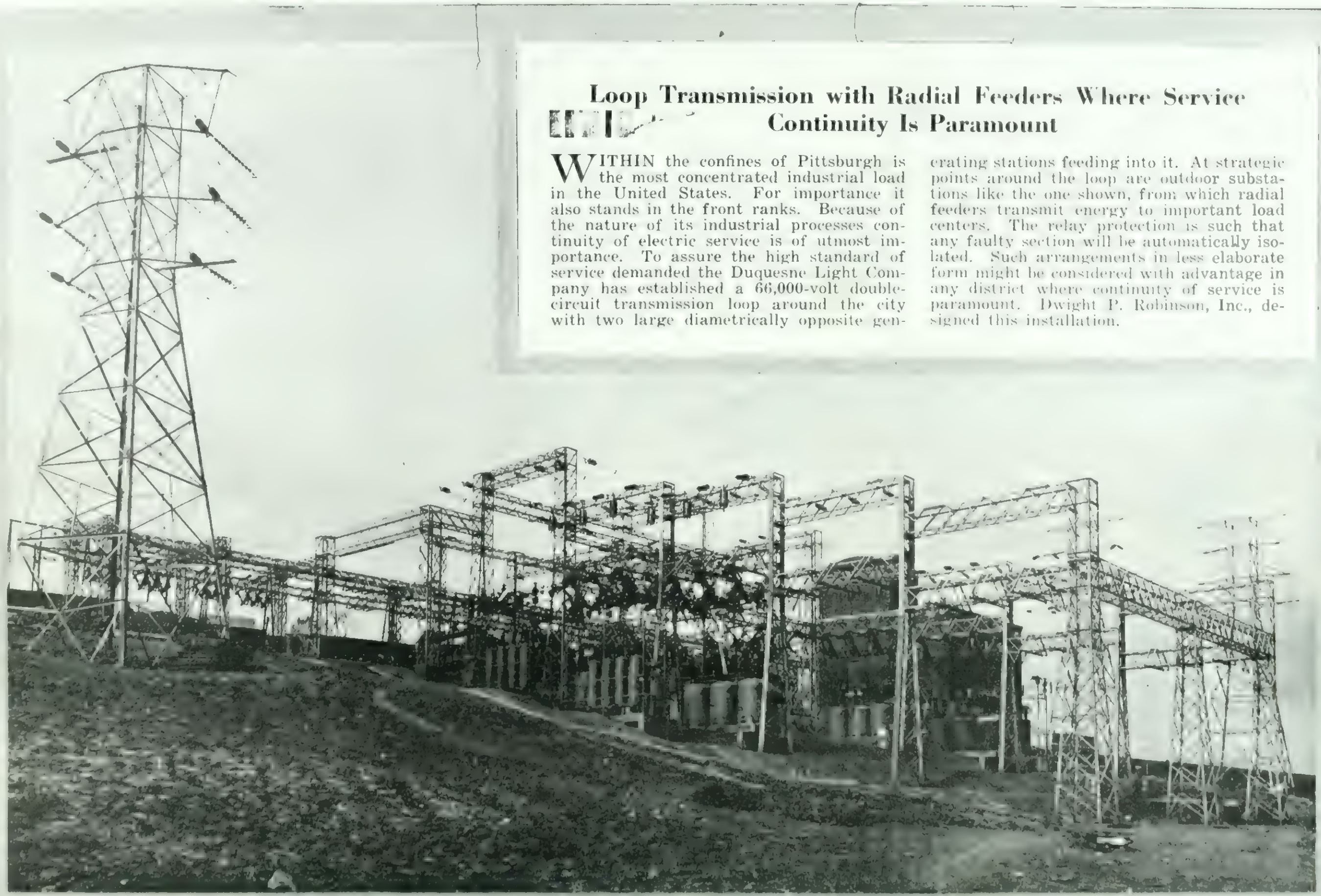
A Study of Switching Stations and German Ingenuity

IN A recent number of the *Elektrotechnische Zeitschrift* some facts were disclosed about recent German electric practice which are illuminating as regards the general Teutonic situation and the way in which it is being met. The discussion deals with switching stations, and the author dwells especially on the desirability of simplicity—real and not hypothetical. He describes the old-fashioned four-story affair with cable potheads and disconnecting switches on one floor, instruments on the next, oil switches on the third, and buses and disconnectors still above these, indicating the waste time and space inevitable with such a station. He emphasizes the desirability of a two-story station with the buses and their disconnectors on the upper floor and everything else below. Such a construction he holds to be the simplest and safest in operation and also the cheapest in construction, and he compares it with the American outdoor practice with rather enlightening results. The outdoor substation as developed in this country started along right lines, but has been coaxed and diverted into a complexity which to a considerable extent defeats its own end of economy. The German writer asserts that building operations in the post-war German republic are sufficiently cheap to enable the closed-in substation to be put up at a price lower than that of the American outdoor structure with its elaboration of oil switches and disconnectors. For indoor use the Teuton, on account of the high cost of porcelain, has been driven to paper insulators, which prove very effective, and thus he can construct and equip the building more cheaply than the American can put up his outdoor structure with all its attendant "frills."

Whatever may be the proper attitude toward Germany, its post-war efficiency, not to say pernicious activity, in manufacture must be acknowledged. Many goods are coming into the United States under innocent neutral labels which bear clear indications of German origin. With Great Britain actively encouraging the upbuilding of German industry even at the risk of serious complications later, this sort of thing is likely to increase, and the economic results may be serious.

Loop Transmission with Radial Feeders Where Service Continuity Is Paramount

WITHIN the confines of Pittsburgh is the most concentrated industrial load in the United States. For importance it also stands in the front ranks. Because of the nature of its industrial processes continuity of electric service is of utmost importance. To assure the high standard of service demanded the Duquesne Light Company has established a 66,000-volt double-circuit transmission loop around the city with two large diametrically opposite generating stations feeding into it. At strategic points around the loop are outdoor substations like the one shown, from which radial feeders transmit energy to important load centers. The relay protection is such that any faulty section will be automatically isolated. Such arrangements in less elaborate form might be considered with advantage in any district where continuity of service is paramount. Dwight P. Robinson, Inc., designed this installation.



Industrial Load in the State of New York

Industrial Load of New York State Has Increased More than 100 per Cent Since 1914—Electrical Energy Consumed by All Industrial Plants During 1920 Estimated at Almost Five Billion Kilowatt-Hours

THE PLANT OF THE ENDICOTT-JOHNSON CORPORATION, WHERE ELECTRIC SERVICE FINDS A WIDE APPLICATION

IN THESE DAYS of continued industrial depression, when the manufacturing and commercial world is engaged in taking inventory and girding on new armor for the successes of tomorrow, it behooves the electric light and power industry to ascertain what part it is playing and will play in the industrial life of the nation.

With this end in view the ELECTRICAL WORLD initiated a detailed country-wide survey to ascertain the extent to which electrical energy is now being used by the various industries of the nation. The investigation of the industries of California was completed last summer, and a detailed analysis of the industrial load in California appeared in the issue of the ELECTRICAL WORLD for Aug. 28, 1920. A similar analysis of the industrial load of the Southern States appeared on June 25, 1921.

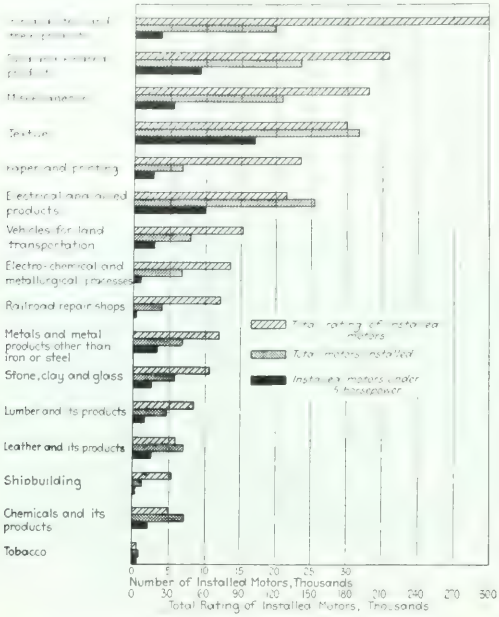
The survey to ascertain the use of electrical energy by various industries of New York State involved the sending out of between 8,000 and 9,000 questionnaires to the larger manufacturing plants of the state. A summary of the replies received from the various industries will be found in Table I.

Although New York is an important agricultural and mining state, its predominance is most marked in manufacturing. The importance of New York in manufacturing is due largely to its geographic position, as well as to the abundant natural wealth of its fields, forests, mines and quarries. The artificial and natural waterways afford an outlet for coastwise and foreign commerce through the most important seaport in the United States. A large percentage of the commercial and manufacturing centers of the state are situated on waterways containing all told approximately 1,550

TABLE I—SEGREGATION OF THE INDUSTRIAL LOAD IN THE STATE OF NEW YORK

These data are compiled from an industrial survey being conducted by the McGraw-Hill Company, Inc., under the supervision of the Editorial Departments of the *Electrical World* and *Power*, and cover plants in all industries employing more than fifty operatives

Industry	Companies Reporting		Electric Generators				Electrical Energy		Motors Installed			Distribution of Drives		
			Direct Current		Alternating Current									
	Total No.	Number Using Electrical Energy	No	Total Rating Hp.	No.	Total Rating, Hp.	Generated, Kw.-Hr	Purchased, Kw.-Hr.	No.	Total Rating, Hp.	No. Under 5 Hp	Belt	Chain	Direct or Geared
Chemicals and allied products	80	40	40	2,745	9	1,716	19,997,205	5,259,399	1,367	5,712	380	1 000	59	308
Electrical equipment and machinery	28	20	13	4,008	7	33,443	58,026,310	61,633,890	15,091	76,062	5,872	13,300	31	1,760
Electrochemical and electrometallurgical processes	9	9	19	6,275	2	8.600	54.727.275	193.219.625	2 670	23.668	384	1 210	450	1,010
Food and kindred products	100	59	51	5,797	18	5.755	46,048.172	30,273,138	4 134	38.215	1,636	2 965	242	927
Iron and steel and their products	323	203	132	22,104	37	19 698	77,960,067	371,274,459	19,195	292,454	3.570	12,950	865	5,380
Leather and its products	37	23	15	628	9	9.463	29.732.636	5,367,199	3,637	18 250	1,262	3.478	84	75
Lumber and its products	143	78	39	2,477	19	5.795	18,457,828	8,388,802	2,071	22.134	664	1,470	120	481
Metals and metal products other than iron and steel	104	63	33	3.496	15 15	5.274	32,676.275	20.225.644	3,303	34,355	1.591	2.640	182	481
Paper and printing	105	67	32	3 213	27	21.922	101,613.480	90.411.264	3,226	67.792	1 278	2.460	231	535
Railroad repair shops	23	16	12	870	7	2,846	10,475,590	48,179,927	1,511	27,453	74	640	57	814
Shipbuilding	8	6	3	765	0	0	1,854,500	11,916,000	540	13,430	121	319	15	206
Stone, clay and glass	79	25	17	857	8	3 453	12,356,192	6,719,843	891	9,806	375	559	43	289
Textiles	401	204	78	7,278	48	20,122	73,935,678	93,325,958	11,312	63.784	6,049	4,820	622	5,870
Tobacco	10	7	4	75	2	195	99,000	1,277,296	230	988	154	135	0	95
Vehicles for land transportation	16	12	7	385	3	168	723,600	2,319,872	263	3,020	92	204	5	54
Miscellaneous	465	34	26	3.220	10	1,924	13,451,274	7,256,498	1,293	12,183	344	625	111	557
Totals for all industries in State	1,931	866	521	64,211	221	140,374	552,135,082	957,048,814	70,734	709,306	23,846	48,775	3,117	18,842



IRON AND STEEL INDUSTRY LEADS IN TOTAL RATING OF INSTALLED MOTORS

square miles of navigable water. The railroads of New York are, of course, also important factors in its industrial development.

The use of electrical energy by the industrial plants of New York State has increased by leaps and bounds during the past six years. In 1914 the connected industrial load of the central generating stations of the state, exclusive of the lighting load, was only 836,000 hp. In the five succeeding years this load increased 106 per cent or to 1,720,000 hp. The increase in the electrical energy sold to power customers, exclusive of railroads, by the central generating stations during this period was even more marked, increasing from 1,071,840,000 kw.-hr. in 1914 to 3,058,000,000 kw.-hr. in 1919, or at the rate of 185 per cent. No statistics are available as to the increase in the operation of private generating plants in the State of New York during that period.

The returns received from the survey have been grouped under sixteen general industries, as indicated in Table I. Complete reports were received from 1,931 plants scattered throughout the state, of which 866 reported the use of electrical energy as the main source of power. The plants using electrical energy reported private generators totaling 204,585 hp., of which direct-current generators totaled 64,211 hp. and alternating-current generators totaled 140,374 hp. The total output in 1920 of these private generating plants was 552,135,082 kw.-hr. The electrical energy purchased by the plants reporting was 957,048,814 kw.-hr. A close study of census data indicates that, taking the industrial plants of the state as a whole, about 54 per cent of the plants generating all or a portion of their electrical energy reported to the ELECTRICAL WORLD and that only about 25 per cent of the plants purchasing all or a portion of their energy made reports. On this basis the indications are that about 21 per cent of the electrical energy used by the industrial plants of the State of New York is generated in private generating plants.

Table II gives the ELECTRICAL WORLD'S estimate of the total use of electrical energy in the industrial plants of New York State, based upon the returns received in the survey, supplemented by federal and state census data. It is estimated that there are 181,250 motors installed in the factories of New York, with a total rating of 1,704,350 hp. Of these motors 64,738, or 35.7 per cent, are under 5 hp. About 65 per cent of the machines are belt-driven, 30 per cent are directly connected and only 5 per cent are chain-drive.

There are 5,241 plants in New York State having more than fifty operatives each. Of this number 3,246 are in Greater New York and 1,995 are outside the metropolis. The accompanying map indicates the relative industrial importance of the various counties in the state, based upon the value of manufactured products. It also serves to designate the fields of greatest industrial activity in the state. New York

TABLE II—"ELECTRICAL WORLD" ESTIMATE OF THE USE OF ELECTRICAL ENERGY IN NEW YORK STATE (BASED ON INDUSTRIAL SURVEY, FEDERAL AND STATE CENSUS DATA)

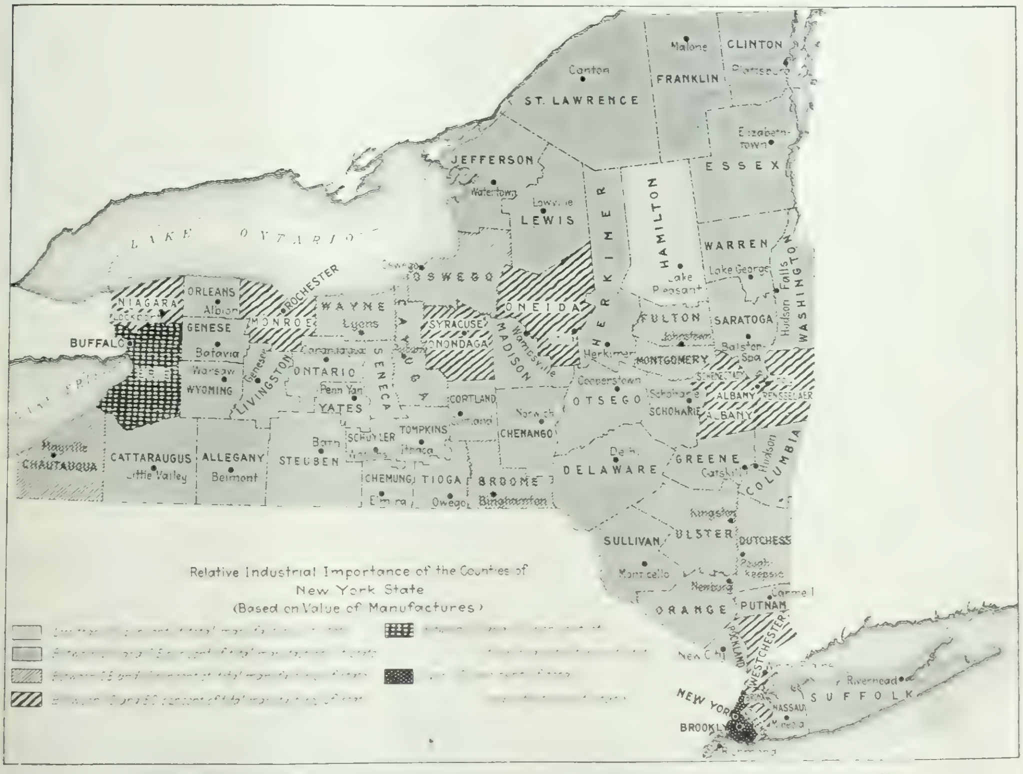
Industry	Industrial Plants Generating Electrical Energy for Own Use			Industrial Plants Purchasing Electrical Energy			Total Electrical Energy Consumed By All Industrial Plants	Total Motors Installed			Distribution of Drives		
		Motors Installed			Motors Installed								
	Energy Generated, Kw.-Hr.	No.	Total Rating, Hp.	Energy Purchased, Kw.-Hr.	No.	Total Rating, Hp.	Kw.-Hr.	No.	Total Rating, Hp.	No. Under 5 Hp.	Belt	Chain	Direct or Connected
Chemicals and allied products	41,900,000	2,270	9,500	91,000,000	4,930	20,600	132,900,000	7,200	30,100	2,000	5,270	310	1,620
Electrical equipment and machinery	59,000,000	7,430	37,500	144,200,000	18,200	91,750	203,200,000	25,630	129,250	9,980	22,600	50	2,980
Electrochemical and electrometallurgical processes	55,000,000	592	5,250	1,700,000,000	6,160	76,500	1,755,000,000	6,752	81,750	970	3,060	1,142	2,550
Food and kindred products	162,300,000	8,780	81,200	271,700,000	14,730	136,200	434,000,000	23,510	217,400	9,300	16,850	1,380	5,280
Iron and steel and their products	78,300,000	3,340	51,000	384,000,000	16,500	251,300	462,300,000	19,840	302,300	3,670	13,390	890	5,560
Leather and its products	30,000,000	3,110	15,600	38,200,000	3,980	19,940	68,200,000	7,090	35,540	2,460	6,780	164	146
Lumber and its products	20,000,000	1,520	16,250	42,000,000	3,240	34,650	62,000,000	4,760	50,900	1,528	3,380	276	1,104
Metals and metal products other than iron and steel	33,000,000	1,978	20,590	79,850,000	4,980	51,770	112,800,000	6,958	72,360	3,350	5,560	385	1,013
Paper and printing	145,500,000	2,450	51,400	260,000,000	4,280	90,000	405,500,000	6,730	141,400	2,667	5,130	482	1,118
Railroad repair shops	54,700,000	1,410	25,600	102,800,000	2,660	48,240	157,500,000	4,070	73,840	192	1,720	153	2,197
Shipbuilding	1,900,000	70	1,850	31,100,000	1,220	30,370	33,000,000	1,290	32,220	289	763	36	491
Stone, clay and glass	57,400,000	2,680	29,500	68,000,000	3,160	34,900	125,400,000	5,840	64,400	2,455	3,660	284	1,896
Textiles	128,000,000	8,650	48,800	343,900,000	23,220	131,060	471,900,000	31,870	179,860	17,030	13,550	1,750	16,570
Tobacco	432,000	70	310	3,533,000	590	2,540	3,965,000	660	2,850	442	388	[illegible]	272
Vehicles for land transportation	5,500,000	480	5,460	87,900,000	7,600	87,260	93,400,000	8,080	92,720	2,830	6,460	154	1,670
Miscellaneous	149,500,000	9,350	88,000	186,000,000	11,620	109,460	335,500,000	20,970	197,460	5,575	10,140	1,800	9,030
Totals for all industries in State	1,022,432,000	54,180	487,810	3,834,133,000	127,070	1,216,540	4,856,565,000	181,250	1,704,350	64,738	118,701	9,256	53,497

City accounts for 65.4 per cent of the commonwealth's total manufactures.

The twelve primary industries of the State of New York in order of importance are as follows: Textiles, paper and printing, iron and steel and their products, food and kindred products, tobacco manufactures, electrical machinery apparatus and supplies, chemicals, leather manufactures, lumber and timber products, metal and metal products other than iron and steel, vehicles for land transportation, and railroad repair shops.

Textiles.—The textile industry, which includes the manufacture of men's and women's clothing, hosiery and knit goods, silk goods, woolen and cotton goods, etc., is by far the most important industry in the State of New York not only in value of product but in persons employed therein. It is estimated that there are about 1,420 textile establishments in New York City employing over fifty operatives each and 458 such plants outside New York City.

The textile industry is the second largest user of electrical energy in New York State. It is estimated that this industry consumed about 471,900,000 kw.-hr. in 1920, of which about 128,000,000 kw.-hr., or 27 per cent, was generated in private plants. The large amount of privately generated energy is rather surprising in view of the fact that a large proportion of the plants are in large cities where central-station service is readily available. There is no doubt that a high percentage of these private generating installations are used for emergency purposes only, when power cannot be obtained from central generating systems, or are used as auxiliaries to the central generating plants in cases of necessity. It is estimated that 31,870 motors, or almost one-sixth of the motors in the industrial plants of the state, are installed in textile plants. The total installed rating of the motors is estimated at 179,860 hp., and about 17,030, or 54 per cent, have a rating under 5 hp. About 52 per cent of the machines are directly connected, 43 per cent are belt-driven and only 5 per cent are chain-driven.



THE RELATIVE INDUSTRIAL IMPORTANCE OF THE VARIOUS COUNTIES OF THE STATE OF NEW YORK

Paper and Printing.—This industry includes the manufacture of paper and pulp, printing and publishing of all kinds, steel engraving and lithographing. New York leads all states in the printing industry as a whole and also in each of its branches. The industry is the second industry in the state in value of products and the fourth in the number of wage earners.

The paper and printing industry consumed about 405,500,000 kw.-hr. of electrical energy in 1920, of which about one-third was generated in private plants. The average rating of the motors reported was 21 hp., and of the total of 6,730 motors about 40 per cent are under 5 hp. More than three-quarters of the motors used in this industry are belt-connected, 17 per cent are directly connected and 7 per cent are chain-driven.

Among the primary uses of motors in paper manufacturing and printing establishments are the operation of rolls, printing presses, grinders, slitters, fans, bag machines, beating engines, mixers, air compressors, pumps, screens, blowers, reels, shredders and cutters.

Electrochemical and Electrometallurgical Industry.—The chemical industry, pushed by a war-created necessity, is now the largest user of electric power in the United States and ranks fourth in size as an industry. It has become one of the most important industries of New York State, being concentrated almost exclusively in the vicinity of Niagara Falls on account of the cheap hydro-electric power which is available at that place.

It is estimated that about 1,755,000,000 kw.-hr. of electrical energy was consumed by the electrochemical and electrometallurgical industry during 1920. This amount is about 36 per cent of the total electrical energy consumed by the industries of New York State and almost 8 per cent of the total electrical energy consumed by all industries in America. The percentage of electrical energy generated in private generating plants in the state is estimated as only about 3 per cent of the total.

TABLE III—NUMBER OF PLANTS IN NEW YORK STATE HAVING MORE THAN 50 OPERATIVES

	Outside of New York City	Within New York City	Total in New York State
Chemicals and allied products	75	122	197
Electrical equipment and machinery	28	66	94
Food and kindred products	199	163	362
Iron and steel and their product	271	166	437
Leather and its products	128	117	245
Lumber and its products	177	161	338
Metals and metal products other than iron and steel	158	149	307
Paper and printing	128	298	426
Railroad repair shops	87	18	105
Shipbuilding	13	20	33
Stone, clay and glass	77	34	111
Textiles	458	1,420	1,878
Tobacco	26	78	104
Vehicles for land transportation	61	43	104
Miscellaneous	109	391	500

By far the greater proportion of electrical energy consumed in this industry is in connection with the operation of furnaces, the operation of motors being to a large extent auxiliary to the operation of these furnaces. About 6,752 motors, with a total rating of 81,750 hp., are estimated to be in use in this industry. Only about 14.3 per cent of the installed motors are rated under 5 hp.

Railroad Repair Shops.—This industry represents the work done in the car shops operated by steam and electric railroad companies and is confined almost exclusively to repairs to the rolling stock and equipment. There are estimated to be 105 railroad repair shops in the state employing fifty or more operatives, of which eighty-seven are outside of New York City.

It is estimated that 4,070 motors are installed in the railroad repair shops of the state with a total rating of 73,840 hp. The motors used in this industry are mostly of large size, there being only 192 installed motors under 5 hp. More than half of the motors are directly connected to the machinery operated.

Electric motors in railroad repair shops are used to operate machine tools, lathes, woodworking machines, air compressors, presses, planes, jointers, shapers, boring mills, threaders, saws, buffing wheels, cranes, fans, hoists and turntables.

One of the future problems of the electric light and power industry in New York State will be the generation of sufficient electrical energy to supply the needs of the industries of the state. In many sections this problem is already of large proportions, and the resumption of normal industrial activity will undoubtedly intensify the situation.

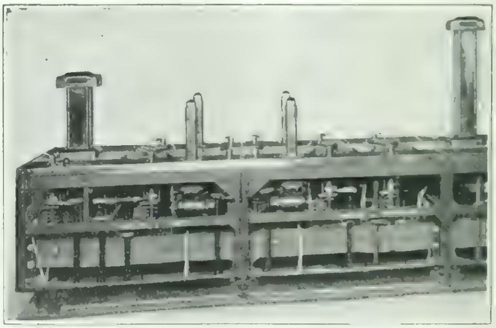
Control for Canal Locks Is Virtually Foolproof

A VERY interesting switchboard has just been completed to control the locks on a new industrial canal built by the Port Commission of New Orleans. This canal will eventually connect the Mississippi River with Lake Pontchartrain and provide a shorter route from New Orleans to the Gulf of Mexico, through Lake Borgne. The control board is noteworthy for its foolproof design and also because it reproduces on a small scale the actual lock elements for the benefit of the operator.

The control board is somewhat similar in appearance and operation to the famous Panama Canal switchboard, being a duplicate in miniature of the locks themselves. It shows both the position of the lock gates and the depth of water in the locks. It is also equipped to show the position of all water valves. The marble slabs on top of the board represent the lock chambers with small gates representing the lock gates. The columns show the positions of water valves for each chamber and also indicate the water levels.

The control handles placed near the outer edge of the horizontal slabs govern the operation of all gates, valves, etc., by throwing current on and off the switching apparatus which controls the operation of the electric machinery. In designing them protection against improper sequence of operation had to be provided by means of some sort of interlocking system which would absolutely prevent accidents from incorrect sequence of control.

The system by which the miniature gates on the board are made to reproduce accurately the action of the lock gates is the Sylsyn system. With this scheme it is possible to indicate at the control board the actual operation of the main system, so as to enable the operator to know at a glance the position of all lock gates, water valves, etc., at any particular moment.



CONTROL BOARD FOR LOCKS AT NEW ORLEANS IS MINIATURE OF LOCKS THEMSELVES

The board was designed and built by the General Electric Company.

Service Department Affords an Important Contact with Public

Tact Is an Essential Qualification of Its Members—Ample Telephone Facilities Necessary—Continuous Trouble-Shooting Service—Utilization Equipment Demands Most Attention Elaborate Transformer Inspection Not Warranted

By S. B. HOOD
Superintendent of Distribution Minneapolis General Electric Company

PROBABLY no branch of an electric service company's work can be studied with as much profit as the customers' service department, or, as it is erroneously called by some companies, including the writer's, the trouble department. Here the records maintained show both collectively and in detail the entire working of the system as it affects the service rendered to the consumer. In the Minneapolis General Electric Company this department consists of a superintendent and his assistant, three operators, one foreman troubleman and fifteen troublemen. Coming into direct contact with the consumers and being virtually the only representatives of the company that the consumers meet, these men have to be selected for their tact and ability to maintain harmonious public relations.

TELEPHONE FACILITIES AN IMPORTANT FACTOR

In most cases the first contact established with the customer who desires correction of service is made over the telephone. In order to insure prompt service a very complete operators' telephone system is used. This is of the cordless type and enables any operator to answer in on any line. This board is connected with the company's private branch exchange board by six trunk lines, so that the customer is seldom annoyed by "line busy" replies. In addition there are two direct trunks to separate main exchanges. These are secret lines known only to employees of the department or company officials. Without these it would be impossible to operate the system owing to the congestion of customers' calls at times of serious system trouble making it impossible for a troubleman to report in over the regular lines.

This trouble-department operating crew is on duty every hour and minute of the year. The troublemen work in rotating eight-hour shifts apportioned over the twenty-four hours in such a way as to provide ample service during those hours when calls are most expected and average service over the less important hours. Men off duty are always subject to call in the event of unexpected trouble peaks occurring. These men are provided with specially equipped Ford runabouts and can reach any section of the territory on short notice. As a rule they do not come in to operating headquarters but receive all instructions over the telephone, reporting after completing each assignment and at regular periods if not otherwise assigned. In the outlying districts the work is covered by five additional patrolmen who regularly patrol definite sections of the transmission line as well as maintaining the local distribution system in their towns, answering all customers' complaints, setting meters and running services.

The total cost of operating this department is about 95 cents per year per customer. This is a small sum for the service rendered, but it is a considerable portion of the average revenue received from each customer when it is considered that the customer from whom the smallest revenue is derived requires the largest amount of attention from this portion of the organization.

COMPLETE RECORDS KEPT

Each man keeps an accurate record of his daily work on the form shown on page 212. From this the total work of the day is tabulated on the daily trouble report which is also shown. Finally an abstract of this report is sent to the superintendent of distribution early in the morning following date of report. This shows all features of system operation of sufficient magnitude to affect seriously the system service, such as line switching, circuits out, apparatus failures, etc.

At the end of each year the various classes of calls as shown on this daily report are totaled and show by comparison with reports of previous years the comparative loss or gain in system-operating efficiency as it relates to "service." During the past year the department attended to approximately 51,000 calls at an average cost of about $1.35 per call. Of this number of calls about 17,700 were in connection with the street lighting system or what are known as "A" calls. These are further subdivided into causes and classified on another type of daily report. The superintendent of street lighting tabulates these and reports results periodically to the distribution superintendent. From this tabulation an accurate follow-up as to efficiency of the street-lighting system is maintained. It is interesting to note that on this basis each street lamp requires some form of special attention in addition to the routine service about five times in each year, one of which can generally be traced to the mischievous small boy on Hallowe'en night.

CUSTOMERS' UTILIZATION EQUIPMENT DEMANDS MOST ATTENTION

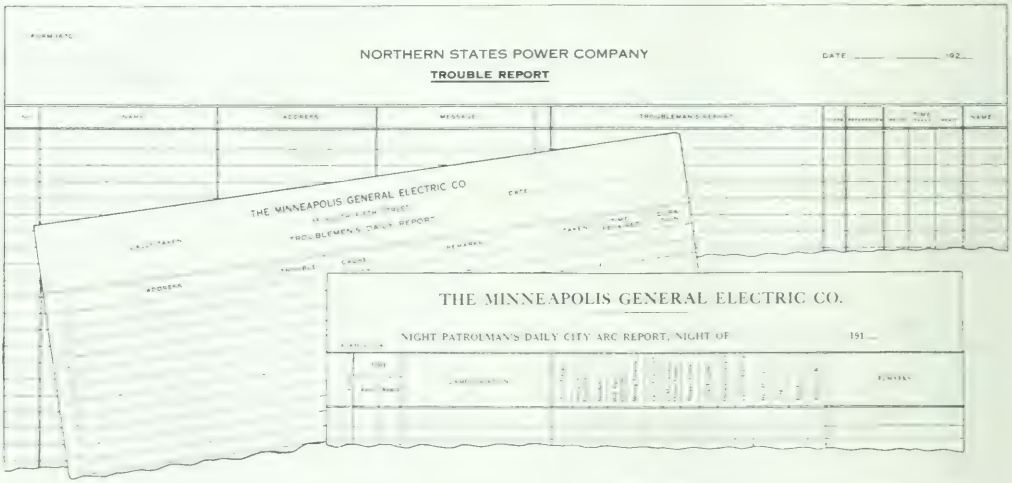
The largest number of calls, amounting to about 21,000 during the past year, were occasioned by some defect in the customers' utilization equipment. It is the duty of the troubleman receiving one of these "C" calls to repair the defective apparatus or equipment, if possible, and restore it to service. He locates the trouble, replaces broken fuses, repairs defective portable cords and performs such work as can be completed without special material while he is on the premises. In more serious cases he refers the customer to a local contractor, making temporary repairs where possible. An interesting figure obtained by analysis of these data is that customers' apparatus fails on an average once in about three and one-half years. This is pretty reliable service when one considers the large number of portable appliances in use, which are usually the direct cause of these calls.

As contrasted with these figures the "D" calls may be considered. These calls show trouble with the overhead distribution system. They numbered only slightly more than 1,000 during the entire year. In other words, the distribution system as a whole is just about twenty times as reliable as that of the customers' equipment which it serves. The rest of the calls are fairly well spread out over the classification list.

The total cost per year per customer for the service rendered him as an individual is, from the above figures, about 40 cents, but it is worth many times this to him. The service indirectly rendered is therefore about 55 cents per year, both small items compared to the direct and indirect losses that would result from even a slight lowering of the efficiency of this important branch of the work.

A classified record of calls that require attention to any of the distribution transformers is maintained and compared from year to year. The transformers involved in this report represent a total capacity of about 40,400 kva. and total 2,855 in number. In the past year just 5 per cent of these had fuses blown for various causes, a very small number if one considers that at this rate each transformer on an average will blow its fuses once in twenty years. Even more interesting is the number of transformers found actually burned out, which totaled 1½ per cent. Both of these figures are based on number of transformers, the corresponding figures based on capacity being 4 per cent and 1 per cent respectively. At this rate of failure it will take just one hundred years to burn up every transformer on the system—a rather creditable record for the manufacturers. This low rate of failure explains why this company, in common with many others, does not find it economical or necessary to maintain an elaborate system of transformer inspection and field maintenance. The total cost of replacement of the burned-out units was less than $3,000, which is far under the cost of any regular inspection system, and even such a system would probably not have prevented many of these burn-outs. Transformers removed from the line for any cause whatever receive a thorough cleaning and internal overhauling and test before being replaced in stock. This is the extent of maintenance found necessary at this time. Should the tabulated figures at the end of any year show a marked increase in failures, then a more detailed inspection may be begun.

In addition to handling complaints and trouble calls, the trouble department organization found time during the past year to make both visual and electrical field inspection on about 21,000 insulator units on transmission lines, some of which were nearly 200 miles from headquarters.


NORTHERN STATES POWER COMPANY
TROUBLE REPORT
DATE ______ 192__

THE MINNEAPOLIS GENERAL ELECTRIC CO
TROUBLEMEN'S DAILY REPORT
DATE

THE MINNEAPOLIS GENERAL ELECTRIC CO.
NIGHT PATROLMAN'S DAILY CITY ARC REPORT, NIGHT OF 191__

MINNEAPOLIS COMPANY DEPENDS ON CAREFUL ANALYSIS OF TROUBLE REPORTS FOR GUIDANCE IN HANDLING MAINTENANCE

The troublemen submit a daily report (center) and the night patrolmen submit an arc report (bottom). These are brought together on the trouble report (top). At the end of each year the reports are combined and compared with previous years. The causes of trouble that need attention are thus made to stand out and steps can be taken to reduce them.

The order department, a sub-department of the trouble department, while entirely clerical in its organization and function, is nevertheless one of the most important links in the chain. Upon it depends the issuance of all orders in such a way that all work shall be done along systematic lines and then only after proper approval and authorization have been given every order. With the system in use there is virtually no work permitted unless it has first received the approval of the commercial, financial and technical branches.

During the year this department issued a total of approximately 75,000 separate and distinct orders, each requiring proper authorization and careful checking against records. The organization of eight employees took care of this work, with an average time of fourteen minutes and an average labor cost of 11 cents per order. This remarkable showing is largely traceable to the use of the Elliott-Fischer bookkeeping and duplicating machines, upon which all orders are made out, some of them with as many as seven copies.

Semi-Automatic Operation Economical in Small Hydro Stations

Southern California Edison Company Plant Cuts Generating Cost by Semi-Automatic Operation—Cost of Extra Equipment Saved in Seven Months—Scheme Suitable for Small Plants with Few Units

By E. R. STAUFFACHER* and G. CLINGWALD†
Southern California Edison Company

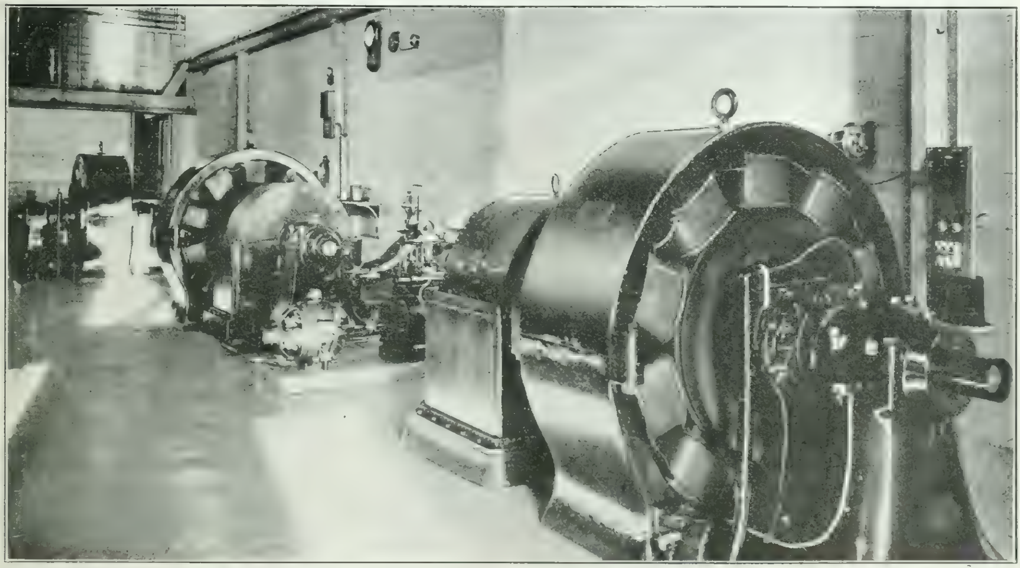


FIG. 1—TWENTY-EIGHT-YEAR-OLD THREE-PHASE HYDRO-ELECTRIC STATION NOW OPERATES SEMI-AUTOMATICALLY

DURING the past few years the Southern California Edison Company, in common with a great many other central stations, has had to combat the situation of the increasing cost of labor and the difficulty of obtaining the proper class of young men for the operation of its smaller generating plants. This condition, coupled with a desire to increase the operating efficiency and thereby generate a kilowatt-hour at a lower cost, has been the incentive causing it to change its smaller plants from manual to semi-automatic operation.

In the case of Mill Creek No. 1, considered in this article, the automatic phase of operation is the control of water in the forebay to prevent wasting over the dam and also to avoid air bubbles in the water due to low level in the forebay. Provision is also made to disconnect generating units in case of short circuits, but these are put back into service by the operator. During 1920, only five months of which were under semi-automatic control, with two operators employed instead of one as will be the case in 1921, the total operating labor cost was 75 per cent of the average cost of labor for the years 1917 to 1919. The estimated cost of operation for 1921 is only 45 per cent of the average cost when the station was under full manual control. In addition to the above saving it has been found that there is a marked saving in supplies and general labor. The cost of the equipment for making this plant semi-automatic was saved during the first seven months of semi-automatic operation. The voltage is stepped up from 2,200 volts to 30,000 volts by means of a bank of three 250-kw. transformers connected delta on the low-tension side and star on the high-tension side. The energy is transmitted to the Redlands substation, from which it is distributed and where connection is made to other 30-kv. transmission lines.

For the semi-automatic operation of the plant it was seen that it would first be necessary to provide means of taking care of the fluctuation of the water in the forebay. Owing to the fact that this water is later used for irrigation below the station, care must be taken by the power company to see that none of the water is unnecessarily wasted. Before the installation of semi-automatic equipment the fluctuations in the forebay were handled by the operators opening and closing the waterwheel nozzles when the long-distance water-level indicator showed that such adjustments

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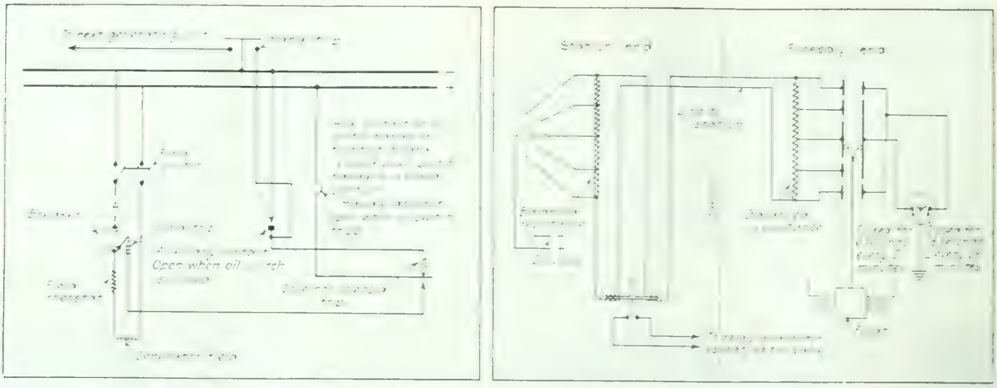
*Protection engineer.
†Assistant superintendent of generation.



FIGS. 2 AND 3—THE EXTRA WIRING USED IS EXTREMELY SIMPLE

were necessary. Another necessity was to get the generators off the line at the time of a short circuit on the transmission line or in the station.

The control of the water in the forebay, which is approximately 2 miles (3 km.) distant from Mill Creek No. 1 at the tailrace of the company's Mill Creek plant known as station Nos. 2 and 3, was handled in the following manner:

During 1920 the company's pioneer three-phase plant, Mill Creek No. 1, near Redlands, was changed over and has been in successful operation for nearly a year. This plant is one of the first of its kind to be placed in operation in this country and has a long record of service since 1893. It consists of three 250-kw. General Electric 2,200-volt, 600-r.p.m. rotating-armature-type generators, driven by impulse waterwheels operating under a 500-ft. (150-m.) head. The waterwheels are governed by old-style water-pressure type F Lombard governors. At the forebay a control mechanism was installed which consists essentially of a float equipped to make electrical contacts and also of a clock mechanism used to operate several other contacts. To the float is attached a vertical rod, the upper end of which is provided with a pair of roller contacts. These rollers make contacts with two sets of vertical segments, as shown in Fig. 3. To one set of segments a group of wire resistors are connected; the other set of segments is connected to a small time switch installed inside Mill Creek station Nos. 2 and 3. This time switch, shown in Fig. 3 consists of a clock mechanism which actuates a series of small contactors at different intervals. As used at present the intervals are as follows: (1) One set of contactors closes for a period of six seconds every five minutes; (2) the second set of contactors closes for a period of eighteen seconds every two and one-half minutes.

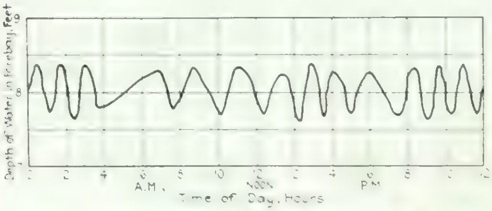


FIG. 4—THE LEVEL OF THE WATER IN THE FOREBAY IS HELD VIRTUALLY CONSTANT

These contactors, together with those controlled by the voltage, are used to energize portions of the group of resistors already mentioned. At Mill Creek No. 1 a similar set of resistors and a differential relay are installed. Two conductors and the earth are used as the circuits between the forebay and the generating station. Energy is supplied from Mill Creek No. 1. The connections are made so that two portions of each group of resistors are balanced through a double-winding differential relay when the forebay float is in a neutral position. This relay, in turn, operates a second relay capable of handling the current necessary to operate the motor used for opening and closing the waterwheel nozzle valve.

CONTROLLING WATER LEVEL IN FOREBAY

If the water in the forebay is high the float will be across the corresponding segments. The time switch will close its circuit for eighteen seconds, which in turn closes the differential relay contacts, thereby causing the waterwheel nozzle valve to open slowly for this period of time. At the end of two and one-half minutes, if the water is still high, this cycle is repeated. If the water is low, the reverse action takes place. In one case the operation is to prevent the spilling or wasting of water, and in the other case the valve is closed so as to prevent the water from getting too low in the forebay and allowing air to enter the pressure line. There are a few instances on record where, previous to the installation of the automatic control, this latter condition caused no little trouble. Therefore it is considered quite as important to prevent air from being trapped as it is to prevent water from being wasted. It may also be seen that this operation is the same as that performed by the station attendant opening or closing the waterwheel nozzle valve slightly when the water is fluctuating in the forebay.

The fact that the control circuit is closed only for a few seconds at a time prevents the valve from being opened too wide. If the mechanism were so arranged that the motor would be in continuous operation so long as the water is above or below the neutral point, the nozzle valve would be continually overtraveling. It is necessary that this opening or closing be made at short intervals so as to take care of the lag of water fluctuation in the forebay. If the float is in a neutral position when the circuits are closed, there is no movement of the motor used for operating the nozzle valve.

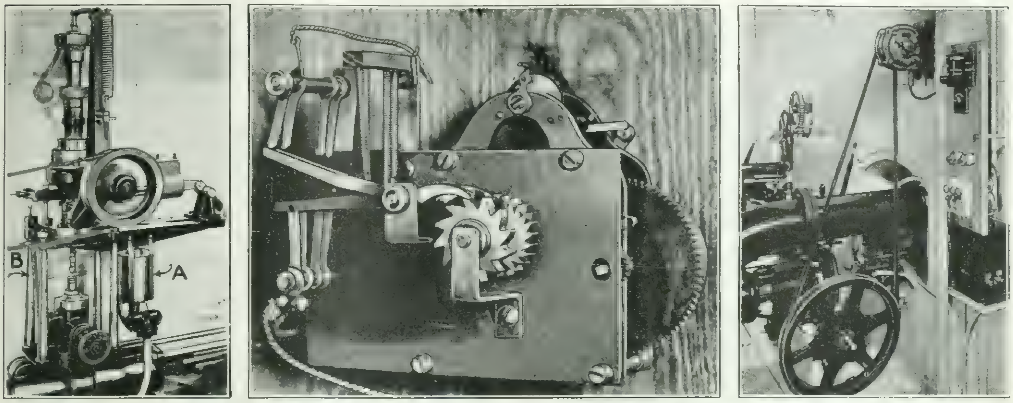


FIG. 5—SOME OF THE AUTOMATIC MECHANISMS EMPLOYED

Left — When the solenoid (in the round casing *A*) operates it releases the spring at *B*, which positively opens the control valve causing the governor to act to shut down the waterwheel. Center—The needle nozzles may be opened or closed periodically under the control of this clock. Right—A motor now operates the nozzle through a belt drive.

If it is slightly above or below this neutral position, the contacts are closed for six seconds every five minutes and the valve is only being opened or closed for this short period of time. It is, of course, not so necessary to make an adjustment in the opening of the waterwheel when the water in the forebay is near to this neutral point as would be the case if the water were almost ready to spill and thereby be wasted, or if it were extremely low in the forebay and there was danger of air being trapped in the pressure pipe.

One of the photographs (Fig. 5) shows the panel upon which the differential relay and the motor relay are mounted and the manner of mounting the nozzle control motor. It may also be seen from this photograph that the nozzle was not designed for motor operation. The belt drive furnished an easy means of making the change.

The curve (Fig. 4) shows that the fluctuations in the forebay through a period of twenty-four hours are approximately 5 in. (12 cm.) above or below the average level. This average level is reached when the water is 8 ft. (2.4 m.) deep in the forebay. It would not be difficult to maintain this level closer than that indicated in the curve, but it does not appear to be necessary under present conditions of operation. The system adopted at Mill Creek No. 1 is to apply this water regulation to the waterwheels of only one of the generators, the remaining generators being operated at full load continuously. One machine which is under water control is able to handle the fluctuations in the forebay without any difficulty.

Electrical Protection Required

The protective equipment considered necessary must meet the following requirements: First, it should clear the generators at the time of a short circuit either outside or inside of the station. Second, at the same time the generators are cleared their fields should also be disconnected. Third, the waterwheel nozzles should be deflected so that there will be no danger of the generators being subjected to excessive speed for an unnecessary length of time. Fourth, the bearings of the generators and exciters should be protected in some manner and an alarm should be given when they become excessively warm. Fifth, an alarm should also be given when the transformers become overheated for an appreciable length of time. These conditions were taken care of by comparatively minor changes and additions to the present equipment in the station.

It was not the intention to make the station entirely automatic, for it was not considered desirable to dispense with the advantage of having an employee at the plant to act as watchman, caretaker and operator. This eliminated the necessity of installing automatic equipment for starting the generators after they had been automatically disconnected from the line, so that it was only necessary to install equipment that would take care of the station at the time of trouble, permitting it to be started manually when the trouble was over.

The first three requirements were met by placing a pair of auxiliary contactors on the present generator oil switches, attaching solenoid trips on the governors and installing an automatic circuit breaker, with its trip coil changed from series to shunt trip, for the opening of the fields of the generators.

Operation During Short Circuit

At the time of a short circuit the generator oil switch opens and in so doing closes the auxiliary contacts which energize the waterwheel governor solenoids. These solenoids trip the governors, thereby taking care of the water end of the generating units. When

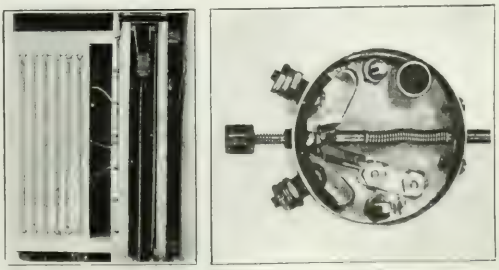


FIG 6—LEFT—FLOAT SWITCH AT FOREBAY CONTROLS NOZZLE OPERATION. RIGHT—THIS THERMOSTAT MAY BE INSERTED IN A ⅛-IN. HOLE IN A SMALL BEARING

the governors trip they close the contacts which energize the shunt trips on the field circuit, breakers thereby opening the fields and completing the last operation of disconnecting the generators. By the above operations the generators have been disconnected from the line both at its armature and at the field. The water nozzles have been deflected by the governors and there is no cessation of the flow of water in the canal beyond the power plant.

To give indications of hot bearings on any of the generators or overheating of the transformers, use was made of the thermostats shown in Fig. 6. The thermostat used consists essentially of a rod passing through a brass tube about 6 in. (21 cm.) long, so arranged that a small link of low-melting-point alloy can be placed around the rod at the end of the tube. When this alloy melts the rod closes the contacts, ringing an alarm as an indication of the bearing in trouble. The location of the thermostat that has just operated is indicated by means of an annunciator which assists the operator to locate the trouble in the minimum time. The alloy used melts at about 150 deg. Fahr. (66 deg. C.) There was some difficulty in the operation of the thermostats when they were first installed due to an unusual amount of vibration to which a few of them were subjected. This condition has been corrected.

When the machine has been automatically disconnected from the line it is started manually. The operator is in the plant only during the day. If anything unusual happens in the station he is notified by the alarm. The stations known as Santa Ana River No. 2 and Lytle Creek are now being rearranged to operate semi-automatically.

Interconnection Is Successful in Eastern Massachusetts

Obviates Heavy Expenditures in Generating Plants, Reduces Combined Peak Loads and Saves 10,000 Tons of Coal per Year

BY F. C. SARGENT
Vice-President Charles H. Tenney & Company, Boston

PRIOR to 1914 a considerable study was made by A. B. Tenney, president of the Malden (Mass.) Electric Company and of the Suburban Gas & Electric Company, Revere, Mass., and the writer to determine the surplus generating capacity which would be available if a large group of the central stations north of Boston were interconnected. The advantages of interconnecting the several plants were even then anticipated, and, as the plan was actually worked out, the expenditure of more than $1,500,000 in generating plants has been saved, the combined system peak has been reduced by about 2,300 kw. and a saving of about 10,000 tons of coal per year has been effected.

Early in 1914 the directors of the Malden and Suburban companies, realizing the need of a large capital outlay to care for the growth of the territory served by these companies and being advised of the advantages of interconnecting the several plants, employed Charles H. Tenney & Company to make a thorough investigation of the situation to determine the advantages associated with the interconnection of these companies and the Salem Electric Lighting Company by a suitable transmission system. A comprehensive report was submitted in the latter part of the year. This was exceedingly favorable for the following reasons:

1. The Salem company was most favorably situated with respect to cheap fuel and ample condensing water and had the more modern boiler and generating plant, with the largest load and output.
2. The Malden company was unfavorably located with regard to fuel, which had to be hauled by team. Its condensing-water supply was inadequate, requiring cooling towers, and thus causing more or less inefficient operation.
3. The Suburban company had fairly good facilities for fuel and condensing water, but was confronted with the large summer load imposed by a great beach resort.
4. The fuel conservation attainable by utilizing the more efficient plant intensively appeared considerable, and in the four years ended Dec. 31, 1920, this interconnection saved over 40,000 gross tons of coal.

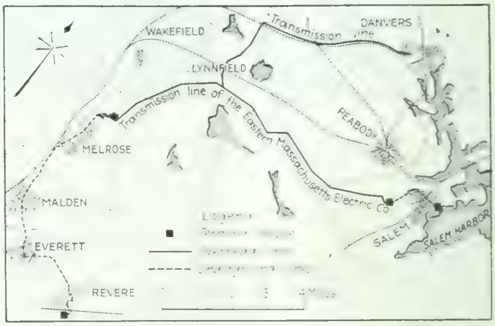


FIG. 1—INTERCONNECTION SAVES 1,000 TONS OF COAL YEARLY

This group of companies served the cities of Salem, Malden, Medford, Melrose, Everett and Revere and the town of Winthrop. Last year the town of Danvers shut down its plant and purchased all its required energy from the interconnected system, which is operated by the Eastern Massachusetts Electric Company, and since early in 1918 the city of Peabody has purchased energy from this source for one of its large customers. About a quarter of a million people are now served by the system, which is shown in the map (Fig. 1).

The generating equipment of the several companies is as follows:

Salem		Malden		Suburban	
No. of Units	Rating, Kw.	No. of Units	Rating, Kw.	No. of Units	Rating, Kw.
2	6,250	1	1,500	1	500
1	7,500	2	750	1	500
1	2,500	1	400	1	400
Total....	22,500		3,400		1,400

All the above are turbo-generators except the two 750-kw. and one 400-kw. units at Malden and the one 500-kw. and one 400-kw. units at Revere. All units are three-phase, 60-cycle, 2,300 volts.

In 1915 the survey and purchase of rights-of-way was authorized and appropriations were made the next year. The line was completed and placed in continuous operation on March 26, 1917. For about half its length it had to be placed under ground, 8,300 ft. (2,530 m.) in Salem and 20,500 ft. (6,250 m.) in the Malden-Melrose district being thus constructed. A former 22,800-ft. (6,950-m.) underground tie line between the Malden and Revere stations was utilized in the interconnection scheme, the 15,000-volt cables on this section being reinsulated for 25,000 volts at the joints. Only two breakdowns have occurred in four years, both being in joints made under unfavorable conditions. The interconnection as a whole is operated at 22,000 volts. The underground sections are provided with two three-conductor, No. 2/0, varnished-cambric, lead-covered cables laid in fiber conduit, the Salem and Melrose-Malden sections being designed for 25,000-volt operation.

The main overhead line consists of 50,371 ft. (15,300 m.) of double-circuit steel tower and A-frame construction, between Salem and Melrose, thirty-one towers and ninety-three A-frames being used. The conductors are No. 2/0 stranded copper, and a $\frac{5}{16}$-in. (8-mm.) steel ground wire is installed. There are twelve angles in this section. The maximum span is 870 ft. (265 m.), the minimum 170 ft. (52 m.) and the average 406 ft. (124 m.). A single-circuit branch line of wooden pole and wishbone construction extends from the main line to Danvers, 32,978 ft. (10,030 m.). This section is of No. 4 copper, the poles being 40 ft. to 45 ft. (12 m. to 13 m.) high, with 36-in. wishbone (0.9 m.) arms, a maximum span of 440 ft. (134 m.) with an average of 172 ft. (52 m.). The estimated capacity of the transmission line is about 10,000 kw. with a 10 per cent loss.

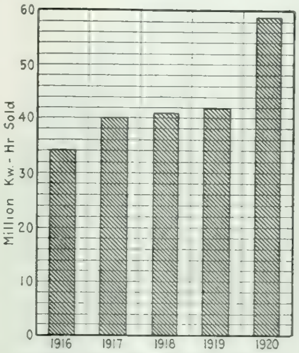


FIG. 2—GROWTH OF LOAD ON NEW ENGLAND SYSTEM

Transformer banks of 22,000/2,300-volt ratio, oil-cooled units, are installed as follows: Salem, 9,000 kva.; Malden, 4,500 kva. (this installation is now being reconstructed to provide for substations in different cities served, with 12,500-kva. aggregate transformer capacity); Revere, 3,000 kva.; Peabody, 600 kva.; Danvers, 1,000 kva. At Revere there is 3,000 kva. in transformers connected with the 13,200-volt lines of the Boston Edison company, permitting emergency service of great value in case of trouble or repairs.

The total cost of the line, including underground cable, two terminal houses, overhead line and rights-of-way, but not the conduit system, was about $310,000. Rights-of-way of 40 ft. (12 m.) minimum width came to $35,000; the overhead line proper, $76,000; underground cable, $153,000; terminal houses and equipment (switching apparatus and lightning arresters), $16,000. The rights-of-way cost $3,630 per mile, overhead line, $8,000, underground cable, $15,750, and the terminal houses cost $0.80 per kilowatt. The Peabody-Danvers branch cost $1,700 per mile for rights-of-way and $8,300 per mile for construction. The main line had the advantage of earlier and lower costs.

It was proposed to operate the entire system from the Salem plant, using the Malden and Revere plants simply in emergency and in case of trouble at Salem or lack of capacity. With this in view, the Malden and Revere plants have been equipped for oil burning to enable them to operate with minimum attendance and to be able to render service in the shortest possible time. Since this system has been inaugurated it has been necessary to operate the Malden plant during the peak-load conditions to a limited extent, and during the past winter it was necessary to operate the Revere plant. This is the first time the Revere plant has been operated since the latter part of 1917.

However, the Salem company is now installing a 7,500-kw. unit, which is included in the previous capacity of the Salem plant inasmuch as it will be operating about the time this article appears, and at that time the capacity will be sufficient to take care of the entire system until its growth shall again exceed the capacity of the plant.

Fig. 2 shows graphically the kilowatt-hours used by the system each year for a period of five calendar years to 1920.

WHAT WAS ACTUALLY ACCOMPLISHED

The most interesting features summarized in connection with the construction of this line are the following:

1. The Malden Electric Company was saved the necessity of raising approximately $1,500,000 to build a new plant at a more suitable location in respect to fuel and water.

2. The Suburban Gas & Electric Company was saved the necessity of raising approximately $150,000 additional capital to increase the capacity of its plant.

Both these companies were able to purchase energy at a price less than they could have generated it to the limited amount of their requirements.

3. By combining the stations and using the old plants simply as auxiliaries the Salem company did not have to add more capacity to its plant than would have been necessary to give sufficient breakdown capacity to take care of its own business.

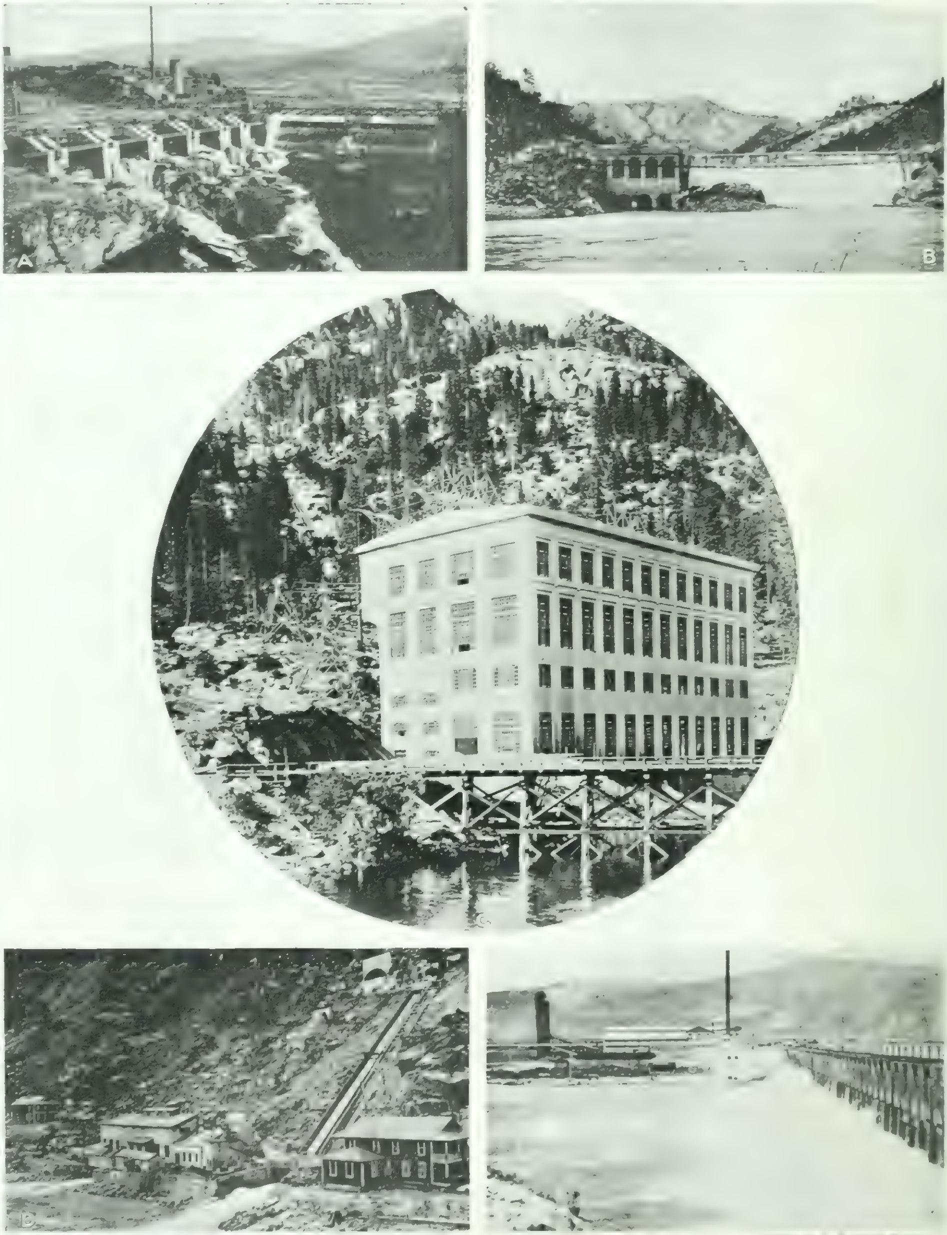
4. The total peaks of each plant compared with the highest simultaneous peak show approximately 2,300 kw. less capacity needed for the system than would have been needed if each plant had been operated separately. This is accounted for by the diversity of load, a large part of it being the high load on the Suburban company during the summer months.

5. Owing to the increased output from the Salem plant, this company was enabled to sell energy at a lower figure and at the same time to lower considerably the cost of energy on its own systems.

6. The conservation of coal by the efficient operation of one plant for a group of companies has amounted under present load conditions to approximately 10,000 gross tons per year.

7. It is interesting to note that the Salem company has operated the plant for the past thirty-six months at an average coal rate of 1.92 lb. per kilowatt-hour. This plant is operated at 150 lb. (10.5 lb. per sq.cm.) steam pressure and 100 deg. F. (38 deg. C.) superheat, the largest turbo unit being of 6,250 kw. This efficiency is unequaled by any operating company in the state under like steam pressure and superheat, and there is but one other company in the state operating at higher pressure and superheat that betters this efficiency. The Salem company is now installing a 7,500-kw. unit and changing over to 200 lb. (14 kg. per sq.cm.) steam pressure and 120 deg. F. (49 deg. C.) superheat. This change will be completed in the next sixty days, and we expect at that time to have the most efficient plant in New England in respect to pounds of coal per kilowatt-hour.

Water-Power Developments in National Forest Reserves



Photos by U. S. Forest Service

A—Post Falls Plant of the Washington Water Power Company within the Washington National Forest, Washington. Installed generator rating 8,150 hp. Tainter gates at left and bear trap gates in rear.

B—Watanza Power Plant, Tennessee.

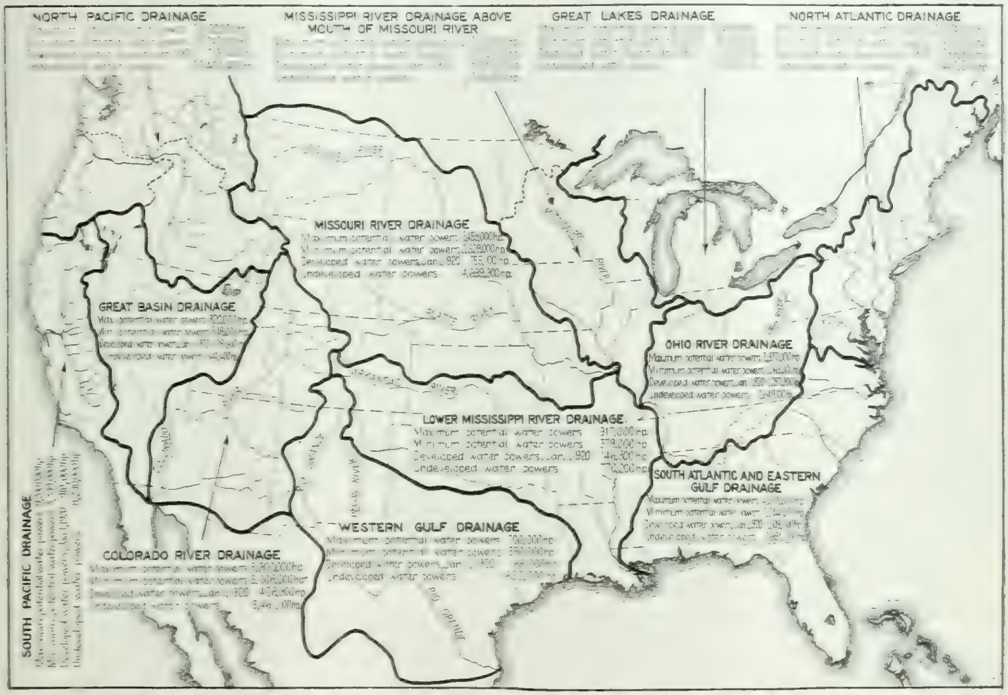
C—Big Creek Canyon Plant of the Pacific Light & Power Company, Sierra National Forest, California. The pipe line has a drop of 2,000 ft.; 42,600 hp. has been developed.

D—Colorado Power Company's power plant on Grand River, Holy Cross National Forest, Colorado; 18,000 hp. developed.

E—Power plant and Barber lumber mill, Boise, Idaho; 1,200 hp. developed.

Probable Water-Power Developments

Tabulation of the Undeveloped Water Powers of Over 10,000 Hp. by Drainage Areas of the Country—More than 5,000 Applications for Preliminary Power Permits Have Been Filed with the Various State and Federal Departments



POTENTIAL, DEVELOPED AND UNDEVELOPED WATER POWERS OF THE UNITED STATES BY DRAINAGE BASINS

AN EXTENDED investigation of state and federal records recently completed by the ELECTRICAL WORLD indicates that more than 5,000 water-power projects have been filed upon or contemplated during the last decade. A very large proportion of these are purely speculative in character or are commercially not susceptible to development. Application for state and federal permits have in many cases been filed in a most promiscuous manner by persons with virtually no knowledge of what constitutes a feasible water-power development. The mere fact that a quantity of water with more or less fall existed was in some cases apparently sufficient to warrant the filing of an application. The engineering problems often received no consideration, and the existence of a possible market for the generated power was wholly a dream. Most of this class of filings, however, are of comparatively small horsepower, though some of those involving larger water powers fall in the same category.

The larger water powers which, it is believed, may be classed as within the realm of possible development inside the next ten years are tabulated on page 220 arranged according to drainages of the country. The development of some of these water-power possibilities would be prevented by the prior development of other water-powers which are also listed, and a detail field investigation will undoubtedly show the impossibility of other projects. The water powers included in the tabulation have been covered in applications for preliminary permits filed with the various state or federal departments, or have received serious consideration from responsible persons. The list includes only those water powers with a possible development of 10,000 hp. or more. Some drainages have been covered in more detail than others owing to the availability of data on the rivers included in these drainages.

The accompanying map shows the maximum and minimum potential, the developed and the undeveloped water powers of the United States by drainage basins. The North Pacific drainage has maximum potential water powers totaling 23,120,000 hp., or about 39 per cent of the potential water powers of the country. The North Atlantic drainage leads in the amount of developed water powers with 1,788,800 hp., being followed by the South Atlantic and Eastern Gulf drainage with 1,509,500 hp. Developed water powers in the Western Gulf drainage total only 68,000 hp., which is by far the lowest development of any drainage. All figures are as of Jan. 1, 1920.

Undeveloped Water Powers of Over 10,000 Hp. by Drainage Basins of the Country

NORTH ATLANTIC DRAINAGE

Kennebec River Basin (Maine):	Hp.
Kennebec River, four sites	102,700
Androscoggin River	23,500
Penobscot River Basin (Maine):	
Penobscot River	13,300
Merrimac River Basin (New Hampshire):	
Merrimac River, Moores Falls	10,000
Merrimac River, Bristol Falls	11,000
Contoocook River, Hillsboro	18,900
Blackwater River, Webster	11,650
Connecticut River Basin:	
Connecticut River, Fifteen Mile Falls, N. H.	54,400
Connecticut River, Piermont, N. H.	19,100
Connecticut River, Quechec Falls, N. H.	24,800
Connecticut River, Windsor Locks, Conn.	32,000
Connecticut River, Bellows Falls, Vt.	32,000
Nutlers River, Mass.	16,000
Deerfield River, Mass.	31,000
Androscoggin River Basin (New Hampshire):	
Androscoggin River	30,000
Housatonic River Basin (Connecticut):	
Stevenson Creek	36,000
Hudson River Basin (New York):	
Hudson River, Troy	11,370
Hudson River, Palmer Falls	10,200
Hudson River, Sherman Island	24,480
Hudson River, Huckleberry Mountain	20,270
Hudson River, Indian River Reservoir	12,265
Hudson River, Sacandaga Reservoir	36,305
Mohawk River, West Canada Creek	13,500
Salmon River	11,000
Saranac River, High Falls	11,440
Delaware River Basin:	
Delaware River, near Barryville, N. Y.	412,300
Delaware River, Foul Rift, N. Y.	20,000
Delaware River, Belvidere, N. J.	432,300
Susquehanna River Basin:	
Oswego River, New York	14,648
Big Sandy Creek	25,000
Susquehanna River	110,000

POTOMAC RIVER BASIN

Potomac River, Great Falls	50,000

SOUTH ATLANTIC AND EASTERN GULF DRAINAGE

Roanoke River Basin (Virginia):	
Roanoke River, Clarksville	60,000
New River	20,000
Savannah River Basin (Georgia):	
Savannah River	110,000
Tugaloo River, Tugaloo	64,000
Tugaloo River, Ralston	53,000
Chattooga River	113,000
Apalachicola River Basin (Georgia):	
Flint River	20,000
Chattahoochee River	138,000
Alabama River Basin:	
Coosa River, Lock 12	19,500
Coosa River, Duncan's Riffle	120,000
Coosa River, Judkin's Riffle	30,000
Tallapoosa River, Cherokee Bluffs	54,500

GREAT LAKES DRAINAGE

St. Lawrence River Basin (New York):	
St. Lawrence River, Baxter's Island	600,000
St. Lawrence River, Long Sault Rapids	750,000
St. Lawrence River, Croil Island	1,000,000
St. Lawrence River, Ogden Island	25,000
St. Lawrence River, Lotus Island	250,000
Niagara River	1,495,000
Black River, Glen Park	16,250
Black River, Watertown	10,070
Genesee River, Mount Morris Gorge	17,000
Genesee River, Portage	36,660
Oswegatchie River, Hailesboro	12,060
Raquette River, South Colton	13,760
Raquette River, Five Falls	11,200
Raquette River, Stark	10,420
Salmon River	15,000
Erie Barge Canal Drainage (New York):	
Erie Canal, Mohawk River	15,543
Erie Canal, Oswego River	15,852

OHIO RIVER DRAINAGE

New River Basin (West Virginia):	
New River, below Anderson Falls	30,000
Cumberland River Basin (Kentucky):	
Cumberland River	186,000
Tennessee River Basin (Tennessee):	Hp.
Powell River, Ore Bed	25,000
Clinch River, Clinch	47,000
Clinch River, Coal Creek	131,000
Clinch River, below Emory River	47,000
Clinch River, above Emory River	73,000
Holston River, Holston Station	56,000
Holston River, Strawberry Plains	68,000
Tennessee River, Knoxville	72,000
Nolichucky River, Embreeville	14,400
Nolichucky River, Bird's Hill	20,800
French Broad River, Danbridge	75,000
French Broad River, Boyd Creek	48,000
Pigeon River, Hurricane Creek	108,000
Little Tennessee River, McGhee Station	20,000
Hiwassee River, Charleston	16,500
Hiwassee River, Murphy	40,900
Hiwassee River, Appalachia Station	82,000
Clinch River, Alabama	25,000
Little Tennessee River, N. C.	200,000
Upper Ohio River Basin (Pennsylvania):	
Shohola Creek	15,000
Crooked Creek	20,000
Clarion River	224,000
Wallenpaupack Creek	15,000

MISSISSIPPI RIVER DRAINAGE ABOVE MOUTH OF MISSOURI RIVER

Chippewa River at Forks, Wis.	75,000
St. Croix River, Minnesota	11,000
Isabelle River, Buck Lake, Minn.	20,000
Des Moines River, Iowa	60,000
Illinois River, Illinois	40,000

MISSOURI RIVER BASIN

Yellowstone River Basin (Montana):	
Yellowstone River, Buffalo Rapids	15,000
Bighorn River, Big Horn Canyon	217,550
Madison River Basin (Montana):	
Madison River	10,800
Missouri River (Montana)	100,000
North Platte River (Wyoming)	36,500
South Platte River Basin (Colorado):	
North and south forks	104,500

LOWER MISSISSIPPI RIVER DRAINAGE

Black River Basin (Missouri):	
Current River, Shannon County	30,000
White River, Cotter, Arkansas	100,000
Ouachita River	25,000
Arkansas River, Neosho River	55,000

WESTERN GULF DRAINAGE

Colorado River, Marble Falls, Texas	64,000
Rio Grande River Basin:	
Pecos River, San Miguel County	25,000
Rio Grande River, Frijole Creek	9,090

COLORADO RIVER BASIN

Grand River Basin (Colorado):	
Frying Pan Creek	50,000
White River Basin (Colorado):	
Blue River	24,000
Green River Basin:	
Duchene River, North Fork	25,000
Green River, 27 miles above Green River	80,000
Green River, Horseshoe Canyon	100,000
Green River from Green River, Wyoming, to mouth of Grand River	912,600
Little Colorado River, Grand Falls, Ariz.	27,900
Colorado River, Colorado Canyon, Ariz.	3,570,000
Gila River Basin (Arizona):	
Verde River, near mouth	37,800

GREAT BASIN DRAINAGE

Great Salt Lake Basin (Idaho):	
Bear River, Grace	14,500
Bear River, Wheelon	36,000
Carson River, East Fork (California)	16,800
Walter Lake Basin (California):	
East Fork Walker River	10,130
Owens Lake Basin (California):	
Rock Creek	15,000
Leevining Creek	19,000
Owens River Gorge	25,000
Los Angeles Aqueduct, San Francisquito Canyon	70,000

SOUTH PACIFIC DRAINAGE

Klamath River Basin:	
Klamath River, Klamath Falls	70,000
Klamath and Bluff Rivers	30,000
Salmon River	143,000
Sacramento River Basin:	
Sacramento River, Deer Creek	22,500
American River, South Fork	72,000
Mokelumne River, North Fork	38,400
Sacramento River Basin (Cont.)	Hp.
Rubicon River and Loon Lake	28,200
Silver Creek, American River	107,000
Yellow Creek, Feather River	18,000
Middle Fork Feather River	79,500
North Fork Yuba River	76,500
Middle Fork Yuba River	30,000
San Joaquin River Basin:	
Kern River, below Forks	12,000
South Fork Kern River	43,450
North, south and middle forks Kings River	600,000
Big Creek, San Joaquin River, three sites	223,000
South fork San Joaquin River	425,000
San Joaquin River, main	995,000
Merced River, Exchequer	40,000
Stanislaus River, middle fork	17,500
Stanislaus River, below forks	30,000
Tuolumne River	159,700
Calavaras River	12,750
Eel River, north fork	23,500
Santa Clara River	10,000
Santa Maria River	15,000
Santa Ana River and Bear Creek	37,000

NORTH PACIFIC DRAINAGE

Columbia River Basin:	
Snake River, American Falls (additions), Idaho	15,000
Snake River, Upper Salmon Falls Idaho	66,000
Snake River, Twin Falls, Idaho.	25,000
South Fork Paquette River, Idaho	12,000
Snake River, Asotin, Ore.	80,000
Snake River, Coon Hollow, Ore.	200,000
Snake River, Cherry Creek, Ore.	300,000
Snake River, Mountain Sheep, Ore.	300,000
Snake River, Salmon River Tunnel, Idaho	200,000
Snake River, Payette River	12,000
Snake River, Palouse River, Wash	25,000
Flathead River, Flathead Lake, Mont.	272,650
Clark Fork, Rock Island Rapids, Mont.	10,900
Priest River, two sites, Idaho	21,400
Clark Fork, below Pend d'Oreille Lake, Idaho	112,000
Clark Fork, Z-Canyon, Wash.	350,000
Kootenai River, Mont.	350,000
Spokane River, Fort George H. Wright, Wash.	10,000
Lewis River, Wash	19,000
Toutle River, Wash.	25,000
Columbia River, Priest Rapids, Wash.	300,000
Columbia River, Rock Island and Cabinet Rapids, Wash.	100,000
Columbia River, Cascades, Ore.	200,000
Columbia River, The Dalles, Ore.	480,000
Columbia River, Umatilla, Ore.	120,000
Deschutes River, Moody, Ore.	54,000
Deschutes River, Lockit, Ore.	28,600
Deschutes River Reclamation, Ore.	47,000
Deschutes River, Sinamox	35,600
Deschutes River, Oak Brook	26,500
Deschutes River, Sherar Falls	40,900
Deschutes River, Oak Springs	10,820
Deschutes River, Maupin	44,500
Deschutes River, Freida	47,360
Deschutes River, White Horse Rapids	47,200
Deschutes River, Coleman	19,680
Deschutes River, Mecca	27,760
Deschutes River, Pelton	18,560
Deschutes River, Metolius	387,000
Metolius River, Riggs	17,200
Metolius River, Whitewater	28,360
Metolius River, Jefferson Creek.	36,360
Metolius River, Jacks Creek	16,360
Clackamas River	22,000
McKenzie River	195,000
Santiam River	52,500
Umqua River	32,700
Rogue River Basin:	
Rogue River, Devils Stair	30,000
Rogue River, Horseshoe Bend	30,000

PUGET SOUND DRAINAGE

Sulton River and Olney Creek	106,000
Sultan River and Lake Chaplain	10,000
Whitechuck River, below Deer Creek	39,000
Skagit River, Canyon Diablo	14,000
Skagit River, Rock Point	19,380
Skagit River, below Ketchum Creek	16,600
Suiattle River below Milk Creek	21,800
Nisqually River	20,000
Skykomish River, north fork	75,000
Skykomish River, south fork	30,000
White River	30,000
Tolt River	40,000
Sauk River, south fork	11,000
Sauk River, north fork	21,500
Puyallup River, south fork	12,700
Wynooche River, headwaters	15,000
Solduc River and Crescent Lake	95,000

Readers' Views and Comments

This is a readers' forum. Comments on questions before the electrical industry presenting economic, financial, engineering or commercial aspects and new or supplementary viewpoints on published articles are cordially invited

Government Aid Is Needed in the Study of Fire Waste

To the Editor of the ELECTRICAL WORLD:

SIR: A letter* by Frank W. Glading in a recent issue of your valuable magazine rings true and has all the evidence of being written by a man of scientific knowledge, backed by practical experience and possessing broad conceptions of a great national issue which must be treated on constructive lines.

A national classification of "causes of fires" should be adopted by our federal government, making it compulsory that all fires be reported to a government official so that uniform statistics might be compiled. Through the provisions of the fire marshals act the province of Ontario has a system of reporting all fires (1) by the chief of the fire department or clerk of the municipality where there is no fire department, (2) by the insurance companies, within three days of occurrence of a fire, (3) by the fire insurance adjusters; all of which is further augmented by newspaper information. The fire statistics of the province may consequently be said to be as nearly correct as it is possible to have them.

In Ontario "causes" are divided into twenty-six classifications, from which I have selected eight of the most frequent or ordinary causes of "preventable" and "partly preventable" fires. According to the statistics for 1918, 1919 and 1920 on number of fires, "lightning" heads the list, followed by "stoves," "matches," "sparks," "exposure," "electricity," "smoking" and "chimneys." In the average amount of the annual loss in the same period "stoves" come first, then "sparks," then "electricity," closely followed by "exposure," with "lightning," "matches," "smoking" and "chimneys" in the order named. These figures bear out Mr. Glading's comment as to the real causes of fire and accentuate the point that everything must be taken into consideration when dealing with this element of destruction.

Without going into a detailed analysis of these figures it may be pointed out that damage from fire in electric plants, carhouses, etc., runs into money quickly so that it isn't necessary to have a great number of electric fires to pile up a heavy loss. We must, therefore, consider the nature of the risk as well as values in congested areas when we make comparison. In the accompanying statistics the largest number of fires was caused by lightning, but the loss caused thereby ranks fifth in the list, probably because the majority of the fires were isolated and there was nothing more to burn.

Faulty construction enters into the losses caused by electricity to a very large extent, which opens up another broad vista in the fire prevention problem. The enactment and universal enforcement of a standard building code would prove to be one of the greatest boons to our body politic that could be brought about by those interested in this progressive movement. The compilation of uniform statistical data would be materially helpful in working up such a code.

Splendid results are being accomplished by the inspection department of the Ontario Hydro-Electric Power Commission, which has control of all inside electric wiring in the province. It is, however, hard to make some people realize that an electric installation which has given good service for twenty years or more is now in a defective and hazardous condition. People do not stop to think of the limited service for which the system was designed, and the many additions and alterations since made thereto, causing a menace to life and property from overloaded circuits, over-fusing and antiquated equipment. The miracle is that there are not more fires and loss of life from defective electric light wiring than actually occur.

Plausible reasons, especially in suspicious or incendiary cases, are frequently given as the cause of fire. Indefensible things that cannot talk back, such as "defective electric light wiring," "lightning" and "matches ignited by mice or rats gnawing them" are frequently given. The theory that mice and matches set fire to buildings has been entirely exploded by long research and thoroughly practical experiments and tests made by the Underwriters' Laboratories at their Chicago plant and also in conjunction with the Diamond Match Company, showing that rats and mice would starve to death before they would eat the modern match head. Inasmuch as the defective wiring excuse can generally be run to earth it has become somewhat obsolete.

CLASSIFICATION OF FIRE HAZARDS ACCORDING TO ANNUAL NUMBER AND FINANCIAL LOSS

(Average of 1918, 1919 and 1920 for Province of Ontario, Canada)

Classification	No. of Fires Yearly	Percentage of Number in Comparison with Total from All Causes	Amount of Annual Loss	Percentage of Loss Compared with Total Loss from All Causes
Preventable Fires				
Defective or overheated stoves, furnaces, boilers and their pipes	1,024	10.81	$1,084,197	8.56
Matches—Carelessness with matches; children playing with matches	1,017	10.73	413,222	3.24
Smoking—Carelessness in smoking	468	4.95	339,296	2.70
Chimneys, overheated or defective	311	3.29	198,458	1.63
Partly Preventable Fires				
Lightning, buildings not rodded	1,067	11.23	575,580	4.67
Sparks on roofs, from chimneys, furnaces, grates, locomotive stacks, threshers, plumbers' furnaces	768	8.09	871,723	7.21
Exposure, from adjoining fire	613	6.45	704,853	5.38
Electricity, electric wires or wiring; trolley wires; defective motors; electric irons	549	5.81	691,588	5.55

The work of fire prevention is a big man's job and the more money spent in the undertaking the more will the country save. It is a problem of the people; they must be taught to use electricity, matches, gasoline and other dangerous materials that are sources of fire hazard with intelligence. Such instrumentalities if used with judgment and proper care are harmless.

GEORGE F. LEWIS,
Deputy Fire Marshal.

Toronto, Canada.

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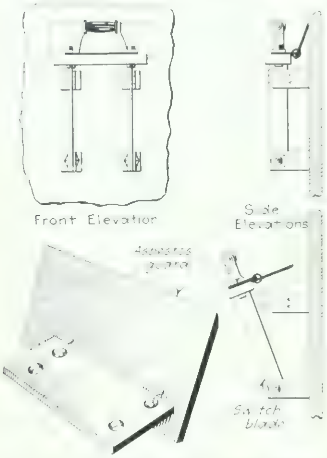
*June 11, 1921, page 1370.

Station and Operating Practice

A Department Devoted to Problems of Installation,
Operation and Maintenance of Equipment for Economical Generation and
Distribution of Electrical Energy

Guard Prevents Burns on Opening a Field Switch



ARC CANNOT BURN HAND WHEN SWITCH IS OPENED

TO prevent the arc of a hand-operated field switch from scorching the hand, a protective guard has been made by the writer. It consists of two pieces of ⅛-in. fiber or asbestos joined together by the two small rings forming a hinge. The small piece is bored to be set under the handle of the switch as indicated. The large piece hinged to the small piece is made to cover all arcing points and has an extension or under tongue to prevent it from dropping any lower than at right angles to the switch. The holes for the hinge rings are made large enough to allow the rings free movement. JOHN E. MCCARTHY.

Tuckahoe, N. Y.

Decay of Poles Depends on Depth of Penetration of Preservative

THAT depth of penetration of preservative in poles has a decided bearing on durability is well illustrated by the test conducted by the Forest Service in co-operation with southern California power companies. In 1909 416 Western red cedar poles were placed in a line near Los Angeles, Cal. Of these poles 375 were treated by the open-tank process and fifty-one were set untreated. No regular procedure was followed in setting the experimental poles, although treated and untreated poles were alternated so far as possible through the line. Because of climatic conditions all poles were continually subjected to decay throughout the year.

Inspection was made in January, 1920. Out of a total of 375 poles that were treated, 349, or 93.1 per cent, were still sound and 26, or 6.9 per cent, were partly decayed after eleven years' service, and out of a total of fifty-one poles untreated, twenty were removed on account of decay, or 39.2 per cent, and thirty-one, or 60.8 per cent, were partly decayed. The average penetration of the treated poles which were partly decayed was only 0.28 in. The decay was caused principally on account of checks through the comparatively thin treated part of the pole and occurred in most cases simply as a decayed pocket.

From these records, the depth of penetration of the preservative appears to exercise the controlling influence on durability of butt-treated Western red-cedar poles.

P. R. Hicks, Forest Products Laboratory, presented this information at a meeting of the American Wood Preservers' Association.

FIELD EDITOR ELECTRICAL WORLD.

San Francisco, Cal.

Street-Lighting Arc Lamps Changed Over to Incandescent Type

TO REDUCE maintenance costs on its street-lighting system and to allow equipment to be used more efficiently, the Augusta-Aiken Railway & Electric Corporation is changing over from alternating-current inclosed series arcs to the compensator-type fixture with incandescent lamps. This company has for years been operating some 300 series arcs on its 7.5-amp. series system and in a great many cases it was necessary that series incandescents and series arcs be operated on the same circuit. It was decided some months ago to convert all arcs to compensator-type fixtures with auto-transformers rated at 7.5 amp. to 20 amp. and 600 cp. Reasons prompting this decision were five: Lower maintenance, lower energy cost per unit, higher power factor, increased illumination and increased station capacity.

The installation of series incandescent lamps will have the effect of a 19 per cent increase in constant-current transformer capacity. At this time some 175 arc lamps have been replaced by compensator fixtures and the reduced load on station constant-current transformers is noticeable. It has been necessary to readjust the four circuits affected.

In addition to the increased capacity the services of one man, at an average saving of $120 per month, can be dispensed with. It is estimated that the cost of making the change will be approximately $11.50 per lamp.

COMPARISON OF SERIES-ARC LAMPS WITH COMPENSATOR-TYPE INCANDESCENT LAMPS

	7.5-Amp. Arc	20-Amp. Series Incandescent
Candlepower of unit 10 deg. below horizontal	325	1,280
Volt-amp. at station	819	434
Power factor	0.65	0.80
Kw.-hr. per year of 4,000 hours	2,128	1,396

It so happens that the company had about fifteen old lamp casings on hand. The auto-transformer used is easily adapted for use with this old inclosed lamp case. This was done by merely removing the arc-lamp mechanism and substituting the auto-transformer and adjustable socket to receive the 600-cp. 20-amp. incandescent lamp.

At the present time no change is being made in the globe or in the lamp shade, but it is intended in the near future to replace the old outer globe with either the Holophane prismatic-band refractor or Holophane prismatic-bowl refractor.

M. H. HUMMEL,
Superintendent Electric Department.
Augusta-Aiken Railway & Electric Corporation,
Augusta, Ga.

Use of Mechanical Stokers in Generating Plants

IN AN endeavor to ascertain the extent to which mechanical stokers are at present installed in the central generating stations of the country, the ELECTRICAL WORLD included a query on this point in its annual questionnaire sent to all operating companies in connection with the forthcoming 1921 issue of the "McGraw Central Station Directory and Year Book."

Definite stoker data were received from 540 operating companies, representing 694 coal-burning plants. Of these plants 225 indicated the installation of mechanical stokers, with a total of 1,080 stokers distributed among thirty-one different makes. The plants having hand-fired furnaces total 459.

Based on these returns, the ELECTRICAL WORLD has made an estimate of the total number of coal-burning central generating plants using mechanical stokers and also of the number having hand-fired furnaces. These figures indicate that only about one-third of the coal-burning central generating plants in the United States are now using mechanical stokers, leaving 2,059 plants in which the furnaces are hand-fired. The number of additional stokers required to equip completely all the 3,147 coal-burning central generating plants in the country is estimated at 12,955.

As is to be expected, the North Central States have the largest number of coal-burning stations, and it is estimated that of a total of 1,504 such plants in this section, 888 have hand-fired furnaces, representing a possible new installation of 5,583 mechanical stokers. The survey indicates that over one-half of the coal-burning central stations in the North Central States are equipped with stokers. Less than one-quarter of the coal-burning stations in the Southern States are using mechanical stokers.

In the accompanying tabulation is given estimates of the stoker situation in each of the states, based on the returns received in the ELECTRICAL WORLD survey.

TABLE I—"ELECTRICAL WORLD" ESTIMATE OF THE INSTALLATION OF MECHANICAL STOKERS IN CENTRAL GENERATING STATION

State and Section	Number of Central Generating Stations	Coal-Burning Central Generating Stations		
		Total Number	Number Using Stokers	Number Not Using Stokers
United States	5,731	3,147	1,088	2,059
SECTIONS:				
New England	369	202	81	121
Middle Atlantic	575	382	144	238
South Atlantic	634	409	85	324
East North Central	1,170	823	427	396
West North Central	1,322	681	189	492
East South Central	368	280	81	199
West South Central	568	208	37	171
Mountain	364	137	38	99
Pacific	361	25	6	19
NEW ENGLAND:				
Maine	98	28	11	17
New Hampshire	55	25	10	15
Vermont	78	39	16	23
Massachusetts	82	69	28	41
Rhode Island	6	6	2	4
Connecticut	50	35	14	21
MIDDLE ATLANTIC:				
New York	295	176	66	110
New Jersey	70	52	20	32
Pennsylvania	210	154	58	96
SOUTH ATLANTIC:				
Delaware	10	10	2	8
Maryland	40	31	6	25
Dist. of Columbia	1	1	1	0
Virginia	93	64	13	51
West Virginia	65	31	6	25
North Carolina	119	79	16	63
South Carolina	77	61	13	48
Georgia	142	99	21	78
Florida	87	33	7	26
EAST NORTH CENTRAL:				
Ohio	235	180	94	86
Indiana	174	151	77	74
Illinois	262	206	107	99
Michigan	251	175	91	84
Wisconsin	248	111	58	53
WEST NORTH CENTRAL:				
Minnesota	209	141	39	102
Iowa	222	151	42	109
Missouri	214	149	41	108
North Dakota	124	35	10	25
South Dakota	104	36	10	26
Nebraska	235	97	27	70
Kansas	214	72	20	52
EAST SOUTH CENTRAL:				
Kentucky	113	79	46	33
Tennessee	103	88	15	73
Alabama	60	45	8	37
Mississippi	92	68	12	56
WEST SOUTH CENTRAL:				
Arkansas	97	62	11	51
Louisiana	60	16	3	13
Oklahoma	151	68	12	56
Texas	260	62	11	51
MOUNTAIN:				
Montana	64	24	7	17
Idaho	52	10	3	7
Wyoming	35	18	5	13
Colorado	85	55	16	39
New Mexico	26	14	4	10
Arizona	30	8	2	6
Utah	60	6	1	5
Nevada	12	2	0	2
PACIFIC:				
Washington	100	22	6	16
Oregon	85	2	0	2
California	176	1	0	1

Hogged Fuel Satisfactory, but Has Its Drawback

HOGGED fuel is a very cheap and satisfactory fuel for central station use where attainable, but has the drawback that the supply fluctuates with the lumber industry. The supply during the past six months, on account of the great number of sawmills being shut down, has been entirely inadequate to supply central station demands depending on it. In most cases this required the burning of oil to make up the shortage, which added greatly to production costs.

Available data indicates that it is not desirable to leave hogged fuel in storage much longer than eight or nine months on account of the loss in fuel value due to heating, which causes the generation of gas which passes into the air, thus lowering the heat value of the fuel. Tests made at the Northwestern Electric Company's plant at Portland, Ore., show a loss of 35 per cent in heat value of hogged fuel stored approximately eight months. Fuel stored for eleven months and longer showed a loss in heat value of 45 to 50 per cent. The latter fuel, however, was from the bottom of the pile and probably depreciated to a greater extent than fuel higher up in the storage.

One of the important factors in the burning of hogged fuel, if loads up to 200 per cent of boiler rating are desired, is to have large furnace capacity. Hogged fuel burns on the surface and the larger the cone the more surface is exposed.

This information was presented in a committee report of the Northwest Electric Light and Power Association.

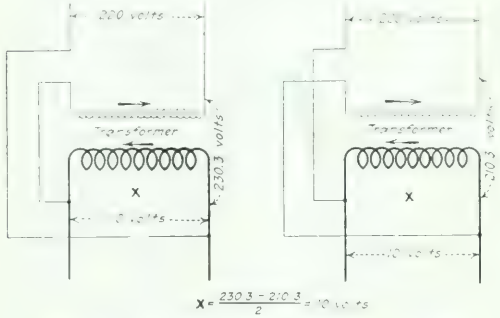
FIELD EDITOR ELECTRICAL WORLD.
San Francisco, Cal.

Industrial Applications

The Economical Utilization of Electrical Energy
in Mills and Factories, Together with Practical Details of Installation, Control,
Testing and Repair of Equipment Required

Measuring Low-Voltage Transformers Without Low-Range Meter

A METHOD for measuring low voltages in the secondaries of transformers such as are used on signs, welding machines, X-ray apparatus, etc., was outlined in the ELECTRICAL WORLD for April 30, page 997. The method illustrated demanded the use of an improvised slide wire for scaling the balance of primary and secondary. In the accompanying diagram is shown a method of making temporary connections whereby the secondary successively opposes and boosts the primary, the average between the two voltages being the potential of the secondary winding. These voltages may be measured by an ordinary 110-volt voltmeter.



MEASURING LOW VOLTAGE WITH A HIGH-RANGE METER

This method is quite accurate for practical purposes, though not for precision measurements, as the difference in phase angle of the two transformer windings might cause a slight error. M. C. VANGUNDY.

Texas Company,
Port Arthur, Tex.

Acetylene Flame Used for Soldering Motor Connections

USE of an acetylene flame in place of the ordinary blow torch for soldering connections greatly speeded up the work of reconnecting a 200-hp. motor for the General Laboratories of the Union Carbide Corporation, Long Island City, N. Y. The machine was changed from three-phase to two-phase, making it necessary to remove 172 jumpers, tin the ends and solder them into new positions. On this particular job an emergency outfit consisting of a small oxyacetylene blowpipe was used, just the tip of the long finger of fire being applied to the work. The conversion was completed in less than a week and at a cost under $200.

The oxyacetylene blowpipe, however, while it performs the work satisfactorily, is not necessary, as sufficient heat and the same advantage it possesses are available in the air-acetylene torch, such as is used by telephone companies in making electrical connections. The air-acetylene torch, moreover, has advantages of its own in being lighter, being adapted for use with a small tank of acetylene, not requiring either oxygen or compressed air, and in its greater consequent economy and convenience. The operator can easily carry it from place to place without a truck and work in any quarter where connections have to be made.

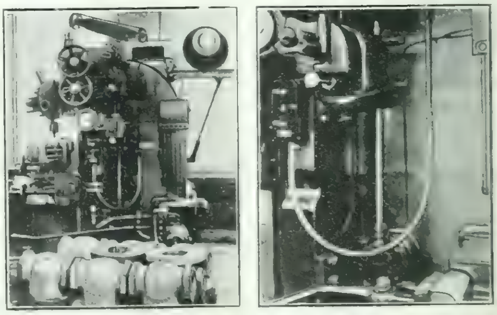
The applicability of acetylene to soldering in difficult places and the speed made with the blowpipe proved so satisfying that it will be used in sweating on approximately 5,000 lugs and in making other electrical connections in the laboratories. W. R. PABST.

Pabst Electric Company,
New York City.

Selection of Remote Control for Machine Tools

THE selection of control equipment for machine-tool motors is a problem of wide range on account of the variety of tools required in the modern shop. The writer is a firm believer in direct current at 220 volts for machine-tool service, since its use enables the shop to get the full benefit of field control, dynamic-braking features and push-button operation.

For general boring-mill operation a constant-speed motor with an inclosed wall-type control which can be installed in an out-of-the-way place near the machine is very good. This should have reversing, over-load-relay and dynamic-braking features controlled from a push-button conveniently placed as regards the operator. In some cases, with a boring mill having a 10-ft. or 15-ft. table, two push-button stations are conveniently used in parallel mounted on either side of the machine and permitting tool control from two points. A ma-



PUSH-BUTTON CONTROL STATION ON 36-IN. BORING MILL TRAVELS WITH MACHINE jority of our operators prefer the push button to the drum or master switch on account of simplicity and space economy. The latter is of great importance around a busy tool. With boring mills having speed-change gears or pulleys this type of control is especially suitable.

Some of the larger mills do not have change-speed gears or cone pulleys to such an extent that it is possible to get all the changes of speed which are needed for all classes of work. In cases like this the same type of control with the addition of field-control features and a variable-speed motor, ranging perhaps from 500 to 1,500 r.p.m., is good practice.

One small boring mill with a 30-in. table equipped with a wall-type self-starter with reversing, dynamic-braking and overload features is controlled with a master switch of the drum type. This works out very nicely. In the larger type of mill push-button control is to be preferred as the motor current is handled entirely by the self-starter.

Multiple drills are best served by variable-speed motors. The self-starter for this type of service is much the same as for boring mills except that there is no occasion for reversing. Dynamic braking, overload relays and field control are important in this service. A push button is mounted on the machine at the most convenient point for the operator.

For radial drills which do not require a motor of more than 5 hp. a control which is operated from a push button has given excellent service. The control is very compact, totally inclosed and inexpensive.

In relation to this subject it is well to say just a word about maintenance and inspection. It has been the writer's experience that the maintenance is so very small that it does not pay to have any regular inspection or make a practice of carrying many spare parts. Controls in continual operation for over three years have needed absolutely no repairs whatever. This, of course, is not the case with all of them, but any failure to operate properly is so small that it is hardly worth considering. A few extra contact tips for some contactors that have to carry considerable current and a few extra push-button stations should be kept on hand.

Chapman Valve Mfg. Co., W. B. ATCHINSON,
Indian Orchard, Mass. Electrical Engineer.

Selecting Oil for Ball Bearings

THE selection of the mineral oils for various classes of ball-bearing service can be guided by the following table and instructions:

Grade	Viscosity*	
Very light	50-100	(A)
Light	100-200	(B)
Medium	200-300	(C)
Heavy	300-500	(D)
Extra-Heavy	500 or above	(E)

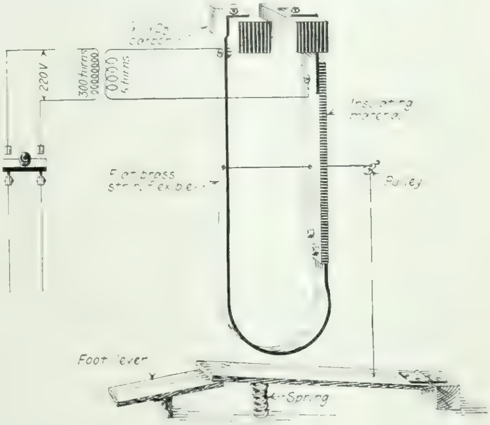
*Saybolt, at 100 deg. Fahr. in seconds

For very high speed, say over 3,000 r.p.m. and up to 25,000 r.p.m., use a light oil such as A. If the surrounding temperature exceeds 150 deg. Fahr., grade C may be used. For speeds from 600 to 3,000 r.p.m., use oil B or C. If the surrounding temperature exceeds 150 deg. Fahr., grade *D* may be used. For speeds from 100 to 600 r.p.m., use oil C., or light-body grease, or if the surrounding temperature exceeds 150 deg. Fahr., oil D. For speeds below 100 r.p.m., use oil D, or medium grease, or if the surrounding temperature exceeds 150 deg. Fahr., oil E. For temperature below 32 deg. Fahr. use oil similar to B with zero cold test.

J. B. Castina embodied these data in a discussion in the *Journal* of the American Society of Lubrication Engineers.

Simple Electric Soldering Machine

FOR soldering cable tips an electric soldering machine, as shown in the drawing, has been in successful use now for many months in the plant of a large electrical manufacturer in the East. From an actual test covering the period of one hour it was found that this machine was quicker than gas and, owing to the workman having better working conditions, his output under continuous operation was still further increased.



ELECTRICALLY HEATED SOLDERING OUTFIT WHICH DOES QUICK WORK

The machine consists essentially of an air-cooled dry-type transformer with its secondary connected to two carbon electrodes. The backs of these electrodes are copper-plated so that they will make good contact with the holders. The transformer is mounted under the workbench by means of iron straps fastened to the core assembly yoke. The primary winding consists of 300 turns of No. 10 double-cotton-covered wire. The secondary winding consists of five turns of No. 3 stranded rubber-covered, double-braid cable. Normally the carbon electrodes are in contact, so that when the switch is closed they begin to heat up. The operator can separate the electrodes by pressing on the foot lever. As very little time is consumed in removing one cable tip from the machine and replacing it with another, it was found that on this work the speed was materially increased by keeping the electrodes together. They cool rapidly and require some time for heating up again.

After the apparatus had been in use for about a year the operator complained that he was not able to make the same speed as formerly. Investigation showed that soldering acid had reached the electrodes and had materially increased the contact resistance between the electrodes and the brass contact plate. By removing the electrodes and plating them and cleaning the brass contact plates the former efficiency was restored.

EUSTACE C. SOARES,
Ophuls, Hill & McCreery, Electrical Engineer.
New York City.

Power Requirements of Machine Tools

An opportunity to check up the power requirements of the various machines in operation in the Southwestern Shipbuilding Company plant at East San Pedro, Cal., and to make such changes as would increase the effectiveness of the electrical installations was afforded when the company settled down to the construction of ships upon a peace basis.

To obtain the necessary information for a study of the existing conditions upon which improvements might be based, a power survey was made of all the 220 motors installed in the plant. The greater number of these motors were installed during the construction period and therefore it was possible to obtain experimental and operating data as to the peculiar requirements of the work to be performed in this particular plant. As operations progressed and observations of power con-

POWER REQUIRED TO DRIVE VARIOUS MACHINES IN SHIPBUILDING PLANT

No.	Machine	Motor Hp. Make	Poles, R.P.M.	Drive	Duty	Character of Load	Volts	Amp. Max.	Amp. Run	Kw.	Power Factor, Per Cent	Load, Per Cent
1	Crane	30	8	Gear	Hoist	Raise ½ ton	440	94	77	16.25	28	72
		U.S.	..			Lower, light	440	.	81	13.0	21	58
4	Crane	30	8	Gear	Hoist	Raise 4½ ton	422	96	62	28.7	65	128
		G.E.	..			Raise ½ ton	426	96	46	17.5	52	78
8	Crane	22	6	Gear	Travel	100 ft. per min	420	29	21	4.25	27	26
		U.S.										
11	Crane	25	6	Gear	Travel	150 ft. per min	424	38	24	8	45	42
		W										
17	Crane	22	6	Gear	Boom	Raise 3 ton	418	58	23	10.5	63	64
		U.S.	..			Lower ½ ton	418		17	1.25	10	8
22	Crane	22	6	Gear	Swing	Average of right and left swing	426	38	33	4.25	18	26
		U.S.										
26	Crane	20	6	Gear	Swing	Full speed right	424	38	21	6	39	30
		W				Full speed left	422	30	19	5	36	22
29	Blower	20	4				426	95	13	8.00	83	54
		G.E.	1,475	Direct		Furnace air						..
30	Gate shear	10	8	Belt		Idle	446	40	7.5	1.75	30	23
		G.E.	865			Shear ¾-in. channel	446	.	14.0	9.5	88	127
						Flywheel	446		15.75	11.25	92	150
31	Angle shear	10	6	Gear		Idle	450	41	6.0	1.87	40	25
		G.E.	1,165			Cut-off 3½-in. x 3½-in. x ½-in. angle iron	450	..	11.5	7.50	84	100
						Cut-off 6-in. x 6-in. x ½-in. angle iron	456		15.0	10.0	85	134
32	Angle bender	10	6	Gear		Idle	450	40	6.5	0.75	15	10
		G.E.	1,020			Bending 3-in. x 3-in. x ½-in. angle	450		7.3	1.87	63	27
33	Plate punch	7.5	6	Gear		Idle	450	60	6.0	0.625	13	11
		G.E.	1,012			¾-in. hole in ½-in. plate	446		7.7	3.75	63	67
34	Vertical punch	7.5	6	Gear		Idle	448	61	6.0	0.625	13	11
		G.E.	1,150			⅞-in. hole in ½-in. plate	448	..	9.0	4.37	62	78
						¾-in. hole in 1-in. plate	444		24.0	17.0	92	300
35	Horizontal	7.5	6	Gear		Idle	446	60	5.25	0.60	15	11
		G.E.	1,020			⅞-in. hole in ⅝-in. plate	445		10.75	6.2	75	110
36	Horizontal	7.5	6	Gear		Idle	446	65	5.75	0.62	14	11
		G.E.	1,200			⅞-in. hole in ⅝-in. iron	448		11.5	6.87	76	123
37	Punch and shear	7.5	6	Gear		Idle	450	66	5.25	0.625	15	11
		W.	950			¾-in. hole in ½-in. iron	450	..	7.75	4.0	71	71
						Trimming liner	452		8.50	5.50	84	98
44	Two-wheel grinder	3	4	Direct		Idle	446	16.5	2.4	0.225	12	10
		G.E.	1,720			Ave. grinding	450		2.5	0.550	28	25
45	Two-wheel buffer	3	4	Direct		Idle	450	13.5	1.95	0.175	12	8
		G.E.	1,720			Buffing, ave. pres	448	..	1.95	0.425	28	19
46	Trip-hammer	2	6	Belt		Idle	448	12.5	1.90	0.25	17	17
		G.E.	1,130			Hammering, full speed	440		2.5	1.00	52	67
48	Compressor 17-in. x 14-in. and 10-in. x 14-in.	150	10	Belt		95-lb. pressure	428	544	154	99.2	87	88
		G.E.	595			28-lb. pressure	...		95	52.0	73	46
55	Compressor, 22-in. x 16-in. and 13-in. x 16-in.	200	12	Belt		97-lb. pressure	456	784	265	184	88	124
		G.E.	485			25-lb. pressure	458	..	165	104	79	70
58	24-in. circ. ripsaw	20	4	Belt		Idle	418	93	9	2.45	38	17
		G.E.	1,520			3½-in. O. P. plank	418	.	20	12.5	86	84
60	36-in. cutoff saw	10	8	Belt		Idle	433	42	5	2.0	49	27
		G.E.	760			Cutting 4-in. x 12-in. O.P. plank	430	.	12.5	8.25	88	111
63	42-in. band saw, 1½-in. blade	5	4	Belt		Idle	420	48	3.75	2.0	73	53
		G.E.	1,485			Slow feed rip 12-in. wood block.	420		8.0	5.0	86	133
64	Two 10-in. wheel grinders	2	4	Direct		Idle	426	13.5	0.9	0.125	19	08
		G.E.	1,480			Average pressure (wood)	426		1.1	0.45	55	30
73	8-ft. reversing planer	7.5	6	Belt		Idle	454	37	8.5	1.87	28	33
		G.E.	1,015			At instant of reversals	454	..	15.0	5.25	45	94
							452		13.0	4.50	44	80
74	Turret lathe	7.5	6	Belt		Heaviest load	448	34	7.0	3.75	70	67
		G.E.	1,005			Idle	454	..	5.5	1.25	29	22
						Cutting-off	454		6.25	3.00	62	54
85	Power saw drill, grinder	7.5	8	Belt		Idle, line shaft	446	36	5.5	0.55	13	10
		G.E.	865	Line shaft		Approx. max. load	440	.	6.3	2.5	52	48
86	Two 20-in. drills, 15-in. lathe, power saw.	7.5	8	Belt		Idle	456	38.5	5.9	0.87	19	16
		G.E.	770			Lathe and drills	456	..	6.2	1.50	31	27
						All machines	456		6.5	2.10	41	37
88	Drill grinder, 8-in. wheel	1	4	Belt		Idle	446	4.4	1.3	0.36	35	48
		G.E.	1,530			Heavy grinding	446		1.5	0.57	50	77
90	Grinder	5	4	Direct		Idle	450	31	3.8	0.42	14	11
		U.S.	1,532			Medium grinding	450		4.6	2.00	56	54
						Heavy grinding	450		5.6	3.00	69	80
91	Two 8-in. wheel grinders	2	4	Direct		Idle	452	8	1.7	0.17	12	11
		G.E.	1,550			Heavy grinding	452	..	2.8	1.75	81	117
						Heavy both wheels	452	.	3.4	2.25	85	150
94	Sensitive drill	1	4	Belt		Idle	444	3.8	1.6	0.22	18	30
		G.E.	1,548			Running idle	444	.	1.6	0.41	32	55
						Drill $\frac{5}{16}$-in. hole	444		1.6	0.45	35	60
95	Pipe threader	7.5	6	Belt		2-in. pipe	450	0.37	6.00	0.70	15	12
		G.E.	1,000			Same end of cut	454	..	6.25	0.87	18	16
						3-in. pipe	454		7.5	1.62	28	29
97	Power saw threader, 20-in. drill	7.5	8	Line		Line shaft	444	39	6.0	0.62	13	11
		G.E.	770	Shaft		All machines running	444		7.0	1.50	28	27
						Threading 7-in. pipe	444		7.25	2.25	41	20
99	Two 8-in. wheel grinders	2	4	Direct		Idle	450	18	3.2	0.21	09	14
		G.E.	1,700			Heavy grinding	452		3.3	0.50	19	34
130	Bolt threader	5	6	Belt		Idle	452	27	4.3	0.67	20	18
		G.E.	1,015			Run over ¾-in. thread	452	.	4.3	0.82	24	22
						Thread ¾-in. bolt	452		4.5	1.20	34	32
131	Nut tapper	7.5	6	Gear		Idle	456	35	5.8	0.90	20	16
		G.E.	1,010			Tap 4 sizes nuts at once	456		6.1	0.95	20	17
132	Two 12-in. wheel grinders	5	6	Direct		Idle	448	30	5.7	0.55	12	15
		U.S.	1,032			Heavy grinding	454		5.9	1.00	22	27

sumed were taken, the plant was found to be operating upon a very low power factor. From this it was evident that overloaded and underloaded motors were in use and that unbalanced conditions of load existed. An improvement of power factor would mean a decrease in the cost of power service and an improvement in rating and loading conditions would decrease the cost of maintenance.

Therefore tests were made on the several feeder circuits and on the individual motors wherever possible. Practically all the machines are driven by individual motors, line and counter shafting being used in comparatively few instances. The total number of motors in operation is approximately 220, ranging in horsepower from ½ to 200. All are alternating-current motors. For machine-tool operation squirrel-cage types and for train and hoist duties wound-rotor variable-speed type motors are used. All motors rated at 1 hp. and above with but one or two exceptions are operated on 440-volt, three-phase, 60-cycle circuits.

Following the survey it was found that many of the machines were improperly motored and many changes were recommended which would improve the power factor and decrease the operating costs. It was also found advisable to recommend the installation of a number of static condensers at points later to be selected. The investment in such condensers would be well warranted by the saving which would be effected in feeder losses.

In making the tests records were taken from voltmeters, ammeters and wattmeters. Curve-drawing wattmeters were used for varying periods of time from a few minutes to twenty-four hours. In particular cases the paper speed of the curve-drawing wattmeter was increased to as much as an inch in five minutes.

The records taken were entered on forms having coordinate sections at the bottom on which might be transferred the load curves. In a few cases only were the curves transferred from the curve-drawing wattmeter charts to these data sheets. In other cases the charts from the curve-drawing wattmeters were filled with the individual power survey sheets.

An inspection of the column entitled "per cent load" indicates that many of the machines are badly overmotored; which is also evidenced from the very low power factor obtaining, although with but few exceptions the voltage applied to the motor terminals is in excess of the 440 volts required, which should increase the power factor.

A. G. HUMPHREYS,
Electrical Engineer.

Southwestern Shipbuilding Company,
East San Pedro, Cal.

Points to Watch on Direct-Current Starter

A DIRECT-CURRENT starter, with its resistance coils, should be looked over carefully at regular intervals. The contact buttons may need a little smoothing with fine sandpaper, the holding magnet may be burned out, the return spring may be broken, or the sliding finger may be badly worn down. An open resistance coil can often be repaired in a few minutes by picking up the broken ends of the wire; but if it is burned out hopelessly, one should either get a new starter or, for a large motor, use a barrel of water with a pound or two of sal soda in it, with iron weights for terminals.

H. S. RICH.

East Berlin, Conn.

Power Equipment of Industries in Superpower Zone

A PRELIMINARY statement of the 1920 census of manufacturers with respect to power equipment and fuel consumption of plants in the Northeast Atlantic Seaboard Superpower Zone has been prepared by the Bureau of the Census, Department of Commerce, in collaboration with the Superpower Survey of the United States Geological Survey, Department of the Interior. This district includes the southern part of New Hampshire, and Vermont, Massachusetts, Rhode Island, Connecticut and New Jersey; southeastern part of New York; eastern Pennsylvania; Delaware and the central portion of Maryland and the District of Columbia.

A—Power equipment by types.

Class	Number of Units	Horsepower
Aggregate.....	......	9,069,471
Prime movers.....	.	6,247,002
Steam engines.....	33,379	4,255,868
Steam turbines......	2,115	1,171,061
Internal combustion engines..	6,246	279,040
Waterwheels	4,708	541,033
Operated by purchased energy...		2,822,469
Electric motors.............	361,961	2,770,715
Other......................	.	51,754
Electric motors, total.........................	560,907	5,336,627
Run by current generated in establishment......	198,946	2,565,912
Run by purchased current....................	361,961	2,770,715

The figures are based upon returns from 95,984 establishments. Of these 76,227, or 79.4 per cent, used power, the same including 73,694 manufacturers, 1,563 laundries, 939 mines and quarries and 31 governmental institutions. The power equipment of these 76,227 establishments aggregated 9,069,471 hp., comprising the following factors:

33,379 steam engines of 4,255,868 hp.
2,115 steam turbines of 1,171,061 hp.
6,245 internal combustion engines of 279,040 hp.
4,708 waterwheels of 541,033 hp.
506,907 electric motors of 5,336,627-hp. rating.
51,754 hp. of purchased power other than electric.

The net total is 9,069,471 hp. of rated power equipment, both primary and purchased, of which 5,336,627 hp., or 58.8 per cent, is represented as utilized by electric motor equipment. These establishments consume 20,910,000 long tons of anthracite, 34,669,000 short tons of bituminous coal and 5,661,000 tons of coke.

B—Horsepower of prime movers and energy purchased by industries

Industries	No. of Establishments Using Power	Horsepower		
		Aggregate	Prime Movers	Purchased Energy
Total....................	76,227	9,069,471	6,247,002	2,822,469
Manufactures:				
Textiles and their products...	18,442	1,914,722	1,440,495	474,227
Iron and steel..............	6,362	1,745,755	1,175,504	570,251
Paper and printing..........	8,291	706,429	489,776	216,653
Chemicals and allied products	2,109	523,849	390,558	133,291
Metals, non-ferrous.........	3,423	405,249	245,774	159,475
Food and kindred products..	11,465	385,184	232,084	153,100
Stone, clay and glass.	2,204	345,018	229,351	115,667
Lumber and its remanufactures	4,710	280,533	206,405	74,128
Leather and its products.	2,707	178,081	104,461	73,620
Railroad repair shops	316	119,906	68,549	51,357
Liquors and beverages.......	1,303	113,934	101,762	12,172
Vehicles	3,862	95,380	28,222	67,158
Tobacco....................	567	15,334	8,773	6,561
Miscellaneous..............	7,933	1,071,524	546,110	525,414
Laundries	1,563	55,087	44,371	10,716
Mines and quarries	939	1,010,757	857,273	153,484
Governmental institutions...	31	102,729	77,534	25,195

The statistics are summarized in the table above, which distributes them according to the different industrial groups.

Central Station Service

A Department Devoted to Commercial Policy
and Management Topics, Including Methods of Increasing the Use
of Electric Light, Power and Heat

Central Maine Power "Plays Up" Better Business

LITTLE gloom is to be found around the headquarters offices of the Central Maine Power Company, at Augusta, Me., regarding the industrial and general business situation. Conditions are distinctly on the mend in the Pine Tree State, judging from the following security selling advertisement recently inserted by this company in several of the leading newspapers of its territory.

Within a year the company has acquired control of the plants and system of the Androscoggin Electric Company, whose headquarters were at Lewiston, and a comparison of the total energy generated and delivered into the combined transmission systems for the first five months of 1920 and 1921 shows an increase of 6,266,039 kw.-hr. for this year to June 1, making a total output to the system of 43,538,531 kw.-hr. "If this be gloom, make the most of it!" say the officials of this utility.

Advertising of this kind is most constructive, and while it is obviously intended to interest people in the preferred stock of the Central Maine Power Company it has a further value in stimulating confidence in general business conditions of the community.

Business Is Better
IN MAINE

"Maine is in better business and financial condition, I believe, than any state in the Union," was the recent verdict of a man who had just finished a trip through the entire East.

Certainly Maine is headed back to normal. Woolen mills are working virtually to normal capacity, with business in sight for months. Cotton mills generally are in good condition. Shoe manufacturing conditions are looking better.

Several towns in central Maine report business as good as ever in their history, with basic conditions sound.

Business Is Good, Too, for Central Maine Power Company

Central Maine Power Company's business reflects conditions in its territory. The company is making and selling more electric energy than ever before in its history.

It is steadily gaining customers. The number gained this year thus far as compared with the gain of 1920 over 1919 is an increase of 89 per cent. Appliance selling is setting records hitherto unheard of.

The company's gross and net income for the twelve months ending January to May respectively showed a gain every month over the corresponding period of the previous year.

The securities of a prosperous company serving a prosperous territory are likely to be highly desirable. More people in Maine have bought our 7 per cent preferred stock than any other security save Government bonds. The price is $107.50 a share, the yield is 6½ per cent net.

Central Maine Power Company
Augusta Maine

Three Essential Points for the Public Service Industry

CONTINUING a series of articles dealing with the problems confronting the electrical industry, W. E. Creed, president of the Pacific Gas & Electric Company, has set forth a policy for the public service industry to follow. The three cardinal points of his policy are: service, frankness and the repelling of slanders. Pointing out the fallacies of home-rule control of public utilities, Mr. Creed says:

"In contrast with the failure of local regulation, state regulation has permitted and encouraged the adoption of sound principles and sentiments in the public service industry. The baneful influence of local regulation created many unhealthy conditions. First, local regulation forced the industry into politics, even against its will, and, second, caused the industry and the public to draw apart. Both results proved disadvantageous alike to the companies and their customers.

"From the progress of the past ten years, the hope may be ventured that eventually the industry can cement a relation with the public which will be to the obvious advantage of both. Future progress will depend in large part upon the policies of the industry. Three essential policies are herewith submitted.

SERVICE

"No other business has learned so well the wisdom of service as the public service industry. The ideal of service is thoroughly established as its guiding star. In practice the industry has given ample demonstration of this fact. For example, there was not a single public service company in California which sought a profit or made a profit during the war.

"An excellent definition of service is that it is 'a state of mind—a quality, not a thing.' There is much truth in the suggestion that service depends on one's attitude toward the subject. As a practical matter service must be definitely interpreted both for the organization and for the management as a whole. Properly interpreted and understood, it will imbue both management and organization with a desire to search out what they can do to promote the public interest. It will go further and direct the efforts of the organization to securing good will as much as securing the revenue to meet costs.

"Obviously, the service ideal requires that the commodity sold be of good quality, be delivered promptly on demand and continuously as demanded and be sold without discrimination, at as low a cost as skill, diligence and reasonable foresight can make possible. But it requires even more. The attitude of the entire organization toward the public must be one of friendly helpfulness. A real test of service comes in the adjustment of complaints. Here there is need for courtesy, tact, patience, sympathy and the ability to make that clear exposition of facts out of which understanding and concord develop.

"Service does not begin and end in contact with the public. The industry must lead in the development of the arts and sciences on which its business is founded. Most large companies accept this aspect of service and consequently maintain laboratories and research departments to discover improvements which will reduce costs or add to service without increased cost. The public is entitled to a progressive policy in this regard.

"Finally, service requires that the industry concern itself with its organizations. In the long run the degree of service attained will depend on the quality of an organization. The obligation therefore rests upon the industry not only to select employees of the highest type but to give them the opportunity to grow in technical skill and to acquire a broad understanding and vision of the business to which they devote themselves. It is not too much to say that company success will be circumscribed by their welfare and their abilities.

FRANKNESS

"The public service industry as a whole should adopt the policy of frankness. Many companies have done so; all the others should follow. Suspicion feeds upon concealment. Most of the distrust of the industry arises from things imagined and not from things known. The facts today are greatly to the credit of the industry, and the facts will do more than anything else to remove doubt, suspicion and question in the public mind. Operations, policies and decisions which are criticised should be explained with complete frankness and in such a way that the reasons compelling them shall be perfectly clear and well understood.

"In the day-to-day life of the companies there are countless incidents which appeal to public interest and give a conception of what must be done to produce the service so commonly accepted as a matter of course without any comprehension of the skilled organization and eternal vigilance behind the service. In the story of the economic position and importance of the industry there is abundant opportunity to bring the public to the attitude of appreciation, and in the exposition of plans of expansion and development romance, adventure and accomplishment will stimulate public support and co-operation. But the fact should not be overlooked that the frank boast of performance requires the equally frank admission of error. Perfection is neither possible nor expected by the public. It does, however, demand that it be neither fooled nor 'stalled.' The best remedy for resentment against service difficulties due to mistake, oversight, or even causes beyond human control, is a frank admission of the facts.

"While the public service industry is not generally competitive, it needs advertising as much as the most highly competitive business in the world. Its chief asset is good will.

"The public service industry has suffered outrageously from charges made without knowledge of the facts or in spite of knowledge of the facts. An analysis of the motives instigating such charges is interesting but unnecessary here. It is a curious fact, however, that the public hears these slanders against the public service industry with complacency or acquiescence, whereas it would instantly resent similar slanders against the banking business. Yet both are public servants, both are regulated, both are honest, both charge for their services, and both are of vital importance to the public. This public attitude is probably an inheritance of the past, but whatever the explanation, the plain duty rests upon the management to repel slander. The public is entitled to know the facts, and the interest of both the public and the industry requires that the facts be known. Unless they are known there can be no substantial basis for that mutual confidence and cooperation between the public and the industry which best serves the interest of all.

"On the whole, management has overlooked an opportunity for real service in failing to protect the public against deception through unfounded charges. The policy of silence has often left impressions from which have come antagonism and suspicion. Both can be eliminated if the determination exists to see to it that the public is not misled but is put in possession of the truth."

A Practical Demonstration of the Convenience Outlet

AT AN electrical exposition and cooking school conducted in Salt Lake City last month under the auspices of the Rocky Mountain Electrical Co-operative League and the *Deseret News* of that city, a most practical demonstration was made of the value of the convenience outlet. As shown in the accompanying illustration, the booth was devoted entirely to featuring the location and use of an adequate number of outlets in the home. In the booth electric household appliances were installed with the proper connections shown. These appliances were not on display, but connected to emphasize the method of using the convenience outlet.

CONVENIENCE-OUTLET DEMONSTRATION BY THE ROCKY MOUNTAIN ELECTRICAL CO-OPERATIVE LEAGUE

Economy through proper installation of convenience outlets was discussed by Earl T. Millham, secretary of the Rocky Mountain Electrical Co-operative League, in informal talks to visitors at the booth. Figures were given showing the annual breakage of fixtures and lamps in the average family on account of removing them for temporary connection of appliances with light sockets. It was shown that the breakage cost in one year will pay for the installation of convenience outlets.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
of the World

Generators, Motors and Transformers

Connections for Multi-Step Transformers to Save Copper.—R. RICHTER.—By connecting the different winding groups of a multi-step transformer successively in series or parallel, all or most of the winding is in use at all times, which permits of a better use of the copper in the transformer, gives less voltage drop, considerable less I^2R loss, and, in some instances, a cheaper switching mechanism. Several practical cases are described, and the losses are tabulated, comparing the new with the old method.—*Elektrotechnische Zeitschrift*, June 9, 1921.

Squirrel Cage and Wound Rotor Induction Motors.—It is said that a small firm can specialize in a standard type of motor that may be manufactured economically and sold in competition with the product of larger organizations by concentrating on economical methods of production. Alternating-current motors manufactured by a British concern are described to illustrate the point.—London *Engineering*, June 17, 1921.

Generation, Transmission and Distribution

Surge Protection on Transmission Lines and Cables.—S. CUNHA and G. C. READ.—A discussion of the protection of electrical apparatus from both high and low frequency disturbances, including the use of condensers attached to the bus-bars in substations through high resistances. The theory of traveling waves is dealt with mathematically.—*Journal of the Engineering Institute of Canada*, June, 1921.

Cost of Power Supply as Influenced by the Present Economic Trend.—P. M. LINCOLN.—The question of the increasing cost of supplying electrical energy is considered and suggestions regarding rate revision to cover increased production expense are made as follows: (1) Costs of producing power have risen to a marked degree during the last few years. These increases affect both the operating costs and the fixed charges. The increase in costs for 1920 over those for 1914 showed the following percentages: Turbo-generators, 225; motor generator sets, 147; rotary convertors, 91; transformers (power), 125; transformers (distributing), 58; voltage regulators, 48; switchboard panels, 126; oil circuit breakers, 79; watt-hour meters (single-phase), 38; watt-hour meters (polyphase), 78; frequency-changer sets, 101. The increase of steam-plant costs in cents per kilowatt-hour was:

	1914	1920
Fixed charges	0.206	0.579
Operation:		
Fuel	0.289	0.649
Oil, waste, and supplies	0.012	0.024
Labor	0.041	0.076
Maintenance:		
Materials	0.026	0.053
Labor	0.021	0.039
Administration	0.008	0.011
Totals	0.603	1.431

Production costs for hydro-electric plants in cents per kilowatt-hour were:

	1914	1920
Fixed charges	0.440	1.260
Operation:		
Oil, waste and supplies	0.009	0.018
Labor	0.033	0.061
Maintenance:		
Materials	0.024	0.048
Labor	0.028	0.052
Administration	0.008	0.011
Totals	0.542	1.450

(2) The increase in operating costs can logically and conveniently be recognized by increasing the energy rate at which power is sold. A much-practiced method for accomplishing this result is to incorporate a coal clause in the power contract, by which the energy rate varies either up or down depending upon the price of coal. (3) The necessity of increasing the demand portion of power rates is not so immediately apparent as that for increasing the energy portion, but must eventually be recognized as soon as the increased cost of equipment has had time to make its effect felt. (4) The demand portion of power should be based on a measured quantity and not inferred from the installed equipment. (5) Power factor should be recognized in the demand portion of a power rate. A method recognizing power factor is suggested.—Paper read before Toronto Section A. I. E. E., 1921.

The Dalmarnock Power Station.—In this number of the series two turbo-generators are considered which were supplied by the English Electric Company having maximum continuous load of 18,750 kw. and 15,000 kw. as the most economical load. A switch gear relay protection and switchboards are also dealt with.—London *Engineering*, June 24, 1921.

Traction

Electrification at Edinburgh.—It is said that gasoline motor buses and electric railway cars have replaced cable operation. This combination is said to give the most effective transportation at lowest over-all costs. The choice was determined by traffic, power and price conditions.—*Electric Railway Journal*, July 2, 1921.

The New Addition to the Valtellina Railway, Lecco to Milan.—G. HULDSCHINER.—After a short description of the old line the new equipment of the recent addition (Lecco-Monza) is described, which brings the line within 10 miles (16 km.) of Milan. Two power houses supply 15-cycle, three-phase current at 20,000 volts through overhead lines and cables. Along the line are distributed nine transformer stations, containing each one 300-kva., 20,000/3,000-volt transformer. These transformers are so designed as to withstand for a short time a 500 per cent overload. The trolley lines consist of two 8-mm. copper wires. Original rolling stock consisting of ten motor cars and two locomotives was installed. The motor cars each have two trucks driven each by two motors. One of these is designed for 3,000 volts and the second motor, always used in cascade with the high-voltage motor, operates on 300 volts. The locomotives have four axles, each driven by a 110-kw. motor. As the density of the travel increased a great many more locomotives were ordered. Of special interest is the Westinghouse 1-C-1-type, which is described for the first time. Its output is 2,200 hp., weight 73 tons, driven by two motors. An interesting switching diagram gives four economical speeds. The motors may be operated either as three-phase, 8-pole motors or as two-phase, 6-pole motors and can be arranged in either case in parallel or in cascade. A highest speed of 100 km. per hour can be maintained. Characteristic running diagrams of the two higher speeds are given. A complete wiring diagram of the locomotive and a schematic connection of the motors for the four speeds are reproduced. Several 2-C-2 Brown-Boveri machines are in operation, which have been described previously. The author mentions in detail the equipment of the power stations and substations, the exact layout of the overhead wires and experiences with the entire line.—*Elektrotechnische Zeitschrift*, May 26 and June 2, 1921.

Electrification of St. Gotthard Line, Switzerland.—HANS W. SCHULER.—The description of this system, where the grade averages 2.5 per cent for 30 miles (48 km.), includes consideration of the power stations, transmission lines, substations and overhead systems.—*Railway Electrical Engineer*, June, 1921.

Installations, Systems and Appliances

Electrical Installations on the Former Austrian Cruiser Prinz Eugen.—A. MESTRAND.—This former Austrian ship, surrendered to France under the peace treaty, has a displacement of about 20,000 tons. She is propelled by four screws, direct connected to steam turbines of a total of 24,000 hp. Electric current is generated in one fore and one aft engine room, each containing two 300 to 400 kw. steam turbine-driven direct-current 126-volt generators. The two central stations operate independently, with no means of paralleling. Besides these, one 75 kw. Diesel engine set is provided. Provision is made to switch any power circuit on any one of these three stations. Distributed all over the boat are thirty-three motor-generator sets, ranging from 4.5 kw. to 120 kw., used in Leonard connection for all larger motor drives. Besides these two direct-current-alternating-current motor generators are installed for the operation of fans, utility motors and some elevators. For the varied and important drives in the four turrets four more motor-generator sets per turret of 440-volt direct current are available. The entire power supply system is unnecessarily complicated by the use of such a vast number of motor-generator sets. Their combined capacity is equal to the total generator output. If the alternating-current system had been used throughout a great saving at the same amount of safety could have been realized, aside from the greater reliability of the alternating-current motor. The entire system, while highly modern, is far too complex, and is not sufficiently sturdy for marine usage.—*Revue Générale de l'Electricité*, May 28, 1921.

Refrigeration Load.—A. R. STEVENSON, JR.—Attention is called to the rapid growth in electric refrigeration, which the author ascribes chiefly to the rising price of coal and labor at a time when electric power has increased in price only slightly. The desirability of the refrigeration load from the point of view of seasonal demand and the possibility of use during light load hours makes this desirable business for central stations.—*General Electric Review*, June, 1921.

Load Conditions in the Glass Industry.—G. W. FICK.—It is pointed out that although the advantages of electric drive are fully appreciated in the glass industry, not more than 20 per cent of the 93,000 hp. installed in glassworks in 1914 was purchased. The reason is, it is said, that the glass manufacturers have their own plants. An analysis is given of the various processes in the glass manufacturing industry showing the proportion of electrical energy used for various processes and the load characteristics.—*General Electric Review*, June, 1921.

Mercury Vapor Rectifiers.—The starting of the first steel-cylinder mercury rectifier operating in England is described. The equipment has a capacity of 120 kw. at 475 volts. The supply is three-phase at 3,000 volts and 50 cycles. The following table shows the efficiency of rectifiers compared to converters and motor-generators at 550 and 1,500 volts.

EFFICIENCY COMPARISON BETWEEN CONVERTERS AND RECTIFIERS

Plant Capacity	Quarter Load Per Cent	Half Load Per Cent	Three-quarter Load Per Cent	Full Load Per Cent
5-kw.,550-volt, 50 periods:				
Rectifier	92.3	93.7	94.0	93.8
Rotary converter	85.0	91.0	92.2	92.6
1,000-kw., 550-volt periods:				
Rectifier	93.0	94.0	94.2	94.0
Rotary converter	87.0	91.4	92.8	93.0
Motor generator	....	87.5	90.5	91.5
1,500-kw., 550-volt, 25 periods:				
Rectifier	92.3	93.6	93.8	93.7
Rotary converter	87.0	91.5	93.2	93.9
1,500-kw., 1,500-volt, 2,500-lb.: rectifier	95.2	96.2	96.3	96.1

It is seen that the efficiency is extremely high for high-voltage systems.—London *Electrical Times*, June 9, 1921.

Electrochemistry and Batteries

Electrical Methods in the Fixation of Nitrogen.—F. ROWLINSON.—The electrical methods for the fixation of nitrogen are classed as follows: (1) The production of nitric acid and other nitrates by oxidation of atmospheric nitrogen in the electric arc; (2) the synthesis of ammonia from nitrogen and hydrogen through the action of a catalyst in an electrically heated furnace; (3) the high temperature production of the nitrides of certain metallic elements; (4) the production of cyanamides and cyanides. These methods are discussed in detail and figures are also given concerning the energy required by the new processes.—*Beama* (British Electrical and Allied Manufacturers' Association), June, 1921.

Units, Measurements and Instruments

An Absolute Voltmeter for 250,000 Volts.—A. PALM.—The principle of this voltmeter is a combination of a current balance and an electrostatic voltmeter. The necessary large electric clearances imposed by the high voltage are kept at a minimum by inclosing the entire balance in an air-tight casing, which stands under nitrogen pressure of 12 atm. A formula has been developed for voltage and current readings, derived from the torque of the balance. Regulation and reading of the scale are distance-operated by insulating rods and two small telescopes. The author claims for this instrument the highest accuracy ever achieved with such apparatus, amounting to 1 per cent at the beginning and 0.3 per cent at the end of the scale.—*Elektrotechnische Zeitschrift*, May 26, 1921.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

New Bedford Utility 6 1-2's Sell at Premium

AN INTERESTING financial feature of last week was the bidding by eastern banking houses for the $572,000 issue of 6½ per cent first mortgage gold bonds, series C, of the New Bedford (Mass.) Gas & Edison Light Company. These bonds, which are legal investment for Massachusetts savings banks, were secured at 102.65 and later offered to investors at 104.65, yielding 6.05 per cent.

Net earnings are more than two and one-half times the interest on the funded debt. Also the company has an enviable dividend record. Annual dividends of not less than $6 per share were paid from 1891 to 1907 and not less than $11 per share since 1907. Since 1917 dividends have been at the rate of $12 per share.

Minnesota Interference Case Settled Temporarily

DISMISSAL of the temporary restraining order and an agreement for issuance of a consent order without prejudice permitting the power company to turn the 2,300-volt current on its circuits so far constructed was the result of an inductive interference case argued in court at Worthington, Minn., on July 19. Thirteen miles of line to be operated at 2,300 volts initially, but for ultimate 6,600-volt operation, is under construction, and operation had been temporarily restrained on the plea that it would put the ground-return telephone lines which it paralleled out of commission. The Citizens' Light, Heat & Power Company of Tracy, the Woodgate Telephone Company and the village of Currie were involved. Service will be given to the village of Currie by the new line. When the voltage is to be raised above 2,300 volts the proceedings may be revived at the option of the telephone company, and the court will then hear the evidence as to the need of a permanent injunction against the operation of the power line at the higher voltage.

Ohio to Adopt Construction and Interference Rules

THE Ohio Legislature at its last session passed a law under which the Public Utilities Commission must promulgate rules governing overhead crossings, and from the wording of the law it is also expected that rules covering inductive interference must also be adopted. The organization of a joint committee to formulate rules is nearly complete. In addition to the representatives of the commission, members representing the communication, power and railroad interests are being chosen. It is regarded as rather unfortunate that with the inductive interference question in its present state it should be included in the work of the committee, because there is every reason to believe that certain of the interests involved will insist on the adoption of detailed rules. Under the law the rules must be adopted before there is any opportunity for the work now under way between the power and telephone interests to be completed.

Financial Plans for Canalization of St. Lawrence Yet to Be Worked Out

ONE of the most serious difficulties yet to be worked out with reference to the St. Lawrence River canalization and incidental water-power development is that of raising the necessary funds. This matter was given serious consideration on the tour of inspection of the proposed system by governors, senators, representatives in Congress, electric light and power men, bankers and other business men, just concluded. It came out that no consideration had been given to any plan whereby the Canadian and United States governments would be required to appropriate any money. The possibility was expressed, however, that an international corporation might be formed to do the financing by bonds guaranteed by the two governments.

Just how the cost is to be divided between the two countries has not been decided, but the feeling was expressed on the trip that when this matter comes up Canada might be willing to bargain in this matter through the division of power. The water power to be developed is expected to pay for the cost of the entire project in fifty years.

"There is no doubt that the power will pay for the entire project in fifty years," said Senator Lenroot to the delegates on the trip, "and when that happens it will become a great national asset which may be developed into a source of revenue, or, as I hope will be the case, may supply power at a merely nominal cost to those sections of the country which need it so badly."

Comprehensive Electrical Exhibit at Chicago Pageant of Progress

GEORGE B. FOSTER, vice-president of the Commonwealth Edison Company, who is in charge of the electrical show at the Chicago Pageant of Progress, starting July 30, has announced that the exhibit will tell the story of electricity from the standpoint of the electric light and power company, the manufacturer and the electric railway. The electrical show committee has arranged for fifty-six booths at the pageant, which is to be given on the Municipal Pier. An attendance of at least a million is expected, and Mr. Foster expressed his belief that the electrical exhibit will be valuable in conveying to the public an idea of the magnitude of the electrical industry and its great service to the people.

The light and power division of the exhibit will depict the part played by the Commonwealth Edison Company in the growth of Chicago. A large map of the city will show the location of the generating stations and substations and the power load of the most important industries, as well as the residence load. A model of the old Harrison Street generating station, at one time the largest in the world, will be contrasted with present-day plants. The manufacturers' exhibit will aim to demonstrate the safety and convenience of electricity.

Supply Manufacturers' New Section Chairman

RESULTS of the Associated Manufacturers of Electrical Supplies section election, held at the New London convention the last week in June, are now being filed at the headquarters of the association, 30 East Forty-second Street, New York City. The list received to date of the new chairmen of the various sections that were chosen follows:

Heating Appliances Section—W. M. Stearns, General Electric Company, Schenectady. Domestic appliance committee of this section—H. S. Mirrielees, Manning, Bowman & Company, New York City; range committee—F. F. Fashee, Westinghouse Electric Products Company, Mansfield, Ohio; industrial heating committee—Harold Fulwider, General Electric Company, Schenectady; technical committee—E. N. Lightfoot, Cutler-Hammer Manufacturing Company, New York City.

Radio Section—D. R. W. Murdock, William J. Murdock Company, Chelsea, Mass.

Snap Switch Section—S. P. Williams, Hart & Hegeman Manufacturing Company, Hartford, Conn.

Line Material Section—Louis McCarthy, Macallan Company, Boston.

Air Circuit Breaker Section—C. T. Evans, Cutler-Hammer Manufacturing Company, Milwaukee.

Outlet Box Section—G. H. Sicard, Pratt-Chuck Company, Frankfort, N. Y.

Fuse Section—C. A. Bates, Bryant Electric Company, Bridgeport, Conn.

Electrical Contractors' Arrangement with Brotherhood Continued

AFTER some debate over the report of the national council to the convention of the National Association of Electrical Contractors and Dealers at Buffalo, N. Y., on Thursday, July 21, the report was adopted. Objection to the continuance of the arrangement existing between the contractors and the International Brotherhood of Electrical Workers was raised chiefly by the delegates from Pennsylvania and Massachusetts, which have refused to enlist the good offices of the national council in settling strikes now in effect. Following are the fundamentals embodied in the council's code, which has been indorsed by both sides:

1. Strikes and lockouts are undesirable from every point of view.
2. No dispute can arise between employer and employee which cannot be settled in friendly negotiation, by conciliation or by arbitration, provided the parties in dispute have the will honestly to try one or more of these methods.
3. The industry cannot fail to thrive on co-operation between employer and employee and will surely languish if such co-operation is absent.
4. Co-operation resulting in mutual good will is the key to increased production and better craftsmanship.
5. The road to the highest efficiency of the individual working unit lies through the field of frank co-operation and fair dealing.
6. Local union leadership must be greatly improved.
7. The mere display of power is the last thing in the world that insures the success of an association, an organization or an industry.
8. Labor unions and associations dealing with them must stop thinking so much about organization and think very much more about the essentials of the cause of the workingman.
9. Labor unions and associations dealing with them must declare their purpose to bring about three things—good working conditions, good wages and the highest possible standard of craftsmanship.
10. Labor unions and associations dealing with them must plan their campaigns wholly on the basis of the service which each is capable of rendering.
11. If a labor union or an association is to make itself desirable and indispensable and cherished for all time, the way to do it is to forget itself in the widest possible service of its cause.

Small-Community Advertising for Utilities to Be Studied

THE executive committee of the Commercial Section of the National Electric Light Association held a meeting last week at Association Island, Henderson Harbor, N. Y., to receive reports on the organization of business and to outline the work for the coming year. It was decided to discontinue the elaborate program of division activities that was undertaken last year by the Bureau of Advertising and Publicity Service and instead to appoint this year a small advisory committee to be composed of representatives of smaller central-station companies who have been successful in publicity work, together with representatives of several manufacturers who have been active in co-operation with the local central-station companies in smaller cities in advertising. It shall be the purpose of this committee to investigate and report on the best methods of advertising in the smaller cities and to make recommendations that will give practical guidance in the utilization of manufacturers' advertising matter and other measures of publicity. No chairman has as yet been selected for this committee.

The educational committee returned to the treasury of the Commercial Section a check for $5,000, the profits of its last year's work, and announced a further balance of $3,000 in the bank, sufficient with the stock on hand to carry on the educational courses through the present administration.

Electric Utilities Making Coal-Storage Arrangements

ALL the member companies of the National Electric Light Association have been cautioned to give attention to the storage of coal for winter, according to Executive Manager M. H. Aylesworth. As was stated in last week's issue of the ELECTRICAL WORLD, this matter was brought to the attention of the joint coal committee of the three national utility associations, of which J. W. Lieb is chairman, by Secretary of Commerce Hoover and former Chairman Clark of the Interstate Commerce Commission.

"The electric light and power companies," Mr. Aylesworth said on Wednesday, "are evidencing a sincere desire to co-operate. We have already heard from a number of our member companies, and most of them had already made arrangements for winter storage. The others say that they are giving the matter consideration and can be counted upon to be found prepared when winter sets in."

Municipal Ownership Bill Reported Adversely in Georgia

TWO bills introduced at this session of the Georgia Legislature and seeking to bring about municipal ownership and operation of street railways and electric light and power companies have been reported adversely by the committee of the House of Representatives to which they were referred. One of the bills proposed an amendment to the State Constitution so that the credit of the State might be used, or debt incurred on behalf of the state to construct or acquire or lease, maintain and operate plants or other means for the generation, transmission and sale of electric or other light, heat and power. The adverse report of the committee on this bill was practically unanimous, the vote being 30 against the bill and only 1 in favor of it.

The other bill provided for an amendment to the State Constitution so as to authorize municipalities to incur debt to the extent of 7 per cent of the assessed valuation of the property therein for taxation (in addition to the 7 per cent now provided by law) for the purpose of acquiring and operating, among other things, public utilities, such as street railways and electric light and power plants. The report on this bill was 24 against and 7 in its favor.

The bills were fostered by the so-called Municipal League of Georgia, which has been actively conducting a campaign in the interest of public ownership and operation of water-power plants in Georgia, along lines somewhat similar to the Hydro-Electric Commission of Ontario, Canada.

Energy Sales by California Irrigation Districts to Power Companies

ANNOUNCEMENT has been made by the California Railroad Commission of its intention to inquire into the sale of electrical energy by irrigation districts to power companies. The intention of the commission was indicated when the application of the Merced Irrigation District to sell power to be developed at the Exchequer Dam, in Mariposa County, was set for formal hearing. The importance of this matter was disclosed by the attendance at a preliminary conference before the commission of officers, engineers and attorneys of the irrigation district, the power company and protesting water users in the district, as well as of attorneys and engineers from Madera and interested listeners from other San Joaquin Valley counties.

In addition to the Merced project there are a number of other contemplated irrigation districts in the valley, in various preliminary stages of development, in which the same issues are involved. In order to be independent of seasonal variation in rainfall and to cover a larger area all these districts are planning storage reservoirs that will cost millions of dollars. To lessen the cost of water to these districts it is proposed to construct power plants at the impounding dams and to sell the electrical energy generated. The commission was told that the general sentiment of the farmers is to wholesale this power to existing companies rather than to put in distributing systems for retail. The commission has no jurisdiction over irrigation districts. It has, however, authority over the power companies. In other words, the commission cannot fix the price at which the districts must sell, but can fix the price at which the power companies may buy.

A. Emory Wishon, general manager of the San Joaquin Light & Power Corporation, told the commission that the policy of that company is to encourage the formation of these irrigation districts, with supplementary power plants, upon the theory that all development enterprises will be of benefit to the company.

Commercial Men Planning Southern Meeting in January

IT WAS definitely decided at the meeting of the N. E. L. A. wiring committee and the Commercial Section executive committee last week at Association Island to arrange for meetings of these two committees and any other committees that may group with them at New Orleans next January. It is believed that there are a large number of men in Southern member central-station companies who are unable to attend meetings in the North but would gladly avail themselves of an opportunity to do so in some city of the far South. At the same time it will put the committees in touch with the sentiment of the Southern companies.

Special invitations are to be sent to Southern members to be present at these meetings and actively participate, and it is hoped and believed that there will be a hearty response. Out of it should come very definite benefits in a closer contact between the Northern and Southern sections of the industry and a more active co-operation. Rawson Collier, general manager of the Georgia Railway & Power Company, has invited the committee members to stop off for a day at Atlanta on the way down, as the guests of his company.

In addition to the New Orleans meeting in January, the Commercial Section bureaus and executive committee have included in their schedule a fall meeting in Rochester, N. Y., at the time of the Illuminating Engineering Society convention there, and spring meetings to be held in March in New York, at the general headquarters of the association.

New Utility Issues Total $17,569,000 This Week

FOUR new issues of utility securities totaling $17,569,000 were offered this week. The largest is $6,000,000 of convertible 8 per cent secured gold notes of the Cincinnati Gas & Electric Company. The notes, which are to provide funds to pay or refund expenditures incurred for construction purposes, are offered at 99¾ and interest.

The Detroit Edison Company issue is $5,569,000 of 6 per cent first and refunding mortgage gold bonds due in 1941 at 88 and interest yielding 7.15 per cent. The proceeds of the issue will be used to retire bank loans and provide additional working capital. The Brooklyn Edison Company is offering $3,000,000 general mortgage series D 7 per cent gold bonds due in 1940 at 98½ and interest to yield about 7.15 per cent. Proceeds are to be used to reimburse the company for the cost of additions and extensions to take care of increasing business.

The fourth issue is $3,000,000 of the Central Maine Power Company's first and general mortgage 7 per cent gold bonds, non-callable during the first five years, maturing in 1941. They are offered at 95½ and interest to yield about 7.45 per cent.

Large Coal Acreage Purchased for Windsor Power Plant

IN ORDER to insure an adequate supply of fuel for its large power plant at Windsor, W. Va., independent of public carrier transportation charges and difficulties during periods of car shortage, the West Penn Power Company, in conjunction with the American Gas & Electric Company, announces the closing of one of the largest coal deals recently consummated in West Virginia. The transaction involves the purchase of 7,000 acres of Pittsburgh vein steam coal by the Penn American Coal Company, owned jointly by the West Penn Power Company and the American Gas & Electric Company, from James A. Paisley of Cleveland, Ohio. The consideration is understood to have been approximately $1,500,000.

With existing holdings of the same interests, which the new tract, comprising approximately 40,000,000 tons, adjoins, title to a solid block of 10,000 acres is obtained, providing coal of high quality sufficient to supply the Windsor power station fifty to sixty years. The output of the mine adjacent to the power plant is now being increased to 2,500 tons per day.

More Interest Displayed in Muscle Shoals Plant Disposition

THE interest being displayed in the Muscle Shoals projects by private manufacturers and by certain chemical companies has revived the subject in Washington. Senator Underwood contends that the public can secure the maximum benefit from these projects through their operation by the government, but he prefers seeing them operated by private interests rather than to see them lie idle. He is of the opinion that Congress has maneuvered itself into a predicament on the proposition. He does not see how it can now refuse to let the dam be finished, in view of the arguments used to kill the appropriation for that purpose. To be consistent, he believes Congress will have to accept any reasonable offer from a responsible private source.

The board of directors of the Mississippi Valley Association, on the strength of the report of a special committee which visited Muscle Shoals, has adopted a formal resolution urging upon Congress the need for an appropriation which will allow the immediate resumption of work on the dam and which will permit of the disposition to private interests of the government's holdings there so as to serve best the public interest.

The detailed proposal submitted by Henry Ford, which has been analyzed by the Chief of Engineers, was stated by Secretary of War Weeks on Monday to be unsatisfactory in its present shape because of the guarantee of 600,000 hp. asked of the government. He and Mr. Ford are soon to confer on the proposition. The other inquiries in regard to the disposal of the Muscle Shoals properties are now being considered.

According to newspaper reports, the Chief of Engineers, Major General L. H. Beach, has advised Secretary Weeks that the Ford offer with certain changes be accepted.

N. E. L. A. Section Committee Chairmen

ANNOUNCEMENT is made this week of the chairmen of most of the principal committees of the Technical, Commercial and Accounting Sections of the National Electric Light Association as follows:

TECHNICAL SECTION.—Electrical apparatus, A. H. Lawton, Consumers' Power Company, Jackson, Mich.; hydraulic power, Markham Cheever, Utah Power & Light Company, Salt Lake City; inductive interference, A. E. Silver, Electric Bond & Share Company, New York City; meter, W. L. Wadsworth, Minneapolis General Electric Company; overhead systems, L. M. Klauber, San Diego Consolidated Gas & Electric Company; prime movers, H. P. Liversidge, Philadelphia Electric Company; safety rules, Thomas Sproule, Public Service Electric Company, Newark, N. J.; underground systems, D. W. Roper, Commonwealth Edison Company, Chicago.

COMMERCIAL SECTION.—Lighting Sales Bureau, L. R. Wallis, Edison Electric Illuminating Company of Boston; Merchandise Sales Bureau, C. E. Greenwood, Edison Electric Illuminating Company of Boston; Power Sales Bureau, C. K. Nichols, New York Edison Company; commercial service and relations with customers, Harold Wright, Commonwealth Edison Company, Chicago; education, Fred R. Jenkins, Commonwealth Edison Company, Chicago; "Electrical Salesman's Handbook," George H. Jones, Commonwealth Edison Company, Chicago; electrically equipped furniture, Joseph F. Becker, United Electric Light & Power Company, New York; finance, Oliver R. Hogue, Commonwealth Edison Company, Chicago.

ACCOUNTING SECTION.—Classification of accounts, reports to commissions and relations with other associations, W. J. Meyers, United Electric Light & Power Company, New York; budget, Harry A. Snow, Detroit Edison Company; customers' records and billing methods, J. D. Jacobus, Detroit Edison Company; purchasing and storeroom accounting, W. F. Stevens, Edison Electric Illuminating Company of Boston; security-holders' records*, Robert Daveny, Consumers' Power Company, Jackson, Mich.; fixed capital records,* J. H. Lobban, Detroit Edison Company; accounting education, Fred R. Jenkins, Commonwealth Edison Company.

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*New committees this year.

Delegates to Contractors' Convention at Buffalo Last Week

Fight for State Ownership of Power Is on in California

BACKED by the Governor of the State and other political leaders, the California League of Municipalities has begun its public campaign to force through an initiative petition for the formation of a state water and power board fashioned after the model of the Hydro-Electric Power Commission of Ontario. A legislative measure to form such a board was defeated at the last session of the California Legislature, which closed two months ago. Following this the League of Municipalities, which is composed of officials of various California cities, met in Sacramento and was advised by Governor Stephens to take all possible means to make the defeated Johnson act a law. This latest step is the result of that conference.

The new measure has been drawn with the assistance of the state legislative counsel under the auspices of a committee composed almost entirely of politicians. In a public statement on July 26 this committee says in part: "The necessity of state action has been indicated by public bodies which have investigated and reported upon the underlying problem of water and power shortage. The State Railroad Commission, in a special report to the Governor in which it summarized the findings of the water emergency conference, estimated that $1,500,000,000 must be spent in California in the next ten years on hydro-electric and irrigation development." The committee is authority for the statement that the same commission report continued: "We believe that the time is past when the state as a whole can afford to sit by and wait for the spasmodic development of its resources by individuals. The problem as a whole may be solved by the state as such, and it is our thought that now is the time for a comprehensive program to be outlined. This the state can do through its power in the enactment of laws and its ability to aid in financing.

"The ends sought by the measure," the committee report goes on, "are three—to place the credit of the state behind public development and the use of hydro-electric energy and water at rates which will attract population and industry to California and supply consumers at the lowest possible cost; a system by which development will keep pace with demand and by which construction will be paid for out of earnings without taxation, and immediate and permanent relief from water and power shortage, stagnation, waste and the high rates now paid."

It is hoped by the committee to get sufficient signatures to place the measure on the ballot in November next year. The statement was signed by six men, including two who were formerly in office as congressman and state senator. The act creates a board of five, of which four are to be directly appointed by the Governor, the fifth being the Director of Public Works. The chairman as executive officer is to receive a salary of $15,000. The other members are to receive only per diem compensation when actually on duty. The measure outlines the procedure whereby cities, towns, irrigation, water, reclamation or public utility districts, acting singly or in groups, may enter into contracts with the board for the construction of works and the supply of hydro-electric energy, or both. The contracting political subdivisions agree to purchase hydro-electric energy or water thus developed at rates which will repay to the state the principal interest, operation and maintenance charges for such service in fifty years.

The act also provides for the issuance and sale by the board of state bonds to the extent of the funds required as contracts are executed and the use of such funds for construction purposes. The ultimate state credit, for this purpose, according to the committee, is limited to $500,000,000. No burden of either interest or principal will be assumed by the state except as the discharge of these obligations is assured from the earnings of the water or power developments. Bond interest is limited to 6 per cent.

Code Changes Suggested to Stimulate Wiring and Appliance Sales

THE wiring committee of the National Electric Light Association held a meeting on Thursday of last week at Association Island, Henderson Harbor, N. Y., at which action was taken on a number of interesting matters. Chairman R. S. Hale reported the results of his investigation of the interchangeability of the different receptacles and plugs now on the market, and he was instructed to gather an official set and publish in the name of the committee a list of those plugs and receptacles which have been found interchangeable as a recognized and acceptable standardization practice. This, of course, is the receptacle fitting the plug with the parallel blades now produced on a common standard by about twelve manufacturers. These various plugs and receptacles are to be submitted to the Electrical Testing Laboratory for actual test to demonstrate that this interchangeability embraces in every case a perfect contact and mechanical strength. The committee also voted to make a similar investigation of the attachment plugs used on the appliance end of the cord and the larger plugs for heater connections, to have these tested and to publish the findings in the effort to develop a common interchangeable standard.

Considerable discussion was given to proposed changes in the National Electrical Code, and the committee voted to recommend formally the following:

1. That solid neutrals be allowed on the grounded side of two-wire taps from three-wire grounded systems.
2. That there should be no limit to the number of outlets installed in residence service on a circuit protected by a proper fuse, provided that no such circuit should supply more than 800 sq.ft. of floor area, and that a 15-amp. fuse be allowed on such circuits.
3. That so long as the fuse properly protects the wire there should be no limit to the nominal size of the lamps or appliances that may be connected to the wire.

It is felt that the adoption of these rules will increase the sale of house wiring by reducing the cost of larger facilities for the use of appliances, since more convenience outlets may be installed without increasing the number of circuits.

In the hope of overcoming in the public mind possible fear of electric flatirons the committee also suggested to the Underwriters that thereafter flatiron fires should not be classed with electric fires due to defective installation but be put in the same class as non-criminal incendiary fires, since there is no difference in principle between lighting a match and leaving it where it will start a fire if not put out and connecting a flatiron and leaving it where it will start a fire if not disconnected.

The Electrical Contractor-Dealer Versus the Non-Electrical Dealer

IN AN address delivered at the annual convention of the National Association of Electrical Contractors and Dealers, held in Buffalo, N. Y., last week, W. E. Robertson, the well-known electrical supply jobber, said that, offhand, it would appear that existing and well-established channels of distribution other than electrical offer the most attractive field for cultivation on the part of both manufacturers and jobber distributers of electrical devices, because to the unthinking it appears much simpler to induce a successful merchant in some other line to establish an electrical department than to develop an electrical contractor or salesman into a first-class merchant. This would undoubtedly be so, he said, but for one unescapable factor. The merchandise ordinarily sold by the department store, the hardware store, the furniture store, the drug store and similar stores requires no servicing, while almost every labor-saving and convenience electrical appliance requires servicing within a short time after it is put into use, and indeed from the beginning if it is improperly used or if it is used on a circuit for which it is not adapted.

All motor-driven devices sooner or later wear out in some part or another. Because of their first cost they cannot be thrown away and new ones bought, and they should be repaired. Most non-motor-driven devices in time require new contact points, new cords, new elements or new plugs, and because of their initial cost and the value of the salvage repairing is justified. This means that the servicing of appliances is as necessary to their use as is the first sale, and a service station or repair shop must be maintained in order to keep a customer satisfied. The maintenance of a service or repair department is so foreign to the conduct of an ordinary merchandising business and introduces such an element of discord that it is only a matter of time when, in Mr. Robertson's estimation, department and other stores will abandon the sale of appliances, especially motor-driven ones.

THE CONTRACTOR-DEALER THE LOGICAL MERCHANT

"In my judgment," said Mr. Robertson, "the ultimate distribution of electric devices of all kinds is going to be through electrical channels, rather than through hardware and department stores and similar mercantile establishments."

Manufacturing capacity has increased tremendously in the last two or three years in the production of appliances. Manufacturers can produce more today than all the department, drug, hardware and electrical stores and plumbing establishments can sell to the public, and they are using every known channel by which to reach the market. One manufacturer here and there sticks to his electrical jobber-contractor as a channel and method of distribution.

"Washing machines are sold by manufacturers to anybody and everybody that will buy them," Mr. Robertson continued. "If you develop today a first-class washing-machine salesman, a manufacturer comes along and makes a retail distributer of him, at your cost. Thus the chaos in the business. But it cannot last. In the end I am satisfied that the electrical contractor-dealer or electrical merchant is going to be the channel through which this great market will be reached.

"Now what has been the experience in trying to help the contractors to capitalize the opportunity and become first-class merchants? Here is a beautiful field of opportunity—but are you going to occupy it?"

Manufacturers and their jobbing distributer connections, according to Mr. Robertson, have spent more money in trying to educate the electrical contractor into becoming an exclusive electrical dealer, or merchant, than has ever been spent before in the history of merchandising in any line. It has been an uphill road full of discouragements and not always fruitful of results because not all contractors are fitted to be merchants.

Out of his experiences Mr. Robertson drew these conclusions:

"To the large contractor who is a successful contractor I say: 'Stick to your contracting.' And I say to the little contractor who will never be a big one, 'Stick to your contracting, but if in connection with the installation of the wiring in a tailor shop or a home, you can sell a washing machine or a vacuum cleaner, do it, because that is your field. But don't invest any money in a sales organization, because you don't know how to do it, and you will simply throw away in six months all the money you have made in ten years.

DEPARTMENTALIZING THE APPLIANCE BUSINESS

"To the contractor who has a fine location, has an open mind and is alive to the opportunities in this business, my advice is to departmentalize his appliance business, put a man in charge of it and hold him responsible for results. The great trouble is that when one talks about departmentalizing the contractor thinks all he has to do is to put a partition in his store and on one side of it conduct his merchandising and on the other his contracting business. Another weakness is that the contractor has been trained as an order taker, and not as a business creator.

"The average contractor goes to an architect or an industrial engineer and gets the plans and specifications and figures on them. He spends his time figuring out how he can do that work economically and yet with a profit to himself, in competition with others who have an opportunity to bid.

"The sale of electrical devices is an intensive proposition. You must create demand. That is something the average contractor knows nothing about. He, perhaps, has been a workman or a foreman, and has finally got into a business of his own. He goes to the customer of his former boss and he says: 'You are going to build so and so; when you get ready I want to do that work.' When four or five of them get ready to go ahead with their work, then is when he starts business. He is an order taker.

"There is a difference in methods, and unless a man recognizes this difference and is prepared to capitalize on leads, to pay fairly big commissions—in the aggregate quite substantial sums—to successful salesmen, he had better keep out of the merchandising business, because it will simply result in shipwreck.

"There is opportunity, as Mr. Goodwin says, in the merchandising of electrical devices by the electrical contractor—the electrical salesman. I think the electrical salesman has as great a chance of success as the average electrical contractor. I believe the market is coming back, virtually in its entirety, to electrical channels; but to cash in on it will require hard work, careful analysis and patience."

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest

Mineral Resources.—A preliminary summary of the "Mineral Resources of the United States in 1920," published by the United States Geological Survey, has just come off the press and may be secured from the government printing office.

Suit Against Arkansas Light & Power Dismissed for Want of Cause.—When the suit for a receivership filed by Morgan & Company against the Arkansas Light & Power Company of Pine Bluff, Ark., came up in the United States court at Little Rock it was dismissed for want of cause, the company showing that it was not a guarantor of the bonds concerning which suit was brought and alleging malice in the action.

Virginian Power Gets Rate Increase.—The West Virginia Public Service Commission has authorized an increase in power rates of the Virginian Power Company and the West Virginia Light & Traction Company. The new rates are $1.65 per kw. demand plus an energy charge of 2.42 cents per kw.-hr. for the first 1,000 kw-hr.; 2.31 cents for the next block of 2,000; 2.20 for the next block of 2,000; 2.035 for the next 5,000, and for all over 500,000 kw.-hr. 1.14 cents.

Pennsylvania to Hold Industrial Relations Conference.—An industrial relations conference is being arranged by Dr. Clifford B. Connelley, Commissioner of the Department of Labor and Industry of Pennsylvania, to be held at Harrisburg, Oct. 24 to 27. This conference will include the features of the welfare and efficiency conferences and safety congresses of other years. The main topics to be discussed will include "Industrial Waste," "Industrial Co-operation," "Industrial Publicity," "Industrial Education," "Women and Children in Industry" and the "Medical Supervision of Industry."

Electric Housing in Glasgow.—The Glasgow Corporation recently decided, by way of experiment, to install electrical equipment in two houses of a semi-detached block erected by the corporation to help meet the housing situation. The equipment in each house will, it is said by the London *Electrician*, consist of an electric oven, electric cooker, electric wash boiler and electric washing machine, while the rooms will be heated by means of electric fires. In one of the houses the hot-water supply will be provided by means of a coal fire in the living room, and in the other water will be heated by means of an electric calorifier set fitted to a storage tank, the living room in this case being heated by an electric fire. The purpose of the experiment is to obtain comparative figures of the actual cost of energy for the two different types of installation.

Electrically Operated Moving Road Proposed in Yokohama.—Between the principal shopping center in Yokohama and "The Bluff," which contains a large foreign colony and some of the best houses in this Japanese city, lies the Jirozaka hill, which, says the Japanese correspondent of *Electrical Industries*, presents a serious obstacle to motorists and jinrikisha men alike. A Japanese engineer has applied for authority to overcome this hindrance to traffic by the construction of a moving roadway which he proposes to operate by electricity, levying a toll on vehicles of every kind which are aided by it.

War Department to Encourage Military Inventions.—Announcement is made that it is the policy of the War Department to encourage the development of military inventions by officers, enlisted men and civil employees. In consideration of assistance to be given by the department in the issue of patents, it will require of inventors no more than a license to manufacture and use their inventions for governmental purposes, thereby reserving to the patentee complete freedom and ownership of the patent in its commercial applications. In special cases of inventions of great military importance, however, provision is made for exclusive government ownership and the utmost secrecy.

Hydro-Electric Energy at Caribou Plant Expressed in Foot-pounds.—The two impulse wheels of the 30,000-hp. generating units installed at the Caribou development of the Great Western Power Company, which were illustrated in the ELECTRICAL WORLD, July 9, page 56, are each driven by a jet of water 11 in. in diameter, operating under an effective head of 1,008 ft. The energy of the jet is equal to the impact each second of a 100-ton locomotive at a speed of 42 miles an hour, or 11,250,000 foot-pounds. This energy is taken up by buckets 36 in. wide which pass through the jet at the rate of sixty a second. Power is transmitted to the San Francisco Bay district, 186 miles distant, at 165,000 volts.

Diversity of Business Served by San Diego Company.—Dairy farms, egg plants, vineyards, turtle farms and lemon orchards are illustrated in the June issue of the *Byllesby Monthly News* as among the diversified customers served by the San Diego (Cal.) Consolidated Gas & Electric Company. The electric transmission system of this company extends from San Juan Capistrano, 77 miles north of San Diego, to Tia Juana, on the Mexican border on the south, and from the coast to a point 30 miles inland. This territory is covered with a network of more than 750 miles of transmission and distribution lines, providing service to forty-six communities. The rural lines of the electric department supply service to 1,200 ranches and farms with combined lighting and power requirements of 7,500 hp. San Diego's population by the 1920 census was in excess of 74,000 and that of the entire district served by the company 110,000.

Curing Sweet Potatoes by Electricity.—What is said to be a new use for electricity will be made at Birmingham next fall by the Alabama Power Company, according to an announcement just made. This will be the curing of sweet potatoes. Those familiar with sweet-potato curing say that it requires a heat of from 85 deg. to 95 deg. to take the moisture out of the vegetable when it is first dug out of the ground. This is necessary in order that the potatoes may be kept through the winter for the spring trade. It is also said that an average heat of 50 deg. is necessary during the winter months to keep sweet potatoes from freezing. It is believed that this heat can be regulated by electricity better than by any other method. Experts from the state experimental station at Auburn college will conduct the experiments.

Associations and Societies

Denver Electrical Co-operative League.—This league has recently been organized, under the guidance of an advisory committee, and extensive plans have been made to assist in the furtherance of the electrical industry by better service, educational and advertising campaigns and closer co-operation within the industry itself. All four branches of the industry are represented in the league, the local contractor-dealers' association holding membership as a unit. T. O. Kennedy, general superintendent of the Denver Gas & Electric Light Company, is chairman of the advisory committee; E. C. Headrick, a prominent contractor-dealer, is vice-chairman, and John J. Cooper of the Mountain Electric Company is secretary and treasurer. Offices have been opened at 301 Gas and Electric Building under the direction of Sidney W. Bishop, recently appointed executive manager

Coming Meetings of Electrical and Other Technical Societies

American Physical Society, Pacific Coast Section—Berkeley, Cal., Aug. 4 and 5.

Michigan Electric Light Association—Ottawa Beach, Mich., Aug. 24-26.

N. E. L. A., New England Division—New London, Conn., Sept. 6-9.

International Association of Municipal Electricians—Colorado Springs, Col., Sept. 6-10.

Pennsylvania Electric Association—Bedford Springs, Pa., Sept. 7-10.

N. E. L. A., Great Lakes Division—French Lick Springs, Sept. 14-16.

Association of Iron and Steel Electrical Engineers—Chicago, Sept. 19-23.

West Virginia-Kentucky Association of Mine, Mechanical and Electrical Engineers—Huntington, W. Va., Sept. 20-23.

Illuminating Engineering Society—Rochester, N. Y., Sept. 26-30.

American Electrochemical Society — Lake Placid Club, N. Y., Sept. 29-Oct. 1.

American Electric Railway Association—Atlantic City, N. J., Oct. 3-7.

N. E. L. A., Southeastern Section—Chattanooga, Tenn., Oct. 18-20.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities

Tentative Valuations.—For the purpose of emergency proceedings a tentative value of utility property is deemed by the Missouri Public Service Commission to be sufficiently reflected by a prior established tentative value plus additions to the plant subsequent thereto where upon a comparison of value with other like property and the inclusion of intangibles a considerably greater value is indicated.

Contingency Reserve to Absorb Fluctuations of Hydro-Electric System.—The California Railroad Commission has expressed its approval of the establishment by the Southern California Edison Company of a contingency reserve which in dry years will be drawn upon to provide for additional operating expense and which in wet years will be replenished from the larger net economies of those years. "It has been clearly shown," the commission said, "that there is such extreme variation in the operating expenses of a utility dependent largely upon hydro-electric sources for its power as to justify some automatic means of preventing these fluctuations from unduly affecting both rates and income. While the principal purpose of the reserve is that of meeting the conditions of variable hydro-electric supply, it is also suggested that the reserve can be properly used to meet other unusual changes in operating costs, emergencies not considered in normal operation, and as a means of postponing possible increases or hastening reductions in rates."

Tennessee Commission Indorses "Cost Plus" Plan.—"Gas and electricity, like railroad, street-railway, telephone and water services, are," the Tennessee Railroad and Public Utilities Commission observed not long ago, "so essential to the general welfare that it is proper that at no time should the public pay an unreasonable price therefor, and yet a just price—that is, one that will induce capital to invest freely in such enterprises and thereby insure the growth and continued maintenance of such essential service—should at all times be paid. No better plan to insure to the public and to those serving the public with these vital essentials just prices for these commodities has yet been devised than what is popularly designated now as 'cost plus' or the 'service at cost' plan. Under this plan the public pays the actual cost of producing the service, provides a fund to be held exclusively for a renewal and replacement of plants, thereby practically insuring the continuance in public service of efficient plants and equipment, and in addition a fair return upon the legitimate investment in properties devoted to serving the public."

Minimum Charge Suspended Until the Establishment of Adequate Service.—Where a small utility with a normal service voltage of 110 was operating at only 80 volts to 90 volts, it was ordered by the Missouri Public Service Commission to discontinue its minimum charge until the necessary equipment for adequate service was installed, notwithstanding that existing rates were admittedly low provided good service had been furnished.

Discrimination and Duty to Render Service.—To permit a small portion, although large consumers, of the total consumers of an electric utility distributing hydro-electric and steam energy to absorb the total dependable supply of hydro-electric energy, thus reaping all the benefits accruing from the supply of such energy to the exclusion of the general consumers' right to participate in the benefits of water-power service, is discrimination, the Missouri Public Service Commission has found. Such a utility should permit all its consumers to participate in the benefit accruing from the use of hydro-electric energy to the extent that such energy is available.

Relation Between Rate Base and Just Compensation.—In the course of its decision in the proceedings to determine the amount to be paid by the city of Redding in acquiring property of the Northern California Power Company, the California Railroad Commission said: "It has been a source of confusion quite evident in this proceeding that the distinction was lost sight of between a rate base and a just compensation figure. We have no patience with the argument that in a reproduction cost estimate for rate-making purposes a power-line pole should stand at one figure and that in a reproduction cost estimate for condemnation purposes the same pole should stand at another figure. It seems clear to us beyond argument that a given property item valued according to a given method must have in its estimate of value new and in its estimate of value depreciated the same figures no matter for what purpose that estimate may be used. To conclude, however, that because of this statement the rate base and the just compensation of a public utility plant must be the same seems to us altogether erroneous. The difference in the final result (depending on whether a given public utility property is to be valued for just compensation purposes or for rate-making purposes) will be found to lie not in the value given to different property items under various methods of valuation but rather in the answer to the final question of whether, in a rate case, the basis for the fair return should be 'value' or 'investment' or 'sacrifice'."

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies

Transit Commission of New York Held To Be Constitutional.—Requisitions were made by the newly constituted Transit Commission to the Board of Estimate and Apportionment of the city of New York for such sums of money as were certified by the commission to be necessary to enable it to perform the duties imposed upon it. The requisitions were not honored by the Board of Estimate and Apportionment and the Transit Commission applied to the State Supreme Court, Appellate Division, for an order requiring the board to make such appropriations. The court issued the desired order. Nearly all of the arguments presented attacked the constitutionality of the act creating the Transit Commission. A most important point was that regarding the right of the Legislature to fix fares without regard to the existing contracts. In declining to hold the act unconstitutional on that ground the court stated that it is now settled beyond reasonable doubt that the Legislature has the right to modify rates for public utilities which are fixed in local franchises.

Mutual Obligations of Commissions and Utilities.—Holding, in Galveston Electric Company vs. City of Galveston, that a street-railway fare ordinance of the city was not so clearly confiscatory as to authorize the issuance of an injunction until operation for a further period had been tried, the United States District Court for the Southern District of Texas observed that "regulation of public service corporations is a delicate and dangerous function and ought to be exercised with a keen sense of justice on the part of the regulating body and met with frank disclosures on the part of the company to be regulated, and the granting or refusal by the court of an injunction in no manner relieves either party to the controversy from the recognition of these obligations in their future dealings." It is the function of the legislative and not of the judicial branch to make rates, and no injunction ought to be granted against the collection of rates established under legislative sanction unless the code is so clear and free from doubt as to compel the court to say that the rates prescribed will necessarily have the effect to deny just compensation for private property taken for public use. (272 Fed. 147.)*

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*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel—Responsibilities and Association Appointments of Men Engaged in Professional, Executive, Operating and Commercial Branches of the Industry

Clayton F. Geiger has been recently appointed superintendent of distribution for the Eastern Pennsylvania Light, Heat & Power Company, Pottsville. Mr. Geiger started work in the public utility field with the Wilmington (Del.) City Electric Company in 1899 as switchboard operator. In 1901 he was transferred to the meter-testing department and in 1903 became foreman of the meter department. In 1905 he was promoted to the position of chief electrician in charge of operation. Six years later he became substation foreman with the Metropolitan Electric Company of Reading, Pa., and in 1916 electric assistant with the J. G. White Engineering Corporation on construction work at Pottsville. The next year he became connected with the Eastern Pennsylvania Light, Heat & Power Company as district foreman in the Frackville and Ashland districts, having charge of the construction of various high-tension lines and substations. He was appointed foreman of electric equipment, substations and construction in 1918 and general foreman in 1920.

C. F. GEIGER

Joseph P. MacSweeney has been placed in charge of the adjuster's department of the Rochester (N. Y.) Gas & Electric Company.

Lewis A. McArthur, general manager Pacific Power & Light Company, has had conferred upon him by the University of Oregon the honorary degree of master of arts in public service. The degree was given in recognition of Mr. McArthur's interest in the history, geography and the physical development of the State of Oregon.

Harris J. Ryan, whose photograph appears as a frontispiece on page 202 of this issue, was born in Powell Valley, Pa., in 1866 and grew up with the first electrical generation in America. From Baltimore City College he entered Lebanon Valley College, where he studied from 1881 to 1883. He then entered Cornell, which was inaugurating an electrical engineering college, and was graduated in electrical engineering in 1887. Immediately following his graduation he entered engineering practice in Lincoln, Neb., with J. G. White and D. C. Jackson under the firm name of the Western Engineering Company. In 1889 he returned to Cornell as instructor in charge of the electrical machinery laboratory. His rise there was rapid. From 1890 to 1895 he was assistant professor of electrical engineering, and at the age of twenty-nine he was made full professor of electrical engineering in charge of the department. His youth earned him the name of "kid of the faculty." It was in the Cornell laboratories that Professor Ryan's high-voltage work really began, and the 90,000-volt transformer with dry insulation built by his class is still in use. He remained at Cornell until 1905, when he went to California to take charge of the electrical engineering department of Stanford University as professor of electrical engineering. This position he had held ever since. Professor Ryan has been a consistent contributor to technical literature, one of his early writings being an article on the heating of armatures printed in the Electrical World in 1892. Since 1909 he has been consulting engineer for the Los Angeles Aqueduct Power Bureau. He is a research member of the power transmission and insulator committees and served as vice-president of the American Institute of Electrical Engineers from 1896 to 1898, and again as special honorary representative and vice-president during the Panama-Pacific Exposition in 1915. In 1904 he was United States delegate to the International Electrical Congress in St. Louis. Professor Ryan served on the juries of awards for both the Chicago World's Fair in 1893 and the Panama-Pacific Exposition. He is a member of the following engineering and scientific societies: National Academy of Sciences, Engineering Section; American Institute of Electrical Engineers, Institute of Radio Engineers, National Electric Light Association, Illuminating Engineering Society, Society for the Promotion of Engineering Education, American Physical Society, American Electrochemical Society and American Association for the Advancement of Science.

Frank L. Dame at a recent meeting of the board of directors of the North American Company was elected its president. Heretofore he has served as vice-president and director. Mr. Dame is a graduate of the Massachusetts Institute of Technology, class of 1889, and entered the public utility operating field in 1890 as general superintendent of the Vancouver (B. C.) Railway & Light Company. For eleven years he was the operating head of various utility properties in the Northwest, including the Seattle Consolidated Street Railway and the Tacoma Railway & Power Company. In 1903 Mr. Dame went to Schenectady as engineer for the committee on local companies of the General Electric Company, which was in charge of all public utility properties then controlled by the General Electric. In the following year he was also made engineer of the newly formed Electric Securities Corporation, a subsidiary of the General Electric. In 1909 he was chosen vice-president of the Electric Bond & Share Company, a position which he held until the latter part of 1912. In 1913 Mr. Dame joined the organization of Harrison Williams, at 60 Broadway, New York. He has served as an officer and director of nearly all of the companies in which Harrison Williams has a controlling interest, including the Central States Electric Corporation, of which he is president; the Cleveland Electric Illuminating Company, of which he is vice-president, and the Republic Railway & Light Company.

F. L. DAME

J. V. Robb of Clinton, Ind., prominent in the western part of Indiana because of large holdings in electric utilities, is convalescing from a serious illness. He was in a sanitarium at Martinsville, Ind., for several weeks and at times his condition was critical. He has left Martinsville for St. Joseph, Mich., where he will spend most of the summer.

Charles S. Crowell, Philadelphia manager of the Underfeed Stoker Company of America, Detroit, Mich., resigned on July 1.

Edwin S. Webster, a member of the firm of Stone & Webster, Boston, has been appointed by Governor Cox a member of the special commission established to investigate the problems relating to the organization work and expenditures of the existing administrative departments of the State of Massachusetts.

F. T. Whiting, manager of the engineering division of the Chicago office of the Westinghouse Electric & Manufacturing Company, has been appointed manager of the industrial division of that office, to succeed N. G. Symonds, who has just been made manager of the Chicago office.

L. C. Mitchell has resigned as works manager of the Pittsburgh Transformer Company. Mr. Mitchell became associated with the company in 1907 as test engineer and has held the positions of electrical engineer and superintendent. For the past several years he has been works manager of the company.

F. F. Espenschied, who has recently opened an engineering and sales office in Pittsburgh, Pa., is district representative for the Commercial Truck Company, Philadelphia, the oldest maker of electric road trucks in America. Mr. Espenschied, after being graduated in electrical engineering from Cornell University in 1905, joined the West Penn Railways Company, in Connellsville and Pittsburgh. He later served with the Ontario Hydro-Electric Power Commission. Upon returning to New York he was assistant chief engineer with the Combustion Engineering Corporation, and later joined with W. E. Moore in Pittsburgh in developing electric furnaces and consulting engineering practice, including power plants and electric steel mills in the interior section of China.

E. C. Richardson, who has been manager of the Western Electric Compania Italiana at Rome and Milan since 1910, and who also saw foreign trade service at Antwerp, has been transferred to Peking, China, as general manager of the China Electric Company, the Far Eastern subsidiary of the International Western Electric Company. He succeeds C. H. Minor, who has supervised the operations of the China Electric Company ever since it started business early in 1918. Mr. Minor is returning to the European organization of the International company and will make his headquarters at London. Mr. Richardson was directing the activities of the Western Electric Compania Italiana last year when its works at Milan were taken over by the Communists. He succeeded in protecting his American interests and, by his tact and knowledge of Italian labor conditions, was able to resume operations long before most of the other foreign-controlled industries in Italy's great labor center.

Isaac Harter has been appointed general superintendent of the Babcock & Wilcox Company, New York City, succeeding the late James P. Sneddon. Mr. Harter was formerly assistant to the president of the company.

E. J. Irish, formerly manager of T. J. Cope, Philadelphia, has gone into business for himself at 628 Filbert Street, Philadelphia, Pa. Mr. Irish will manufacture underground and overhead electrical supplies of various descriptions as well as bonding wire and durable wire rope.

Robert D. Black, who was formerly assistant sales manager of the Black & Decker Manufacturing Company, Towson Heights, Baltimore, Md., has been appointed manager of the company's Philadelphia branch office with headquarters at 318 North Broad Street. Mr. Black succeeds W. C. Allen, who has been made a special factory representative with headquarters at the company's Cleveland branch office, 6225 Carnegie Avenue.

Prof. Arthur M. Greene of Rensselaer Polytechnic Institute has accepted the call of the trustees of Princeton University to become dean of the engineering school and professor of mechanical engineering. He will take up his new duties in September, 1922. Professor Greene is a graduate of the University of Pennsylvania and also holds the honorary degree of D. Sc., conferred in 1916. He has taught mechanical engineering at Drexel Institute, at the Universities of Pennsylvania and Missouri and at Rensselaer, and has been prominent in the American Society of Mechanical Engineers as manager and vice-president and at the present time is chairman of the research committee. Princeton has given an undergraduate course in civil engineering and a graduate course in electrical engineering for many years. Next fall undergraduate courses in mechanical, electrical, mining and chemical engineering will be added to the curriculum. A four-year course will lead to the degree of bachelor of science in engineering and is designed to meet the needs of the student who does not expect to practice the profession of engineering but wishes the engineering training to fit him for business or manufacturing. For those who decide to follow engineering as a profession an additional year of special work in the chosen branch will bring the engineer's degree. The establishment of the new courses has been largely due to the untiring efforts of certain of Princeton's engineering alumni through the graduate body known as the Princeton Engineering Association.

Obituary

Albert Taylor, manager north Atlantic district of the Electric Storage Battery Company, died suddenly on July 6 in New York. Mr. Taylor was born in Liverpool, England, on Feb. 6, 1864. In 1884 he was graduated from Princeton University. He served an apprenticeship with the Edison General Electric Company, and in 1885 joined the United States Electric Company. This company was absorbed by the Westinghouse interests in 1889 and in the following spring he became associated with the Stanley Electric Manufacturing Company, Pittsfield, Mass., remaining there for eight years. In 1898 Mr. Taylor entered the employ of the electric Storage Battery Company as a salesman in the New York office. In January, 1900, he was made assistant manager and in March of the same year was appointed manager of the New York office. When, in February, 1920, the growing business of the company made it necessary to divide its territory into five districts, Mr. Taylor was selected as manager of the north Atlantic district, embracing branches in New York, Rochester and Boston, covering the States of Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York and a portion of New Jersey. Mr. Taylor also devoted considerable time as representative of the company in connection with the use of its product by submarine boat building companies. He was a member of the Engineers' Club, Lawyers' Club, and Lotos Club of New York, and the Wykagyl Country Club, New Rochelle, N. Y.

John Clark McMynn, well known as a consulting engineer and for ten years editor of *Electrical Engineering*, died recently at his home in Chicago. Mr. McMynn was fifty-two years old and was born at Racine, Wis. He received the degree of A.B. at Williams College in 1890, and that of M.E. at Cornell University in 1891. In 1892 Cornell conferred upon him the degree of M.M.E. as a specialist in the electrical and naval branches of mechanical engineering. Immediately after leaving school he became connected with the Robert W. Hunt Company, manufacturer of steel products, where he was in full charge of the electrical and mechanical testing laboratory. He was electrical and mechanical engineer in charge of the construction of the Ferris wheel, built during the Chicago World's Fair. Later he acted as official representative of the city of Chicago in the testing of eight municipal pumping stations and the Thirty-ninth Street sewage pumping station. He was also connected with the construction and testing of water works at Pittsburgh, Davenport, Iowa; Buffalo, St. Paul, St. Louis. He supervised the construction of the town of Ziegler, built to serve a coal mining community in southern Illinois. For several years he served as consulting engineer for the state institutions of Wisconsin.

Trade and Market Conditions

Business Reviews, Together with Market Letters
from Important Trade Centers, on the Supply, Demand and Prevailing Prices of
Electrical Apparatus and Supplies

Better Industrial Undertone Apparent

WITHOUT attempting to forecast the future, it may be pointed out that a better industrial feeling has been manifest in the past two weeks. There are more reasons today for a hopeful feeling than have existed since the first of the year.

Bankers who generally are pessimistic are now frankly optimistic. Money is becoming more plentiful and cheaper —in fact, call money has in the past few days gone as low as 4½ per cent. Bond prices are strengthening, which the financial statisticians all agree immediately precedes a stock market boom, and this in turn is the immediate forerunner of increased industrial activity.

Textile, woolen and leather mills are once more back on a full schedule, and prices in these lines are actually strengthening. Automobile factories are in better shape than they were. The railroad buying is now felt to be quite close. In fact, one of the large Eastern roads this week began again to increase its repair forces.

In the agricultural districts the general undertone is more optimistic. It is realized that the high prices of the war are not to be expected, but at the same time labor is cheaper. In the building trades the wage question is being debated in many places. In others workmen took a reduction without argument. The net result, of course, is going to be lower building costs.

Other similar elements that are straws in the wind have given to people a brighter vision.

Electrical Exports Continue to Fall Off

FIGURES for the June exports of electrical merchandise are the lowest for any month since last July. During the latter part of 1920 the foreign market received monthly more and more goods, reaching a climax in January. Since then the shipments have fallen off just as rapidly. The story is told by the figures. January electrical exports were valued at $15,332,955 and June at $7,315,794.

The falling off is apparent in the shipments of virtually every line. There is, however, an explanation due. The heavy shipments of December and January were on back orders for which merchandise was finally available. Not all orders were filled, however, and since then the demand has dropped away considerably. Some orders were canceled and others were held up by the manufacturers because of credit conditions. Since the first of the year there has been a severe cut in export prices. In many cases where the credit was satisfactory goods have been sold to foreign buyers at almost the buyer's price. This has naturally had considerable to do with the falling totals.

	June, 1920	June, 1921
Batteries	$578,146	$246,844
Carbons	113,109	24,211
Dynamos and generators	571,340	581,992
Fans	191,434	45,540
Heating and cooking apparatus	164,344	77,866
Insulated wire and cable	593,370	588,211
Interior wiring supplies	270,709	105,436
Arc lamps	7,743	167
Carbon-filament lamps	4,518	11,985
Metal-filament lamps	364,864	246,450
Magnetos, spark plugs, etc	290,723	106,890
Meters and measuring instruments	237,735	269,504
Motors	1,250,638	1,437,812
Rheostats and controllers	83,504	85,568
Switches and accessories	608,394	263,516
Telegraph apparatus	30,458	13,417
Telephones	275,212	299,066
Transformers	402,016	544,644
All others	2,973,756	2,366,675
Total	$9,012,013	$7,315,794

For the first half of the year the totals stand at $63,818,994, or $17,000,000 ahead of the first six months of any previous year.

Cedar Pole Stocks Are Good

A SURVEY of the cedar pole market finds generally slack conditions of buying, though by no means a pessimistic outlook on the part of producers. The first half of the year has been pretty quiet in this line, with prospects that the fall will show some improvement. Some producers, however, do not look for an active market before next spring. There is much work being held in abeyance that should result in pole buying, it is stated, and on the expectation that by next spring sales should be brisk pole producers intend to go right ahead and produce a normal quantity this fall and winter.

There have been some inquiries in the market from central stations but up to this time electric railways have shown little or no interest. A large producer of Southern white cedar poles reports that though April and May were quiet months, June sales showed up better. One of the factors cutting demand for cedar poles has been the increased competition from local chestnut poles, which make their appeal on the ground of lower cost. Existing high freight rates on pole shipments from the West serve to maintain this advantage but producers are hopeful of relief.

Competition in the pole market is keen right now, with good stocks held at distribution points and immediate shipments generally made. Prices have not changed since three months ago on Western red cedar poles, at which time a cut of 15 to 22 per cent was made. Northern white cedar poles have not been reduced, it is stated, and in the opinion of a prominent producer are not very likely to be reduced because of their increasing scarcity. Current quotations on Western red cedar poles are as follows, f.o.b. New York: 30-ft. 7-in. top, $9.55; 35-ft. 8-in. top, $16.10; 40-ft. 8-in. top, $19.15; and the same poles f.o.b. Chicago, $8.30; $13.90; and $16.30 respectively.

Lamp Production Still on Pretty Low Basis

PRODUCTION of lamps has been showing a falling off during the last few months. From reports on factory operation it would seem that production now is on a basis of about 65 to 70 per cent of capacity, and when it comes time for the two weeks' summer shutdown of those factories which expect to close it is probable this term will be extended a week or so.

Although factory lamp stocks are pretty large, there are a few signs that point to a possible reduction. There has been a noticeable pick-up in activity among the textile mills in New England, although the metal industries there and in general are still dull. The longest days of the year are a month and more behind us and the earlier evenings are already noticeable. From some quarters it is reported that lamp distributers have been cutting down on their lamp orders to a greater degree than their lamp sales have dropped off, indicating a reduction of their stocks. If this is so, their orders, it seems, should soon begin to increase in size. Of course, the lighting load on central stations shows a decrease throughout the summer months this year as well as in the past, and in addition the industrial depression has kept many lamps dark.

THE WEEK
IN TRADE

Prices When Quoted Are Those Prevailing at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

SLIGHT improvement in the electrical market is reported in the Southeast, but elsewhere conditions are unchanged. Strikes in the electrical and building trades have reduced buying of wiring supplies in most of the large industrial centers, and until a settlement is reached the demand for electrical supplies can hardly be expected to grow very much.

Fan sales apparently reached their climax during the first half of the month. Both the jobbers and the dealers are now very wary about ordering stocks, and it is apparent that the manufacturers will have to carry virtually all the fans that are held over this year.

Prices are dropping with great frequency and apparently are having little effect in bringing orders. Lower prices are reported on transformers, lamp cord, metal molding, tape, panelboards, and other apparatus.

Collections generally are on the same basis, but indications are that they will become better in the fall. Increased industrial activity and good crop prospects are seen as hopeful signs.

NEW YORK

Business is dragging along upon the same quiet level as heretofore. There is no real life to the movement of any electrical item with the possible exception of fans, and even they have recently slumped badly from the brisk demand that was felt for a number of weeks.

Better sales of armored conductor are reported in several quarters, attributed to residence construction in outlying districts. According to one of the largest manufacturers of watt-hour meters, sales of this product have shown a noticeable increase recently, which is further evidence that construction of residences is on the upgrade. Contractors, however, are not stocking electrical material but are buying only to cover jobs on hand. Jobbers, too, continue to buy nothing ahead, and some are still engaged in liquidating goods on hand.

This latter circumstance, together with the large number of jobbers competing for a curtailed amount of business, has resulted in price competition that is cutting profit margins to the bone. Quotations at virtually cost are being made on a number of items where stocks are large, and in other cases prices closely approach cost. Manufacturers have recently decreased prices on metal molding and on lamp cord. Collections are holding their own.

Conduit.—In 2,500-ft. lots prices quoted this week on black are as follows: ½-in., $55 to $58; ¾-in., $72 to $77.90; 1-in., $105 to $110. On galvanized, some sizes, quotations are $60 to $66, $80 to $84.82, and $116 to $121. There is very little market in general, so only medium stocks are held.

Flexible Armored Conductor.—Some slight increase in the movement is seen in certain quarters, due to residence construction in outlying districts. From $48 to $49.50 per 1,000 ft. in that quantity is the current price for No. 14, two-wire, single and double strip.

Rubber-Covered Wire.—Stocks are fair to large, but demand shows little fluctuation, being on a low level. No. 14 single-braid in 10,000-ft. lots is selling for $6.50 to $6.75 per 1 000 ft.

Non-Metallic Flexible Conduit.—Sales are poor and stocks are kept low. In 1,000-ft. lots the $\frac{7}{32}$-in. size sells for $20 to $25 and ½-in. for $20 to $27 per 1,000 ft.

Lamp Cord.—The market is weak with only small sales. A large manufacturer reduced prices on July 19 about 5 per cent. Stocks vary from fair to large. No. 18 cotton twisted brings $13 to $13.50, and No. 18 cotton parallel from $15.50 to $16.10 per 1,000 ft. in that quantity.

Flashlight.—Vacation business is nowhere near up to normal with most jobbers. Renewal business is fair and good stocks are carried. Discounts allowed in standard packages are 40 and 10; in unit packages 40, and less than unit packages 33⅓ per cent.

Dry Cells.—Demand is spotty, some of the trade finding a fairly good vacation demand with increased sales since the price drop, while others report a poor market. Quoted price on No. 6 regulars in barrel lots is 29 cents each and 30 cents on igniters, but these prices are being cut to within a cent of cost by some.

Fans.—The strong demand previously experienced seems to have slumped. Jobbers generally report lighter sales and will proceed cautiously on replenishing stock. Gyrating ceiling fans are moving fairly well, but not other types. A fair demand for exhaust fans is reported. Non-oscillating desk and bracket fans are not moving very well, 16-in., 12-in., and 9-in. or 10-in. oscillator fans being the most popular.

Outlet Boxes.—The new discount quoted by jobbers since the price drop ranges from 50 to 55 per cent on black boxes and 45 to 50 per cent on galvanized in lots of 100. Demand is quiet, and to move his stock at least one jobber is giving 60 per cent on black and 50 and 10 per cent on galvanized boxes.

Metal Molding.—Prices have recently dropped about 5 per cent since the steel cut. Some jobbers report a fair demand, but it is rather spotty. In 1,000-ft. lots the three-wire size brings $5.92 to $6.40 per 100 ft.

CHICAGO

The week shows a continuation of the same underlying conditions in the electrical field as well as in general business. The trade of the Chicago district is largely dependent on two factors—agriculture and steel. Until some definite change for the better occurs in those factors there can be no large change in business conditions. The farm regions have by no means recovered from the slump in prices. The steel mills, now operating at from 10 to 20 per cent capacity, have no increased demand in sight. When the railroads get their affairs in such shape as, when once moving, to place substantial orders for cars and rails, increased steel activity will come, and with it increased buying power and better general business.

The building situation remains in the same sorry tangle that has enveloped it since May 1. The arbitrator, owing to the failure of the various interests to agree on uniform working conditions, has not yet rendered a wage decision. The season is now so far advanced as to render unlikely the initiation of any great volume of big work when that decision is rendered. There will, of course, be many millions in work to go ahead in smaller jobs, and therein, it is felt, lies to a considerable degree the hope of a reasonable prosperity in the electrical trade this fall.

Retailers, jobbers and manufacturers are all looking for business to result from the "Pageant of Progress," a great exposition of Chicago industry to be held on the Municipal Pier from July 30 to Aug. 14. Nation-wide advertising has been given to this show, and the expectation is that over a million visitors will visit the displays, including thousands of out-of-town people. Naturally, the exhibits are designed to attract trade, and the placing of many orders will of course result. The electrical industry will occupy fifty-six exhibition spaces in the "Pageant."

Apparently the retail electrical trade is faring better in these dull weeks than other retail lines. There is no question that many lines of trade are having difficulties in keeping the balance on the right side of the ledger. Electrical dealers all seem to be doing reasonably well, as the very warm weather, which has now lasted for six weeks, is causing an excellent fan business and keeping trade lively in percolators, irons, toasters and similar devices.

One large concern is pushing a flatiron campaign, offering as a premium an ironing board with every iron. Active sales effort is bringing very satisfactory results.

All lines report slow collections. In general collections are about one-half normal.

Price changes in the electrical line are negligible and have no effect on the market. Buying is limited strictly to actual requirements, and a cut on any article or line produces little interest.

ATLANTA

Electrical jobbers report a slow improvement both in size and volume of orders in their general business, though no lines show any very great increase in activity. The final figures for the month of June show that this month was the most successful this year, and indications are that July will probably be quite as good, except for the falling off in the total volume of fan sales. Industrial plants are making many inquiries, though few orders of moment have been received from this class of business. Municipal plants and small central stations, however, are buying on a more liberal basis than for some time past, the result of an urgent demand for extension of lines and improvements long deferred. The construction of small and moderate-size homes continues to increase, especially in the larger centers. Savannah, for the first time this year, shows an increase in building permits over the corresponding period of last year, June permits being valued at $221.270 as compared with $175,000 last June.

Agricultural reports from the fruit and melon section of Georgia are excellent, and money realized from the sales of these products is materially assisting in providing local business. The action of the federal government in approving bona fide advances on cotton to export corporations and indications that it really intends to assist the South in moving the coming cotton crop, as well as the staple carried over from last year, are naturally the subject of a great deal of comment. Opinion seems to have it that this will serve materially to build up the confidence of the rural districts in the outlook for better conditions in the early fall.

Friction Tape.—A reduction in price of 10 per cent is announced this week, in spite of a brisk demand for both this and rubber tape. Stocks are reported in fair condition and shipments are excellent.

Washing Machines.—The dullness in this line continues, though a noticeable increase in the movement of this specialty is to be noted in those sections where there is ready money. This has served to move retailers' stocks, but as yet they are not reordering from jobbers, whose stocks remain very heavy. Price reductions do not seem to stimulate sales as was expected.

Panelboards.—Fair activity is reported on the moderate sizes for commercial buildings and apartment houses, but very little demand is to be found for the large sizes. A reduction of approximately 10 per cent was announced in the past few days and shipments are reported as considerably improved.

Poles and Cross-Arms.—Demand is spotty, most of the sales being made to large centers and to surrounding small towns for the purpose of taking care of the extensions required to reach houses nearing completion. Little construction of large transmission lines is under way in this section. Prices remain steady.

Lightning Arresters.—This line should ordinarily be most active in the spring, but few purchases were made at that time, which is causing a quite satisfactory movement to replace damaged apparatus and protect new lines. The compression type continues to be the most popular variety. No price changes are yet reported and stocks are in good condition.

Street-Lighting Equipment.—Both manufacturers and jobbers find considerable activity in varying lines of street-lighting equipment, though the central span type with 250-watt to 500-watt lamps seems to lead in popularity. This material is going largely to the smaller communities. A slight recession in price is to be noted and factory shipments are quite satisfactory.

ST. LOUIS

The strike by the electrical workers in St. Louis and the immediate vicinity has caused a material reduction in demand for electrical goods during the past week. The old contract covering their employment has expired and the employers are endeavoring to renew at a lower wage. The controversy hinges on the wages to be paid other artisans in the building industries and a fairly early settlement is anticipated.

Outside of St. Louis there still continues to be felt a gradual lessening of demand, but there is a possibility of betterment in the more agricultural districts as crop conditions throughout this entire territory are reported to be excellent. Wheat is being threshed and as a rule is being immediately marketed. Predictions are that the corn crop this year will be materially heavier than the average if rains are at all favorable.

Building permits in St. Louis for June show heavy increase, but this is entirely due to the commencement of work on two large apartment buildings, which has been anticipated for some time. Other construction work is on the decline and almost no industrial construction is being done.

In new industrial building permits issued since the first of the year the monthly average shows a number of four, with estimated valuation of $37,000. The total estimated valuations for new work and alterations by months since the first of the year are as follows: January, $330,025; February, $714,845; March, $974,405; April, $1,127,155; May, $1,087,195; June, $2,150,069; total, $6,383,694. Total for the first six months of 1920 was $10,701,608.

Pliers.—A reduction in Klein tools approximating 25 per cent is announced. New prices on side cutting pliers are: 5-in., $2.60; 6-in., $2.80; 7-in., $3.35; 8-in., $3.75; 9-in., $4.45. Local stocks are rather low and some difficulty is found in getting satisfactory shipments.

Conduit.—Since the reduction of nine points in the discounts made at the close of the week before, the following representative prices have been established: ½-in. black, $58.57 per 1,000 ft.; ½-in. galvanized, $63.67; 2-in. black, $236.43; 2-in. galvanized, $258.63. All prices are subject to 5 per cent discount for cash. Good stocks are reported, but the demand has been quiet, especially since the electrical strike began.

Knobs and Tubes.—Slightly easier prices obtain. "Nail-it" knobs are being offered at $18 to $19 per 1,000 in barrel lots. Representative prices on tubes are: 2½-in., $7 per 1,000; 3-in., $8; 4-in., $9.25. Stocks are reported to be as a rule moderate, but some jobbers have heavy supplies. The demand has been adversely affected by the strike of electrical workers.

Schedule Material.—A very light demand exists and stocks vary from moderate to heavy. The items finding the heaviest stocks are entrance switches, rosettes and porcelain receptacles.

Safety Switches.—In face of the lower prices which have prevailed since July 1 the demand continues to be extremely light. Most jobbers report heavy stocks. Outside of St. Louis little demand is found, and owing to the lack of industrial activity the movement there has not been at all attractive for some time.

Wire.—A tendency to stiffen the prices of copper wire is noted. No. 14 rubber-covered, recently quoted by a large jobber at $6.75 per 1,000 ft. in 5,000-ft. lots, is now quoted by the same jobber at $7.15. In 100,000-ft. lots the price is $6.40. No. 6 rubber-covered, in 5,000-ft. lots, is quoted at $39. Weatherproof is on a 17-cent base and bare wire is on a 16-cent base, both f.o.b. St. Louis. The demand is very light and is for small sizes. Stocks of weatherproof are in good shape, but those of rubber-covered are reported by some jobbers as heavy.

Fans.—The stocks of fans, which were somewhat low last week because of the exceptionally heavy call then prevailing, have been bettered to some extent by shipments from the manufacturers. The demand continues good but is somewhat less than that existing last week.

SEATTLE—PORTLAND

The situation generally is characterized by continued slow sales and decreasing prices. During the past ten days household appliances have dropped from 5 to 10 per cent, as follows: Electric ranges, 10 per cent; sewing machines, from 5 to 10; ironing machines and certain lines of hollow-ware devices, 5. Motors of all sizes are holding firm as are wire and wiring devices. Stocks of all lines, generally speaking, are heavy and collections show but little improvement. However, in spite of these conditions, both jobbers and dealers throughout the district are more or less optimistic and many state that in their opinion good times are just around the corner. These opinions are predicated upon several factors, mainly conditions of crops in fruit-growing and wheat-raising sections which are exceptional. Coupled with good crops are low production costs and gradual liquidation of debts by farmers and orchardists. Residence construction is still on the increase, and there is a considerable amount of big building work to be started immediately or now under way. Building-material prices generally are holding up well, and particularly is this so in the case of lumber, brick, cement, etc. There is a plentifully supply of building laborers and mechanics. Western Oregon and Washington mills report production last week to have been 35 per cent below normal.

Manufacturers' agents in the Portland district report that the general volume of business has not changed materially. However, there seems to be greater activity manifest, although it is not felt that this necessarily means anything permanent. Transformer price reductions are announced of 10 per cent on 500-kva. and larger and 5 per cent on smaller sizes. Stocks are somewhat unbalanced owing to accumulation of back orders and present business inactivity. Jobbing business continues about the same, but a better tone is noted recently. Pole-line material has had several price reductions but is still above the pre-war basis. Stimulation of business due to the recent general price reductions seems to be reflected primarily in wiring devices. The contractor-dealer business is still slow and virtually as it was thirty days ago. The work in view is no greater than for some time past, and work actually under way is somewhat less.

Spokane jobbers report comparatively light business in all lines. Owing to the cool summer, the fan business has not shown its usual activity. Deliveries are good. Collections are only fair. Excellent crop prospects throughout the Inland Empire, in many parts of which harvest has already started, give hopes of a good fall business. This is particularly true with respect to farm-lighting systems. The bulk of the electrical business in Spokane has been furnished by the large number of small houses which have been under construction in the last several months.

Wire.—The demand for rubber-covered wire is below normal. No price changes have been noted. A healthy demand exists for weatherproof wire in the various sizes. Sales are from 17 to 17¾ cents per pound in carload lots, depending upon the size. Bare copper sells from 15 to 16½ cents per pound in carload lots. Stocks are good in all lines.

Motors.—The demand is slow. Following the closing of the shipyards and allied industries the local market was flooded with second-hand motors as well as conduit and wire to a certain extent. The second-hand conduit and wire stocks have been cleaned up, but motors are still available and cause the market to sag.

Vacuum Cleaners.—A reputable appliance dealer in Seattle states that sales during the first six months of the year were from 60 to 75 per cent greater than for the same period last year. Stocks of all makes are in good shape and replacements are easy to obtain. Prices show no change.

Sewing Machines.—Machines and machine motors, particularly, are active, and the recent deduction in price of 10 per cent is expected further to augment sales volumes.

Automobile Batteries.—Movement has dropped off leaving jobbers with heavy stocks on hands. Prices are holding, but decreases would not be unexpected.

SAN FRANCISCO

The fourteenth week of the building strike finds public opinion generally acknowledging the defeat of the radical elements of the labor unions. This note of optimism comes largely because of the action of the saner elements of the unions. In repudiating the leaders who called the strike by separately choosing a delegate from each union to form a new body whose officers are to confer with the Building Exchange with a view toward a speedy settlement. It is estimated that nearly $8,000,000 has been lost to the merchants of San Francisco, Oakland and other bay cities because of the strike. The seamen's strike continues, with apparently an increasing amount of sabotage, several steamers having been towed to port in a disabled condition.

Collections are rather poorer than they were a month or so ago, but as this condition is due to the strike merchants are not exerting undue pressure. They are, however, watching closely new orders from customers with high accounts and are stipulating that such orders are to be for minimum amounts and only where urgently needed. Crops will be large, although some of them, such as the pear crop, have been damaged by frost. Other crops, especially grapes, are selling heavily and are already bringing as much as $80 a ton. The real test will come about a month later, when the various fruit associations will strive to come to terms with the packers. Some of these, such as the almond growers, are exerting pressure at Washington to secure higher protective duties against foreign shipment.

The Metal Market Situation

THE copper market situation is far from favorable. Prices are ¼ cent lower than when last quoted. Pressure to sell by outside interests is held responsible for the weaker prices, but even large producers have lowered their quotations to 12.75 cents for August shipment. With small producers copper is available at 12.50 cents delivered for August and 12.25 for prompt shipment. Consumers have not reacted to these lower prices, however; in fact, as selling interests become more anxious to unload buyers hold off all the more. It is stated that as low a price as 12.12½ cents per pound delivered has been made by second hands. Wire base has dropped ¼ cent to 14 to 14.50 cents.

The Copper Export Association has called in for redemption on Aug. 15 $1,000,000 of its 8 per cent gold notes, series A, due Feb. 15, 1922. The securities to be redeemed represent about 10,000,000 lb. of copper.

The value of non-ferrous scrap metals recovered in 1920, according to the Geological Survey, amounted to $188,507,260, or $6,666,000 more than in 1919. Copper recovered in 1920, including that in alloys other than brass, had a value of $48,060,800, compared with $41,812,000 the preceding year. In the same period brass scrap remelted increased from $75,944,100 in 1919 to $77,454,000 last year.

The lead market is quiet with prices steady. Tin has dropped again and is cheap at its present low price of 26 cents, but buying interest has not reacted as yet. Zinc is a shade firmer, and though sales are still quiet, producers are not pressing to sell.

NEW YORK METAL MARKET PRICE

	July 19, 1921	July 26, 1921
Copper	£ s d	£ s d
London, standard spot	70 2 6	70 0 0
	Cents per Pound	Cents per Pound
Prime Lake	12.75	12.50
Electrolytic	12.50—12.75	12.25
Casting	11.75	11.50
Wire base	14.25—14.75	14.00—14.50
Lead, trust price	4.40	4.40
Antimony	4.75	4.75
Nickel, ingot	41.00	41.00
Sheet zinc f. o. b. smelter	10.00	10.00
Zinc, spot	4.70—4.75	4.75
Tin	27.00	26.00
Aluminum, 98 to 99 per cent	24.50	24.50

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	9.50—10.00	9.50—10.00
Brass, heavy	4.25— 4.50	4.25— 4.50
Brass, light	3.50— 3.75	3.50— 3.75
Lead, heavy	3.25— 3.37½	3.25— 3.37½
Zinc, old scrap	2.00— 2.25	2.00— 2.25

Manufacturers' Activities

Devoted to the Business Side of Manufacturing, Distribution and Sales, News fromJobbers and Foreign Fields and a Record of New Devices and Trade Literature

Export Association to Meet in October

The twelfth annual convention of the American Manufacturers' Export Association will be held in New York at the Waldorf-Astoria Hotel, Oct. 5 and 6. A. W. Willmann, 160 Broadway, New York City, is secretary.

Schimme Electric Supply Established in New Building

The Schimmel Electric Supply Company has removed from 318 Market Street, Philadelphia, where it has been located for the past seven years, to 526 Arch Street, where it occupies a six-story building, containing 42,000 sq.ft., which has been completely remodeled and equipped as a modern electrical supply house. Samuel Schimmel, head of the company, is very optimistic and thinks it is now time to prepare for the wave of prosperity that is on the way here.

Anylite Electric Adds Several Specialties to Its Line

Arrangements have been completed by the Anylite Electric Company, Fort Wayne, Ind., to manufacture a number of new conveniences which, officials state, are selling remarkably well regardless of the slow market that has prevailed for the last few months. The company is now producing a twin electric light plug, and an extension plug for appliance use has recently been completed and production on it is being started. Production has been started on a regulator for a certain make of electric bed warmer, now being manufactured by Henry Gordon, Muncie, Ind., and for which large contracts have been made covering the next few years.

National Conduit & Cable Company Not Solvent

Appointment of a receiver in equity of the National Conduit & Cable Company, Hastings-on-Hudson, N. Y., as announced in the ELECTRICAL WORLD last week, was the result of a rather unusual situation, and according to Clarence G. Galston, receiver, the company is by no means insolvent. The action was based on a mortgage dated April 1, 1917, made to secure an issue of $5,000,000 first mortgage 6 per cent ten-year sinking-fund bonds, of which $4,380,000 are outstanding. A clause in the mortgage required the company at all times to maintain net quick assets at an amount in excess of the aggregate outstanding bonded debt of the company. This requirement had previously embarrassed the company's operations, and in February of this year the net quick assets fell somewhat below the stipulated amount. A bondholders' protective committee was formed at that time and the present suit was brought, with a view to conserving the company's assets pending reorganization.

The National Conduit & Cable Company has not defaulted on its bond interest, and Mr. Galston states that the cash position of the company is very strong.

New Electrical Supply House Opens in Houston

A new firm, to be known as the Empire Electric Supply Company, has been organized in Houston for the purpose of distributing and selling, wholesale only, electrical supplies and apparatus in the State of Texas. The company is located at Williams and Sterrett Streets. It has railroad sidings into its warehouse and is well equipped for wholesale distribution. The officers of the company are: E. F. Hail, president and general manager; H. F. Reichardt, vice-president and treasurer, and T. B. Matthews, secretary and assistant manager.

Fixture Manufacturer Makes Change in Name

The Lion Electrical Manufacturing Company, manufacturer of lighting fixtures and of portable lamps, with main office and factory at 360 Morgan Avenue, Brooklyn, N. Y., is the new name for the former Lion Electrical Appliance Company. The company believed that its former name was not sufficiently representative of its business as a manufacturer and decided on the change.

The New York City office and showroom is at 26 Warren Street. There has been no change in manufacturing or sales policies, nor in its product. The old officers continue in charge.

Reading Storage Battery Company Organized

The Reading Storage Battery Company, 336 Chestnut Street, Reading, Pa., has recently been organized to take over the holdings and property of the Storage Battery & Appliance Corporation of Pennsylvania. The company as organized has a capitalization of $150,000 with a capacity of 140 batteries per week, though changes in the near future will place this at 250 per week. All types of storage, lighting and ignition batteries will be manufactured, under the name of "The Reading." Two grades of battery will be made, one a standard type using wood separator, which is being marketed at present, and the other a non-separator type which will be placed on the market about the first of August. Howard J. Kline, director of the Keystone Institute, Reading, Pa., is president; Theodore R. Mausen, New Brunswick, N. J., is vice-president and general manager; William F. Gring, superintendent of Hodges Mattress Factory, Reading, is secretary and treasurer, and W. Howard Crissey and Carroll L. Boughter, chief engineer and plant manager respectively of the Reading Storage Battery Company, are directors.

Airdry Corporation Takes Over Groton Electrical Devices

The Groton Electrical Devices, Inc., Groton, N. Y., has been reorganized under the name of the Airdry Corporation. The manufacturing and sales policies remain the same as under the old company. With additional capital the company will be able to open other agencies and do more advertising. The officers of the new company are: Ben Conger, president; Charles Bullard, Elmira, vice-president; L. J. Conger, secretary, and D. J. Watrous, treasurer and general manager.

Larger Quarters for New York Motor Distributer

C. O. Hall, distributer of the Allis-Chalmers, Peerless and Kimble motors, has moved from 147 West Thirty-fifth Street to 71 Eighth Avenue, New York City. The new building which he occupies entirely now is 25 ft. by 100 ft., four stories and basement, and gives him much larger and better facilities besides being more centrally located. Full stocks of these motors are carried here. On Peerless fans, however, he has been about cleaned out following the recent hot weather but new orders in small amounts by express will keep him in working stock.

Good-Will Advertising by Electric Vacuum Cleaner Company

The Electric Vacuum Cleaner Company, Inc., Cleveland, has prepared and is distributing a good-will folder in every carton and original package leaving its factory. This message urging consumer support of and cooperation with central stations, and which is along the line of the original idea of G. A. Hughes of the Edison Electric Appliance Company, is a direct tie-in with the national good-will movement furthered by the N. E. L. A. This message of the cleaner company will get into the hands of some 10.000 householders during the present year, says the executive manager of the N. E. L. A., and other manufacturers of appliances are expected to follow the same plan during the fall and winter months.

New Express Company Orders Thirty Electric Trucks

The Southeastern Express Company has recently opened in the South, with headquarters in Washington, D. C. The officials being former express men, the question of equipment was settled in favor of electric vehicles, and the first order for thirty trucks was given to the Commercial Truck Company of Philadelphia. These trucks will be for use in Washington, Baltimore, Norfolk and Richmond, and later, it is stated, the service will be extended to other cities.

New Line for New York Jobber

Hirschfield Electrical Supply Company, Inc., electrical supply jobber at 147 Bowery, New York City, which opened a branch store at 78 Warren Street in May, has recently added wireless equipment to its line of supplies. Sales of fans the present season, it is stated, are larger than for several years.

Utility Compressor Company to Build New Plant at Adrian

Contract has been awarded by the Utility Compressor Company, Detroit, manufacturer of the "Utility" electric refrigerator, compressor and vacuum pumps, for the erection of a new plant at Adrian, Mich. Work has started on the new building, which will be 240 ft. long and 50 ft. wide, with an L about 120 ft. long. It will have a floor space of 16,000 sq.ft. and will be equipped with modern machinery for the manufacture of electric refrigerators, and will have a capacity of about twenty-five outfits per day. It is expected to have the plant ready for occupancy about the first of September. The company has applications for representation in practically every territory in the United States, and it proposes to open up these territories from time to time as production warrants. It also has many applications from foreign countries, but it will probably be some time before the company will be in a position to supply the foreign market.

Electricity's Part in Chemical Exposition Next September

With the seventh national exposition of chemical industries to be held at the Eighth Coast Artillery Armory in New York City during the week of Sept. 12 the electrical industry will find itself affiliated to a greater extent than ever before. During the last decade the industry has shown a remarkable growth, and since the war it has had a special impetus. Throughout its whole growth the electrical industry has played a greater and greater part each year, and the dependence of the chemical industry upon the electrical industry for the solution of many of its problems will be clearly outlined at the coming exposition.

From the list of exhibitors which is at present available there are well over fifty manufacturers who have a definite connection with the electrical industry. Some of the points and apparatus which will be featured at this show are air conditioning, dust collection and arresting, the question of storage economy and material handling, shipping and shipping containers, refrigerating apparatus, fire-fighting equipment, mining equipment and pumps, water heating, filtering and softening, pumps and condensers, ovens, furnace equipment and automatic controls for temperature, pressure, time, level, etc. Moving pictures will show the power plant in coal and heat saving and will display electrolytic processes.

Charles Cory Adds Line of Flow Meters

Charles Cory & Son, Inc., 183-187 Varick Street, New York City, has secured the manufacturing and selling rights for the Royer line of portable and stationary flow indicators. These devices are designed for indicating the flow of all kinds of corrosive and non-corrosive gases, vapors and liquids and were formerly manufactured and sold by the A. H. Sloan Company of Detroit, Mich. It is intended, through the increased manufacturing facilities provided by the Cory company, to increase the production of these meters and make further extensions to the Royer line.

Walker Electric Vehicle Orders at 75 per Cent of 1920

The Walker Electric Vehicle Company, Chicago, reports an average production for the first six months of the year reaching 75 per cent of last year's business. Orders are coming in steadily, according to G. A. Freeman, vice-president, a great many of them being repeat orders from operators of large truck fleets.

Malcolmson Briquet and St. Louis Briquette Consolidate

Announcement has been made of the consolidation of the Malcolmson Briquet Engineering Company, organized in 1912, and the St. Louis Briquette Machine Company, organized in 1911, under the corporate name of the Malcolmson Engineering & Machine Corporation. The company will continue to act as engineers and contractors for the building of complete plants for fuel briquetting, peat harvesting, low-temperature distillation of fuels, preparation of phosphate rock, and for drying, crushing and screening of coal and rock products. It will also maintain an engineering department devoted to the generation and use of steam, special furnace design and other heat problems.

In addition it will manufacture "Rutledge," "Komarek" and improved roll-type briquetting presses, fluxers and other special machinery and machine parts, direct and indirect heat dryers and vibrating screens. The officers of the new company are: C. T. Malcolmson, president; G. Komarek, vice-president; C. E. House, secretary, and W. J. Monahan, treasurer. The offices of the company are located in the Old Colony Building, Chicago; 818 Security Building, St. Louis, and 39 Cortlandt Street, New York City.

New House Organ for International G. E.

The International General Electrical Company, Schenectady, N. Y., has started the publication of a new house organ—The *Digest*. This magazine is issued in alternate months in English and Spanish and it receives wide distribution in the foreign field only. Besides its primary purpose of establishing contracts and stimulating interest throughout the company's organization in all parts of the globe, the *Digest* will discuss the latest applications of electricity in the household and in industry and the economies it effects, announce electrical inventions and achievements and review electrical developments of other countries.

Hotel and Schoolhouse Lighting Business Good in New England

A healthy business is being handled in New England at present in connection with the lighting of summer hotels and schoolhouses, according to M. W. Vye, vice-president of the McKenney & Waterbury Company, Inc., Boston, jobbers. To a representative of ELECTRICAL WORLD Mr. Vye said that a considerable amount of new wiring and refurnishing of vacation establishments both along the coast and in the mountain districts is in evidence, including cottages and summer residences. Some important jobs were, of course, planned and executed earlier in the season, but orders are still being received for fair quantities of supplies. The material used as a rule follows standard lines of design, and direct lighting is in the main adopted. New England jobbers are at present figuring actively on supplies for wiring jobs to be done in large public-school buildings at Boston and elsewhere, and while no record sales are in sight, the amount of business these jobs represents is thoroughly pleasing as an evidence of the constantly growing popularity of carefully planned electrical illumination.

The Wagner Electric Manufacturing Company, St. Louis, has established a factory branch at 538 First Avenue South, Seattle, in charge of M. E. Cundall.

The Marathon Electric Manufacturing Company, Wausau, Wis., manufacturer of small electric motors and motor-driven utilities, is considering the erection of a one-story brick and steel addition, 40 ft. x 180 ft., to be equipped as a machine shop, assembling floor, shipping room, offices, etc.

The American Accumulator Company, Owatonna, Minn., manufacturer of electric storage batteries, has awarded contract for the construction of a one-story plant, 90 ft. x 106 ft.

The Battery Service Company, Muskogee, Okla., contemplates the construction of a building, 170 ft. by 110 ft. J. H. Schmidt is president and manager.

The Universal Battery Company, 3410 South La Salle Street, Chicago, has awarded contract for construction of a one-story building, 50 ft. x 138 ft., at 3419-25 Wentworth Avenue.

The G. A. Ball Bearing Manufacturing Company, 3051 West Lake Street, Chicago, is asking for bids for the erection of a one-story plant at West Lake Street and Albany Avenue, to cost about $65,000.

J. R. Crawford, general sales manager of the Union Carbide Sales Company, New York City, has been appointed general sales manager of the National Carbon Company, Inc., Cleveland, succeeding N. C. Catabish, who takes up other duties with the company.

The Clary-Cummings Battery Company, Columbus, S. C., manufacturer of storage batteries, contemplates increasing its capital stock from $10,000 to $20,000. The company would like to receive catalogs from manufacturers of battery boxes, plates, lead parts, separators, rubber jars and lead-coated bronze terminals, etc.

The M. J. Dougherty Company, Twenty-fifth Street and Washington Avenue, Philadelphia, piping fabricator and engineer, announces that it has made arrangements with the Tomlinson Steam Specialty Company of Cleveland, Detroit and Akron to act as its representative in the upper half of the State of Ohio and all of Michigan.

The Dayton-Dowd Company, Quincy, Ill., manufacturer of centrifugal pumps, has established a district office in the Pioneer Building, St. Paul, in charge of George M. Kenyon, with whom are associated Robert D. Lewis, vice-president, and James C. Wilson, vice-president. Mr. Kenyon has been established in St. Paul since 1891 as factory representative for various concerns.

The Steel City Electric Company, 1207-1219 Columbus Avenue, Pittsburgh, manufacturer of electrical specialties, announces the appointment of Kearton & Nagle, 71 West Twenty-third Street, New York City, as its district sales representatives for the Metropolitan District, New York City and Newark, N. J.

The Domestic Electric Appliance Company, 315 South Jefferson Avenue, Peoria, Ill., has recently been reorganized with an increase in capital stock from $25,000 to $50,000. The incorporators under the reorganization, it is stated, are Milton V. Stagg, 327 Callender Avenue; R. B. Cherry, 115 South Maplewood Avenue, and Elmo G. Kuecks, 220 North University Avenue, Peoria.

Foreign Trade Notes

ELECTRIC POWER PROJECT PROPOSED FOR FEDERATED MALAY STATES.—At a meeting of the Federal Council of the Federated Malay States, held during April at Kuala Lumpur, it was decided to create an electrical investigation staff to investigate the question of a public power supply. A preliminary survey has already been made by the government electrical adviser, which calls for an expenditure of approximately $[illegible] (Straits). It is proposed to erect electric generating stations near Taiping, Ipoh, Kuala Lumpur and Serembar. Each town is to have its own generating station, but will be connected with Kuala Lumpur for emergency service. In electrical circles it is thought that these plans can hardly be brought into operation for some time.

ELECTRIFICATION OF LEGHORN, ITALY, RAILWAY.—In the plan for general electrification of the Italian railways, the Leghorn-Pisa branch was omitted. The Ministry of Public Works at Rome, Consul Lucien Menninger at Leghorn, now writes, has informed the Leghorn authorities that the Italian State Railway Administration is authorized to take the necessary steps to equip the line for electrical operation.

ELECTRIC UNDERGROUND RAILWAY PROPOSED FOR BARCELONA, SPAIN.—A company, to be known as Gran Metropolitano de Barcelona, S.A., has been organized with a capital stock of 15,000 000 pesetas to construct and operate an electric underground railway in Barcelona, for which the Banco de Vizcaya holds the concession. The capital has been subscribed entirely by the Vizcaya, Hispaño Colonial and Arnús-Gari banks, the Sociédad de los Tranvias de Barcelona and the Ferrocarriles de Cataluna.

INCREASE IN ELECTRIC LIGHT INSTALLATION IN CHINA.—Vice-Consul Huston, Hankow, China, in his report on the industrial progress in that district states that further extensions of electric light installations are being made in Central China.

MICA OUTPUT DROPS IN NORWAY.—Before the war the greater part of the demand for mica in Norway was covered by Norwegian production. During the war this industry grew fast and considerable quantities of mica were exported. Consul-General Osborne, in a report from Christiania, states that at present the production is small on account of high working expenses. When normal times return the mica industry of Norway, in his opinion, will become active again. The feldspar mines produce much mica scrap, which at present may be bought at a reasonable rate.

NEW POLISH ELECTRICAL COMPANY.—The joint stock company, Brown, Boveri & Company, Baden, Poland, in cooperation with the Bank Zjednoczonych Ziem Polskich (Bank of United Polish Territories), Warsaw, according to Warsaw papers, has founded the Polish Society of Electricity, Brown, Boveri, a joint stock company, with headquarters at Warsaw. The company will install electrical apparatus in all parts of Poland. The factory is already established in Trzebinia, and will begin active operation during the summer.

HYDRO-ELECTRIC PLANTS FOR JAPAN.—Plans, it is understood, are under consideration by the Hyogo Prefectural Assembly for the construction of nine hydro-electric plants to utilize the water power of the Sho and Chigusa Rivers. It is proposed to begin construction in 1921 and to complete three plants every two years until 1926.

LOAN FOR ELECTRIFICATION OF SWISS RAILWAYS ISSUED.—The Federal Railway loan recently issued by the Swiss Government was doubly subscribed. The amount originally offered was 100,000,000 francs, and when applications for double the total amount were received the government decided to allot 200,000,000 francs. The proceeds of the loan are to be used for the electrification of the Swiss railway system.

FRENCH MANUFACTURER CLOSES SUCCESSFUL YEAR.—In the annual report of the Compagnie Francaise pour l'Exploitation des Procédés Thomson-Houston for the past year, according to the *Electrical Review*, London, the electrical industry is one of those which has suffered the least from the economic crisis following the war. On the whole the production of plants of small capacity has considerably diminished for the time being, but, on the other hand, the manufacture of equipment of large size has not slackened. The equipment of waterfalls and the construction of large generating stations are being continued [illegible] proceeding with the electrification of an important part of their network. In this connection the Orleans Railway Company has begun preparations for the electrification of lines from Paris to Orleans. The value of the orders which the French Company filled in 1920 [illegible] per cent greater than the value of the orders for the preceding year. Manufacture has been concentrated at the various works: Jarville for small alternating-current motors, Neuilly for small direct-current motors, Vaugirard and Lecourbe for heavy plant, Suresnes for large apparatus and Colombes for insulating material. New works are being added at Saint-Ouen, where production is already under way of large size high-voltage machines. The Lesquin Works is being reconstructed for foundry use and for a large shop for small electrical apparatus.

BRITISH LAMP MAKERS WORKING FOR PROTECTION FROM IMPORTS.—The British Chemical Ware Manufacturers' Association, by way of demonstration that English manufacturers and workmen are capable of producing delicate glasswork, recently sent to members of Parliament a sample of a glass bulb for an electric lamp, according to the *Electrical Review*, London. The lamp-bulb manufacturers are seeking protection from the importation of electric lamp bulbs from foreign countries, and although the British government proposes to put a 33⅓ per cent duty on imported bulbs and lamps, as is provided in the key industries bill, these manufacturers believe that this duty is not enough. They seek prohibition of the foreign article for a time at any rate, holding that this is necessary if the English industry, which could give much more employment, is to be saved. According to the secretary of the association, that country uses up 1,000,000 electric lamps a week.

Foreign Trade Notes

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

A merchant in Italy (No. 35,203) desires to purchase an agency for the sale of incandescent lamps, etc.

A mercantile firm in England (No. 35,207) desires to purchase and secure an agency for the sale of washing machines, dishwashing machines and other domestic labor-saving novelties and appliances.

A commission agent in India (No. 35,229) desires to be placed in touch with exporters of electrical goods, etc.

New Apparatus and Publications

LIGHTING FIXTURES.—The Beardslee Chandelier Manufacturing Company, 216 South Jefferson Street, Chicago, has issued catalog A, covering its different types of lighting fixtures.

COMBINATION RANGE.—The Rathbone Sard Company, Aurora, Ill., is distributing a circular describing its "Acorn combination electric and coal range, No. 2550.

DISHWATER.—A new "Quaker" dishwasher has recently been placed on the market, which is being distributed through the Quaker Dishwasher Sales Company, 240 Cherry Street, Philadelphia.

CENTRIFUGAL PUMPS.—The Dayton-Dowd Company, Quincy, Ill., is distributing catalogs Nos. 241, [illegible] and 244, describing its type C. S. U. multistage centrifugal pumps, [illegible] type SS centrifugal pumps and type CS centrifugal pumps respectively.

SAFETY DISCONNECTING HANGERS. The Thompson Electric Company, [illegible] St. Clair Avenue, N. E., Cleveland, has issued catalog B-20, covering the "Thompson' safety disconnecting hangers (new underslung model).

BOILERS.—The Heine Safety Boiler Company, St. Louis, has issued the twenty-seventh edition of "Helios." It has been entirely rewritten [illegible] comprehensive treatise on steam boiler engineering.

SAFETY INTERLOCK SYSTEM.—"Safeguarding Vital [illegible]" is the title of a booklet published by the [illegible] Safety-Appliance Corporation, 325 Church Street, New York City, in which it describes the Schlesinger safety interlock system.

LUBRICATION.—"Steam Cylinder Lubrication" is the subject of the leading articles in the June issue of *Lubrication*, published by the Texas Company, 17 Battery Place, New York City.

PORTABLE COMPRESSORS.—"Portable Air Service" is the title of a four-page leaflet distributed by the Ingersoll-Rand Drill Company, 11 Broadway, New York City, describing the different types of "Ingersoll-Rand" portable compressors.

APPARATUS FOR ELECTRIC FURNACES.—Bulletin No. 48,710B, superseding bulletin No. 48,710A, published by the General Electric Company, Schenectady, N. Y., describes and illustrates auxiliary apparatus for electric arc furnaces.

ADJUSTABLE LIGHTING FIXTURES.—The O. C. White Company, 15-21 Hermon Street, Worcester, Mass., is distributing a circular describing "The White," style No. 9M, adjustable electric fixture for adding machines, recently developed by the company.

ELECTRIC APPLIANCES.—The Russell Electric Company, 140 West Austin Avenue, Chicago, has recently placed on the market a new electric marcel waver. The company is distributing a six-page leaflet, covering its "Hold-Heet" electric appliances.

PORTABLE LAMP.—The Russell-Stoll Company, 17 Vandewater Street, New York City, has recently placed on the market a new type of portable lamp.

EQUIPMENT FOR WINDOW LIGHTING.—"Selling With Colored Light" is the title of a booklet issued by the Ivanhoe-Regent Works of the General Electric Company, Cleveland, describing its "Iris" equipment for display window lighting. The company is also distributing a leaflet giving distinctive features of its "Iris" equipment and also instructions for assembling and installing.

BRAZING TORCH.—The Production Engineering Corporation, 40 Sudbury Street, Boston is distributing a circular covering the "Bantam" electric-gas brazing torch, recently developed by the company.

USES OF SMALL MOTOR.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has recently issued folder No. 4456, entitled "The Center of Power" in which it illustrates the many uses of the small motor.

ELECTRICAL WIRING DEVICES.—The Connecticut Electric Manufacturing Company, Bridgeport, Conn., has issued a new 288-page catalog covering its "Cemco" electrical wiring devices.

New Incorporations

THE HALIFAX POWER COMPANY, South Boston, Mass., has been incorporated with a capital of $1,000,000 to generate and distribute electric energy. The incorporators are Ira Vaughn, Philadelphia, Pa., president; James F. Penrose, secretary, Philadelphia, Pa.; T. C. Watkins, South Boston, Mass.; C. L. Reid, Richmond, Mass., and R. Holt Easley, Halifax, Mass.

THE LAMAR (S. C.) POWER & LIGHT COMPANY has been chartered with a capital of $31,200 to generate and distribute electricity and gas for light, heat and power purposes. The officers of the company are H. Segars, president; C. G. Segars, vice-president; L. C. Huff, secretary, and R. P. Berry, treasurer.

THE VERNE MANUFACTURING COMPANY, New York, N. Y., has been incorporated with a capital of $100,000 to manufacture electrical specialties, hair wavers, etc. The incorporators are S. S. Rand, S. T. Paley and E. J. Whitlock. H. S. Manfield, 55 Liberty Street, is attorney.

THE MUTE-a-PHONE CORPORATION, New York, N. Y., has been incorporated by H. C. and L. Tucker and L. Scher. The company is capitalized at $20,000, and proposes to manufacture telephone mufflers. D. Kassel, 256 Broadway, is attorney.

THE RAPID ELECTRIC COMPANY, LTD., Sault Ste. Marie, Ontario, Canada, has been incorporated by Charles H. Toombs, George L. Wilson, Arthur P. Crawford and others. The company is capitalized at $40,000 and proposed to manufacture electrical machinery, tools, etc.

THE TWO-IN-ONE SIGNAL LAMP CORPORATION, New Haven, Conn., has been chartered with a capital of $50,000 to manufacture electric lamps and signal devices. The incorporators are J. M. Chapnick, 279 Whalley Avenue, and I. Fine, 607 Elm Street.

THE NATIONAL RADIO ELECTRIC SIGN COMPANY, Jersey City, N. J., has been chartered with a capital of $25,000 to manufacture electrically-operated signs. Cornelius A. Cole, Hackensack, N. J., represents the company.

THE MINIATURE BULB COMPANY, Warren Street, Newark, N. J., has been organized to manufacture incandescent electric lamps. Angelo Paione 695 Ridge Street, is interested in the company.

THE RITE ELECTRIC LAMP COMPANY, New York, N. Y., has been incorporated with a capital of $20,000 to manufacture incandescent electric lamps. The incorporators are I. Rendelmen, M. Soni and S. J. Berkowitz, 898 Broadway, Brooklyn.

THE UTILITY BATTERY COMPANY OF AMERICA, Mount Prospect, Ill., has filed articles of incorporation under the laws of the State of Delaware. The incorporators are T. C. Fredericks, M. Luce and H. L. Wuerffel, Mount Prospect. The company is capitalized at $5,000,000 and proposes to manufacture electric storage batteries, etc. The Capital Trust Company, Dover, Del., represents the company.

THE ELECTRIC UTENSILS COMPANY, 1405 South Hill Street, Los Angeles, Cal., has been organized to manufacture electric specialties. Kenneth H. Woolson, 910 Third Street, is interested in the company.

Record of Electrical Patents

Notes on United States Patents

(Issued July 19, 1921)

1,384,734. ELECTRICAL TESTING SYSTEM AND APPARATUS; Clarence A. Anderson, Abilene, Kan. App. filed Sept. 24, 1919. For use as a troubleman's or lineman's portable test set.

1,384,745. STEERING MECHANISM FOR DIRIGIBLE BODIES; Kennedy Dougan, Minneapolis, Minn. App. filed Aug. 2, 1915. For torpedoes.

1,384,769. ELECTRIC GUN; Frederick B. MacLaren, Jersey City, N. J. App. filed March 16, 1916. Projectile propelled by moving magnetic field.

1,384,864. ELECTRICAL GENERATOR AND MOTOR; Joseph Shepherd, Leeds, England. App. filed June 5, 1919. Effective cooling of rotor windings.

1,384,865. ELECTRIC GENERATOR AND MOTOR; Joseph Shepherd, Leeds, England. App. filed June 13, 1919. Heat generated within machine is dissipated by hollow cooling elements.

1,384,867. AIR-CURRENT INDICATOR FOR AËROPLANES; Lawrence B. Sperry, Brooklyn, N. Y. App. filed Oct. 9, 1916. Shows direction of flight.

1,384,906. SAFETY HAIR-STRAIGHTENING DEVICE; Edwin S. Lee, Kansas City, Mo. App. filed Sept. 4, 1920. Either electrically or otherwise heated.

1,384,928. HANDLE FOR SADIRONS; John J. Schilder, San Francisco, Cal. App. filed Aug. 29, 1919. Switch within handle operates in conjunction with heating coils.

1,384,953. VACUUM ELECTRIC APPARATUS; Peter Cooper Hewitt, Ringwood Manor, N. J. App. filed June 27, 1916. Audion applied to telephone.

1,384,961. LAMP-SECURING MEANS; Harry Klein, Freeport, N. Y. App. filed Nov. 3, 1919. Locking socket.

1,384,980. TELEPHONE EXCHANGE SYSTEM; Arthur C. Stuart, Cleveland, Ohio. App. filed Nov. 11, 1912. Semi-automatic system.

1,384,981. ELECTRICAL SYSTEM; William I. Thomson, Newark, N. J. App. filed Dec. 14, 1916. Distribution used in car lighting.

1,384,991. TELEPHONE REPEATER EQUIPMENT; Charles S. Demarest, New York, N. Y. App. filed April 16, 1919. Operator may supervise, talk and ring on transmission circuits which include repeater elements.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

MARION, MASS.—The power plant and transmission line to Provincetown of the Southeastern Massachusetts Power & Electric Company, it is reported, were badly damaged by a recent storm.

WORCESTER, MASS.—The M. J. Whittal Associates contemplate the construction of a new weave shed at their carpet mills, to cost about $125,000. The plans provide for a new power plant with a 100-ft. stack.

PAWTUCKET, R. I.—The Moore Fabric Company, Washington Street, has filed plans for the construction of a new one-story power house. The company will also install considerable electric equipment in the addition to the mill now under construction.

WATERBURY, CONN.—Plans are under way by the board of directors of St. Margaret's School, Grove Street, for the construction of a power house at the institution. Clark, McMullen & Riley, 101 Park Avenue, New York City, are engineers.

Middle Atlantic States

AMSTERDAM, N. Y.—The Adirondack Power & Light Corporation has issued $1,000,000 in bonds, the proceeds to be used for extensions and improvements to its plant and system, etc. J. Ledlie Heeds is president.

BINGHAMTON, N. Y.—Plans have been prepared by Russomello & Price, architects, 226 Scranton Life Building, Scranton, Pa., for the construction of a power plant, 76 ft. x 76 ft., in Binghamton, N. Y., to cost about $36,000. The owner's name has been withheld.

BROOKLYN, N. Y.—Notice has been filed by the Queensboro Gas & Electric Company of an increase in its capital stock from $2,000,000 to $7,000,000.

FLUSHING, N. Y.—The Board of Estimate is considering a resolution authorizing the issue of $20,000 corporate stock for the construction of a transformer station in the vicinity of Flushing, to be used in connection with the municipal operation of the lines of the former New York & North Shore Traction Company. Electrical energy will be purchased from the New York & Queens Electric Light & Power Company.

NEW YORK, N. Y.—Plans have been filed by the New York Edison Company for the construction of a one-story addition to its Waterside power plant, 63 ft. x 94 ft., at Fortieth Street and First Avenue, to cost about $125,000.

OSWEGO, N. Y.—The Oswego Shade Cloth Company is considering the construction of a new one-story power house at its plant on Utica Street.

YAPHANK, N. Y.—A moving picture studio of large proportion is being built at this place by the Ferndale Film Studios, Inc., of which George E. Crater, Jr., Empire Theater Building, New York, N. Y., is engineer in charge of construction and purchasing. The power house will contain a 400-kw. motor-generator set with two 25-kw. balancers and one 7-kw. exciter. The plant will also contain a complete 1500-hp. steam equipment. A 1000-amp. motor-generator set with 200 kw. capacity will be installed, with six distributing panels. The specifications call for the following additional equipment: One totalizing meter panel; two equalizing panels for the 200-kw. set; one main panel for the 400-kw. set; four three-phase, 110-volt panels; one synchronous motor starting panel; one induction motor panel and a battery of three-phase, 2500-volt oil switches; three 100-kw., three-phase transformers; one 50-kw., single-phase transformer; two 50 kw., three-phase transformers; one 15-kw., 125-volt motor generator set; twenty-four Cooper Hewitt eight tube elevated stands; twenty-four Cooper Hewitt eight-tube floor banks; four Cooper Hewitt eight tube elevated stands and wings; twenty 70-amp. spot lamps; ten 100-amp. spot lamps; thirty-five Wohl duplex single tilt stand lamps; ten Wohl broadside lamps; four Wohl three-lamp-effect domes with lamps; eighteen duplex top lamps with funnels; four semi-indirect top lamps; six sunlight arcs rated at 100,000 cp. floodlight and 2,400,000 cp. spotlight.

BOONTON, N. J. — Arrangements have been made by the Board of Aldermen for an appropriation of $100,000 for extensions and improvements to the municipal water system. The plans provide for the construction of an electrically operated pumping plant in the Sheep Hill section. Frederick V. Pitney, 21 South Street, Morristown, N. J., is engineer.

GLASSBORO, N. J.—The Council is considering replacing the gas-lighting system now in use with electric lamps. Service will be supplied by the Public Service Company.

LAUREL SPRINGS, N. J.—The Laurel Springs Improvement Association is considering the installation of an electric light and power plant in Laurel Springs.

PHILADELPHIA, PA.—John Bromley & Sons, Front Street & Lehigh Avenue, have filed plans for the construction of an addition to the power house at their plant.

PHILADELPHIA, PA. — A permit has been granted to the Quaker Lace Company, Somerset Street, for improvements to its power house.

PITTSBURGH, PA.—The Duquesne Light & Power Company, it is reported, has preliminary plans under way for the construction of additional units at its new generating plant at Ohrswick, Pa. The plans provide for an ultimate of six units, two of which have already been completed. The total cost of the project is estimated at about $15,000,000. A. W. Thompson is president.

PITTSBURGH, PA.—The City Council has passed an ordinance appropriating the sum of $30,000 for the reconstruction of the power plant at the Municipal Hospital.

WILMINGTON, DEL.—An appropriation of $15,000 has been approved by the City Council for improvements to the municipal fire alarm signal and electrical service.

FROSTBURG, MD.—The Hagerstown & Frederick Railway Company is planning to erect a transmission line from Frostburg to Eckhart to supply electricity to the latter town. The cost of the line is estimated at $5,000.

NORFOLK, VA.—The Board of Supervisors of Norfolk County are considering the installation of an independent lighting plant in the county jail.

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing the following: Until Aug. 9, various Eastern and Western Yards, Schedule 8481—miscellaneous quantity of motor generator sets, motor generators and dynamotors; Schedule 3483—thirty storage batteries.

North Central States

BELMONT, MICH. The Belmont Sand & Gravel Company, Fourth National Bank Building, Grand Rapids, recently organized, contemplates building a new plant at Belmont near Grand Rapids. The plans provide for a power house equipped with oil engines. Crushing machinery, washing equipment, hoisting and conveying apparatus will also be required. Maurice Sluyter is president.

IRON RIVER, MICH.—The forge shop, woodworking plant and a portion of the power house and pumping plant at the works of the Bates Iron Mining Company were recently destroyed by fire, causing a loss of about $30,000.

ONAWAY, MICH. — Fire recently destroyed property occupied by the Onaway Light & Power Company, causing a loss of about $25,000.

REED CITY, MICH. — Bonds to the amount of $70,000 have been voted for the construction of a municipal light plant.

BARBERTON, OHIO.—The Council has approved the installation of a lighting system in the east end of the city.

CALDWELL, OHIO.—Plans are under consideration for enlarging the municipal electric light plant to meet the increasing demands for electrical service.

CLEVELAND, OHIO.—Bids will be received at the office of the Commissioner of Purchases and Supplies, City Hall, Cleveland, Ohio, until Aug. 5 for furnishing paper-insulated, lead-covered cable. Specifications may be obtained upon application to Room 204, City Hall.

WOOSTER, OHIO.—The installation of an ornamental lighting system on several streets in the city is under consideration.

MEMPHIS, IND.—The Memphis Electric Light Company, recently organized, contemplates supplying several small communities in the vicinity of Memphis with light, heat and power. L. C. Malott and P. R. Carr, Memphis, are interested in the project.

TERRE HAUTE, IND. — The Board of Education is considering remodeling and making improvements to the Wiley High School to cost about $120,000. The plans provide for the construction of a new power house. Miller, Johnson & Miller, 105 South Seventh Street, are architects.

WAUKESHA, WIS. — The Manitowac Church Furniture Company is considering the construction of a power-plant addition and a new stack. The plans also provide for the installation of a 125-kw. generating unit. Charles F. Schuetze is general manager.

CALUMET, MINN.—Plans are being prepared for the installation of electric lamps on various streets and for other city improvements. F. W. Hill is clerk.

HOPKINTON, IOWA.—Plans have been completed by the Hopkinton Electric Light & Power Company for the construction of its proposed hydro-electric power plant to cost about $35,000. W. Z. Milroy is president. Holland, Ackerman & Holland, 122 North Fourth Avenue, Ann Arbor, Mich., are engineers.

PAULLINA, IOWA.—Bonds to the amount of $39,000 have been voted for the municipal electric light plant.

KANSAS CITY, MO. — Bonds to the amount of $750,000 have been voted for extensions and improvements to the municipal electric light plant, and $300,000 for improvements and extensions to the waterworks.

MARCELINE, MO.—The installation of an electric lighting system in Marceline is under consideration.

BEATRICE, NEB.—The City Commissioners have ordered the electrical engineer to submit an estimate of the cost of an addition to the municipal light plant, to enable it to supply electricity to private consumers. At present it furnishes street-lighting service only.

DEXTER, KAN.—Plans are under consideration for remodeling the power plant and erecting a transmission line to Winfield, a distance of 19 miles. The W. B. Rollins Engineering Company, Railway Exchange Building, Kansas City, Mo., is engineer.

McPHERSON, KAN.—The installation of a 500-kw. generating unit at the municipal electric light and water works plant is under consideration. Henry Fox is chief engineer.

Southern States

GOLDSBORO, N. C.—Bids will soon be received for the construction of a one-story electric power plant and a two-story ice-manufacturing plant at the State Hospital for the Insane, to cost about $75,000. Dr. W. W. Faison is director. Wiley & Wilson, Lynchburg, Va., are engineers.

FLORIDA CITY, FLA.—C. B. Clinton, acting town clerk, has been authorized to issue $30,000 in light and street bonds.

MOORE HAVEN, FLA.—Bonds to the amount of $20,300 have been voted for the construction of an electric light plant in Moore Haven.

WEBSTER, FLA. — Bonds which were recently voted for the construction of a municipal electric plant have been sold.

COLUMBIA, TENN. — W. B. Greenlow contemplates the installation of an electric lighting unit consisting of a generator and crude-oil engine.

BELZONI, MISS.—At an election to be held Aug. 1 the proposal to issue $125,000 in bonds for improvements and extensions to the electric light and water plant will be submitted to the voters.

AMITE, LA.—Bids will be received by the Mayor and Board of Alderman of Amite, La., until Aug. 16 for the construction of a waterworks system complete, including construction of building reservoir, furnishing and installing oil engines, pumping equipment, switchboard and motor, etc. Massena L. Culley, Jackson, Miss., is consulting engineer.

PAWHUSKA, OKLA.—The City Council is considering the installation of an electric light and power plant, storm sewers, etc.

WELEETKA, OKLA.—Bonds to the amount of $82,500 have been voted to construct and equip a municipal electric light plant in Weleetka. L. T. Newton is clerk.

Pacific and Mountain States

SPOKANE, WASH.—The Washington Water Power Company has purchased the Kettle Falls power site on the Columbia River, in Stevens and Ferry Counties, from the Granby Consolidated Mining, Smelting & Power Company, Ltd.

COTTAGE GROVE, ORE. — The City Council has decided to call an election to submit to the voters the proposal to issue bonds for the establishment of a municipal electric light plant.

NEWPORT, ORE.—The lines and plant of the Yaquina Electric Company, it is reported, have been purchased by H. A. Holland of Portland. No immediate changes, it is understood, will be made to the property.

STAYTON, ORE.—The City Council has granted a franchise to Walter Ross of Portland to distribute electricity in the town of Stayton for light and power purposes. The plans provide for the construction of a power plant, 50 ft. x 100 ft., at Second and High Streets, on the Salem Ditch.

ANGELS CAMP, CAL. — The power house, operating plant and mechanical buildings of the Sultana Mining Company were recently destroyed by fire, causing a loss of about $100,000.

BEAR VALLEY, CAL.—The Bear Valley Utility Company, recently incorporated with a capital of $100,000, has secured a franchise to erect and operate an electric transmission line in Bear Valley. The company contemplates furnishing electricity for the operation of Gold Mountain Mills. B. T Ergenbright, Victorville, is president.

GLENDALE, CAL.—The Glendale Gateway Club is considering plans for the installation of a street-lighting system in various parts of the southern section of the town.

LOS ANGELES, CAL.—Plans are under consideration for the installation of 128 street-lamps of 60 cp. in Monterey Park.

BOWIE, ARIZ.—The organization of a stock company to be capitalized at $25,000, is under consideration. The purpose of the company is to install an electric light, ice and waterworks plant. M. L. Morgan is interested.

WINNEMUCCA, NEV.—The power plant of the Winnemucca Water & Light Company was recently destroyed by fire, causing a loss of about $100,000.

Canada

DAYSLAND, ALTA. — The construction of an electric light plant in Daysland, to cost, with equipment, about $14,000, is under consideration.

WINNIPEG, MAN.—The City Council is considering the installation of an ornamental lighting system on Garry Street from Portage Avenue to Graham Avenue. The cost is estimated at $4,000.

WINNIPEG, MAN.—The Manitoba government is considering the extension of its hydro-electric system to serve the towns of Gladstone, McGregor and Austin. The proposed line will connect with the power line to Portage la Prairie. The cost is estimated between $175,000 to $180,000.

KENORA, ONT.—The Town Council has authorized the issue of $6,000 in debenture bonds for the extension of the electric lighting system and $20,000 for the installation of new pumping engines in the municipal pump house. F. J. Hooper is clerk.

OTTAWA, ONT.—Improvements are contemplated to the municipal electric light and water plant, including a concrete stack, 200 ft. tall. The cost of the improvements is estimated at about $250,000.

PORT BURWELL, ONT.—The town officials are considering the construction of an electric light and power distribution plant. For further information address G. A. Vanorden, Port Burwell.

QUEBEC, QUE.—The Quebec Development Company, of which W. Price is president, 145 Grand Allée Avenue, is having plans prepared for the development of about 250,000 hp., by utilizing water from Lake St. John. The cost of the project is estimated at about $3,000,000. The Running Streams Commission, 54 Notre Dame Street, Montreal, is engineer.

Electrical World

New York, Saturday, August 6, 1921

Why Electrical Men Will Dominate the Electrical Trade

THE oft-recurring question is abroad again: *"Who is to be the electrical merchant?"* Conditions in the country just now are focusing the minds of the business-thinking men of the industry on this problem of local distribution. It is being freely discussed. Opinions differ. Yet, after all, are there not simple facts that point the answer clear?

The electrical retail merchant of today is passing through the very early stages of his evolution. Central-station electric shop managers are selling appliances. So are electrical contractors, dealers and jobbers. So are non-electrical men in hardware, drug and department stores. Each is experimenting and developing a new line, a new market, a new trade. In this new trade the ever-present basic laws of natural selection are daily at work. Out of it all will come the answer.

W. E. Robertson told the contractors in Buffalo just recently that the electrical man will be the dominant appliance merchant because he can most easily service the appliances he sells. This is sound sense, but back of it is still another reason. The electrical man will hold his leadership in this great field also because he has a better background of electrical experience linked with a clearer vision of the coming scope and power of electric service. Selling appliances to him is and will ever be more than mere merchandising. There is a purpose and a prospect in his mind that make the selling of a flatiron or a lamp mean something more to him than to a hardware man. The influence of this impelling spirit of our industry brings practical advantage.

The question as to whether the electric store in any town will be manned by a contractor or a central-station company is another issue that will unfold itself by still another process of natural selection. The best man will win—according to his talent for the merchant's trade. It matters little from which class he comes. A liking for the work will call the many. Special merchandising genius will select the few who ultimately will be leading us.

The task is now to educate and stimulate the merchants that we have and raise up bigger, more productive, more effective men for the better electric shops that are to come. The ELECTRICAL WORLD is eagerly endeavoring to help speed this gradual natural evolution by providing a practical service of trade news, news of the industry and guidance in commercial practice that must be ever an essential background of the electrical merchant's mind.

Charles Edward Skinner

Scientist of international reputation whose extensive research work, especially on insulation, has had a marked effect on the development of electrical machine design

FROM the time of the first generator there has been a constant effort to raise the quality of electrical equipment. Manufacturers have never slackened in their efforts to produce equipment that will do better work and do it more economically, with less chance of a breakdown. To obtain reliable data many of the manufacturers maintain research laboratories directed by scientists of the highest type. Such a laboratory is maintained at East Pittsburgh by the Westinghouse Electric & Manufacturing Company and is directed by C. E. Skinner, to whose researches is due no inconsiderable part of the advance in electric machine design.

The most important of Mr. Skinner's contributions to science and to the industry is undoubtedly his work on insulation. Insulation was his first assignment, and probably every month that has since passed has brought to him a new problem.

The determination of the most suitable kind of steel for core use is another of his well-known achievements. To him is credited the discovery that steel with a silicon content of 4 to 5 per cent is low in hysteresis losses and does not age.

Special attention has also been given by Mr. Skinner to the subject of copper alloys for structural, current-carrying, resistance and bearing purposes, and he has discovered at least thirty-two new alloys. Many other subjects have engaged his attention and that of his staff, including electrical hazards, wave-forms and apparatus design.

Mr. Skinner was born near Redfield, Ohio, on May 30, 1865, and was graduated with the class of 1890 from Ohio State University. In that year he joined the Westinghouse organization in the controller department and supervised the construction of the first controller turned out by this company. Soon afterward he was placed in charge of the testing of insulation, and in 1892 he was transferred to the research department. In 1896 he was placed in charge of insulation design in the engineering department, taking charge in 1902 of the insulation division of this department, together with the chemical and physical laboratories. Four years later he organized the research division, of which he has remained in charge.

Mr. Skinner has contributed frequently to the literature of the industry and is well known for his researches abroad as well as in this country. In 1915 he was the special representative of the American Institute of Electrical Engineers, of which he is a fellow, at the international conference on electrical standards held in London, and he is now a member of the committee representing the Institute on the International Electrotechnical Commission. He was chairman of the American delegates to the Brussels meeting in 1920. He is, besides, a member of the Franklin Institute, the American Physical Society and the American Society for Testing Materials. Mr. Skinner was a member of the National Research Council in 1917 and 1918 and also a member of the advisory council of the Division of Engineering.

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Larger Sales of Junior Securities Necessary

LAST week there was offered to the public about twenty-three millions of electric public utility securities in the shape of bonds and gold notes paying a return of from 7.15 to 8 per cent. These issues were intended for the most part to retire loans or to provide additional working capital, and the rapidity with which they were sold indicates a better appreciation on the part of investors of the value of electric public utility securities. But, excellent as the showing is, it must not be overlooked that with every bond the necessary equity should be provided through junior financing. Generally capital requirements should represent about from 60 to 70 per cent bonds and from 30 to 40 per cent stocks. It is one thing to dispose of bonds, and the general public may gain the impression that because bonds are quickly salable the financing needs of the utility are being met. But stocks as well as bonds need to be sold, and since it is about ten times as difficult to sell stocks, every effort to dispose of such junior securities through the sale of preferred or common stock to customers or to employees and others should be followed energetically and persistently if a sound financial structure is to be assured.

What Does the Customer Think?

PSYCHOLOGY is a much-worked if not an overworked word, but nevertheless the thing it denotes plays a tremendous, yet too little understood, part in utility dealings with the public. At a recent convention an operator told of the resentment of a customer against his company because of the use of the initials of a clerk in countersigning a customer's deposit receipt. The initials formed a common and vulgar street expression that increased the customer's irritation over the deposit rule. The occurrence resulted in an order that all papers intended for the public and requiring an employee's signature must be signed with the employee's full name.

Some time ago one prominent electric utility executive in discussing proposed rate schedules with members of his official staff objected to the word "demand," because, he said, "People resent anything that hints of demands on them." Ever since this objection was made none of the newly drawn rate schedules of one of the largest utility property groups in the United States have carried this word, though the demand form of rate continues to be extensively used.

Such incidents, while they may at first glance seem ridiculous, are merely further indications that customers are human beings and, as such, are very "uncertain quantities." Ability to foresee the effect on the public of the little things in company practice is a vital factor in the make-up of a successful utility operator. Many men of long experience would be astounded at some of their customers' viewpoints. It is well for executive officers to study these viewpoints carefully and as far as possible put themselves in the customer's position.

Lower Prices Contingent on Lower Labor Costs

THERE are a lot of people who refrain from buying on the theory that prices are still too high. Deflation, they say, must run its course, and to that all agree. But how are we to enjoy pre-war prices with transportation, labor and taxes at their present high level? Having mortgaged the country to carry on the war, we must meet our war obligations of more than four billions a year for at least five years, which means that the tax burdens will remain about as they are, although distributed differently. Transportation, however, is double the pre-war cost, owing chiefly to the high price of labor, and labor because of living costs which are still 61.6 per cent above 1914 insists on its increased wage. The effect of these causes is well illustrated in the case of such a basic commodity as steel. The present base rate on bars at Pittsburgh is $35 a ton. Freight on the raw materials necessary to make the ton of steel is $20. Although handicapped with freight double the pre-war rate and increased fuel costs, steel, so far as the manufacturer is concerned, is below the ten-year average before the war. Copper, also, as every one knows, is less than it was ten years before the war, so that the highest cost of manufactured electrical goods made up chiefly of steel and copper represents labor and transportation, which is largely labor. Therefore there is no escaping the conclusion that if prices are to come down labor costs must come down or labor must produce more to offset the handicap.

Will the Coal Industry Clean House?

IN CONSIDERING the coal problem it is well to remember that that industry is suffering from the extended spree of the post-armistice period in just the same way as every other line of business activity. The speculative fever of a year ago was only the culmination. It is probably true that the business as a whole is not making money at the present time. The cries about losses now being taken are no more than can be heard from many another industry and are produced by the same fundamental causes. The industry, along with the rest of the country, is simply paying the price that was to be expected, and the answer to its problem is the same answer that every other industry must find. In effect it is a thorough housecleaning. In this housecleaning must be included not only the reduction of miners' wages and of freight rates but a reduction of margins all along the line to a point where a profit can be made on the production that ought to exist to supply the needs of a prosperous and busy country, and not on the production that obtains at present because the consumer cannot or will not pay the prices necessary to give a profit on a low production basis.

The coal industry is one of the vital industries of the nation. It must clean house and get down to a sane business basis. Will that cleaning come from internal or from external sources? If the cleaning must come from an external source, not only will the producers suffer, but the miner, the sales forces and every factor in the industry. There must be an end to the internal "passing of the buck" that is now being indulged in. Transportation costs, cost of power to operate all industry and the cost of living are affected vitally. Some one will find the solution. Who shall it be?

Team Play Between Industrial Engineers and Accountants

IN THE course of the rapid advance of the industrial electrical engineer from the status of a wiring supervisor and all-around repair foreman many loose ends in organizing effort have been left to dangle hither and yon. Many industrial plants are improving their organizations in these days of looking equipment and methods squarely in the face, and this is an excellent time for strengthening interdepartmental relations all along the line from the "front office" to the storehouse. Much good might be effected in some plants by taking advantage of the present opportunity for establishing better inventory methods, operating and maintenance cost records, for rerouting reports of service performance, and for scrutinizing charts and tabular data pouring into executive quarters from remote instrumental locations and concentrated centers of electrical supply and distribution. Here the industrial electrical engineer and the accountant can "get together" for their mutual benefit and for the good of the company.

The whole scheme of accounts classification, so far as it relates to the operation of the electrical sections of a plant, always should be understood clearly by the men responsible for electrical operations. There is a danger that insularity in relations will obscure this understanding if things go on year after year with little or no personal contact between the plant electrical engineer and the accounting executive. Changes in equipment often lead to the discarding of accounting forms—or should do so—in order to make way for something better. Subordinates may be tempted now and then to include certain expense items under incorrect classifications, and so wrong conclusions may be drawn at headquarters about the performance of equipment, with a resulting train of untoward possibilities. It is open to consideration whether some accounting classifications are not too "wooden" to yield any really useful technical information, while others which are very valuable suffer from the absence of joint consideration by representatives of the engineering and accounting branches of an establishment. No new classification should be put into effect without giving the industrial plant engineer some opportunity to study the proposed layout and to discuss it with his colleagues of the accounting department. Each branch can learn much from the other, and where team play of the right kind exists real progress is virtually guaranteed. But open-minded willingness to learn as well as to suggest is the price here as in many other places.

Customer Ownership of Securities A Help in Rural Service

THE businesslike way in which the San Joaquin Light & Power Corporation is attacking the problem of serving rural consumers in central California is very well described by E. P. Smith in this issue. A controlling committee has been organized which has charge of all of the important phases of the work. Only by such means could the work be completed within the time allowed. As the financing of rural extensions is an absorbing topic at this time, the San Joaquin Light & Power Corporation is indeed fortunate in having laid a foundation of customer ownership which has facilitated its financing. The consumers and prospective consumers in the territory served by that company have become convinced of the fact that electric service, particularly for pumping water for irrigation, is a prime necessity, and they have ardently supported the company in its efforts to dispose of its securities in its own territory. Readers of the ELECTRICAL WORLD will recall the articles by A. E. Wishon, general manager of that company, who fathered the self-interest appeal based upon statistics derived from the San Joaquin Valley. These statistics showed not only that the growth of the rural districts was dependent upon electrical energy, but also that the industries and the cities were equally dependent upon it as a consequence of its utilization in the suburban districts.

Make Rate Schedules Less Technical

"WE HAVE been doing the finest job of technical work that the world ever saw, but as merchants we in the central-station industry have been about the worst," was a remark that started a lively discussion during a talk on the subject of rates for the sale of electrical energy. The remark was made by a man whose duties at the present time are all concerned with rate problems, but he spoke from an experience that extends far back into the early days of the industry and has dealt with both its technical and commercial phases. He pointed out that rate schedules have usually been so technical in character as to prevent the ordinary individual from getting a mental grasp of their meaning. The practical result has been the education of consumers to a belief that an understanding of the product they purchase is beyond their mental capacity. That this has played an important part in the feeling of distrust that has been so large a problem in the electric light and power field is the settled belief of the official we have quoted.

There is considerably more than a grain of truth in the statement. All electrical men are more or less familiar with rate schedules that even the rate expert must reduce to the form of a curve in order to see what they mean. In the effort to solve technical problems sight has been lost of the fact that the product to be sold must go to people who are not interested in the technical aspects presented. Sight has also been lost of the fact that the unit of measurement employed is not the thing that is being sold any more than the dry-goods dealer sells the yard in selling his wares. He is selling the goods, or in reality the service they are capable of giving. The yard is only a convenient unit of measurement. The central-station company is selling service, and the kilowatt-hour is only the measure of that service. Unfortunately attention has been concentrated on the unit of measurement until the customer has lost sight of the real thing that he is paying for. In place of concentrating his efforts on the understanding of the nature of the service he has been vainly trying to obtain a mental grasp of the technicalities of the unit of measurement. The consumer should be no more concerned with the technical foundation of that unit than he is with the technical foundation of the units of anything that he purchases. He never thinks of the physical meaning of the other units of measure that he comes into contact with because he has never been educated to think of them in any other way than as measures of something he pays for.

The difficulty lies in the predominance of the technical side of central-station business during its development period. We are now at the point where the technical side of the work may be said to have reached a condition of stability. This does not mean that further technical progress will be slow and more or less at an end, but only that ways of accomplishing results have developed so that there are well-tried methods available for accomplishing any desired ends. These will be depended on until further experience develops better methods, and the industry will not be lost in the meantime. In the future it will be necessary to view the industry so far as the public is interested from a merchandising point of view. It has ceased to be a novelty and has become a necessity. Its technicalities must be buried within itself as are the technicalities in every other well-developed industry. This means the better development of merchandising methods. One of the important problems is developing rate schedules that can be understood by the customer and that will teach him to think of the thing that he is really paying for.

More Industrial Plants Should Study Maximum Demands

IN ALMOST all manufacturing processes the value of electric power has been demonstrated, yet it is a fact that a great many manufacturing installations are far from being as efficient as they should be. This condition is shown up in the load factors as the central station finds them, and in the maximum demands on which the payments for power generally turn. A brief paper by R. S. Lowry cites some telling instances of wasted power having its origin in clear inattention to the operating detail in a plant. One such, for example, is a thoroughly modern steel mill in which it was found that the maximum demand for the month, which counted heavily in the bills, had its origin in high calls for power on every Monday morning. This information was disclosed by inspection of the graphic meters, which tell an invaluable tale in manufacturing operations. It turned out that insufficient time was allowed for warming up the roll trains to their work, which resulted in an excessive demand that showed unpleasantly when the meters were read for the month. A little further investigation disclosed that the demand could be considerably reduced by careful alignment of the roll train and close attention to the bearings. The latter cause came in with especially unpleasant effect in the cold-rolling operations, here traced to abnormal friction which could be obviated. And so the story went. A thorough investigation of the power consumption in the plant indicated changes which when made showed a reduction in power costs at the rate of $24,000 per annum.

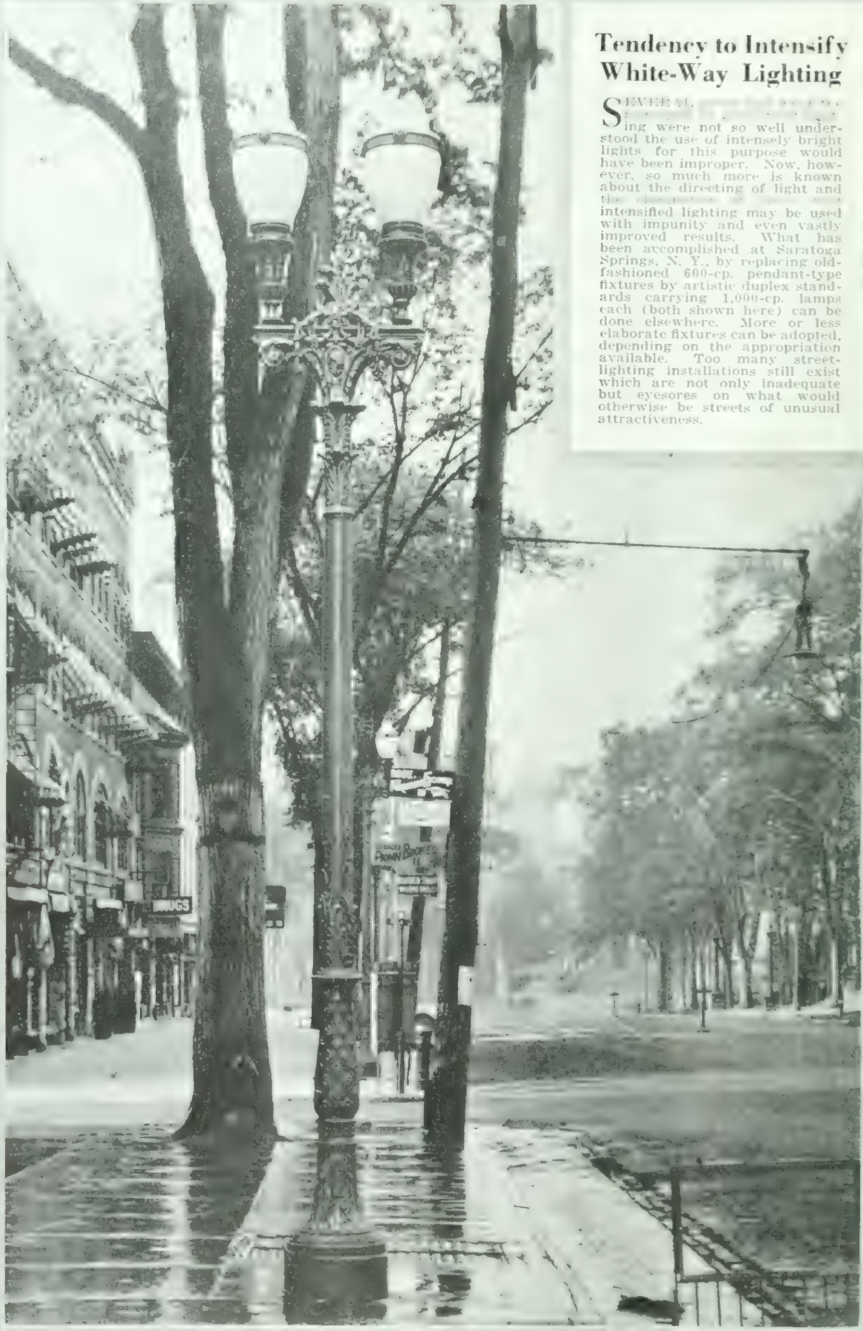
This figure is more than sufficient to cover the costs of far more elaborate investigation than was required and suggests that time and money spent in plugging financial leaks like this are well invested. Cases such as Mr. Lowry describes are far more common than the average manufacturer realizes.

A New Opportunity—the Central Station to Flash the Correct Time

SOMETIMES we have to go a long way off to find a simple thought that should have come to us at home. Such is the new idea of a service of correct time from the electric light company that has been universally established in the Republic of Uruguay. Every evening there at 8 o'clock in every community served by a central station the lights are "dipped" and go dim for an instant, thereby flashing the correct time. In the homes, in stores, restaurants, offices, public buildings or on the streets the message reaches all the people. Throughout that country the clocks and watches are habitually regulated to this time flash and the service is greatly appreciated.

Here is an idea for American central-station companies—an opportunity to inaugurate a new service free to the entire community that will unquestionably win hearty popular approval. The experience of the telephone companies is proof that the service will be appreciated, for the requests from telephone subscribers to be told the time placed so heavy a burden on telephone operators that during the war they had to be prohibited as a measure of conservation. The fact that the announcement by electricity of the evening hour has been standardized in the South American republic and is, for that matter, already instituted as a service innovation in Schenectady is evidence that it is practicable from an operating standpoint. It cannot be an expensive service, but, cost what it may, the fact that it will be the most conspicuous evidence of thoughtfulness that the electric light and power company has ever been able to express will make it of no small value from the public policy point of view, and the importance of that point of view is more widely recognized at this time than it has ever been before.

A service of correct time flashed to all the people —consumer and non-consumer alike—would literally make every citizen think once every day of the electric light company and think favorably. It would be a daily reminder of the dependence which all place upon the modern utility. It would be an impressive little act of courtesy that all men would notice and commend. The central-station company has never had within its reach a simpler, more appealing means of expressing the spirit of its service, and its cost will be negligible. Correct time signals should be made a feature of electric lighting service throughout the land.



Tendency to Intensify White-Way Lighting

SEVERAL [illegible] ing were not so well understood the use of intensely bright lights for this purpose would have been improper. Now, however, so much more is known about the directing of light and the [illegible] intensified lighting may be used with impunity and even vastly improved results. What has been accomplished at Saratoga Springs, N. Y., by replacing old-fashioned 600-cp. pendant-type fixtures by artistic duplex standards carrying 1,000-cp. lamps each (both shown here) can be done elsewhere. More or less elaborate fixtures can be adopted, depending on the appropriation available. Too many street-lighting installations still exist which are not only inadequate but eyesores on what would otherwise be streets of unusual attractiveness.

Reducing Manufacturing Costs by Studying Power Demand

Systematic Study of This and Energy Consumption Will Often Disclose Inefficient Operating Conditions and Causes ot Unnecessary Expenditures—Methods of Handling Some Specific Problems Outlined

By R. S. LOWRY*

THE principal reason that manufacturers in the United States have been able to compete with those in Europe, where labor is so cheap, is because machinery has been used to a greater extent in this country as a substitute for labor. Even though the cost of power to run that machinery is a small percentage of the cost of producing the manufactured article it must be kept at its lowest figure to help meet the keener growing competition. Until the small, inefficient generating stations are supplanted by a few great central stations, however, energy cannot be obtained much cheaper than it is at the present time. Therefore the strictest economy must be practiced in the use of power, inasmuch as paying for power wasted is the same as paying for energy at a higher rate.

In an attempt to reduce labor costs some concerns employ unskilled men as electricians, their duties being merely to keep the electrical equipment running in some manner or other, and no questions are asked as to how efficiently. However, money saved in labor costs and paid out in power bills never adds to the earnings of the manufacturing company, although it does allow a different distribution of operating costs. In any industry where a systematic study of the monthly power demand and consumption and their relation to production has not been made the results of an intelligent investigation will be found startling.

INTELLIGENT SUPERVISION WORTH ITS COST

Sometimes serious faults may exist in the original installations or faults may develop later which cause unnecessary power cost. An example of this kind occurred in a roofing-tile works near Chicago. In the company's two years of operation with electric drive there had been continual shutdowns on account of overloaded generators and various troubles in the electrical equipment, and the power cost was excessive. An investigation disclosed that a second-hand 100-kw. compound-wound generator had been installed as a motor on a clay-crushing machine without changing any connections on the generator. Obviously the differentially connected motor speeded up excessively when the load occurred and the increased speed of the crushing machine caused it to "pull" very heavily on the power. On the same line with the crushing machine motor a 100-hp. mixing-machine motor had been connected. When the crushing machine motor pulled so heavily that it blew its fuses the mixing-machine motor also blew its fuses due to the surge in the voltage. At times the main circuit breaker went out and completely stopped operations. By simply cutting out the series field of the differentially connected motor and using it as a shunt motor the worst troubles were ended and the load on the power plant never went above its capacity.

Efficient working of the machinery in operation and not larger generating equipment was needed in this plant. Power was being wasted. The foregoing is an exceptional case where the largest power saving was brought about by improvement in the installation.

NO PLANT SHOULD BE WITHOUT GRAPHIC METERS

Sometimes the original equipment may be faultless and yet there may be great opportunities to create power saving by a study of operating conditions, a rearrangement of loads, etc. Studies of this kind should start with an examination of the demand charts. If the customer has a few exceptionally high peaks he will have to pay for his share† of the annual cost of equipment necessary to furnish that service for only a few minutes' use of the service. So far as his maximum demand bill for the month is concerned he might just as well have used the maximum steadily throughout the month as the demand billing would have been the same, although the consumption charge would be higher. In other words, the maximum-demand charge is the rent the consumer must pay the electric service company for use of equipment of a certain capacity determined by the demand meter. He can use that equipment for the full month for no extra charge, except the consumption charge, once the maximum demand has been determined by a few minutes' use.

Evidently it is to the service user's interest not to demand a higher capacity than he can use steadily throughout the month. The desired end may be arrived at in a number of ways, depending on conditions. Sometimes certain operations can be performed at night if the day load is heavy. Where a number of large machines are to be started they might be thrown on the line at various times instead of all at one time. Numerous ways will suggest themselves to one familiar with conditions. The first important step in reducing power bills is lowering the demand to the minimum figure. This may be determined in a few minutes, depending on the period of the demand meter and the number of high points required by the service company in averaging the billing demand.

HOW RECORDS SHOWED A POWER WASTE

An interesting example of the possibilities of reducing manufacturing costs by way of the power bill is afforded by a steel mill in the Mahoning Valley making high-grade sheets for automobiles. This mill has the most up-to-date machinery and is entirely electrically driven. After this steel works had been in operation to its capacity for one month an examination of the demand chart of the total mill load disclosed the following condition: The highest peaks usually came at about 2 a.m. each Monday, the curve dropping off slightly toward 7 a.m., and then suddenly rising at that hour to about where it had been at 2 a.m. A slight sloping off in the curve after 7 a.m. then began and continued the rest of the day, when the curve with the exception of a few occasional peaks became fairly straight the rest of the week. It was apparent that four or five days in the month, or, worse yet, about fifteen minutes out of each of these days, were regularly determining the month's demand bill.

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*Formerly electrical engineer Newton Steel Company.

†Purpose of maximum demand charge.

Sheet-steel mills shut down the hot mills for changing rolls and repairs on Saturday morning and start operations again at midnight Sunday. Of course the roll train and driving equipment cools off in that time and necessarily pulls hard when started. In this particular mill one hour had been allowed for "warming up," it being assumed that in that time any troubles in the roll train would show up before the first turn came on. However, an inspection of the demand curve of the drive motor showed a steady rise from the time the first turn started until a maximum peak was reached at about 2 a.m., when all mills were working at capacity. This work load, piled on top of the heavy friction load of the roll train, accounted for the peak around 2 a.m. As the mills warmed up the curve dropped off somewhat. At 7 o'clock the cold rolls mills came on, and being started after the shutdown over Sunday, when the mills cooled off, they added their friction load and work load to that of the hot mills motor.

The demand curve of the drive motor of the hot mills showed that it took four to six hours for the friction of the roll train to reach constant value. Starting the drive that much earlier would have hastened this condition, but it would not pay, as the consumption of the motor would increase and tend to counteract the reduction in the demand. Three hours for warming-up was found sufficient to flatten the curve. Likewise by allowing the cold-roll mills a warming-up period of one hour the peak of their demand curve, which had been occurring at 7 o'clock, was flattened.

Demand Curve Shows Various Troubles

Careful alignment of the roll train at each setting-up time is a big factor in reducing the demand and consumption of the drive motors. The demand curve quickly shows up poor alignment once the minimum necessary idle demand is known. In changing mills each week for years there is liable to be some carelessness in setting up and this is paid for in power bills. The condition of bearings also affects the pull greatly. Brasses that cut and wear badly, scarcely lasting the week out, must be replaced by a better quality. In this plant it was found possible to get brasses that stood up for several weeks without cutting or wearing seriously. Worn and broken brasses cause a low mill and spoil the alignment; low housings or sunken bedplates cause the same trouble. These troubles all show up seriously in the power bills.

Next to the hot-mill motor the cold-roll motors were the largest users of power in the plant under consideration. As the mills are generally allowed to run several weeks without changing rolls worn bearings may develop and spoil the alignment, running the power demand considerably above normal. When some quality of sheets are being cold rolled it is the practice of the cold-roll foreman to use running water on the roll necks to cause an uneven expansion of the rolls and give the desired contour. By cooling the necks below a good running heat, however, the water greatly increases the friction and causes the demand curve to mount rapidly. For such periods the high points for the billing demand are often determined as double the normal power requirement. Since heating the rolls by electricity is very expensive, the desired result may be obtained by using a kerosene blow torch applied to the middle of the bottom roll. If natural gas is available a gas burner would be better. Eliminating the water and using applied heat to obtain the unequal expansion reduces the power demand to normal.

The powdered coal plant, being the next heavy user of power, came in for its share of investigation. As near as possible all grinding was done at night when the cold rolls were not running. No two pulverizing mills were started at the same time so their demands were not additive. Sufficient coal was ground on Sundays so that no grinding would have to be done when the shift came on at midnight and the mills were warming up. Being a scattered load, the remaining motors in the mill had less effect, but by eliminating unnecessary friction and operation considerable reduction was effected in the energy consumption.

After one month's running under the improved conditions and with an equivalent production the total power bill for the month showed a reduction of 12 per cent compared with the previous month, or approximately $24,000 for the year.

Any attempt by an engineer at reducing power bills is made easier by first enlisting the co-operation of the foremen of each department of the mill or factory. The demand charts of their respective departments should be explained to them and the causes of the various peaks discussed. The foremen should be encouraged to watch the chart through the day and to develop the habit of using the demand meter as a clock for telling the time of day, as it is very accurate and draws their attention to the chart. As the foremen are familiar with the product of their departments they know whether there is any variation in the quality of the output that would cause any wide variation in the demand on the power or whether some undesirable condition is present that could be eliminated. For instance, annealed sheet steel pulls harder on the motor in cold rolling than in hard sheets, and finishing long sheets in the hot mills uses up the stored energy of the flywheels and draws heavily on the power. At these times a peak in the demand chart would be expected. By a careful study of the demand charts each month it is possible to tell just which department is wasting power and therefore is responsible for determining the demand bill for the month. Usually when the fact is brought to the attention of the foremen a few times they will make a special effort to save power.

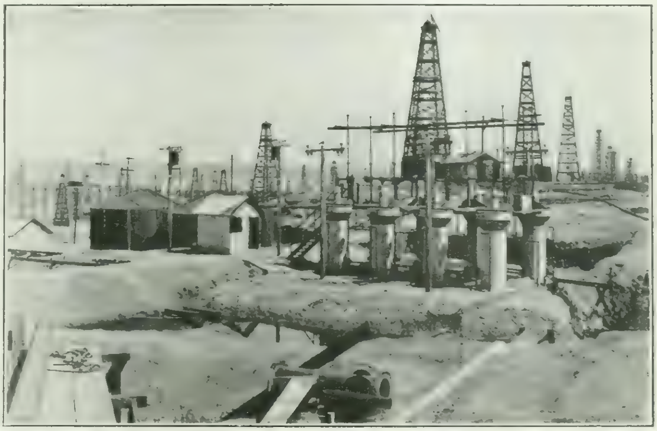
Where an industrial plant generates its own power there is a tendency to be wasteful in its use because a settlement does not have to be made each month for use of a definite number of kilowatt-hours and kilowatts of demand. However, if efficiency studies start with the building of the mill or factory, a smaller generating plant will be needed and the extra investment in large reserve capacity to take care of a few unnecessary peaks, like the "warming up" peaks of a steel mill, will be eliminated.

Connecting 44,000 Hp. of Rural Load

Careful Planning Is Found Necessary to Handle Four Thousand Service Connections in the Order in Which Application Was Made

By E. P. Smith
San Joaquin Light & Power Corporation

At the time the armistice was signed the San Joaquin Light & Power Corporation found itself, like other companies of California, with an accumulation of three years' unfilled business following a period of unusual activity during which no generating stations were constructed. The situation was made more acute by a failure of the normal snowfall and rainfall, which greatly reduced hydro-electric power and made it necessary to operate obsolete steam plants to take care of the heavy load. After additional generating facilities had been provided and the power crisis had passed attention was directed to a waiting list of 3,688 prospective consumers. This list had grown from one of about 200 at the close of the war.



PUMPING MAKES UP A CONSIDERABLE PART OF THE RURAL LOAD IN CALIFORNIA

On the left is shown a typical farm irrigation pumping plant. The average installation requires a 10-hp. motor which pumps water for a 40-acre farm. About 2,500 plants of this type will be installed this summer in the San Joaquin Valley alone. On the right is shown an oil field with a bank of dehydrators in foreground. The demand for power in the oil fields is growing.

To handle this work an organization known as the priority committee was formed, consisting of a representative from the general manager's office, the purchasing agent, the manager of the commercial department, the general storekeeper, a clerk from the construction department and a secretary for the committee work. The duties of this committee were to look after all work pertaining to new line construction and consumer connections. The priority list, a duplicate of which was in the hands of the California Railroad Commission, was used as a guide in making connections. All applications for extensions had to pass through the regular routine of the estimating department, and the cost of making extensions was properly apportioned. These estimates, or jobs, were then listed in order ready for action by the committee. Materials were ordered, freight shipments were traced, truck equipment was provided, and materials were distributed to various districts where needed. Help was also obtained for the construction work.

Where an application was made for rural service the following ruling was observed:

> All agricultural service will be normally rendered when the annual revenue to be derived equals or exceeds 33⅓ per cent of the cost of the extension. If such annual revenue is less than 33⅓ per cent but more than 20 per cent of the cost of the extension, the applicant may obtain service by first advancing the entire cost of the extension, such ad-

TABLE I—SUMMARY OF THE APPLICATIONS, CLASS OF SERVICE AND CONNECTED LOAD

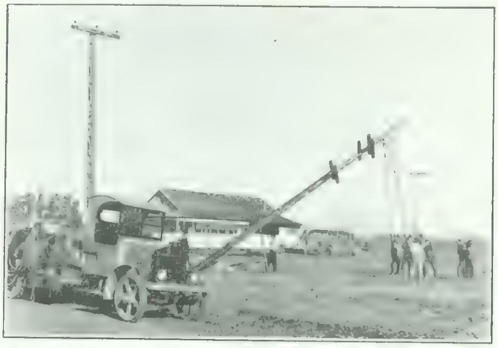
(Nov. 1, 1920 to Jan. 15, 1921)

Class of Service	Applications	Horsepower
Irrigation	2,471	35,907
Industrial	180	3,898
Oil well	28	2,085
Domestic	590	1,069
Lighting	1,233	1,644
Total	4,502	44,603

TABLE II—TRANSFORMERS REQUIRED TO HANDLE THE RURAL LOAD IN TABLE I

The following complete list of transformers purchased indicates the relative segregation that may be found in rural service. The 3-kw. size predominates both in actual numbers and total capacity, the 5-kw. size being second in total capacity. The combined total capacity of all the transformers is 42,955 kw., or 112.9 per cent of the applied-for kilowatts.

No.	Rating, Kw.	Voltage Primary	Voltage Secondary		Total Capacity, Kw.
1,615	1½	6,600	110	200	2,425
2,470	3	6,600	110	200	7,410
1,159	5	6,600	110	200	5,800
394	7½	6,600	110	200	2,955
72	10	6,600	110	200	720
164	10	6,600	220	440	1,640
136	15	6,600	220	440	2,200
41	15	6,600	110	220	615
1	20	6,600	220	440	20
145	25	6,600	220	440	2,900
12	25	6,600	110	220	300
1,340	2½	11,000	110	220	3,350
482	5	11,000	110	220	2,410
54	10	11,000	110	220	540
12	10	11,000	220	440	120
6	15	11,000	220	440	90
12	15	11,000	110	220	180
[illegible]	20	11,000	110	220	180
5	25	11,000	110	220	125
6	25	11,000	220	440	150
92	37½	11,000	220	440	3,450
28	50	11,000	220	440	1,400
7	50	11,000	110	220	350
12	75	11,000	220	440	900
15	75	11,000	460	2,300	1,125
4	100	11,000	220	440	400
3	150	11,000	220	440	450
3	150	11,000	460	2,300	450
3	100	11,000	460	2,300	300
8,302					42,955



THIRTY-NINE LINE CREWS SIMILAR TO THIS WORKED ON EXTENSIONS REQUIRED IMMEDIATELY AFTER ARMISTICE

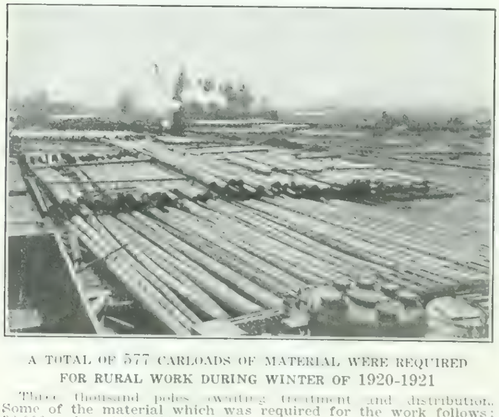
vancement to be refunded on the basis of 20 per cent of the monthly bills.

If the applicant constructed at his own expense a part of the line sufficient to make the annual revenue equal 33⅓ per cent of the cost of that part of the extension which was made at the company's expense, the application was also granted. On account of franchise rights and similar considerations, the company in this case built the entire extension and the consumer advanced the difference between the three-year revenue and the cost of the extension.

The applicant could also insure the building of the extension by guaranteeing business of a kind acceptable to the company sufficient to equal 33⅓ per cent of the cost of the extension. When the annual revenue to be derived was less than 20 per cent of the cost of extension, the company was not normally required to render service.

In a few cases of long extensions requiring transmission lines and substation installations the applicant was requested to aid in financing the extensions by the purchase of stock to cover part or all of the cost. However, an endeavor was made to adhere strictly to the 33⅓ per cent rule, and in no case was service made contingent on the purchase of stock.

The handling and distribution of the vast stores of materials necessary was a big problem in itself. A fleet of thirty-nine trucks was used to handle the line work. Each truck carried a crew of eleven men, consisting of a foreman, four linemen, five groundmen and a truck driver. The total of the thirty-nine crews required approximately 430 men in the field to construct distribution lines. The line crews built the lines, handled the transformers and strung the service wires, while other crews set the meters and made the connections. Under normal conditions a crew setting meters and making service connections can connect only about six a day.



A TOTAL OF 577 CARLOADS OF MATERIAL WERE REQUIRED FOR RURAL WORK DURING WINTER OF 1920-1921

Three thousand poles awaiting treatment and distribution. Some of the material which was required for the work follows: 20,000 poles, 2,000,000 lb. wire, 150,000 insulators, 900,000 ft. [illegible] material, 2,600 single phase meters, 1,100 polyphase meters and 8,302 transformers.

Choice of Electric Furnace Refractories

NEARLY all the interior refractories used in electric furnaces fail to meet the requirements of present furnace practice. It is therefore important to analyze the different furnace requirements if the best use is to be made of the available refractories.

Some of the special requirements of refractories for the electric furnace are contained in the following summary:

1. *Melting Point.*—Must be at least as high as that of silica (1,700 deg. to 1,750 deg. C.) and preferably much higher.
2. *Resistance to Sudden Temperature Changes.*—This is important, since a furnace must often turn out a heat in two hours, starting cold. This requirement is much more severe than with the slower-melting, fuel-fired furnaces.
3. *Constancy of Volume.*—Refractories which have been fired only at the temperatures attainable in fuel-fired furnaces may undergo marked volume changes when used in the higher-temperature electric furnaces. The ideal refractory for electric furnace use should therefore be calcined in an electric furnace during manufacture.
4. *Resistance to Slags.*—In steel-melting practice an oxidizing and a reducing slag are used in conjunction with a very high temperature—the severest possible service for the refractories on the slag line. If an induction furnace is used, the slag corrosion may be increased by erosion problems because of circulation of the metal bath. The same is true to some extent of rocking or rotating arc furnaces.
5. *Resistance to Corrosion by Fumes.*—The point of attack is the roof. The fume corrosion may be increased by particles of molten slag thrown up from the hearth. The extremely high temperature of the roof accelerates the corroding effect. Furthermore, the roof is subjected to many mechanical strains due to the water-cooled parts being adjacent to parts subjected to extremely high temperatures.
6. *Mechanical Properties at Very High Temperatures.*—If a circulating metal bath is used, as in induction furnaces and in some forms of arc furnaces, the refractory has to possess high resistance to abrasion at elevated temperatures.

In order to meet, or attempt to meet, these requirements, several classes of refractories have been tried out for the different parts of the furnace.

Present practice is to use a good grade of firebrick for the outer walls; this is sometimes laid next to silocel, asbestos or a similar efficient heat insulator. Magnesite bricks are usually laid against the firebrick for forming the inner side walls of the furnace and one or two courses are laid over the bottom layer of firebrick. The rammed-in or built-up hearth of dead-burned magnesite, dolomite, "syndolag" or similar material is then built in. The roof is most frequently made of silica brick, although carborundum and electrically fused magnesite have also been used. The research laboratory of the Foote Mineral Company, Philadelphia, gave out this information at a meeting of the Electric Furnace Association at Columbus, Ohio.

What Constitutes a Reasonable Return

The Point at Which Confiscation Begins Marks the Border Line in Valuation and Rate Fixing for Public Utilities—Exhaustive Citation of Legal Decisions Bearing on This Aspect of Successful Utility Operation

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THE border line of return to public utilities is briefly discussed in this article under the headings which immediately follow. This discussion is supported by the long list of citations of decisions handed down by federal and high state courts, the numerals preceding each separate group of citations corresponding to the numerals in parentheses that are scattered through the article proper.—EDITOR.

I. Introductory, § 1.
II. In general, § 2.
III. Cost of money, §§ 3-5.
  A. Interest rate on utility securities, § 3.
  B. Legal rate of interest, § 4.
  C. Prevailing rate of interest, § 5.
IV. Prevailing return on comparable enterprises, § 6.
V. Fluctuations, § 7.

§ 1. I. Introductory.—Constitutional terms providing against the deprivation of property without due process of law (1), the denial of the equal protection of the law (2) and the taking of private property for public use without just compensation (3) safeguard private property devoted to the service of the public in utility enterprises (4). From the monetary standpoint, the constitutional protections afforded have been measured, by the adjudicated cases, in terms per centum on the

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1. U. S. Const. Amend. Art. 5 ("No person shall be . . . nor deprived of . . . property without due process of law."); U. S. Const. Amend. Art. 14 ("No state shall make or enforce any law . . . nor shall any state deprive any person of . . . property without due process of law"). See state constitutions.

2. U. S. Const. Amend. Art. 14 ("No state shall make or enforce any law . . . nor deny to any person within its jurisdiction the equal protection of the laws.")

3. U. S. Const. Amend. Art. 5 ("No person shall be . . . nor shall private property be taken for public use without just compensation."). See state constitutions.

4. Smythe v. Ames, 169 U. S. 466, 18 Sup. Ct. 418, 42 L. ed, 819; Reagan v. Farmers L. & T. Co., 154 U. S. 362, 38 L. ed. 1014, 14 Sup. Ct. 1047; Cotting v. Kansas City Stockyards Co., 183 U. S. 79, 22 Sup. Ct. 30, 46 L. ed. 92; Pioneer T. & T. Co. v. Westenhaver, 29 Okla. 429, 118 Pac. 354, 38 L. R. A. (N. S.) 1209; Spring Valley Wks. Co. v. San Francisco, 165 Fed. 667; Coal & Coke R. Co. v. Conley, 67 W. Va. 129, 67 S. E. 613; Chicago, M. & St. P. Ry. Co. v. Minnesota, 134 U. S. 418, 33 L. ed 970, 10 Sup. Ct. 462, to enumerate a few only.

5. Smythe v. Ames, 169 U. S. 466, 18 Sup. Ct. 418, 42 L. ed. 819; Covington, etc. T. R. Co. v. Sandford, 164 U. S. 578, 17 Sup. Ct. 198, 41 L. ed. 560; Reagan v. Farmers L. & T. Co., 154 U. S. 362. 14 Sup. Ct. 1047; 38 L. ed. 1014; Brass v. North Dakota, 153 U. S. 391, 14 Sup. Ct. 857, 38 L. ed. 757; Stone v. Farmers' L. & T. Co., 116 U. S. 307, 6 Sup. Ct. 334, 338, 1191, 29 L. ed. 636, to enumerate a few only.

6. Northern Pac. Ry. Co. v. Lee, 199 Fed. 621.

7. Home Tel. Co. v. Carthage, 235 Mo. 644, 139 S. W. 547; Coal & Coke R. Co. v. Conley, 67 W. Va. 129, 67 S. E. 613, and see the many cases cited herein.

8. Omaha & C. B. Ry. Co. v. Nebraska Ry. Comm., 103 Neb. 695; 173 N. W. 690, P. U. R. 1919F, 307, 312; Re Peoples Natural Gas Co., P. U. R. 1916A, 349.

9. Spring Valley Wks. Co. v. San Francisco, 124 Fed. 574; Spring Valley Wks. Co. v. San Francisco, 165 Fed. 667 ("To say that a body of rates which affords some compensation, but something less than a reasonable compensation, is not confiscatory, is simply to say that the constitution protects a portion, but not all of a man's property" l.c. 678); Monongahela Nav. Co. v. United States, 148 U.S. 312 13 Sup. Ct. 622, 37 L. ed 463 ("Before this property can be taken away from its owner, the whole value must be paid." l.c. 329); Virginia & T. Rd. Co. v. Henry, 8 Nev. 165 ("It is difficult to imagine an unjust compensation; but the word 'just' is used evidently to intensify the meaning of the word 'compensation'. To convey the idea that the equivalent to be rendered for property taken shall be real, substantial, full, ample; and no legislature can diminish by one jot the rotund expression of the constitution. So are all the decided cases." l.c. 171) Spring Valley Wks. Co. v. San Francisco, 82 Cal. 286, 22 Pac. 910, 6 L. R. A. 756, 16 Am. St. Rep. 116 ("When the constitution provides for the fixing of rates or compensation, it means *reasonable* rates and *just* compensation. To fix such rates and compensation is the duty and within the jurisdiction of the board. To fix rates not reasonable or compensation not just is a plain violation of duty." 82 Cal. l.c. 306).

Reason.—"As the right to use property for any lawful purpose to the extent of the realization therefrom of a return or reward commensurate with the reasonable and just value of such use is an element of property, property itself *pro tanto*, since without the right of such use, it would be wholly or partially valueless, according to the extent of the restraint upon its use, deprivation of the use thereof, or denial of the power to earn such reasonable and just return or reward by the use thereof, in whole or in part, without compensation therefor, amounts to such wrongful taking thereof, and therefore to confiscation within the meaning of the decisions in cases of this kind. To constitute such confiscation, the taking need not extend to the corpus of the property nor total deprivation of reward for the use thereof. If the law renders it impossible to obtain from the use of the property a reasonable and fair return, it is confiscatory in its operation and effect, though valid on its face. The extent of such deprivation is not the test. Whether a statute is thus confiscatory does not depend upon the amount it takes in violation of the constitution, or the extent to which it interferes with the right of use of property guaranteed by the organic law. It is void if it so takes any at all, or so interferes to any extent whatever. It is condemned, not by the extent of the pecuniary injury wrought, but by its transgression of constitutional limits, its invasion of a constitutional right, as sacred to corporations as to the humblest citizen of the land, and justly so, for the reason, among others, that the property of corporations is in fact the property of citizens, and the law cannot and ought not, in its ultimate results, to favor one citizen or class of citizens over another." Coal & Coke R. Co. v. Conley, 67 W. Va. 129, 188. And see note 12, *infra*.

10. Detroit v. Detroit United Rys. Co., 172 Mich. 136, 137 N. W. 645; Simpson v. Shepard, 230 U. S. 352, 433, 434, 33 Sup. Ct. 729, 57 L. ed. 1511, 1555, 1556, 48 L. R. A. (N. S.) 1151, Ann. Cas. 1916A, 18; Denver v. Denver Union W. Co., 246 U. S. 178, 62 L. ed. 649, 38 Sup. Ct. 278, P. U. R. 1918C, 640; Doherty & Co. v. Toledo Rys. & L. Co., 254 Fed. 597, P. U. R. 1919C, 231.

11. Coal & Coke R. Co. v. Conley, 67 W. Va. 129, 67 S. E. 613; Hammond Lumber Co. v. Oregon Pub. Serv. Comm., 96 Ore. [illegible], 189 Pac. 639, P. U. R. 1920E, 144.

12. Spring Valley Wks. Co. v. San Francisco, 124 Fed. 574; Central Ry. Co. v. Alabama Rd. Comm., 161 Fed. 925; Atchison, T. & S. F. Ry. Co. v. Campbell, 61 Kan. 439, 59 Pac. 1051, 48 L. R. A. 251, 78 Am. St. Rep. 328; Coal & Coke R. Co. v. Conley, 67 W. Va. 129, 67 S. E. 613; and see Contra Costa W. Co. v. Oakland, 159 Cal. 323, 113 Pac. 668; Stone v. Farmers' L. & T. Co., 116 U. S. 307, 6 Sup. Ct. 334, 338, 1191, 29 L. ed. 636 (dissenting opinions).

Just Compensation.—"What is the meaning of 'just compensation'? . . . The ancient maxim *'De minimis non curat lex'* has no application. 'The violation of a constitutional right should never be measured or met by any such plea. It is said that counsel once attempted to argue before Chief Justice Marshall that in the particular instance before the court the invasion of constitutional rights was slight, but he was sternly reminded that the case involved the constitution of the United States and that the degree or extent of the invasion had no bearing upon the point. When a constitutional right is invaded, we are not bound to stand silent so long as moderation is practiced. There can be no greater political blindness, no more dangerous policy than to sanction the infringement of constitutional rights because the particular instance is in itself apparently harmless or seems expedient. Admit the wedge ever so little and there is nothing to prevent its being driven home. We are not compelled to wait until the unconstitutional measure becomes ruinous confiscation or an intolerable interference with personal liberty. In respect to constitutional guaranties we have a right to expect absolute security and protection, and the courts are under a duty to enforce the constitutional provisions guaranteeing our rights wholly irrespective of the degree of infringement. Present inconvenience, however great, present expediency, however tempting, can never justify the slightest disregard of any provision of the constitution." Spring Valley Wks. Co. v. San Francisco, 124 Fed. l.c. 601. (2) "It is clear that the fundamental law, both state and federal, compels the legislature to regulate rates 'in such manner that no injustice shall be done' the property owner. He must have 'just' compensation. Any schedule of rates is forbidden which produces any injustice. The quantum of injustice is immaterial. There must be 'no injustice.'" Central Ry. Co. v. Alabama Rd. Comm., 161 Fed. l.c. 995. (3) "Some writers have spoken of a 'twilight zone of injustice,' in which the legislative body may roam at will in fixing rates, and while acting in this unilluminated region the courts are powerless to control its judgment. That is, as intimated in the majority opinion, that the council may adopt a rate which the court would not, if sitting as a legislative body, regard as reasonable, and yet, sitting as a court, it cannot say is unreasonable. If there is warrant in reason for such a doctrine, the court should at least place some sort of limit to the field in which the rate-making body may exercise an uncontrolled discretion. It is within the proper and rightful value of the property as evidenced by the income derived from the enterprise above all just charges to operation and depreciation (5). The point where confiscation begins is therefore of importance, and it is with the factors basing most closely upon this border ground for utility endeavors conceived in sound business judgment and efficiently and prudently conducted that the present article is concerned.

§ 2. II. In General.—What is a reasonable return is a mixed question of law and fact (6), for the ascertainment of which an unvarying rule has not been announced (7), a fair return being as necessary and proper as the wages of a laborer or any other just compensation (8). "Just compensation" as used in the constitution means full compensation (9) notwithstanding the expiration of franchise privileges (10), in the nature of a return from the commencement of the undertaking (11), precluding the approval of a return lower, however infinitesimal, than that which the court can consider as failing to measure up to the constitutional requirements (12).

§ 3. III. Cost of Money: A. Interest Rate on Utility Securities.—For a prudently conducted utility enterprise the rate of interest it is compelled to pay for borrowed money furnishes a safe criterion of the minimum return to which it is entitled (13); but as the stockholder's lien on the property is subordinate to that of the lender (14), attended with all the risks of

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exercise of its functions for the court to say to the legislative body that any rate which fails to measure up to what the court may declare to be reasonable compensation would be void as unreasonable, and, in my judgment, it is competent for the court, in view of all the circumstances, to say what this minimum should be, having reference to the nature and character of the service to be rendered." Contra Costa W. Co. v. Oakland, 159 Cal. 323, l.c. 358. See, also, note 9, *supra*.

13. Wilkes-Barre v. Spring Brook W. Sup. Co., 4 Lack. Leg. News 367; San Diego W. Co. v. San Diego, 118 Cal. 556, 50 Pac. 633, 38 L. R. A. 460, 62 Am. St. Rep. 261 ("An important circumstance will always be the rate of interest at which money can be borrowed for investment in such a business, and, where the business appears to be honestly and prudently conducted, the rate which the company would be compelled to pay for borrowed money will furnish a safe, though not always conclusive, criterion of the rate of profit which will be deemed reasonable. In ordinary cases, where the management is fair and economical, it would be unreasonable to fix the rates so low as to prevent the company from paying interest on borrowed money at the lowest market rate obtainable; and even then some allowance or margin should be made for any risk to which the company may be exposed, over and above the risk taken by the lender." 50 Pac. l.c. 637).

14. Briggs v. Peaks Island Corp. (Me.), P. U. R. 1917E, 750 ("The return on the investment, the cost not exceeding the value of the service, should be sufficient to attract capital to similar investments, with the expectation of getting its reward in dividends from regular earnings—not from the flotation of securities. It must be larger than the rate on money loaned to such corporations, because the lender has a lien upon the property superior to the owner and takes none of the responsibilities of management." l.c. 761).

15. San Diego W. Co. v. San Diego, 118 Cal. 556, 50 Pac. 633, 38 L. R. A. 460, 62 Am. St. Rep. 261; Briggs v. Peaks Island Corp. (Me.), P. U. R. 1917E, 750; Murchie v. St. Croix Gaslight Co. (Me.), P. U. R. 1917B, 384.

16. Murchie v. St. Croix Gaslight Co. (Me.), P. U. R. 1917B, 384.

17. Wilkes-Barre v. Spring Brook W. Sup. Co., 4 Lack. Leg. News 367 (holding other action would remove the inducement of investing in such undertakings); Briggs v. Peaks Island Corp. (Me.), P. U. R. 1917E, 750; Murchie v. St. Croix Gaslight Co. (Me.), P. U. R. 1917B, 384 ("If the rate of interest paid by a corporation for money borrowed is 6 per cent, the stockholder ought, under normal conditions, to be permitted to receive a higher return in dividends, if the corporation can earn them." l.c. 394).

18. Re Idaho Power Co. (Idaho), P. U. R. 1920D, 809.

19. Re San Joaquin L. & P. Co. (Cal.), P. U. R. 1920D, 958; Re Mt. Whitney P. & E. Co. (Cal.), P. U. R. 1920D, 938.

20. Re Mount Whitney P. & E. Co. (Cal.), P. U. R. 1920D, 937 ("The cost of money to applicant is in excess of 6 per cent. It has rendered service during the past three years at an average rate of approximately 5 per cent on its reasonable investment, which is a rate of return less than the cost of money it has had to borrow to meet the demands of applicants for service. This cannot continue indefinitely without detriment to service or a condition of additional increase of rate on Southern California Edison Company's system which will be unfair to consumers on that system." l.c. 937).

21. Brymer v. Butler W. Co., 179 Pa. St. 231, 36 Atl. 249; Pennsylvania Rd. Co. v. Philadelphia County, 220 Pa. St. 100, 68 Atl. 676, 15 L. R. A. (N. S.) 108; Ben Avon v. Ohio Valley W. Co., 68 Pa. Sup. Ct. 561, P. U. R. 1918A, l.c. 176; Wilkes-Barre v. Spring Brook W. Sup. Co., 4 Lack. Leg. News 367; Missouri, K. & T. Ry. Co. v. Love, 177 Fed. 493; Re Mountain States Tp. & Tg. Co., P. U. R. 1917B, 297 (allowing, but holding the legal rate of interest not controlling).

Reason.—See note 26, *infra*.

22. Wayne Title & T. Co. v. Wayne Sewerage Co. (Pa.), P. U. R. 1919D, 404.

23. Lincoln Gas & El. Co. v. Lincoln, 250 U. S. 256, 39 Sup. Ct. 454, 63 L. ed. 968 (holding a return less than the lowest rate of interest sought and generally received and 1 per cent lower than the legal rate of interest not free from the objection of being confiscatory).

24. Louisville & N. Rd. Co. v. Florida Rd. Comm., 123 Fed. 947 (holding *prima facie* case for issuance of injunctive order *pendente lite* established upon showing of such return for nineteen years).

25. San Diego L. & T. Co. v. Jasper, 189 U. S. 439, 23 Sup. Ct. 571, 47 L. ed. 892 (this, however, is another subject matter).

26. See note 21, *supra*.

Legal Rate of Interest the Minimum.—"What was said in Brymer v. Water Co., 179 Pa. 231, was that the company was entitled to a fair return, not less than the legal rate of interest. In naming the legal rate the court was naming a minimum, not maximum, rate. Six per cent is the legal estimate of the legitimate profit from the ordinary safe use of money. No business man in 1846, even if now, went into a new and extensive venture of uncertain outcome without the hope of more than common interest. Because his judgment or foresight was good is no reason that he should be shorn of his profits in the result. What is a fair profit is a complicated and difficult question, but there are certain elements that are plainly to be regarded to avoid injustice, such as the original investment, the risks assumed at that time, the return as compared with other enterprises as nearly similar as may be, the cost of maintenance and improvement, the prospects of increase and present value in view of the preceding elements. Injustice is done by anything that fails to consider these and to deal equitably with the private as well as the public interest involved." Pennsylvania Rd. Co. v. Philadelphia County, 220 Pa. St. l.c. 115. (2) "If a legal rate of return was all that was offered the investor could very well answer that, without risk and with a safe margin of value, money could be loaned on lands and buildings at this rate of return. When solicited to invest in a new project, with the uncertainty of success before him, the investor demands a return commensurate with the risk involved, and that must be something more than a legal-rate investment. If the venture is a failure the investor is compelled to take his loss without any hope of recoupement; but it is equally unfair to require him to suffer all the loss if the enterprise fails, and to deprive him of the chance of additional gain if the venture is a successful one." Ben Avon v. Ohio Valley W. Co., 68 Pa. Sup. Ct. l.c. 591, P. U. R. 1920A, l.c. 176. (3) "The rate of return should primarily be based upon the actual investment in the property and should bear some relation to the rate of interest allowed by law, as that is the legislative standard by which the just return for borrowed money is fixed. . . . We wish to emphasize this by repeating that the legislative standard of 6 per cent with some margin for uncertainties furnishes a rule which in a general way should be controlling. . . . It is enough [in refusing to discuss reasons] to say that a return that barely escapes the level of confiscation will in a short time produce a condition of squalor, and squalor spells inefficiency. The return that allows rates that are unreasonably high when compared with rates from other useful lines of business in time produces arrogance, which in turn arouses hostility upon the part of the public that may lead to disastrous results." Bucharach v. Consolidated G. El. L. & P. Co. (Md.), 14 A. T. & T. Co. Comm. L. 154, l.c. 179, 180.

27. Buell v. Chicago, M. & St. P. Ry. Co., 1 Wis. R. C. 324.

Statement.—"It has been quite generally held that a fair rate of interest is a rate which, other things being equal, corresponds to the current market rates on money. This is a position with which it is not easy to take issue, for it is quite clear that whatever rate money brings in the market is a safe index as to what it is generally worth for investment purposes. It may also be said, and with a great deal of force, that a fair rate of interest for any particular road is the rate of income which its securities bring on the market value. The market rate includes the ordinary risks, as it is usually considerably higher than the rate which is obtained on government and other securities where substantially no risks at all are involved." Buell v. Chicago, M. & St. P. Ry. Co., 1 Wis. R. C. 324, 447.

28. Spring Valley Wks. Co. v. San Francisco, 124 Fed. 574 (controlling); Missouri, K. & T. Ry. Co. v. Love, 177 Fed. 493; Milwaukee El. Ry. & L. Co. v. Milwaukee, 87 Fed. 577 (where the prevailing rate of the local market on real estate and like securities was given consideration and interest paid by the utility, which was below that which was paid on such loans, was considered the minimum); Milwaukee v. Milwaukee El. Ry. Co., 11 Wis. R. C. 1, 240; and see other cases cited (this) §5.

29. Consolidated Gas Co. v. New York, 157 Fed. 849; Wilcox v. Consolidated Gas Co., 212 U. S. l.c. 50, 29 Sup. Ct. 192, 53 L. ed. 382; Milwaukee El. Ry. & L. Co. v. Milwaukee, 87 Fed. 577.

Reason.—"Nor can I think that the legal rate of interest in the state of complainant's incorporation or operation affords any light on the subject, merely because it is established by law. As was observed by counsel equally learned in law and politics it would be easy to amend the legal rate, and judicial dependence upon an interest rate susceptible of change, by the same legislature that regulates the rate of earnings, would be, to say the least, inadvisable. There is, however, evidential value in the established rate of usance for money, in so far as it expresses the settled conviction of the business community as to the worth of capital invested in enterprises not usually considered as hazardous. . . . What would that prudent man acquainted with business (so familiar to the readers of legal literature) do regarding such an investment, if it were offered to him? I think he would take it, not with enthusiasm, but as fairly safe local property, promising a rate of return sufficiently above the local mortgage market to compensate for the additional and non-insurable hazard." Consolidated Gas Co. v. New York, 157 Fed. l.c. 870; approved in Wilcox v. Consolidated Gas Co., 212 U. S. l.c. 50. See also, note 43 (a), *infra*.

30. Lincoln Gas & El. Co. v. Lincoln, 250 U. S. 256, 39 Sup. Ct. 454, 63 L. ed. 968 (holding rates yielding 6 per cent on utility invested capital are not free from objection on the grounds of confiscation where 8 per cent is the prevailing rate on investments in banking, merchandising and other local

management (15) and subject to last participation in earnings (16), the return allowed should be sufficiently above the rate of interest demanded of the utility to attract capital (17), including that capital needed for necessary additions to the rendition of adequate service (18)—a so self-evident proposition as to demand the ready recognition of consumers (19)—as continued service at less than the cost of money will subsequently react in inadequate service or service at an unfair rate (20).

§ 4. B. Legal Rate of Interest.—Likewise, for an efficiently conducted enterprise, the legal rate of interest in the locality where the utility operates is the minimum rate of return to which it is entitled (21), even though such return results in temporary rates greater than the cost of a substitute for the service (22). A rate of return lower than the legal rate of interest is subject to attack on the ground of confiscation (23), and establishes a *prima facie* case for the issuance of injunctive relief *pendente lite* to restrain reductions in charges (24), such a return being justifiable only where the business has not been developed sufficiently to be remunerative or the plant has been overdeveloped to meet the probable future demands of the business (25).

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business in the vicinity, and 7 per cent the legal rate of interest).

31. Central Ry. Co. v. Alabama Rd. Comm., 161 Fed. 925; Louisville & N. R. Co. v. Brown, 123 Fed. 946; Louisville & N. R. Co. v. Alabama Rd. Comm., 196 Fed. 800 (8 per cent); Western Ry. of Alabama v. Alabama Rd. Comm., 197 Fed. 954 (8 per cent).

Prevailing Interest Rate as Just Compensation.—(1) "When the rights of the public are protected by a schedule of just rates in that respect has the legislature the power, in the face of the provision of the Fourteenth Amendment, to go further either by express limitation in the statute or by necessary operation of the rates for which it provides, and prevent the carrier from earning any profit above a certain per centum of the value of the property, although its business be done at just and reasonable rates for the service, and without unjust discrimination? Lochner v. New York, 198 U. S. 45, 46, 25 Sup. Ct. 539, 49 L. ed 937. Has the state any such right under its own constitution? . . . The state fixes 8 per cent per annum as the rate for the use of property in the shape of loans for money. . . . The evidence shows the current rates of profit upon property used in business enterprises similar to railroads gives a net income upon the value of such property not lower than 8 per cent per annum. Whether we take the legal rate of profit by way of interest on loans of money, or the rate of profit which common experience shows to be the average, and therefore approximately a just return from the use of other forms of property, both modes lead to the same result. We can find no better standard by which to measure what is a fair and just return for the use of railroad property under the conditions governing the business of conducting railroad transportation in this state." Central Ry. Co. v. Alabama Rd. Comm., 161 Fed. 994, 996. (2) "I think it will be conceded that so long as the rates are reasonable and do not unjustly discriminate the company is entitled to earn some amount; and it seems reasonably clear to me that if entitled to earn something under the above conditions it is entitled to earn under the same conditions a compensatory amount equal, at least, to the usual rate of interest in the locality where the railroad is situated." Louisville & N. R. Co. v. Brown, 123 Fed. 946, 951.

32. Denver v. Denver Union W. Co., 246 U. S. 178, 62 L. ed. 649, 38 Sup. Ct. 278, P. U. R. 1918C, 640 (holding rates yielding a return of 4.28 per cent in a locality where the prevailing rate of interest is 6 per cent result in confiscation of property without due process of law); Doherty & Co. v. Toledo Rys. & L. Co., 254 Fed. 597, P. U. R. 1919C, 231 (following the *Denver* case).

33. Montana W. & S. R. Co. v. Morley, 198 Fed. 991 (holding the owner entitled to such a return); Cumberland T. & T. Co. v. Louisiana Rd. Comm., 156 Fed. 823 (holding rates yielding a fair return (7 per cent are not to be disturbed).

34. Havelock v. Lincoln Tr. Co., 4 Neb. R. C. R. 91 ("No hard and fast rule can be established in respect to a fixed rate of income upon investments of this nature, but we have no hesitancy in saying that under ordinary conditions, where the good faith of the company and its fairness with respect to its patrons appears, the maximum return to such investors (provided the rate charged is not an unusual one) should not exceed 3 per cent in excess of the customary and existing rate of interest received by those whose investments are represented in fixed interest-bearing securities. In other words the building of electric lines should be encouraged and the returns upon such investments should be sufficiently large to attract capital to such enterprises. If the rate of interest on fixed interest-bearing securities in any given locality is 5 per cent a maximum return to the investors in electric railways would not be unreasonable or excessive at 8 per cent." l.c. 96. Decision dated May 7, 1911.)

35. Cedar Rapids Gaslight Co. v. Cedar Rapids, 144 Iowa 426, 120 N. W. 966, 48 L. R. A. (N. S.) 1025, 138 Am. St. Rep. 229; 223 U. S. 655, 32 Sup. Ct. 389, 56 L. ed. 549 (where a return somewhat above 5 per cent was considered free from attack on the ground of confiscation upon considering the rate of 2 per cent on government bonds, 4 per cent on state and municipal bonds and 5 per cent on utility securities).

36. San Diego W. Co. v. San Diego, 118 Cal. 556, 150 Pac. 633, 38 L. R. A. 460, 62 Am. St. Rep. 261; Consolidated Gas Co. v. New York, 157 Fed. 849; Coal & Coke R. Co. v. Conley, 67 W. Va. 129, 67 S. E. 613.

37. Bly v. Winslow El. L. & P. Co. (Ariz.), P. U. R. 1916A, 227 (10 per cent); Arizona Corp. Comm. v. Morenci W. Co. (Ariz.), P. U. R. 1915C, 546 (10-12 per cent); Ely v. Ely L. & P. Co. (Nev.), 24 A. T. & T. Co. Com. L. 587 (holding long life and large financial transactions of utilities distinguish them from short time small loans).

Reasons.—"Such testimony [prevailing rates on local commercial transactions] has value in showing the local financial conditions, although commercial interest rates or returns in private industrial undertakings are not analogous to investments in public utilities operating without fear of undue competion and with a knowledge that the property devoted to public use will be protected in earning the rate of return found to be reasonable. Hazards ever present in private undertakings are reduced to a minimum, if not to nil, in the conduct of public utilities, such as to the one under review." Bly v. Winslow L. & P. Co., P. U. R. 1916A, l.c. 232.

38. Wilkes-Barre v. Spring Brook W. Sup. Co., 4 Lack. Leg. News 367.

Municipal Bonds.—"Such investments are not by any means analogous to investments in water-works. Good bonds . . . [municipal] remain intact. They are not liable to change or diminution in the principal. At a time certain the principal is to be repaid to the investor to the last cent. If the rate paid on such investments shall determine the percentage of profit to be paid water companies there would be no inducement for anybody to invest money in works of a public nature. It would be much less wearisome to sit down twice a year and cut off the coupons from bonds. Enterprise and industrial progress would be at a standstill. It must be remembered that those who embark their capital in water companies place their property to a great extent in the hands of the public, as do all companies having the power of eminent domain. They must be always ready to supply the public demand and must take the risk of any falling off in that demand. They cannot convert their property to any other use, however unprofitable the public use may become. While they have a right to manage their property according to their own judgment they are, nevertheless, subject to supervisory powers of the courts. If the water for any reason becomes unwholesome the courts will prevent the collection of rates until it becomes reasonably pure. Nor can the companies charge any rate they please, as if the water plant were a purely private matter. Consumers have a right to appeal to the courts, who have the power to decrease the charges if they are not just and equitable. It is evident, therefore, that the rate of interest paid on city bonds is not by any means conclusive as to the return a water company is entitled on its investments." Wilkes-Barre v. Spring Brook W. Sup. Co., 4 Lack. Leg. News l.c. 380.

39. Elizabethtown Gas L. Co. v. New Jersey Pub. Serv. Commrs.—N. J.—, 111 Atl. 729, P. U. R. 1920F, 1001; Consolidated Gas Co. v. Newton, 267 Fed. 231, P. U. R. 1920F, 483.

Government Bonds.—"The evidence in this record indicates that 8 per cent is the going rate at the present time, and that stands uncontradicted. For many months past the United States, certainly the most solvent debtor in the world, has paid either 6 or nearly 6 per cent, and other governments higher. As the facts develop in this case I need not find any rate except to say that less than 6 per cent would be insufficient." Consolidated Gas Co. v. Newton, 267 Fed. l.c. 241. See also note 54, *infra.*

40. Re Laclede Gaslight Co., 7 Mo. P. S. C. 507; Rhode Island Pub. S. C. v. Providence Gas Co. (R. I.), P. U. R. 1919B, 531, 1918 R I. 99; Omaha & Council Bluffs St. Ry. Co. v. Nebraska St. Ry. Comm., 103 Neb. 695, 173 N. W. 690, P. U. R. 1919F, 307; Re Ft. Smith L. & Tr. Co. (Ark.), P. U. R. 1920C, 419; Re Eastern Ore L. & P. Co. (Ore.), P. U. R. 1920D, 744; Re Southern California Edison Co. (Cal.), P. U. R. 1920F, 558.

Utility Credit.—(1) "The public is interested in maintaining the credit of the gas company so as to enable it to refund its securities and borrow money for improvements and additions at the lowest possible interest rates. A policy of fair dealing by the constituted state authorities will inspire confidence in the investors and eventually reduce interest rates for the securities of the utilities of the state so as to approximate the prevailing rates for municipal bonds; and unless such a result can be secured state regulation will inevitably be superseded by state or municipal ownership. Under state regulation a reduction in the interest rates paid by a utility is reflected in reduced charges for the commodity which the utility furnishes to the public." Re Laclede Gaslight Co., 7 Mo. P. S. C. l.c. 507. (2) "We believe, without the slightest hesitation, that neither the commission nor the public nor any community in this state, if left free to act, would from greed or ignorance, ever desire to take the property of the utility without compensation. They know that in the loss of these utilities the public would suffer most. The state must be careful to do nothing which may rightfully take away from it that valuable right of jurisdiction and control over its own local property and institutions." Omaha & Council Bluffs St. Ry. Co. v. Nebraska St. Ry. Comm., 103 Neb. l.c. 699. (3) "We firmly believe that the public interest requires that the credit of the utility locally owned, controlled and financed shall be maintained in order that capital may be readily available for additions and extensions, and that such credit can be best maintained by the continuance of an annual dividend rate of 8 per cent upon its capital stock, each dollar of which has been actually paid in cash." Rhode Island Pub. S. C. v. Providence Gas Co. 1918 R. I. 111. (4) "The utilities have been deprived of the power to make unjust profits; they should also be protected against unjust losses." Re Ft. Smith L. & Tr. Co., P. U. R. 1920C, l.c. 426. (5) "While this feature [poor credit] may properly be given serious consideration when shown to have resulted from unreasonably low rates, yet it is entitled to little weight when traceable to the financial policy of the utility." Re Eastern Ore. L. & P. Co., P. U. R. 1920D, l.c. 745.

41. Re Illinois Nthn. Util. Co. (Ill.), P. U. R. 1920D, 1000; Re Perth Amboy Gas L. Co. (N. J. Comm.), May 12, 1920.

Reason—(1) "It is manifest that a prosperous and well-managed utility is an asset to a community, while one able to maintain only a bare existence is a source of loss to its owner and the cause of constant irritation to the consumers of its inferior service." Re Illinois Nthn. Util. Co. (Ill.), Again, the utility is entitled to a margin of profit above the legal rate of interest (26).

§ 5. C. *Prevailing Rate of Interest.*—Since whatever rate of interest money borrowed on the market brings is a safe index of its value (27), the prevailing rate of interest for approved non-hazardous securities in the locality affected constitutes a factor (28) of greater weight than the legal rate of interest (29) in determining the confiscatory character of rates for utility endeavor. A return lower than the prevailing rate of interest is subject to attack on the grounds of confiscation (30) and in that it denies the just compensation guaranteed by federal and state constitutions (31), although the franchises of the utility have expired and it is permitted to exist through sufferance (32). Thus, it has been expressly held that a return equivalent to the prevailing rate of interest in the locailty where the business is conducted must be allowed (33); and, whereas a return of 3 per cent in excess of the prevailing rate of interest has been considered the maximum to which utilities are entitled (34), a return somewhat above the prevailing interest charge has been considered free from attack on the ground of confiscation of property (35). It follows that the utility is not entitled to the greatest rate of interest realized upon any given kind of investment, nor is it compelled to be satisfied

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P. U. R. 1920D, l.c. 1000. (2) "That to increase rates enough to attract capital will increase the cost of living is in a measure true, but the refusal to grant sufficient rates is 'penny wise and pound foolish' and inadequate service will result, which, through indirect costs, will increase the cost of living many times the increases necessary to attract capital." Re Perth Amboy Gas L. Co. (N. J. Comm.), May 12, 1920.

42. Louisville & N. R. Co. v. Alabama Rd. Comm., 196 Fed. 800; Western Ry Co. of Ala. v. Alabama Rd. Comm., 197 Fed. 954; Home Tel. Co. v. Carthage, 235 Mo. 644, 139 S. W. 547; Wilkes-Barre v. Spring Brook W. Sup. Co., 4 Lack. Leg. News 367.

Municipal Bonds.—See note 38, *supra*.

Government Bonds.—See notes 39, *supra*, 54, *infra*.

Reason.—"Each case must of necessity depend upon the surrounding facts and circumstances. The prevailing rate of interest on money loaned, the hazard of the business, the life of the property used, the reliance upon the constancy of a return, which depends largely upon the existence or probability of competition, these, as well as many others, are proper matters for consideration. . . . It follows that unless the maximum rate be placed at such a figure that is above the average rate of return upon reasonably safe investments in private ventures capital will naturally turn to channels in which no maximum limit as to return exists." Home Tel. Co. v. Carthage, 235 Mo. l.c. 667.

Attraction of Capital.—Ben Avon v. Ohio Valley W. Co., 68 Pa. Sup. Ct. 561, P. U. R. 1918A, 161 (holding mere assurance of non-confiscation insufficient, some gain commensurate with that of other business essential); Missouri, K. & T. Ry. Co. v. Love, 177 Fed. 493 (holding investment should not be repelled or the owner embarrassed). See also note 40, *supra*, 43 (d), (3), *infra*, directing attention to a few only.

43. Wilcox v. Consolidated Gas Co., 212 U. S. 19, 29 Sup. Ct. 192, 53 L. ed. 382; Lincoln Gas & El. Co. v. Lincoln, 250 U. S. 256, 39 Sup. Ct. 454, 63 L. ed. 968; Denver v. Denver Union W. Co., 246 U. S. 178, 38 Sup. Ct. 278, 62 L. ed. 649, P. U. R. 1918C, 640; Coal & Coke R. Co. v. Conley, 67 W. Va. 129, 67 S. E. 613; Home Tel. Co. v. Carthage, 235 Mo. 664, 139 S. W. 547; Puget Sound El. R. Co. v. Washington Rd. Comm., 65 Wash. 75, 117 Pac. 739, Ann. Cas. 1913B, 763 (approving 7 per cent where evidence showed 7 per cent the prevailing return on long-time first-class securities, 8 per cent on ordinary commercial paper and the company loaned money to an allied utility in the same locality for 6 per cent); Shepard v. Northern Pac. Ry. Co., 184 Fed. 765; Central Rd. Co. v. Alabama Rd. Comm., 161 Fed. 925; Consolidated Gas Co. v. New York, 157 Fed. 849; Montana W. & S. R. Co. v. Morley, 198 Fed. 991, 1009; Louisville & N. Ry. Co. v. Brown, 123 Fed. 946; Missouri, K. & T. Ry. Co. v. Love, 177 Fed. 493; Cumberland T. & T. Co. v. Louisiana Rd. Comm., 156 Fed. 823; Cumberland T. & T. Co. v. Louisville, 187 Fed. 637; Des Moines W. Co. v. Des Moines, 192 Fed. 193; Louisville & N. R. Co. v. Alabama Rd. Comm., 196 Fed. 830; Western Ry. Co. v. Alabama Rd. Comm., 197 Fed. 954; Boyle v. St. Louis & S. F. R. Co., 222 Fed. 539; P. U. R. 1916A, 49, 244 U. S. 106, 37 Sup. Ct. 577, 61 L. ed. 1022, P. U. R. 1917E, 685. And see Brunswick & T. W. Dist. v. Maine W. Co., 99 Me. 371, 59 Atl. 537; Metropolitan Trs. Co. v. Houston & T. C. R. Co., 90 Fed. 683.

(a) Statement.—(1) "Such compensation must depend greatly upon circumstances and locality, among other things, the amount of risk in the business is a most important factor, as well as the locality where the business is conducted, and the rate expected and usually realized upon investments of a somewhat similar nature with regard to the risk attending them." Wilcox v. Consolidated Gas Co., 212 U. S. l.c. 48 (frequently quoted in later decisions). (2) "Whether we take the legal rate of profit by way of interest on loans of money, or the rate of profit which common experience shows to be the average, and therefore approximately a just, return from the use of other forms of property, both modes lead to the same result. We can find no better standard by which to measure what is a fair and just return for the use of railroad property under the conditions governing the business of conducting railroad transportation in this state." Central Ry. Co. v. Alabama Rd. Comm., 161 Fed. l.c. 996. (3) "They are therefore entitled to a return which approximates the rate of interest which prevails in other lines of industry in and about that part of Montana wherein their railroad is operated. . . . Eight per cent per annum is the legal rate of interest in the State of Montana, and within 2 per cent of what bankers have testified is a rate frequently demanded upon small loans in Carbon County, Montana, in which this railroad runs. So without fixing any rate, but merely for further illustration, we will hold to 8 per cent. . . . Enough has been said to demonstrate that under the order of the commission the complainant company falls far short of enjoying a reasonable return on capital invested, not to mention the element of some uncertainty which goes with the investment, and upon which investors are justified in expecting a chance of added profit to compensate the risk." Montana W. & S. R. Co. v. Morley, 198 Fed. l.c. 1007.

(b) Qualification.—"It seems to be generally held that in the absence of peculiar and extraordinary conditions, such as a more costly plant than the public service of the community requires, or the erection of a plant at an actual, though extravagant, cost, or the purchase of one at an exorbitant or inflated price, the actual amount of money invested is to be taken as the basis, and upon this a return must be allowed equivalent to that which is ordinarily received in the locality in which the business is done, upon capital invested in similar enterprises. In addition to this, consideration must be given to the nature of the investment, a higher return being regarded as justified by the risk incident to a hazardous investment. . . . [l.c. 191. Finding none of these elements present—l.c. 200—the court holds.] Ordinarily the return generally realized upon similar investments in the locality of the one under consideration is deemed fair and guaranteed to the investor." [l.c. 189] Coal & Coke R. Co. v. Conley, 67 W. Va. l.c. 189, *et seq.*

(c) Banking, Merchandising, Etc.—"We cannot approve the finding that no return yielding as much as 6 per cent upon the invested capital could be regarded as confiscatory, in view of the undisputed evidence, accepted by the master, that 8 per cent was the lowest rate sought and generally obtained as a return upon capital invested in banking, merchandising and other business in the vicinity; 7 per cent being the 'legal rate' of interest in Nebraska. Complainant had not such a monopoly nor were its profits 'virtually guaranteed' in such a sense as to permit the public authorities to restrict it to a return of 6 per cent upon its invested capital." Lincoln Gas & El. Co. v. Lincoln, 250 U. S. l.c. 267. See also this note (d), (2), *infra*.

(d) Reasons.—(1) *Return Not Guaranteed.*—"In passing upon the question [reasonableness of return] the fact should not be overlooked that no return whatever is guaranteed the owner of the public utility. Upon that score it occupies no better ground than the owner of capital invested in private enterprise. It follows that unless the maximum rate be placed at such a figure as is above the average rate of return upon reasonably safe investments in private ventures capital will naturally turn to channels in which no maximum limitation as to return exists." Home Tel. Co. v. Carthage, 235 Mo. l.c. 667. (2) *Obligations of Regulation.*—"An investment in a bank, in a factory, in a mercantile, manufacturing or agricultural business is substantially free from regulation and exempt from any duty to the public, except that of paying taxes. If the business in which such an investment is made is unprofitable its owners may promptly discontinue its operation until more prosperous days come and then return to their undertaking. An investment in a railroad which operates in many states is subject to regulation of its business by many governments. Its owners owe the duty to the governments and to the public to operate their railroad continually in days when its operation is unprofitable as well as when it is remunerative, a duty they must discharge under the penalty of the forfeiture of their property if they fail. In view of these facts they ought to be permitted to receive a return large enough to enable them to accumulate in prosperous days a surplus sufficient to enable them to protect their property in days of disaster and to make their average return through days of prosperity and adversity fair and just. . . . The legal rate of interest on a debt in Minnesota, in the absence of a contract, is 6 per cent, and by contract it may be 10 per cent per annum. . . . Rational investments in agriculture, manufacturing, mercantile and other industrial pursuits, and even well-secured loans, yield returns in Minnesota corresponding to these lawful rates. Investments in railroads and the returns thereon are at the risk of failures and partial failures of crops, of the disasters, delays and expenses of unusual storms, snow and cold, of the great financial disasters which occasionally prevent or delay the movement of traffic, and of the burden of continuous operation, whether profitable or unremunerative. It is an axiom in economics that the greater the risk the greater must the return be upon invested capital, and the conclusion is irresistible that a net return of 7 per cent per annum upon the respective values of the properties of these companies in Minnesota devoted to transportation is not more than the fair return to which they are entitled under the constitution of the United States." Shepard v. Northern Pac. Ry. Co., 184 Fed. 765, 815, reversed on other grounds in Simpson v. Shepard, 230 U. S. 352, 33 Sup. Ct. 729, 57 L. ed. 1511, 48 L. R. A. (N. S.) 1151. (3) *Attraction of Capital.*—(a) "We are entirely satisfied that no prudent business man would willingly incur all the risks of the business and be content to earn less than that [7] per cent of profit. And while many of us would not feel entirely willing to contribute to the earning of that much income we would [illegible] more unwilling to supply the capital for such an enterprise unless it might be allowed to earn, if it could, that much for us." Cumberland T. & T. Co. v. Louisville, 187 Fed. 637, 648. (b) "What would a prudent man acquainted with business (so familiar to readers of legal literature) do regarding such an investment if it were offered to him? I think he would take it, not with enthusiasm, but as fairly safe local property, promising a rate of return sufficiently above the local mortgage market to compensate for the additional and non-insurable hazard." Consolidated Gas Co. v. New York, 157 Fed. l.c. 872. (c) "Capital can be attracted to these enterprises only as there is confidence that fair returns under reasonably capable management will be allowed." Omaha & C. B. St. Ry. Co. v.

with the lowest rate which capital obtains (36), on the one hand as evidenced by the rate of interest demanded on small loans (37), and on the other by that paid on municipal (38) or government (39) bonds; as the interest of the public in utility enterprises subject to regulation extends to the maintenance of the credit of the utility (40), and sound business economy, and one might add "public policy," demands that utilities be permitted to enter the money markets and successfully compete with others requiring financial assistance (41), for if rates are to be reduced whenever dividends exceed the prevailing rate of interest, investors will seek other fields where the hazard is less or the opportunity greater (42).

§ 6. *IV. Prevailing Return on Comparable Enterprises.*—For a utility enterprise conceived and conducted as those with which this article treats, the better reasoned, as well as the later, cases of controlling authority, wherein the question has been presented for consideration, hold that such utilities may confidently expect, under the constitutional guaranties, a rate of return equivalent to that obtaining in comparable (involving similar risk) enterprises of the given locality (43), such as that received in banking, merchandising, manufacturing, agricultural and other pursuits (44). This, among other reasons, because utilities are not guaranteed a return (45), are subject to all the risks of business management (46) and, in addition thereto,

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Nebraska St. Ry. Comm., 103 Neb. 700. (d) "New capital cannot be obtained by public utilities at all, except where rates are such as will afford reasonable assurance, with efficient management, of earnings sufficient to care for legitimate fixed charges and establish for them a basis of credit. This does not mean that rates should be such as in themselves will supply new capital, but that they be such as to justify capital investments in competition with other business ventures. A public utility with rates providing only a 5 or 6 per cent return cannot secure new capital in competition with private business earning an 8 or 10 per cent return." Re Georgia Ry. & P. Co., P. U. R. 1921A, l.c. 177.

44. Lincoln Gas & El. Co. v. Lincoln, 250 U. S. 256, 39 Sup. Ct. 454, 63 L. ed. 968 (note 43, (c) *supra*); Shepard v. Northern Pac. Ry. Co., 184 Fed. 765 (note 43, (d), (2), *supra*).

45. Home Tel. Co. v. Carthage, 235 Mo. 664, 139 S. W. 547.

46. See, among many cases, note 43, *supra*; also notes 15, 26, *supra*.

47. Coal & Coke R. Co. v. Conley, 67 W. Va. 129, 67 S. E. 613; Shepard v. Northern Pac. Ry. Co., 184 Fed. 765; Home Tel. Co. v. Carthage, 235 Mo. 664, 139 S. W. 547.

48. See note 43, (d), (3), *supra*; also notes 17, 18, 40, 41, 42, *supra*.

49. See note 38, *supra*.

50. Spring Valley Wks. Co. v. San Francisco, 124 Fed. 574; see also note 39, *supra*, 54, *infra*.

51. Consolidated Gas Co. v. New York, 157 Fed. 849; see also note 29, *supra*.

52. Home Tel. Co. v. Carthage, 235 Mo. 664, 139 S. W. 547; see also note 43, (d), (1), *supra*.

53. Cumberland T. & T. Co. v. Louisville, 187 Fed. 637, 658 (where the competing utility charged lower rates and was admittedly earning a scant return, the return received in banking enterprises was considered not controlling).

54. Lincoln Gas & El. Co. v. Lincoln, 250 U. S. 256, 39 Sup. Ct. 454, 63 L. ed 968; Elizabethtown Gas L. Co. v. New Jersey Pub. Util. Comrs., N. J.——, 111 Atl. 729, P. U. R. 1920F, 1001; Coal & Coke R. Co. v. Conley, 67 W. Va. 129, 67 S. E. 613 (holding the return must be equivalent to the prevailing rate of return: "It is obvious that the courts have not, and cannot, establish any particular rate for all concerns, all classes of business and all commodities, as a limit upon the powers of the legislature to regulate it. To some extent, therefore, every case must stand upon its own circumstances in respect to the rate to be allowed as well as the valuation upon which it is to be calculated; but the rate is obviously affected to a lesser degree by particular circumstances than the valuation to which it is applicable." l.c. 640); Metropolitan Trs. Co. v. Houston & Tex. Cen. Rd. Co., 90 Fed. 683 (an early case); Re Milwaukee El. Ry. & L. Co. (Wis.), P. U. R. 1919A, 137, P. U. R. 1920D, 319; Re Peoples Gas Light Coke Co. (Ill.), P. U. R. 1920E, 497; Re Warrensburg El. L. H. & P. Co., 10 Mo. P. S. C. 245; Re Georgia Ry. & P. Co., P. U. R. 1921A, 177; Southwestern T. & T. Co. v. Houston, 268 Fed. 878.

Reason.—"It is a matter of common knowledge that owing principally to the world war the cost of labor and supplies of every kind have greatly advanced since the ordinance was adopted, and largely since this cause was last heard in the court below. And it is equally well known that annual rates upon capital and enterprise the world over have materially increased, so that what would have been a proper rate of return for capital invested in gas plants and similar public utilities a few years ago furnishes no safe criterion for the present or for the future." Lincoln Gas & El. Co. v. Lincoln, 250 U. S. l.c. 268 (modifying decree dismissing injunction proceedings so as to permit showing of effect of change). (2) "Unquestionably the circumstances of the cost of money should be given some consideration in fixing the rate of interest which is to be allowed the utility. . . . It would not be fair or equitable to the utility itself, nor would it serve public policy, to overlook the fact that the company has been required and may in the future be required to finance some of its additions and extentions through money secured at high rates of interest. We believe that the company should have relief . . . designed to place them on an 8 per cent earning basis as related to the fair value of the property." Re Milwaukee El. Ry. & L. Co., P. U. R. 1919A, l.c. 142. (3) "The complainant in this case has to pay wages and buy materials at present advances. In such case a percentage of return in an active business in which the risks, hazard and cost of operation had been increased is much less than the same percentage in previous years." St. Joseph Ry. L. H. & P. Co. v. Missouri Pub. Serv. Comm., 268 Fed. l.c. 270. (4) "To what extent the increase in prices may be due to an inflation of the currency or to any particular cause we do not know. What we do know is that the dollar of 1919 and the dollar of 1920 is worth less than the dollar of 1916 and still less compared with the dollar of the average year from 1911 to 1916." Elizabethtown Gas L. Co. v. New Jersey Pub. Util. Commrs. N. J.—111 Atl. l.c. 730. (5) "It should be further borne in mind that because of the decreased purchasing power of the dollar a return of 8 per cent now is not the equivalent of a 6 per cent return prior to the war. Re Georgia Ry. & P. Co., P. U. R. 1921A, l.c. 177.

Government Bonds.—"In the year 1919 the rate of interest had increased so that on securities of undoubted value, such as United States government bonds, the rate of interest instead of being 3 per cent, or perhaps less, had gone up to the neighborhood of 6 per cent. Obviously in such a situation an 8 per cent return in an active business in which the risks and hazards had been increased was much less than a rate of 8 per cent in 1913 when the Passaic case was decided. No allowance seems to have been made for this increase in the rate of interest. . . . This suffices to show that the amount of return allowed to the companies would probably be insufficient under present circumstances to attract capital to the business, and this was one of the important tests of justice and reasonableness of the rate as decided in the Passaic case." Elizabethown Gas L. Co. v. New Jersey Pub. Util. Commrs. N. J.—111 Atl. l.c. 730.

55. Doherty & Co. v. Toledo Rys. & L. Co., 254 Fed. 597, P. U. R. 1919C, 230; Re Lincoln Tr. Co. (Neb.), P. U. R. 1921 B, 157.

Service Below Cost.—"From his [Mayor's] testimony and arguments submitted in behalf of the city it does not appear that he had any confidence that this rate was adequate; for he says that in fixing upon it he was moved by the theory that the car rider, the car men and the car company each must sacrifice something in the present emergency. But the Mayor of Toledo has no right to demand of this franchiseless company that it render service to the city at a sacrifice nor has he the right to say to the employees of the company that they must work for less wages than their services are fairly worth. He ignores the fact that it is no sacrifice for the car riders of the city to pay any rate of fare which is what the service to them actually costs, and the economic truths that they should pay what the service to them costs, that the car men are entitled to a reasonable wage, and that the car company is entitled to a compensation which will allow it to live. No one has the right, whether an official or not, to ask either the car men or the company to make 'sacrifices' that the car riders may get service at less than cost, and, of course, the court can listen to no such proposition as that to support an insistence that an inadequate rate should be imposed." Doherty & Co. v. Toledo Rys. & L. Co., P. U. R. 1919C, l.c. 241; and see Western U. T. Co. v. Wyatt, 98 Fed. 335.

56. Spring Valley Wks. Co. v. San Francisco, 165 Fed. 667 ("In times of financial distress, when money is very much needed and not easily obtained, rates of interest go up, and many of those who most need money are forced to throw on the market property which otherwise they would hold. When unusual quantities of property are for sale by owners who must have cash prices fall. Thus it often occurs that high rates of interest are followed and counterbalanced by lower prices." l.c. 684).

57. Winona v. Wisconsin-Minnesota L. & P. Co.—Fed.—, P. U. R. 1921A, 146; Consolidated Gas Co. v. Newton, 267 Fed. 231, P. U. R. 1920F, 483; New York & Queens Gas Co. v. Newton, — Fed.—, P. U. R. 1921A, 530; and see note 54, *supra*.

Statement.—"Two things, however, seem tolerably clear: first, that though present prices may be somewhat too high to form a proper basis as unit prices, yet it is more than probable that a plane of prices much higher than the one existing before 1914 will continue for a considerable and perhaps for an indefinite period; second, that the defendant company, a public utility, not being prevented by contract from invoking a continuous fair return on a reasonable valuation, is in a position to rightfully demand revision upward of the prices charged for gas because of present condition of high values, high operating costs and high rates of return, even though the adjustment may fit a comparatively short period of years." Winona v. Winconsin-Minn. L. & P. Co., P. U. R. 1921A, l.c. 155.

In General.—"So far as I have found in the books a test of two years is enough. In the Minnesota Rate Cases, 230 U. S. 352, 469-472, 33 Sup. Ct. 729, 57 L. ed. 1511, 48 L. R. A. (N. S.) 1151, Ann. Cas. 1916A, 14, the rate fixed by the authorities for the Minneapolis & St. Louis Railway, the only one disturbed, was set aside on an experience of only one year. In Municipal Gas Co. v. Public Serv. Comm., 225 N. Y. 89, 98, 121 N. E. 772, P. U. R. 1919C, 364, a complaint was sustained which alleged the insufficiency of a rate for a period of only two years, 1917 and 1918. In Darnell v. Edwards, 244 U. S. 564, 37 Sup. Ct. 701, 61 L. ed. 1317, P. U. R. 1917F, 64, the period was thought too short, but it included only six months, and those not including the recent era of inflation. In Rowland v. Boyle, 244 U. S. 106, 37 Sup. Ct. 577, 61 L. ed. 1022, P. U. R. 1917E 685, a rate was upset upon a showing of only two months, coupled with opinion evidence of its being a fair test. Excepting these cases I know of no judicial ruling on what length of time is necessary." Consol. Gas Co. v. Newton, 267 Fed. l.c. 236.

Year 1919.—"The year 1919 is in this case 'a sufficient basis for the calculation of the cost of production and the "rate base" for a future long enough to call for some judicial action.' Municipal Gas Co. v. Public Service Commission, 225 N. Y. 89, P. U. R. 1919C, 364, 121 N. E. 772; Consolidated Gas Co. v. Newton, 267 Fed. 231, P. U. R. 1920F, 483; Kings County Lighting Co. v. Nixon, 268 Fed. 143." New York & Queens Gas Co. v. Newton, P. U. R. 1921A, [illegible] a restriction of return under regulation (47), as well as the ever-present necessity of attracting needed capital (48). Returns on utility property should exceed the yield on municipal (49) or government (50) securities and local mortgages (51) and should not be limited strictly to the prevailing return on comparable industries of the locality (52), especially where the utility is subject to unfair competition (53).

§ 7. V. *Fluctuations.*—Fluctuations in the factors upon which the reasonableness of the return is determined justify a higher return on utility property during periods of prevailing high costs (54). Clearly, an undue shifting of the burdens brought about through abnormal conditions upon utilities is not warranted that the public at large may be somewhat relieved thereby (55). A recent increase of apparent temporary character in the prevailing interest rates is insufficient to justify conclusively an increase in the return (56), but increased rates of return, coincident with general increased prices likely to continue for a comparatively short period of time (57), are sufficient upon which to base judicial action.

Radio Serves Western Power Companies

Proves More Dependable Than Telephone Communication in Some Mountainous Regions of Far West—Useful Both for Operating and Construction-Camp Service—Sets Are Inexpensive and Quickly Installed

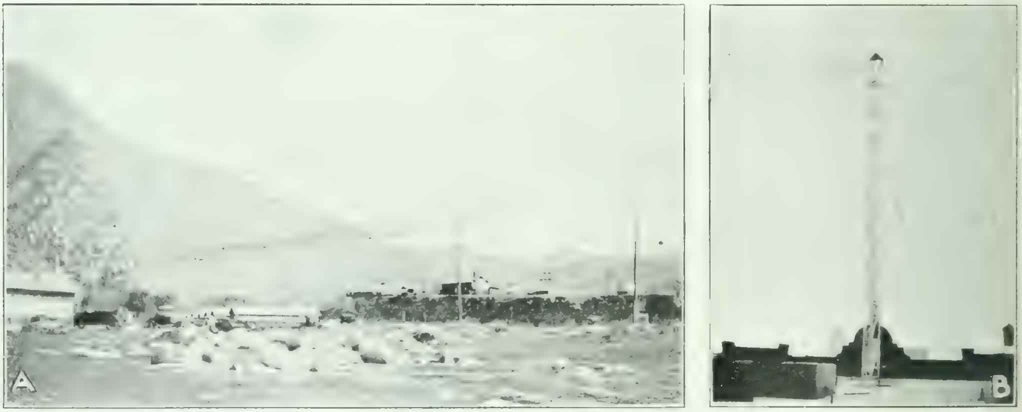

FIG. 1—RADIO COMMUNICATION PLAYS AN IMPORTANT PART IN THE CONSTRUCTION OF THE KERN CANYON DEVELOPMENT OF THE SAN JOAQUIN LIGHT & POWER CORPORATION

A—Aerial installation at Kern Canyon power house. B—Antenna on the roof of office building in Fresno.

A DEMONSTRATION of how effectively a power company can use radio was given as long ago as 1916, when the Northwestern Electric Company maintained radio communication continuously with an isolated generating station during and after a heavy storm, thus greatly expediting the repair of a serious transmission line break.* In 1917 all wireless operations by private individuals and companies were stopped by government order, but with the lifting of the ban after the war interest in the opportunities afforded by radio was greatly increased both by the much more effective apparatus developed during the war and by the larger number of men trained in the installation and operation of radio equipment.

The remote and inaccessible location of many generating plants on the Pacific Coast and the rough, unpopulated territory through which the long power lines—and hence the telephone lines also—are often carried present special inducements for Western power companies to use radio. Despite the limited experience thus far, the feeling on the Coast is decidedly favorable to radio as an adjunct to the power company's communication systems, and the common belief is that its importance will steadily increase. A résumé of features of radio systems used by two California companies is presented in the following paragraphs:

The extensions of the Southern California Edison Company's development in the Big Creek and San Joaquin River districts are being made in wholly uninhabited territory at altitudes ranging from 4,000 ft. to 10,000 ft. (1,200 m. to 3,000 m.). The snow and sleet conditions of winter time are such that telephone lines are not considered practicable where permanent reliable service is essential. The demands on the system of communication are the greater because of the complex transportation system involved. The large quantity of supplies, materials and equipment used on these operations, after leaving the railroad (construction headquarters at Cascada), is taken up an incline 7,000 ft. (2,100 m.) long with a 2,000-ft. (600-m.) rise and then over a 2-mile (3.2-km.) standard-gage railroad to the boat landing on Huntington Lake. Here the material is loaded on a barge and towed 5 miles (8 km.) to the upper end of the lake. Finally the freight is loaded on sleds and hauled about 12 miles (19 km.) over a mountain pass 2,300 ft. (700 m.) above the level of the lake and 9,300 ft. (2,800 m.) above sea level.

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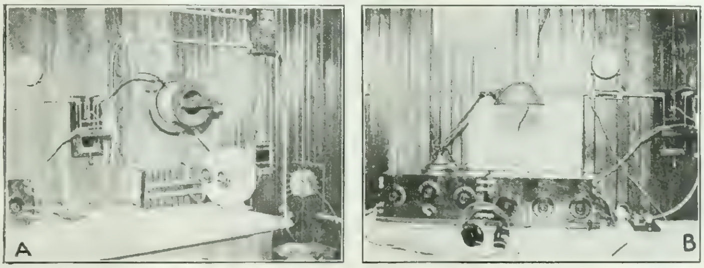
*See Electrical World, Jan. 1, 1916, page 41.

When the construction work was undertaken, decision was made to establish radio communication at three points, namely, Cascada, Camp 60 and Camp 61. Cascada is at an elevation of 5,000 ft. (1,500 m.) at the head of a canyon approximately 2,000 ft. (600 m.) deep with abrupt walls on three sides. Camp 60 is at an elevation of 7,000 ft. (2,100 m.), 7½ miles (12 km.) in an air line northeast of Cascada at the head of Huntington Lake. Camp 61 is 8 miles (13 km.) in an air line northeast of Camp 60, and although only 300 ft. (90 m.) above it, is on the other side of a mountain range which is 9,300 ft. to 10,000 ft. (2,800 m. to 3,000 m.) above sea level.

Because of the high altitude and the irregular topography, as well as the meager information available about radio communication in mountainous territory, considerable experimenting was done before the radio sets were finally built. The experiments were well justified, as is shown by the fact that radio sets which gave satisfactory service in the level country around Los Angeles were found to require about ten times as much power for transmission over corresponding distances in the mountainous country.



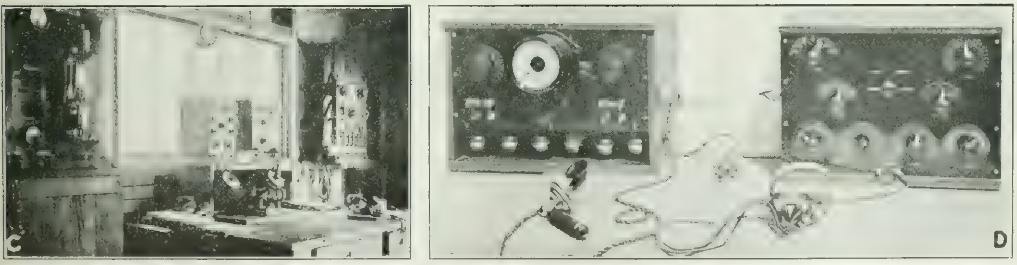


FIG. 2 — RADIO TELEGRAPH IS USED EXTENSIVELY FOR BOTH OPERATING AND CONSTRUCTION PURPOSES BY THE SOUTHERN CALIFORNIA EDISON COMPANY—TRANSMITTING AND RECEIVING SETS USED IN THE DIFFERENT STATIONS ARE SHOWN

The sets first used were of the tube type and could be employed either for the continuous-wave system or for tonal radiation, and thus served either for telephone or telegraph. The use of the telegraph was found to be the more practicable because of the comparative stability of the transmitting sets as well as its greater range under unfavorable atmospheric or topographical conditions. Although these were specially designed sets, they were built in twelve days.

The set at Cascada obtains its power for operation from the Big Creek No. 1 power plant there. At Camps 60 and 61 the sets are supplied by 220-volt, three-phase motors coupled to 32-volt direct-current generators and 1,500-volt direct-current generators. Under normal conditions the 32-volt generator furnishes power for the tube filaments and the 1,500-volt generator supplies the plates. In case of failure of the transmission line which supplies both Camp 60 and Camp 61, the power is supplied by the storage batteries of the mine locomotives which are in use at both camps. In this emergency the 32-volt generator is operated as a motor. In case of a breakdown of either the motor or the generators the radio sets may be used for telegraphic operation by means of switching facilities which use alternating current in both the filament and plates.

The antennas, which are practically the same for all three stations, consist of five No. 8 B. & S. copper conductors spaced 4 ft. (1.2 m.) apart and with 16-ft. (4.9-m.) spreaders. Large strain insulators are cut into the halyards, which consist of $\frac{9}{16}$-in. (1.42-cm.) cable. The masts for the antennas are in all cases tall pine trees which have been stripped of their branches. When experiments were under way at the outset it was found that a continuous-wave set radiating 2½ amp. antenna current at Cascada gave louder and clearer signals at Camps 60 and 61 than a damped-wave set radiating 4 amp. antenna current. The sets in use all operate on a 540-m. wave length, the normal radiation from the three stations being as follows: Cascada, 2.8 amp.; Camp 60, 1.8 amp.; Camp 61, 1.8 amp.

Only one stage of amplification is used at Camps 60 and 61. At Cascada one stage is always used and at certain times of the day, on account of local interference in the plant, it is usual to use two stages of amplification. During December, 1920, with the operators on duty eight hours a day, approximately 32,000 words were handled between Cascada and Camp 60. This included a considerable amount of private commercial communication.

The success which has attended the operation of the radio sets during the winter months under conditions where company officials regard it as doubtful if a metallic circuit could have been used have led to very satisfactory reports on the use of radio sets, and additional studies and investigations are now contemplated. The company has announced that a radio station somewhere near the proposed Colorado River development is proposed so that direct communication may be maintained between that point and the offices in Los Angeles.

When the San Joaquin Light & Power Corporation last year undertook the construction of the Kern Canyon hydro-electric development, which is 125 miles (200 km.) from the headquarters office in Fresno, telephone communication with the site was entirely inadequate. Radio communication was decided upon, and within a month thereafter two 2-kw. sets, one at the site and one at Fresno headquarters, were installed at a total cost for the two stations of approximately $750. Their operation is reported to be entirely satisfactory, and the plant is virtually being built by wireless. The stations are licensed for limited commercial operation on a wave length of 425 meters, and operators holding at least second-grade commercial licenses are required by law for their operation.

Transmitting and Receiving Sets

The transmitting equipment at both stations is the spark or damped-wave system. Ordinary distribution transformers of 2-kw. rating are used to raise the voltage from 220 to 6,600. Other parts of the equipment, such as condensers, spark gap, oscillation transformers, key, etc., were purchased from radio manufacturers and assembled under the direction of R. C. Denny, operating engineer San Joaquin Light & Power Corporation. The receiving apparatus used is the completely self-contained cabinet type, such as can be purchased in the open market from any one of several manufacturers. For this work a short-wave regenerative receiver was selected, and two stages of amplification were used in connection with supersensitive telephone receivers.

At the Fresno station a ten-wire inverted-L-type aërial is suspended between two 45-ft. (13.7-m.) wooden towers above the roof, making a total of 75 ft. (23 m.) above the ground. A ground is obtained by connection with the water pipes. At the power house site a ten-wire fan-type aërial is stretched between two 75-ft. poles set 75 ft. apart. As the ground conditions at this point were very poor owing to the small amount of subsoil and to a gravel bed that extended a considerable depth, a heavy stranded copper cable was buried under the aërial and a heavy lead was led thence to a pit kept filled with water.

In the absence of an alarm or calling device, a schedule of operation is fixed each morning for the coming day, the operator reporting at the beginning of the day and after clearing all business in hand setting a time not actually operating the sets the operators are kept busy at the drafting table or some other clerical work so that their time is fully employed.

Thus far, under all weather conditions, the operation of these two stations has been very satisfactory, power officials report, despite the necessity for erecting the aërial at the site not far from a high-tension line. At first some difficulty was experienced from inductive interference due to static leaks on high-voltage insulators. This was materially relieved by putting a large-capacity variable condenser in the ground lead and detuning the secondary circuit off reasonance. Of course this decreased the efficiency of the set, but since the communication ordinarily requires only about one-quarter the rated capacity of the installation, that fact was immaterial. During the summer months, when static and atmospheric disturbances are more prevalent, somewhat more power is required for operation than at other times of the year.

This company is also operating in an experimental way two radio-telephone stations and has begun the assembly of portable radio sets which are to have a range of up to 25 miles (40 km.) and will be used to keep the various construction camps in communication with the main or base camps during the construction of the Kings River hydro-electric plant. The latter camp will be equipped with a larger radio set intended for constant communication with the Fresno head office. The present indications are that during the construction of extensions to this company's system in the mountain regions radio will be depended upon as the chief means of communication.

By way of illustrating the flexibility of radio in power-company service, the Fresno operator recently reported: "During a general storm in the valley we were completely out of touch with our Bakersfield steam plant on account of both telephone lines going down. By relaying over about 20 miles (32 km.) of telephone line from the nearest radio station, we were able to communicate with the Bakersfield plant and thus render assistance to dispatchers in reaching a plant not included among those that radio was to serve."

In discussing plans for the use of radio on the system of the Southern Sierras Power Company, R. H. Halpenny, electrical engineer for that company, recently said: "Our plan now is to make use of the transmission line as an aid to wireless transmission, since previous tests disclosed the fact that by placing the aërials with a certain relation to the transmission line the effect at the receiving end was very much intensified. This method might be referred to as 'wired wireless' and is sufficiently important to be taken advantage of."

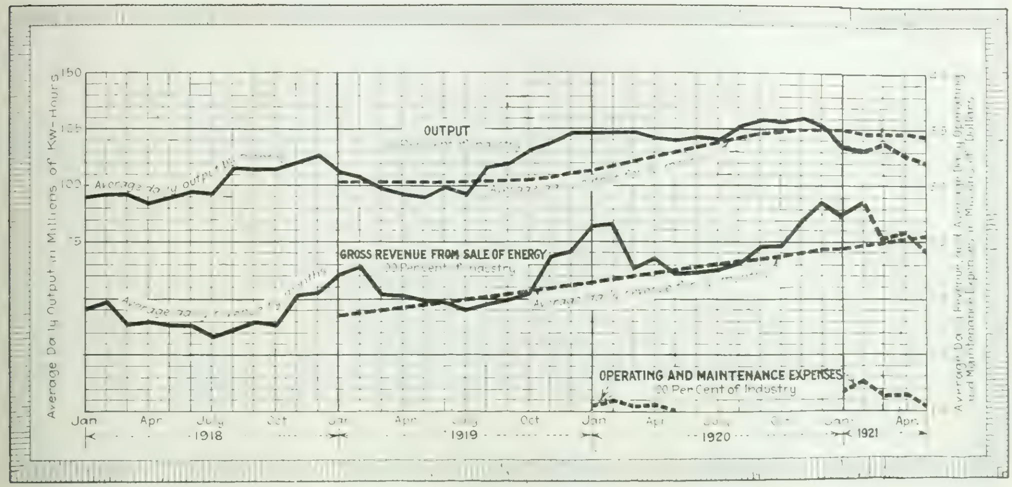
Less than 7 per Cent of Average Family Income Goes for Utility Services

Less than 7 per cent of the average yearly income of Ohio families is spent for public utility service according to figures compiled by the Department of Home Economics of Ohio State University. This compilation shows that the actual amount spent in 1920 by the average family having an annual income of $1,500 to $6,000 for the services of the utility companies was only 6.49 per cent of the total income.

The families included in the survey spent 1.01 per cent of their income for electricity, 2.27 per cent went for street-car rides, 1 per cent for telephone service and 2.45 per cent for gas.

The compilation shows that in a family where the income was $2,700 for the year 1.78 per cent was spent for gas, 0.78 per cent for electricity, 1.33 per cent for the telephone and 1.44 per cent for street-car service. In comparison with the small amount that is spent for utility services, household budget experts of large banking concerns and industrial plants in the state estimate that 43 per cent of the average income is spent for food, 17 per cent for rent and taxes, 13 per cent for clothing and 20 per cent for miscellaneous items, such as doctors' and dentists' bills, amusements, charities, savings, books, etc. The compilation plainly shows that, although the utility services are of utmost and vital importance in the life of every one, the amount spent for them is of minor importance in the average family budget.

Slight Industrial Curtailments Continue



AVERAGE DAILY OUTPUT LOWEST SINCE SEPTEMBER, 1919

RETURNS of electric light and power operation received by the ELECTRICAL WORLD for the month of May indicate a slight decline in industrial activity throughout the country with the exception of a few sections devoted to industries largely affected by seasonal demand. The curtailment in consumption of electrical energy for power purposes was not large but was sufficient to offset the increased activities shown in some industries. The average daily output of 110,100,000 kw.-hr. was the lowest central-station output reported since September, 1919.

The most encouraging fact derived from the returns is that while the gross revenue for the month had increased by $8,500,000 over that reported for May, 1920, the operating and maintenance expenses, exclusive of interest, taxes, depreciation and sinking fund, had increased by only $950,000 for the same period. A close study of the returns indicates that this decrease in the operating ratio was confined almost exclusively to the companies having steam and combined steam and hydro-electric generating systems.

Industrial activity in New England was slightly improved during May, many of the larger textile mills operating at above 90 per cent capacity. The shoe manufacturers also reported increased activity, but other manufacturing industries in this section reported operations about on a par with those of the previous month. However, the slightly increased consumption of electrical energy for power purposes was more than overcome by the decreased lighting load due to the advancing season, resulting in an average daily central-station output of about 400,000 kw.-hr. less than that reported for April.

Production in the iron and steel industry during May was at the lowest ebb for many years, operations being reported at not more than 25 per cent of capacity. Added to this decreased energy demand by the iron and steel industry of the North Atlantic States was a strike of large proportions in the paper and printing industry of that section. On the other hand, in the South Atlantic States the textile mills, which consume more than 40 per cent of the energy sold to power customers by the central-station companies of that section, reported that only about 1 per cent of the cotton spindles were idle during May. The de-

TABLE I—CENTRAL-STATION RETURNS FOR TWELVE MONTHS

	Percentage of Installed Ratings Represented	Kw.-Hr. Output (Companies Reporting)			Percentage of Installed Ratings Represented	Revenue from the Sale of Energy (Companies Reporting)		
		1920 Thousands	1919 Thousands	Per Cent Increase		1920 Thousands	1919 Thousands	Per Cent Increase
June	71	2,630,831	2,175,645	20.2	66	$44,434	$35,528	24.5
July	71	2,677,131	2,234,215	20.0	66	46,608	36,265	28.5
Aug	71	2,769,175	2,303,099	20.1	66	47,410	36,713	29.1
Sept.	71	2,734,179	2,327,460	17.4	66	49,224	38,209	28.5
Oct.	71	2,797,625	2,499,488	11.9	66	51,370	41,055	25.1
Nov.	71	2,741,705	2,503,402	9.6	66	54,620	44,711	22.0
Dec.	71	2,792,554	2,648,746	5.4	66	57,697	48,580	18.6
		1921	1920			1921	1920	
Jan.	76	2,765,632	2,943,349	-6.0	70	58,855	50,861	15.8
Feb.	76	2,453,671	2,711,800	-9.4	70	55,540	48,633	14.3
Mar.	77*	2,806,609	2,989,581	-6.1	72*	55,513	49,071	13.3
April	78†	2,675,949	2,895,067	-7.0	72†	55,328	49,064	12.8
May	78‡	2,660,883	2,891,570	-8.0	72‡	53,967	47,861	12.7

	Percentage of Installed Ratings Represented	Operating and Maintenance Expenses (Companies reporting			OPERATING RATIO					
					Steam Plants		Hydro Plants		Combined Systems of Steam and Hydro	
		1921 Thousands of Dollars	1920 Thousands of Dollars	Per Cent Increase	1921	1920	1921	1920	1921	1920
Jan	40	14,562	13,085	11.3	56.1	55.3	26.8	27.0	38.1	45.6
Feb.	43	15,085	13,640	10.5	55.6	54.5	22.9	26.0	44.1	47.3
Mar	53	18,757	17,249	8.7	56.1	57.7	23.4	19.6	40.2	44.8
April	53	17,816	16,641	7.1	53.0	56.5	23.9	19.8	41.4	43.3
May	53	17,169	16,612	3.3	55.4	56.8	24.2	22.9	40.6	44.8

*Includes estimates for thirty-nine companies, representing 4.2 per cent of the total installed rating of all central stations.

†Includes estimates for forty-six companies, representing 9.5 per cent of the total installed rating of all central stations.

‡Includes estimates for seventy-four companies, representing 16.7 per cent of the total installed rating of all central stations.

TABLE II—CENTRAL-STATION RETURNS BY SECTIONS OVER A TWELVE-MONTH PERIOD

	Month	Percentage of Installed Ratings Represented	New England States 1920 Thousands	New England States 1919 Thousands	New England States Per Cent Increase	Percentage of Installed Ratings Represented	Atlantic States 1920 Thousands	Atlantic States 1919 Thousands	Atlantic States Per Cent Increase	Percentage of Installed Ratings Represented	North Central States 1920 Thousands	North Central States 1919 Thousands	North Central States Per Cent Increase	Percentage of Installed Ratings Represented	South Central States 1920 Thousands	South Central States 1919 Thousands	South Central States Per Cent Increase	Percentage of Installed Ratings Represented	Pacific and Mountain States 1920 Thousands	Pacific and Mountain States 1919 Thousands	Pacific and Mountain States Per Cent Increase
KW.-HR. OUTPUT	June	82	189,934	149,607	26.5	66	865,714	721,688	19.9	74	855,013	681,780	25.5	56	132,733	99,660	33.2	79	587,437	522,901	12.2
	July	82	190,668	159,000	20.0	66	881,241	714,485	23.5	74	841,351	702,302	19.7	56	138,937	106,460	30.1	79	614,934	551,959	13.4
	Aug	82	194,028	171,002	13.5	66	905,170	728,097	24.2	74	891,712	750,787	18.6	56	147,082	111,573	32.0	79	631,183	541,640	16.5
	Sept.	82	194,730	170,593	14.1	66	905,872	758,737	19.5	74	878,237	758,017	15.9	56	147,524	113,649	30.0	79	607,816	526,464	15.5
	Oct.	82	196,310	191,132	2.7	66	964,739	841,694	14.5	74	896,241	817,757	9.5	56	157,267	126,769	24.1	79	583,068	522,136	11.7
	Nov.	82	193,231	183,624	5.4	66	953,436	825,011	15.5	74	895,229	861,352	10.5	56	144,889	125,438	15.0	79	554,920	507,977	9.2
	Dec.	82	210,494	227,403	7.4	66	969,909	917,945	5.7	74	903,628	852,264	5.9	56	140,485	133,419	5.3	79	568,038	517,715	9.6
			1921	1920			1921	1920			1921	1920			1921	1920			1921	1920	
	Jan.	81	200,269	247,800	-19.2	77	1,003,223	1,043,650	-3.9	73	860,643	956,078	-10.0	62	144,936	145,336	-0.3	81	556,561	550,685	1.1
	Feb.	81	178,694	216,890	-17.6	77	902,030	970,539	-7.0	73	789,539	882,873	-10.6	63	131,654	132,537	-0.7	81	451,754	508,961	-11.2
	Mar.	81	205,348	230,309	10.8	79	1,029,120	1,119,428	-8.1	73	894,500	941,893	-5.0	63	139,381	136,017	2.4	81	538,260	561,934	-4.2
	April	81	196,680	227,008	-13.3	79	963,659	1,052,716	-8.4	73	828,457	894,028	-7.3	63	132,075	135,421	-2.5	88	555,078	586,894	-5.4
	May	82	190,971	219,294	-12.9	79	933,883	991,840	-5.8	73	820,546	901,929	-9.0	63	134,321	138,392	-2.9	89	581,162	640,115	-9.2
REVENUE			1920	1919			1920	1919			1920	1919			1920	1919			1920	1919	
	June	82	$4,948	$3,778	30.5	65	$16,525	$13,449	22.1	57	$12,412	$9,776	26.9	54	$2,849	$2,127	33.9	79	$7,700	$6,398	20.5
	July	82	5,009	3,802	28.5	65	16,899	13,438	25.5	57	12,822	9,793	30.9	54	2,747	2,194	35.0	79	9,131	6,948	31.5
	Aug.	82	5,075	4,093	24.0	65	17,210	13,731	25.9	57	13,497	10,151	32.9	54	3,168	2,281	38.1	79	8,460	6,457	31.1
	Sept.	82	5,409	4,296	25.9	65	18,081	14,456	24.5	57	13,834	10,522	31.5	54	3,262	2,386	36.5	79	8,638	6,549	32.0
	Oct.	82	5,675	4,623	22.7	65	19,201	15,722	22.0	57	14,458	11,667	23.9	54	3,504	2,551	37.3	79	8,532	6,492	31.5
	Nov.	82	5,898	5,017	17.5	65	20,938	17,119	22.2	57	15,158	12,561	20.8	54	3,853	2,910	32.4	79	8,775	7,104	23.5
	Dec.	82	6,548	5,744	14.0	65	22,332	19,149	16.7	57	16,004	13,142	21.8	54	3,722	3,113	19.8	79	9,091	7,432	22.3
			1921	1920			1921	1920			1921	1920			1921	1920			1921	1920	
	Jan.	81	6,379	6,170	3.5	74	22,180	19,225	15.3	59	16,818	14,436	17.3	62	4,155	3,484	19.3	81	9,323	7,546	23.6
	Feb.	81	5,925	5,728	3.4	74	21,492	18,327	17.4	59	15,971	14,070	13.6	62	3,915	3,329	17.6	81	8,237	7,179	14.7
	Mar.	81	5,784	5,566	3.8	76	21,822	18,934	15.3	59	15,853	14,103	12.4	63	3,747	3,246	15.5	81	8,307	7,222	15.0
	April	81	5,665	5,554	2.0	76	21,594	18,609	15.8	60	15,506	13,822	12.2	63	3,744	3,312	13.2	88	8,819	7,767	13.4
	May	82	5,366	5,342	0.5	76	20,759	17,611	17.8	60	14,952	13,561	10.3	63	3,572	3,179	17.0	89	9,318	8,168	14.0
OPERATING EXPENSES:			1921	1920			1921	1920			1921	1920			1921	1920			1921	1920	
	Jan.	34	$1,098	$1,288	-14.7	48	$6,373	$5,411	17.8	28	$3,941	$3,451	14.2	37	$1,015	$905	12.2	54	$2,135	$2,030	5.2
	Feb.	35	1,069	1,242	-13.9	53	6,799	5,937	14.5	29	3,958	3,445	14.8	44	1,217	1,053	15.5	55	2,042	1,965	3.9
	Mar.	45	1,576	1,651	-4.5	59	7,969	7,241	10.0	35	4,570	4,228	8.2	51	1,776	1,514	17.2	79	2,866	2,614	9.7
	April	45	1,418	1,479	-4.1	59	7,590	7,168	5.9	36	4,347	4,112	5.7	51	1,567	1,403	11.6	79	2,894	2,479	16.8
	May	48	1,489	1,517	-1.8	56	6,919	6,652	4.0	37	4,262	4,287	-0.6	52	1,553	1,459	6.5	81	2,947	2,698	9.3

creased lighting load and the curtailed power requirements of the northern portion of the Atlantic section resulted in an average daily output by the electric light and power companies of 2,600,000 kw.-hr. below that reported for April.

Reports from the Central States indicate that factory and mill operations were about stable during May, with a probable slight decrease in the energy consumption by the iron and steel industry and the automobile and related industries. A decreased central-station daily output of 1,700,000 kw.-hr. is indicated by the returns from the Central States, much of which, of course, is due to decreased lighting requirements.

It would appear from the returns that the industrial depression has at last hit the Northwest in no uncertain manner. Reports from electric light and power companies in Washington indicate generally decreased energy requirements, these being 7 per cent under those of April. This decreased central-station load seems to be confined to the extreme Northwest, however, as reports from the Mountain section show an increased output of about 2.2 per cent. Both California and Oregon also show slight general increases over April.

Returns for the first five months of the year show that the average operating ratio of systems having steam plants only was 56.9 in 1921 and 58.1 in 1920; systems having hydraulic plants only had an average operating ratio of 24.4 in 1921 and 23.9 in 1920; and systems having both steam and hydro plants reported average operating ratio of 41.9 in 1921 and 45.7 in 1920.

TABLE III—AGGREGATE OPERATING RATIO OF COMPANIES REPORTING DATA MONTHLY TO THE "ELECTRICAL WORLD"

Type of Generating Plant and Month	New England States				Atlantic States				North Central States				South Central States				Mountain and Pacific States			
			Average for Year				Average for Year				Average for Year				Average for Year				Average for Year	
	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920
Steam Plants:																				
January	54.0	60.8	54.0	60.8	53.5	50.9	53.5	50.9	61.2	61.8	61.2	61.8	53.1	53.7	53.1	53.7	69.0	60.5	69.0	60.5
February	54.3	59.5	54.2	60.3	52.3	53.0	52.7	52.1	63.0	57.9	62.1	59.8	59.1	51.2	56.2	52.3	60.2	60.3	64.3	60.3
March	64.0	70.0	56.7	62.5	54.5	56.7	53.3	53.7	58.4	59.7	60.8	59.8	53.3	50.9	55.0	51.9	68.4	62.5	65.9	61.2
April	59.4	63.5	57.3	62.7	50.9	54.3	52.8	53.8	54.8	61.2	59.3	60.2	54.1	52.8	54.7	52.1	53.7	53.7	61.8	58.6
May	63.2	69.1	58.3	63.8	56.2	58.6	53.4	54.5	54.7	63.3	58.5	60.8	53.3	56.0	54.4	53.0	55.0	57.0	59.9	58.3
Hydro Plants.																				
January	26.5	35.2	26.5	35.2	21.2	21.2	21.2	21.2	25.0	20.8	25.0	20.8	26.4	20.1	26.4	20.1	27.5	27.3	27.5	27.3
February	30.1	46.5	26.8	35.6	20.1	20.6	20.7	20.9	24.1	20.6	24.6	20.6	28.6	21.4	27.4	20.5	23.9	27.9	26.0	27.6
March	29.9	30.0	26.9	35.3	21.0	20.6	20.8	20.8	23.0	20.6	23.5	20.6	30.4	23.2	28.4	21.3	24.9	19.0	25.8	25.6
April	24.6	34.7	26.5	35.2	18.2	18.8	20.2	20.3	24.8	20.8	24.2	20.7	22.4	25.0	26.8	21.2	27.3	19.2	26.0	24.2
May	26.5	25.6	26.5	34.3	15.5	17.4	19.2	19.7	21.5	20.1	22.5	20.5	27.9	21.2	27.1	21.2	29.8	22.9	26.6	24.0
Combined Systems of Steam and Hydro Plants:																				
January	45.3	53.5	45.3	53.5	43.5	45.8	43.5	45.8	39.5	38.6	39.5	38.6	38.6	46.6	38.6	46.6	35.2	45.6	35.2	45.5
February	44.3	[illegible]	44.7	58.8	41.8	41.9	42.6	43.8	42.4	49.8	41.9	48.2	41.7	39.6	40.5	42.0	39.6	43.8	37.4	44.7
March	49.7	53.8	47.3	56.0	39.7	47.3	42.0	45.3	41.5	46.0	41.8	47.3	38.6	39.2	40.2	41.2	36.4	39.7	36.9	43.0
April	46.6	48.5	47.1	53.5	42.9	43.9	41.9	44.8	45.0	48.3	42.7	47.5	43.6	48.6	40.7	42.8	37.0	36.8	37.0	[illegible]
May	49.2	48.5	47.6	52.3	39.8	44.2	41.4	44.7	47.0	52.8	43.7	48.8	40.7	39.6	40.6	42.2	35.0	38.3	36.4	40.3

Readers' Views and Comments

This is a readers' forum. Comments on questions before the electrical industry presenting economic, financial, engineering or commercial aspects and new or supplementary viewpoints on published articles are cordially invited

Meter Policy That Has Reduced Complaints

To the Editors of the ELECTRICAL WORLD:

During the few years just past a change in the method of handling removal of meters has been inaugurated by the Minneapolis General Electric Company that has not only effected a great economy but has speeded up the service rendered very materially. Formerly where premises were vacated the meter was taken out within a very few days. The present practice is to seal the service fuses and meter and leave it in position for a period of three months unless it is evident that energy will not be used again at this address. During the year approximately 8,500 meters were sealed in this way and all but 375 of them were in service again within the three-month period, thus obviating removing and resetting in a very short time.

One of the most important features of the work is that known as "matching of orders." By this is meant a very careful and prompt comparison of installation and removal orders in order to prevent the removal of a meter after it is in service again by a succeeding tenant. This overlapping may occur by a matter of minutes and unless very carefully checked will cause a most annoying interruption of service to the consumer, and a brand new consumer at that. As an example of what may occur, Mrs. Jones comes in and leaves word that she is moving that day. An order goes through to read and seal her meter and render final bill. There being no question as to credit or other details, this type of order goes through very quickly. On the same day Mrs. Smith comes in and signs a contract for service at this location. Her order is slightly delayed for credit approval and checking for availability of service and reaches the meter department after the take-out or seal order for the same address. Without careful matching there is more than a 50-50 chance that the meterman will go there and find a meter already in. Before he can report this another man gets around and seals the meter and Mrs. Smith finds herself and family that night in a pitch-dark house. As a result the complaint which she promptly telephones in to the trouble department is in a tone that requires some diplomacy to soften if her good will toward the company is not to be sacrificed.

With the present system a mistake of this kind very rarely occurs as shown by the trouble department records. During the entire year there were only 1,890 calls that could in any way be traceable to meters or metering. By far the larger portion of these were cases where the order was received too late in the day to give service through regular channels and the trouble-man was assigned to give emergency service until the following day. Taking all the work handled during the year by the meter department and spreading it over the total number of consumers, it is found that the average labor cost per consumer per year is only 63 cents.

S. B. HOOD.

Minneapolis General Electric Company,
Minneapolis, Minn.

Discussion on Inductive Interference at A. I. E. E. Convention

To the Editors of the ELECTRICAL WORLD:

May I request the courtesy of inserting in the ELECTRICAL WORLD a correction to your report of my remarks at the Salt Lake City Convention of the A. I. E. E.? At the top of page 10 of your issue of July 2, 1921, the condensed report needs correction in several particulars.

First—In reference to the matter of interference from 220,000-volt lines, I stated that telephone engineers so far as I knew were not pessimistic as to the success of superpower lines, including the ability to solve any interference problems which might arise. The inference might be drawn from your report that there extra-high-voltage transmission line over a transmission is an advantage from an interference standpoint of the line of present upper voltage practice, say 100,000 volts. This is, of course, contrary to the fact, for, with conditions otherwise the same, there would be a greater tendency for the higher voltage line to interfere, but even so I am not pessimistic as to the ability of power and telephone engineers to solve successfully any such problems as may arise.

Second—The statement that I attributed inductive interference to the transformer requires a more complete report to be understood. The discussion related to the source of triple harmonics, and I stated that past experience indicated that transformers with grounded neutrals were much the more important source, rather than corona, which was then being considered.

Third—As regards star-star-connected transformers, I stated that nothing had developed to make the star-star connection more desirable from an interference standpoint; it has always been undesirable on account of its relatively large tendency to cause triple harmonics in the line. I stated that the addition of the tertiary delta winding is beneficial, just the opposite of your report, and that a still better connection is the full delta star, since that gives a larger capacity (lower impedance) delta for shunting triple harmonics from the line.

Fourth—In reference to shell and core type transformers my exact words were: "As regards the production of third harmonic neutral and residual currents, the three-phase core type transformer in particular cases may not have any particular advantage over the shell type or three single-phase units."

At the bottom of page 12 you refer to my discussion of Mr. Lewis' paper. That discussion pointed out that the data of the paper itself were sufficient to throw out the transformer hypothesis for the source of the triple harmonics observed in those tests. I also showed calculations based on the assumption of the line as the source which agreed very well with the observed results of test 44 and explained the inconsistency in Fig. 22 pointed out by Mr. Lewis. Contrary inferences might be drawn from your report.

LIVINGSTON P. FERRIS,
Department of Development and Research.
American Telephone & Telegraph Company,
New York City.

Station and Operating Practice

A Department Devoted to Problems of Installation,
Operation and Maintenance of Equipment for Economical Generation and
Distribution of Electrical Energy

Recent Central-Station Equipment Costs

FROM a tabulation of equipment costs presented to the Massachusetts Department of Public Utilities by one of the larger companies supplying electric service the accompanying items are taken because of their usefulness in plant estimates. As a rule these items are quoted at the factory or warehouse price, freight and installation charges being extra. The apparatus listed was purchased during the periods indicated in the table, which covers the time from December, 1918, to March, 1921.

FIELD EDITOR ELECTRICAL WORLD.

Boston, Mass.

RECENT COSTS OF CENTRAL-STATION EQUIPMENT

[illegible]	[illegible]
Dec. 1, 1918, to June 30, 1919	
[illegible]	[illegible]
[illegible] D 22	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
One power-factor meter	[illegible]
One 5-amp. a.c. ammeter	[illegible]
One 300-amp. 15,000-volt oil circuit-breaker	[illegible]
[illegible]	6,870 00
[illegible]	1,359 00
July 1, 1919, to June 30, 1920.	
[illegible]	240 00
Six pieces wire screen, 11 ft. 10 in. by 16 ft. 6 in.	110 00
Six Negus-Tiffany coal agitators, installed	2,046 77
One 10-in. Foxboro recording thermometer	[illegible]
[illegible]	273 60
One 60-kw. 2,300-volt I.R.S. regulator	[illegible]
Two 46-kva. 2,300-volt I.R.S. regulators	[illegible]
[illegible]	90 75
[illegible]	900 00
Thirty-five 4-amp. magnetite arc lamps	1,530 00
[illegible]	[illegible]
July 1, 1920, to March 31, 1921.	
Two Negus-Tiffany coal agitators	[illegible]
Three underfeed stokers, fourteen-retort	[illegible]
Three Bigelow boilers, 1,266 hp. each (not installed)	[illegible]
[illegible]	16,510 86
Two Detrick arches for stokers	2,020 00
Three Foster superheaters	20,900 00
[illegible]	52 00
[illegible]	60 50
One three-way ammeter switch	12 41
One eight-point potential receptacle	[illegible]
Two eight-point potential receptacles, synchronous type	25 80
[illegible] transformers	5,990 00
Two 300-amp. 15,000-volt type F K oil circuit breakers	465 92
Two overload attachments for circuit breakers	17 92
Fifty 1-A induction relays	1,320 00
One Frahm switchboard frequency meter 52.6 to 67.5 cycles	79 75
[illegible]	82 60

Experience with Grounded Pins and Crossarms

A STUDY of the effect of grounding insulator pins and hangers and crossarms was discussed at a recent meeting of the Northwest Electric Light and Power Association. Briefly summarized, the conclusions from the data collected are as follows: For wood crossarm construction, opinion and practice are nearly unanimous in favor of ungrounded insulator pins and hangers, irrespective of voltage or of whether or not the system neutral is grounded. Widespread experience has shown a definite and important superiority in insulator performance, arising both from lessened dielectric stresses and from less likelihood of damage in case of insulator flashover. Insulators of much higher rating appear to be necessary to give even approximately as satisfactory performance when pins are grounded. Trouble from burning of crossarms or poles with ungrounded pins appears to be inconsiderable except under exceptional climatic conditions such as those obtaining in California.

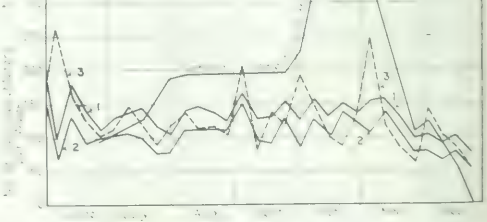
For steel crossarm construction on wood poles experience appears to be about equally divided as to grounding of arms. In some cases there has been trouble from burning of the pole at point of attachment if the arms are not grounded or bonded together. Apparently sound practice would be not to ground steel arms unless experience under the particular conditions obtaining has shown grounding to be desirable.

FIELD EDITOR ELECTRICAL WORLD.

San Francisoo, Cal.

Curves Aid Meter Department in Keeping Records

IN ORDER to show the progress of the meter department's work graphic records are charted weekly by the Worcester (Mass.) Electric Light Company's distribution department. This curve sheet shows the number of meters installed during each week, the net gain per week, the number transferred and the total number of meters in service. Another curve, No. 5, shows a temporary condition. This shows the number of service connections at the end of each week on which no meters were installed on account of inability to obtain them in large enough number from the manufacturers. It will be noted that in the month of December, when



WORK OF THE METER DEPARTMENT IS EASILY VISUALIZED BY CURVES SUCH AS THESE meters were received in larger numbers, the curve dropped to zero.

Curves of a similar nature have been prepared for helping the management of this company in several ways. Some of them have already been described in Electrical World, and more will be shown in later issues.

J. M. Hardy,
Superintendent.
Worcester Electric Light Company,
Worcester, Mass.

Some Methods Used to Clean Condenser Tubes

CLEANING condenser tubes is a problem on which various methods have been tried with different degrees of success, depending on the deposit found in the tubes. The baking method has been successful where the deposit is light and gummy. The circulating water is cut off and steam turned in to bring the temperature up to about 212 deg. This bakes the light deposit and it curls up. When the circulating water is again brought up it washes the tubes clean. This method is rather dangerous as the shell may be cracked or stay rods broken due to unequal expansion. However, it is a quick, effective method and is used successfully in many plants.

The brushing or scraping method is a common one. The early attempts were by using brushes or scrapers on rods and running them through by hand. This took a long time and the labor cost was excessive. Later, plugs were developed, soft rubber plugs, rubber plugs with abrasives, plugs cut from packing with nails driven through them, plugs with flat coiled steel springs, plugs with wire brushes, which were shot through the tubes with air or water. This cut down on time and labor and gave as good results as scrapers. In many cases where soft rubber plugs were used it was found that a hard scale would gradually form on the tubes and the heat transfer would be cut down as much as 200 B.t.u. A method of removing this hard scale was then necessary. Sand blasting has been used with fair success. Tubes have been sand blasted in place, the sand blast being so rigged that four men could work at once. The turbine-driven revolving cleaner, similar to the boiler-tube cleaner, is also used, but in tubes 20 ft. long and 1 in. diameter this process is found to be very slow and tedious. At first there was danger of cutting the tubes but lately cleaners have been developed which do not touch the tubes.

Chemicals are used to some extent, more in England than in this country. Solutions of caustic soda or acid have been used to loosen the scale. Hydrochloric acid from 5 to 40 per cent has been circulated through the tubes and then they were thoroughly washed out. Caustic soda from 1 to 7 per cent has been used successfully. This method is expensive and requires careful attention or the tubes will be ruined. In many cases too the scale is not touched by either chemical.

Washing the tubes with high-pressure water is done in many plants successfully. Pressures up to 250 lb. are used and in many cases it is found that it takes the high velocities to cut the deposits off. In some cases, however, merely increasing the circulating-pump speed will clean out the tubes. Some European installations have an arrangement of flap valves whereby some of the tubes may be cut off, this increasing the head on the remaining tubes and washing them clean.

An interesting method, recently patented, for cleaning tubes without disturbing operation whatever has been developed by one of the large condenser manufacturers and according to their report has proved successful on all installations that have been made. This consists of washing the tubes with high pressure water—250 lb.

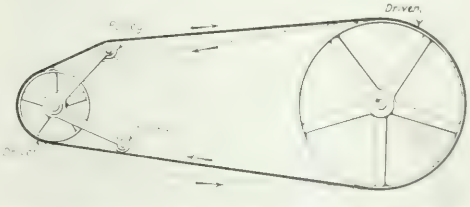
Long lance-like steel tubes connected by hose to the supply pump are stuck through special close-fitting swivel valves arranged in the water box heads. The end of the lance comes about ½ in. from the ends of the condenser tubes and is then swung back and forth over the group of tubes. The water at 250-lb. pressure knocks all the deposit off the tubes and the flow of circulating water washes it out. This method will not remove scale already deposited in the tubes, but it is claimed will prevent the formation of any scale. This is probably the only method for cleaning tubes of a serious deposit which does not interfere with the operation.

This information was contained in a paper read before the station operating committee of the Ohio Electric Light Association by A. Carnegie of the Pennsylvania-Ohio Power & Light Company, Youngstown, Ohio.

Field Editor Electrical World.
Chicago, Ill.

Taking Up Lost Motion in Waterwheel Control

ONE hydro-electric station in New England experienced a great deal of trouble from excess play in the rope drive between waterwheel governors and the wheel gates. These rope drives are in almost constant motion, driving first one way and then the other, thus alternating the tight and loose sides of the belt. This meant that a certain amount of slack rope had to be taken up each time the direction of motion was reversed. It was impossible under such conditions to set the governors at a given opening and be sure that the opening of the gates would correspond.



IDLER TAKES UP SLACK IN ROPE DRIVE INDEPENDENT OF DIRECTION OF DRIVING

The illustration shows the double idler devised to meet the problem. A hub with a bearing slightly larger than the governor shaft, to permit of free movement, branches out into two arms set at a predetermined angle. These arms in turn support the two smaller idler pulleys. Dotted lines in the illustration show the positions of the idlers and drive ropes in the two directions of motion.

With this arrangement there is practically no lost motion and the setting of the governor now regulates to a close margin the opening of the gates.

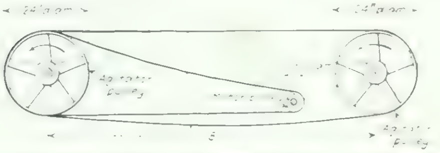
New York, N. Y. E. L. Bragdon.

Industrial Applications

The Economical Utilization of Electrical Energy
in Mills and Factories, Together with Practical Details of Installation, Control,
Testing and Repair of Equipment Required

Double Belt Drive That Occupies Minimum Space

A SIMPLE belt drive that occupies minimum space is used in the French government fish-freezing plant at St. Pierre, Miquelon. In this plant two pulleys of 24-in. diameter are direct-connected to agitators on an ice tank and operate at about 220 r.p.m. They are driven by 2-hp., 220-volt, two-phase, 1,200-r.p.m. induction motor. On account of space limitations the motor is set between the two large pulleys and belt-connected to one. On the same shaft with this pulley is another which drives a belt on the second agitator.



SPACE IS SAVED BY PLACING MOTOR BETWEEN LARGE PULLEYS

As the motor is only a 2-hp. machine it is started by throwing it directly across the line. On account of the short centers there is some slippage, but teasing the motor overcomes this. This practice is not very objectionable because the motor is small and when once started runs for several days without stopping.

EUSTACE C. SOARES,
Ophuls, Hill & McCreery, Inc., Electrical Engineer.
New York City.

Peculiar Trouble on Ungrounded Three-Wire System

TROUBLE which may result from a three-wire system without a grounded neutral was well illustrated in a case which recently came to the writer's attention. This plant has a 115/230-volt three-wire Edison system and, as stated, had at that time no ground on the neutral wire. One morning it was noticed that half of all the lamps on the poles in the yard were burning in broad daylight. All these lamps which were burning were connected on one side of the three-wire circuit while the remaining lamps in the yard, which were not burning, were connected on the other side. It was supposed that the engineer had forgotten to turn them off and that a fuse had blown, but investigation showed that the circuit switch was open.

After some investigation a ground was found on the negative side of another three-wire circuit supplying lamps along a railroad trestle. This circuit switch was opened and the lamps on the yard circuit went out. Likewise a ground was found on the negative side of the yard circuit. These two grounds explained the behavior of the lights.

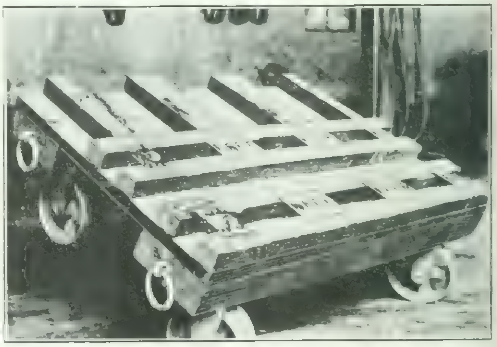
Owing to the fact that there was a ground on the negative wire of the track circuit and also a ground on the negative wire of the yard circuit and because the neutrals of all circuits are connected together on the back of the switchboard, everything was all right as long as both the yard lighting switch and the track lighting switch were either on or off, but when it was desired to throw off the yard lamps while the track circuit switch was in, current from the live negative wire of the track circuit passed through the ground to the grounded dead negative wire of the yard circuit, then through the lamps connected on that side to the neutral of that circuit and back to the switchboard, where this neutral was directly connected to the neutral of the track circuit.

Shortly after this the neutral wire was grounded according to standard rules of the National Board of Fire Underwriters and such unusual trouble as this has not reoccurred.

RAYMOND N. COFFMAN,
Heath Refinery, Chief Electrician.
Heath, Ohio.

Trucks to Facilitate Work of Handling Vehicle Batteries

IN ORDER to make the handling of batteries easy in the vehicle department of the United Dressed Beef Company, New York City, a small truck with rollers mounted on top, as shown in the accompanying illustration, has been developed. The truck is built as shown with 3-in. x 4-in. pieces screwed on top of it. Into these pieces are fitted rollers about 2 in. in diameter. The truck is pushed up to the battery box on the vehicle, the floor of the box coming just level with the top of the small truck. Then the trays are pulled out, one at a time, on to the truck, this operation being made easy by means of the rollers in the top of the truck.



BATTERY TRAYS ARE ROLLED OUT ON TOP OF TRUCK AND EASILY TRANSPORTED TO REPAIR ROOM

In the photograph one edge of the truck is raised in order to show the top more clearly

The truck accommodates three trays. Into each end of the truck two rings are fitted. By means of two iron hooks placed in the rings the truck may be easily pulled where desired. The truck is pulled from the vehicle into the repair room, and the battery is left upon it until it is repaired and ready to be taken back to the vehicle.

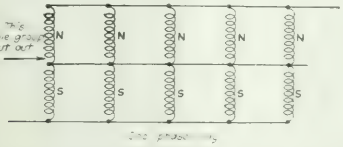
To prevent the acid from destroying the wood a coat of black acid-proof varnish is given to the truck.

A. M. CAMPBELL,
Foreman Battery Department.
United Dressed Beef Company,
New York, N. Y.

Trouble Resulting from Cutting Out Coils in Induction Motor

WHEN two coils were found short-circuited between themselves on a ten-pole induction motor, the first attempt to remove the trouble was to open these two coils and reconnect the coil group from which they came. This was a six-coil group on a ten-pole machine which was connected in five-parallel, one-phase of which is shown in the accompanying drawing. When these two coils were cut out of the group and the four coils used instead of six, the result was that these four coils overheated in a very short time. This was because the voltage upon them was too great and too large a current flowed in them. The remedy was to disconnect this entire coil group from the motor section. The motor operated satisfactorily after this was done until new coils could be put in. E. R. DEBMAN.

East Orange, N. J.



FIVE-PARALLEL CONNECTION OF TEN-POLE MOTOR

Bolts and Nuts Must Be Kept Tight on a Motor

PERIODIC examination of the base bolts of a motor is necessary, as vibration and the jerk of the belt, chain or gear are likely to loosen them. If bolts persist in loosening, they should be replaced by longer ones having a locknut and perhaps a cotter pin. Lag screws should not be used for suspended motors. The base bolts holding down a gear-driven motor must be tight to permit the gears to mesh at all loads. The nuts of the brush-holder studs of direct-current motors should be tightened once in a while, since they will loosen from heat and vibration. Bolts protruding from the frame of direct-current motors, holding the pole pieces, should be tightened once in a while, because vibration is liable to loosen the poles and perhaps allow them to strike the armature.

When the motor is stopped examine the set screws in the pulley. If they repeatedly loosen, use longer ones with cup ends and with a hexagon nut turned down tightly against the hub. With direct-connected motors see that the coupling bolts are tight, or a nut may fly off the motor when it is running. H. S. RICH.

East Berlin, Conn.

Thorough System of Baking Coils, Armatures and Stators

A THOROUGH system of impregnating and baking motors and coils has been found fully to justify its adoption because of the increased reliability of the motors repaired by the Airedale Electric & Manufacturing Company, Ltd., Bradford, England. For machines above 15 hp. having open slots the coils are fully insulated for the working voltage before being inserted, in which case the cotton-covered wire is run through a special tank containing air-drying varnish as the coils are being wound. This tank is fitted with a wiper to remove varnish not absorbed by the cotton covering. After being wound and having slot insulation applied the coils are taped with cotton tape which has been previously impregnated in the bulk. The foregoing precautions are taken because experience has proved that if the wire and tape are left in their natural state (white) and the coils immersed in an impregnating tank, the varnish does not penetrate through the slot insulation, but leaves portions unimpregnated.

The coils are next pulled to the required shape and size, then placed in an oven and baked for twenty-four hours, after which they are placed in an impregnating tank while hot and allowed to remain until all bubbling has ceased. They are then removed and hung over the tank so that the superfluous varnish drips back into it.

The oven is steam-heated and kept at a temperature of 180 deg. Fahr., the heat being regulated by means of a damper in the chimney through which the fumes pass out to the atmosphere. The varnish is also heated to a similar temperature by means of a steam coil placed at the bottom of the tank. The joints of the coil, in addition to being screwed, are welded as a precaution against leaking. This coil is easily removed from the tank for cleaning, etc., by means of a union joint placed well above the tank.

COILS ARE BAKED FOR FIFTY HOURS

After dripping for one hour the coils are put into the oven and baked for a period of fifty hours. Judging from the outward appearance, they appear at this time to be perfectly baked, but on one occasion when it was necessary to remove the outer insulation from a set of coils it was discovered that the inside turns were almost as wet with varnish as though they had not been baked. From that time on all coils of this type, after being treated in the same manner, were dried out after they had been placed in the slots of the machine by passing current through them. The phases are connected in series so that the current traverses the whole of the coils. For this purpose a 10-kw. single-phase transformer is used having secondary voltages of 55, 110 and 220 volts, the various voltages being used according to the current required for a particular winding. A tarpaulin is placed over the whole machine which is allowed to reach a temperature of 180 deg. Fahr., the temperature being controlled by uncovering a portion of the machine.

For machines having mush or pull-through windings with semi-closed slots, the wire is impregnated before use, the end winding taped with previously impregnated material, then sprayed with air-drying varnish and baked in the manner previously described (by current) for a period of forty-eight hours.

For motors not above 15 hp. in size the wire, tape, insulation, etc., are left in their natural state (white) during the process of winding. When winding is completed the stator is placed in the oven and baked for a period of twenty-four hours, then placed bodily in the impregnating tank and allowed to remain until bubbling ceases. It is then suspended above the tank for half an hour to drip, then turned over so that the varnish runs into the windings. During the time allowed for dripping the varnish is cleaned from the stator casing. The stator is next placed in the oven and baked for fifty hours.

Insulation tests are taken by a 1,000-volt, 200-megohm megger at the following times: (1) Before any heat is applied immediately after winding; (2) while hot and before impregnation; (3) while hot and after impregnation and baking, and (4) when cold. When apparatus is thoroughly baked an "infinity" reading should be obtained, *i.e.*, 200 megohms. As a safeguard against the possibility of weak spots a voltage of at least three times full normal working voltage is applied for five minutes. L. E. Wood.

Airedale Electrical & Manufacturing Company, Ltd.
Bradford, England.

Electric Furnace Costs Better Oil-Heating Figures for Hardening Tools

A COMPARISON between the cost of maintaining working temperature in an electric furnace for tool hardening and the expense of operating an oil-fired furnace in similar work was recently presented by H. W. Derry, power engineer Hartford (Conn.) Electric Light Company, before the Power Division of the New England Geographic Division, N. E. L. A. The data showed that for comparable service the electric furnace maintained the required temperature at about 50 per cent of the cost resulting from the use of the oil furnace. Tests were run on furnaces having about the same hearth area and doing the same kind of work at the same temperature. The results shown in the accompanying table were attained.

ELECTRIC FURNACE COMPARED WITH OIL-FIRED FOR TOOL HARDENING

ELECTRIC FURNACE	
Inside dimensions	30 in. wide, 36 in. long, [illegible] in. high
Rating of furnace, kw	20
[illegible] covered by test	19
Total working hours	[illegible]
Total weight of steel heated, lb	1,[illegible]
Temperature, deg. Fahr	1,[illegible]
Average kw-hr. per hour in working hours	[illegible]
Average kw-hr. per hour empty (condition [illegible] only)	[illegible]
Fuel cost per hour at 1.[illegible] cents per kw-hr., cents	[illegible]
OIL FURNACE	
Inside dimensions	46 in. long, 25 in. wide, 20 in. high
Average temperature held, deg. Fahr	1,400
Specific gravity of oil at 60 deg. Fahr	0.8
Degree Baumé	[illegible]
Total time test was run, hours	46
Total gallons of oil used	84
Weight of steel heated, lb	[illegible]
Total time heating steel, hours	[illegible]
Average gallons per hour heating steel	1.9
Average gallons per 100 lb of steel	[illegible]
Time furnace was empty (holding temperature only), hours	[illegible]
Average gallons per hour, holding temperature only	[illegible]
Fuel cost per hour at 14 cents per gallon, cents	23.1

The electric furnace was provided with automatic temperature control and a time switch for throwing off the power at the end of the working day and switching it on in the early morning, so that the furnace was always ready for use. The repair cost for the electric furnace was practically nil.

Boston, Mass. Field Editor Electrical World.

Troubles on Compensators Which Should Be Checked at Start

A NUMBER of troubles may develop on compensators which will not cause serious damage if they are checked in time. In the case of a motor refusing to start and the load being such that it is inconvenient to remove, raising the taps to some higher point will remedy the difficulty provided that the motor is not at fault or the load is not too heavy. A buzzing sound in the windings will denote either loose laminations or a ground. If the laminations are loose they should be wedged tightly together. In case of a ground it must be located and removed or the coil will burn out. The action in this case is peculiar. One side of the transformer is always connected to the line, and a ground will cause a current heavy enough in most cases to heat the windings and cause them to burn out, while at the same time it grounds one phase of the motor and acts as a ground on the motor, besides unbalancing the phases. About the only way to remove a ground from a compensator coil is to replace the coil with a new one. A short-circuited coil will probably do no more damage than speed up the motor too quickly on starting, while an open-circuited coil will seldom be met with.

A rumbling noise in the oil tank denotes a bad contact. Press the contact jaws together, add more tension to the springs, or if too badly pitted or burned renew the contacts. Heating of the oil tank denotes the presence of water in the oil. Remove oil at once and refill with fresh oil.

The presence of a burned-out low-voltage coil will be denoted by the plunger remaining down when the compensator is energized. However, this may indicate other trouble on a compensator equipped with overload relays as the circuits of the relays and the low-voltage coil are interconnected. A loose connection on the relay mechanism will cause the plunger to remain down or inoperative. Hammering of the plunger will denote that the circuit from the overload relay is being made and broken at intervals because of a loose or burned connection. This will trip the operating lever in time.

It is sometimes impossible to get the compensator handle to stay in the operating position owing to the relay or relays being stuck in a high position. This may be caused by the oil in the dashpots becoming too thick or being too thin, or from a ground. Thickened oil may be detected by the resistance offered when forcing the relay to its right position. Changing the oil or setting the relay to a lower setting will overcome this difficulty. If the oil is too thin the relay acts too quickly and cannot drop back. To overcome this defect use thicker oil or raise the setting or time limit. If there is a ground present, it will be noticed by the inability to move the mechanism and by a puncture in some part of the mechanism where it has become welded to some other part.

In case of serious trouble where it is necessary to keep a motor in operation and where no spare starter is available, an emergency starter may be made. For either two-phase or three-phase induction or wound-rotor motors a couple of pails, wooden preferred, are secured, or if these are not available, use metal pails, being careful to insulate them from each other and from the ground. Fill the pails with water and place a large washer or floor flange in the bottom of each pail and connect a wire from the flange to the motor. The other two lines should be attached to two flanges.

Hold these two lines apart. It is well to hold them by means of a cord to avoid receiving a shock. Drop first one and then the other slowly in the water. As soon as the second touches the water the motor will rotate. Gradually lower the flanges until they touch the flanges at the bottom of the pail, when full line voltage is applied. While running, the pails should be shunted by a knife switch of ample size. This method is safe and takes only a few minutes to put into operation.

Provincial Paper Mills, H. E. Stafford,
Port Arthur, Ontario. Electrical Engineer.

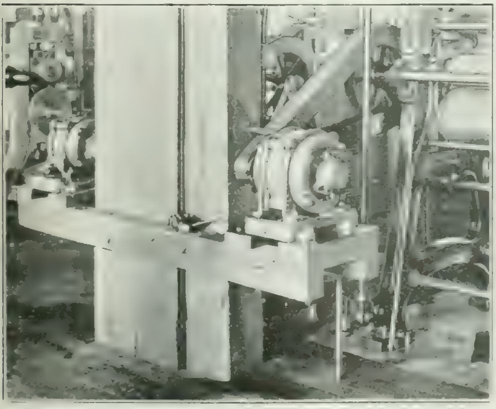
Oil in Large Motors Requires Filtering

If a large motor is isolated, a small semi-batch filter should be used to purify the oil, the oil being withdrawn at intervals and passed through the filter. If, however, the motor is used in connection with drive-shaft or reduction-gear bearings, the oil should be passed through the circulating system used for these other bearings. Overflow sights should be placed in the line from the motor-bearing reservoir to maintain a predetermined oil level.

Carver Wood embodied these remarks in a recent article in the *Journal* of the American Society of Lubricating Engineers.

Mounting Motors on a Wide Column

Economy of floor space and a symmetrical drive of two embossing machines is secured in the plant of the Springfield, (Mass.) Glazed Paper Company by mounting the motors on a home-made bracket bolted to a column 2 ft. 10 in. wide, as shown in the accompanying illustration. Two 3-hp. General Electric three-phase, 440-volt induction motors are required, one running at 1,200 and the other at 1,800 revolutions per minute. The motors are provided with high-resistance rotors to allow starting under load, and the embossers are driven by Link-Belt chains. The motors are mounted on 3½-in. x 3½-in. base blocks attached by 1-in. bolts to 3½-in. x 6-in. timbers similarly bolted to the columns. This arrangement provides for easy inspection with a well-balanced mechanical drive, without the inconvenience of avoiding the motors during floor cleaning.

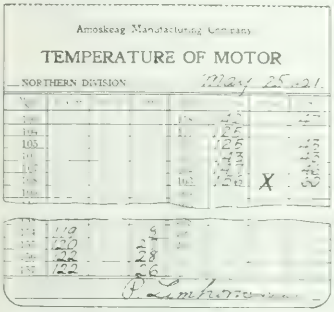


TWO MOTORS MOUNTED CLEAR OF FLOOR

Springfield Glazed Paper Co. J. H. Whitehouse,
West Springfield, Mass. Superintendent.

Systematic Temperature Records Reduce Motor Operating Troubles

Four temperature readings daily are taken on each group-drive motor by inspectors for the electrical department of the Amoskeag Manufacturing Company, Manchester, N. H. Preventive inspection has cut down operating failures of motors to less than two in six months in the mill, where as a whole about 2,000 motors are in service, ranging in size from ¾ hp. to 300 hp. Temperature records are kept on 4-in. x 10-in. loose-leaf sheets as shown, two sets of sheets being used daily for each group of motors. All motors are numbered, and if the temperature exceeds 150 deg. F., it is brought to the attention of the chief electrical engineer of the company. Space for current readings is also provided on these forms. About 1,200 motors are in service on group drives. Ten men are regularly engaged in motor inspection in this plant. The temperature records are regularly checked by the electrical department.



Amoskeag Manufacturing Company

TEMPERATURE OF MOTOR

NORTHERN DIVISION May 25 -21.

TEMPERATURE OF MOTORS IS RECORDED FOUR TIMES A DAY IN THIS SHEET

F. L. Clarke,
Chief Electrical Engineer.
Amoskeag Manufacturing Company,
Manchester, N. H.

Spare Motor-Driven Exciter Saves Shutdowns

By coupling a spare reserve exciter to a motor, interruptions to production have been prevented in a large cyanide mill where two synchronous motors are used for stamp-battery drive. Each of these synchronous machines has its own exciter belted to it. A spare exciter has always been kept in readiness to replace either exciter should a defect develop. The exciters are so located that they are rather difficult to reach for substituting the spare. Considerable time was usually lost in taking out a defective machine and replacing it.

A motor of the proper size becoming available, it was decided to make a flexible coupling and to mount the spare exciter and the motor on a base for use as a motor-generator set. A three-pole double-throw switch was provided and an equalizer bus was run to all three machines.

With this arrangement it is now possible to furnish exciting current from the motor generator set to either of the two synchronous motors. When trouble occurs in the exciter of one or the other, it is a simple matter to start up the set, bring the voltage of the generator up to that of the exciter to be cut out, throw the switch to the proper side and slip the belt of the defective exciter. Repairs can then be made whenever convenient. Frederick Krug.

New York & Honduras Rosario Mining Company,
San Juancito, Honduras, C. A.

Central Station Service

A Department Devoted to Commercial Policy
and Management Topics, Including Methods of Increasing the Use
of Electric Light, Power and Heat

Publicity to Prevent Breakage of Street Lamp Globes

PRIZE WINNING POSTER NEEDS NO EXPLANATION

According to the records of the Rochester (N.Y.) Gas & Electric Corporation the number of broken street lamp globes has increased from year to year until the loss now approximates $17,000 a year. Though the company has made every effort to reduce this loss by the use of strong globes and secure fastenings, it is estimated that fully one-half of the total breakage is due to mischief and careless driving. It was believed that this could be reduced only with the co-operation of the public.

With this in view the company arranged with authorities of the public and parochial schools to distribute educational literature to each pupil showing the money cost and damage to life that resulted from broken globes. In keeping with this plan, a poster-drawing contest was conducted by the Mechanics' Institute in which mischievous breakage of globes was opposed. Prizes were given by the company for the three best posters. First prize was won by the poster shown here, entitled "It's Not Fun," by Roy Miller, and it was decided to reproduce the drawing in full color on 7½-in. x 5½-in. posters for distribution among the school children of Rochester.

While the plates and run of 60,000 impressions of the poster were being made the school authorities were planning to devote a definite time throughout all the schools to a study of this phase of civic instruction. Distribution of the posters was made so that this lesson was assigned for Friday, June 3. The reverse side of the poster carried the accompanying message from the Rochester Gas & Electric Corporation and formed a nucleus about which the teacher's lesson could be built.

Perhaps no more opportune time could have been selected for the campaign than that last week of school before the summer vacation months. That the campaign will be successful in reducing the number of lamp globes broken through mischief is attested by the hearty co-operation promised in class letters received by the company and in letters from a large number of the school children.

Breakage of Street Lamp Globes

This poster received the winning prize given by The Rochester Gas and Electric Corporation in a contest conducted by Mechanics Institute.

It illustrates unnecessary suffering caused by the mischievous breakage of street lamp globes. The company desires through it to arouse interest so that globes will not be carelessly broken.

Many of the city's street lights require globes, which protect the lamp, spread the light and improve the appearance of the pole.

Broken globes are dangerous and cause serious injuries to children, adults and animals. They also cut and ruin rubber tires. Unlighted lamps cause accidents, and encourage the activities of rowdies, thieves and burglars. Broken globes add to the expense of street lighting. To replace those broken in 1920 cost over $17,000, at least one half of which was due to mischief and careless driving. The other half was due to breakage by the wind.

The company is doing its part to provide good globes and to fasten them securely. Drivers should be careful not to drive into lamp poles. Boys should remember that "It's not fun" to injure others, to cause accidents and to destroy property.

REMEMBER. Any street lamp or fallen wire may have a dangerously high voltage, and many persons have been killed through climbing poles and touching fallen wires. LEAVE THEM ALONE.

TEXT OF POSTER ISSUED BY THE ROCHESTER GAS & ELECTRIC CORPORATION

Important Factors in Bettering Public Relations

Discussing the advances that have been made toward a better understanding of utility problems on the part of the public, John A. Britton, chairman of the public policy committee of the Pacific Coast Division of the National Electric Light Association, pointed out in the committee's report that the many consumer-ownership plans of financing had proved of inestimable worth to the utilities from a public policy point of view. The report said in part:

"It has been estimated that there is in the neighborhood of $5,500,000,000 now invested in the gas and electric utility companies in the United States and, reading the future by the past, it is estimated that the annual average growth will be about 8 per cent. This will mean an annual requirement of nearly $500,000,000 of new money in the United States in the immediate future, or considerably in excess of $5,000,000,000 in the next ten years if the present rate of growth is to be maintained. At least a goodly portion of this great sum must come from the pocketbook of the consumer through his ownership of the junior securities of the utility which serves him. There is probably no better way in which to arrest the unrest of the people and dissatisfaction, which in most cases is imaginary, with public service bodies than to have the consumers interested as stockholders and boosters in the enterprise. The attitude of the public service corporations should be not only to enlist the investment of consumers but to make it their business to see that these investing consumers are given the full facts in connection with the operations of the utility of which they are a part, so that they may be agencies in their community to help in establishing a true relation as between the utility and the public. With that interest fully centered it is certain that much of the agitation for municipal ownership or state control would rapidly disappear."

Having in view the promotion of a better understanding of public utility questions, the committee said: "It would appear to your committee that member companies have a duty to perform which has been more or less neglected in the past, and which may be and possibly is responsible for some of the distrust still lingering in the minds of the people concerning the management and the operation and financing of public utilities, and that is the lack of proper information obtained by the young man and woman attending public schools and universities. It would seem as if colleges commonly used as a method of exploitation for certain subjects should be used by utilities in insuring the appearance of men trained in the affairs of public utilities before at least the high schools and universities of this country in proper explanation of the present status of public utilities and their aims and ambitions, to counteract the mistaken ideas of past errors still existing in the minds of the teachers, who cannot reasonably be expected in the multitude of their duties to be thoroughly informed on the subject of utility regulation and finance. There is no more fertile field for the dissemination of true knowledge of the business of public utilities than the medium afforded by high schools and universities. The error exists commonly in public utility affairs of telling the story to those cognizant of the facts and leaving the uninformed masses ignorant of the truth in connection with this great industry."

The day of profiteering in public utilities, the committee pointed out, has gone down into the dim and distant past, and among all the industries of this country today there is not in existence one that serves the public with less margin of profit than does the public utility. It is virtually doing business on an economical cost basis, earning only sufficient to pay the interest on the money which it must borrow to develop and carry on its work of service and lay a sufficient margin aside to care for the depreciation on its property. The committee felt that the past year had been one of understanding and that the realization will come to the mass of the people within a brief period that the utility which serves them is as much an integral part of the state as is any merchant or manufacturer, and that an industry which helps in developing the state's industries and without which the state could not prosper is entitled to a fair hearing before the court of public opinion.

Employees of Illinois Utility Sell Entire Note Issue in One Week

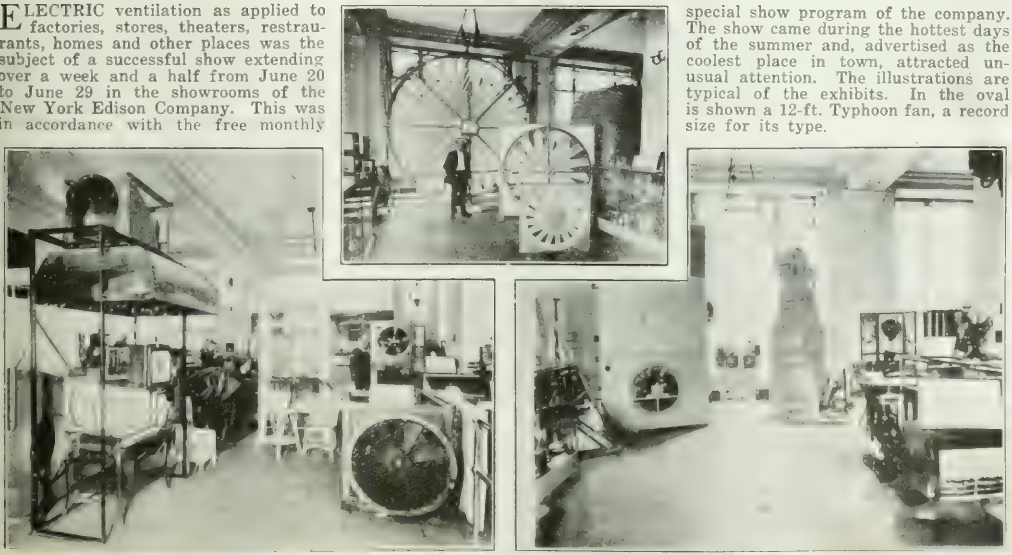
WITH the employees acting as salesmen, an entire issue of $233,000 of bond secured gold notes of the Danville, Champaign & Decatur (Ill.) Railway & Light Company was sold to the public and employees within one week. Commenting on the success of the campaign, F. W. Bedard, general superintendent of the company's property at Champaign, said:

"Up to the present time virtually all funds for developing our properties have been secured from outside investors by selling the entire issue to a broker to be resold to his clients. Our recent plan of offering customers and employees an opportunity to buy this security, which was an especially attractive one for the investor, was in the nature of an experiment.

"It is necessary for a utility company operating in growing communities of this size to spend from $100,000 to $400,000 each year in normal times in extensions and improvements in order to keep pace with the city. In the future it will be the policy of our company to offer residents and customers in these communities securities it would be required to sell in order to make these extensions."

New York Has Successful Electric Ventilating Show

ELECTRIC ventilation as applied to factories, stores, theaters, restraurants, homes and other places was the subject of a successful show extending over a week and a half from June 20 to June 29 in the showrooms of the New York Edison Company. This was in accordance with the free monthly special show program of the company. The show came during the hottest days of the summer and, advertised as the coolest place in town, attracted unusual attention. The illustrations are typical of the exhibits. In the oval is shown a 12-ft. Typhoon fan, a record size for its type.



Digest of Electrical Literature

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

Relationship Between Efficiency and Working Costs of Small Motors and Generators. E. G. KENNARD.—The writer points out that there is a greater difference in the efficiency of motors and generators rated alike than is generally recognized. On account of the increasing cost of electrical energy this has become a more important matter than formerly, and he undertakes to show how to balance a difference in efficiency against the difference in first cost.—London *Electrical Review*, June 17, 1921.

Welding a Hydro-Electric Generator Shaft.—A description of the famous welding of a broken hydroelectric generator shaft. The diameter of the shaft is 5 in. (12.7 cm.).—*Power*, July 12, 1921.

Lamps and Lighting

Luminescence of Certain Oxides Sublimed in the Electric Arc.—E. L. NICHOLS and D. T. WILBER.—Oxides prepared by sublimation are found to respond to excitation by cathode rays, as well as to flame excitation through a wide range of temperatures. The temperature at which excitation ceases is in general the same, taking each band separately for flame excitation and for cathode excitation. The shift in the color of luminescence is in general toward the violet with rising temperature. The influence of pressure on luminescence is also discussed.—*Physical Review*, June, 1921.

Recent Developments of the Quartz-Tube Mercury Lamp.—M. LEBLANC.—The author mentions the different problems which occur in the construction of the quartz-tube inclosed mercury arc, describing the improvements made since 1914. The article is well illustrated and contains details on leading-in wires, gas-filled lamps, additional heating coils, metal anodes, equilibrium of the mercury between the electrodes, cooling methods, and alternating-current lamps.—*Bulletin de la Société Française des Electriciens*, Vol. I, No. 2 (1921), page 89.

Generation, Transmission and Distribution

Difficulties of the Smaller Electricity Supply Companies.—A. N. RYE.—The problems of the small utilities in England are set forth to show that with rising expenses and with revenues restricted by legislation these companies have not had sufficient profit to warrant any increase in capital expenditure, greatly to the detriment of the industries.—London *Electrician*, June 24, 1921.

Industrial Plant Substations.—E. G. MERRICK and B. NIKIFOROFF.—Several simplified one-line diagrams of substations are included in this article, and a brief analysis is given of each in order to illustrate more clearly the considerations governing the selection of different types of stations to meet various conditions.—*General Electric Review*, June, 1921.

A Country Hydro-Electric Installation. — The description of a small installation in which the pipe line is about 2,000 ft. (600 m.) long operating under a head of 287 ft. (87 m.). The generating units consist of a waterwheel generator rated at 22 kw. and operating at 650 r.p.m. A concrete dam 6 ft. (2 m.) high with about 9 ft. (3 m.) spillway and 6 in. thick, is used —London *Electrical Review*, May 27, 1921.

Electric Vehicles from the Power Station Engineer's Viewpoint.—RAYMOND J. MITCHELL.—The writer believes that central-station managements in England are losing an opportunity to push electric vehicle service as an off-peak load.—London *Electrician*, June 24, 1921.

Ash Disposal in Large Boiler Houses.—R. SCHOLTES.—An interesting article containing details about different methods of ash disposal and their operating cost per ton of ashes. It was found from answers to a circular letter sent out to a number of steam power plants that there is a large variation of the cost of the disposal of ashes in the different plants, from a minimum of 6.38 to a maximum of 43.02 marks per ton. Employing hand power, a man can handle about 3 tons of ashes per day, and at present wages receives 42 marks a day, so that an amount of 14 marks per ton would be normal. During the war a large number of prisoners were used for ash handling in many German power plants. A tabulation is given comparing pneumatic, conveyor and hand systems:

System	Pneumatic	Conveyer	[illegible]
Cost per ton.........	[illegible]	13.20	[illegible]
[illegible]	5 tons	[illegible]	[illegible]

—*Elektrische Kraftbetriebe und Bahnen*, June 10, 1921.

The Electric Melting Furnace as a Central-Station Load.—H. A. WINNE.—The author points out the importance of electric furnace loads both for steel making and brass melting, giving the accompanying table on the development of the electric steel furnace industry:

TOTAL CAPACITY AND POWER CONSUMPTION OF ELECTRIC STEEL FURNACES

Year	Estimated Total Installed Kva. [illegible]	Estimated Total Annual Kw.-Hr. Power [illegible]
[illegible]	[illegible]	[illegible]
1915...............	25,000	45,000,000
1917...............	100,000	155,000,000
[illegible]	240,000	[illegible]
1921	320,000	

He discusses the matter of power factor to show that the electric furnace is not an undesirable central-station load. Both arc and induction furnaces are considered. —*General Electric Review*, June, 1921.

Ground Protection.—A. ROTH.—The author compiles the many different methods used today for ground protection and criticises their properties and reliability. The article considers: (1) Compensation of the ground current; (2) Y-point grounding; (3) horn gap with resistance; (4) cylinder gap with resistance; (5) aluminum cells; (6) lead superoxide cells; (7) Nicholson arc quencher. A great number of tests on actual lines, to study the size and length of the arc formed and to analyze each case, conclude the article.—*Elektrotechnische Zeitschrift*, June 23, 1921.

The Dalmarnock Power Station.—A continuation of the article appearing in the May 27 issue, in which further details of the 15,000-kw. generator as installed in this plant are given.—London *Engineering*, June, 10, 1921.

Traction

Standardizing of Output of Motors for Street Railways, Branch Line Roads and Main Roads.—A. WICHERT.—This is an attempt at economical motor standardization on a scientific basis. For all trolley lines, suburban roads, subway and city surface lines, which are operated by direct current, motors should be designed in steps of the cube root of two, that is at about a 25 per cent increase from step to step, and it is assumed that with ten types all requirements could be covered up to 1,000 hp. For alternating-current main roads steps according to the square root of two, or about 41 per cent increase between motor sizes, are suggested. For speeds within 45 km. to 125 km. per hour and locomotive types with two to six driving axles of a total of from 580 hp. to 2,320 hp. only two types of motors would be sufficient.—*Elektrotechnische Zeitschrift*, June 23, 1921.

Pioneer Trackless Trolley Installation.—It is said that the trackless trolley bus has been put in operation in conjunction with rail service in the city of Richmond. Tests are being conducted to demonstrate its worth and flexibility in comparison with cars running on tracks. Details of construction are given which show this bus to be comparable to the one-man safety car. The double trolley overhead construction is also described.—*Electric Railway Journal*, June 25, 1921.

Fundamentals of Rational Electrification.—GEORGE R. HENDERSON.—An example is worked out to show what factors should govern the adoption of electric operation on heavy grades.—*Railway Electrical Engineer*, June, 1921.

Installations, Systems and Appliances

Electric Driving in the Paper Mill on Heat Economy Lines. — A. B. MALLINSON. — In paper manufacture steam is said to be a necessity for several processes. It is shown how steam otherwise wasted can be used for electric generation. Various types of power houses are discussed for the utilization of this surplus steam.—London *Electrician*, June 17, 1921.

Electric Drive for Small Automatic Self-Dumping Skip Hoists.—R. H. MCLAIN and C. B. CONNELY.—The authors discuss three general classes of self-dumping skip hoists with the idea of showing their usefulness and also their limitations. They express the opinion that the field of usefulness of these skip hoists could be considerably extended by a careful study.—*General Electric Review*, June, 1921.

Ground Choke Coils as a Protection Against Ground Current and Overvoltages.—R. BAUCH.—A long theoretical treatise dealing with the action of a grounding choke coil. Without the use of such a coil a voltage of about four times the normal value has to pass through one phase of a three-phase transformer in case of a ground on one phase, which will in most cases cause a puncture. Connecting a grounding choke coil to the Y-point of the transformer will prevent the reflection back through the transformer with increased potential, of a line disturbance caused by a ground on the line, but will annihilate this oncoming energy and pass it to ground. It is necessary, however, to have all this energy pass through the winding of the transformer. Its coils will not stand this stress if the overvoltage disturbance is backed by a large amount of energy. The grounding choke coil is therefore not suited for the safe annihilation of traveling waves. By means of theoretical calculations the author finds that it is much better to employ on a three-phase line three-pole grounding coils instead of one Y-point choke coil. Such a pole ground should consist of a three-phase transformer with a fourth magnetic return, *i.e.*, a four-legged core. Its primary is star-connected with grounded neutral: the secondary is an open delta, closed over a special regulating iron-core reactance. The author describes in detail laboratory experiments, made with such "quenching transformers," using the oscillograph extensively to investigate its operation. Finally the actual construction of these transformers and their proper connection is given. — *Elektrotechnische Zeitschrift*, June 2 and 9, 1921.

Electric Pumping.—L. F. ADAMS and R. A. JONES.—A comparison between pumping by electricity, gas engines and steam engines, showing the economy of the electric drive for this purpose.—*General Electric Review*, June, 1921.

Telegraphy, Telephony and Signals

Radio Telephony: A Survey.—R. L. SMITH-ROSE.—This is the first of a series of articles on the development of radio telephony. In this number the author discusses problems and principles in a general way and also the Duddell-Poulsen arc.—*Beama* (British Electrical and Allied Manufacturers' Association), June, 1921.

Automatic Telephone Systems.—M. GUTTZEIT.—The installation of automatic telephones offers great technical and economical advantages. The system of Stowger-Siemens and the Western Electric apparatus are described. In spite of the high development of these systems, they are not fully worked out as yet, the final tendencies being toward the cheapening of the equipment. The self-connecting telephone is excellently suited for private exchanges, even those of smallest extent. It may also be used to advantage for the betterment of manually operated exchanges. The paper is well illustrated.—*Vereines Deutscher Ingenieure*, June 11, 1921.

Miscellaneous

The English Electrical Industry.—E. ROSENBERG.—The following points of decisive importance are considered: (1) Free trade, whereby the English industry remained unprotected from foreign competition, while it was not dependent on English suppliers alone for raw material; (2) the strength of the trade unions, which everywhere hampered free development; (3) the large number of manufacturers, mostly small or of moderate size only, carrying on unlimited competition with one another; (4) owing to the severe competition between firms, the position of the buyer, and particularly that of the buyer's technical expert, became all-powerful. The writer deplores the severe guarantee conditions which, as an outgrowth of these conditions, have been imposed by consulting engineers.—London *Electrician*, June 3, 1921.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

President of American Engineering Council to Be Elected Next Month

ELECTION of a president in succession to Secretary of Commerce Hoover will be the most important business before the American Engineering Council of the Federated American Engineering Societies when it meets in the Cosmos Club at Washington on Sept. 30 with Vice-chairman Calvert Townley in the chair. Nominations for the presidency were ordered at the last meeting of the executive board to be reported at the September meeting.

It is probable that the board will decide at this meeting whether to hold future meetings regularly at its headquarters in Washington or to continue to meet at various engineering centers as in the past year. Other matters that will come up for consideration are plans for the engineering assembly, extension of employment service and the question of licensing and registration of engineers. A. P. Davis is chairman of the engineering assembly committee, the other members being Philip N. Moore, L. P. Alford, John C. Hoyt and F. A. Vaughn. Present plans are to make this assembly a three-day meeting in January. One day will be given to special meetings of the executive boards of member organizations and committees of the A. E. C.; one day will be given to the sessions of the A. E. C., and at least one day will be given to the discussion of some special topic such as elimination of waste, licensing and engineers, the national department of public works or some other subject of equal importance to the engineering profession.

On the question of licensing of engineers it is contemplated that the council's licensing committee will be able to submit a complete report to the board as a result of hearings to be held before the committee on this subject.

New Orleans Utility Held Not Justified in Refusing New Service

HOLDING that the light and power supply of New Orleans is in a precarious condition, the committee appointed by the Commission Council of that city to investigate the stations of the New Orleans Railway & Light Company has none the less reported that the company, which is in the hands of a receiver, had no justification for refusing to take on additional small consumers in the districts now served or contiguous areas. The committee, of which City Engineer Korer and City Electrician Cullinan are members, made recommendations looking to the speedy rehabilitation of the company's plant and the installation of new equipment to keep pace with the city's needs. It declares that in order to have the situation in hand by the winter of 1922-1923 it is essential that two 10,000-kw. alternating-current generators and nearly equivalent boiler capacity should be supplied. It suggests that if no other means of raising funds can be found receivers' certificates to cover the cost of this equipment shall be issued.

Commissioner of Public Utilities Maloney announced that he and the utility expert employed by the city would take up immediately with the railroad officials, Receiver O'Keefe and General Manager Kempster, the matter of the company's refusal to take on small consumers of light and power.

Service-Running Contests Popular

SERVICE-RUNNING contests like the one put on at the Drake Hotel during the Chicago convention of the National Electric Light Association are rapidly becoming a feature of central-station employees' outing picnics. One was held at the Edison picnic in Chicago on June 18 in which a crew each from Chicago and Milwaukee participated, the Milwaukee crew winning. At the annual picnic of the employees of the Milwaukee Electric Railway & Light Company on July 27 the same crews participated in a contest which was won by Chicago. The elapsed time for the Chicago and Milwaukee crews respectively in the latter contest was nine minutes and fifty-nine seconds and ten minutes and forty-seven seconds, with corrected time for penalties of ten minutes and thirty-four seconds and twelve minutes and twenty-two seconds. The corrected time in the former contest was 14:32.2 for Milwaukee and 15:07.5 for Chicago. The total penalties assessed in the former contest were 205 seconds, of which 135 were for the violation of safety rules. Penalties for accidental dropping of tools and materials are not counted as violations of safety rules. The reduced time at Milwaukee is due partly to a reduction in amount of work done but also to much better and cleaner work on the part of the crews.

The employees of the Cleveland Electric Illuminating Company recently staged a contest of this kind and a number of other Middle Western companies are also holding contests within their own ranks. The Chicago-Milwaukee contests are the first ones between the employees of different companies. They have excited a great deal of attention and are becoming the subject of inquiries from all over the country.

Seattle to Continue Work on Skagit Development

ADDITIONAL bonds in the amount of $5,500,000 have been voted by the City Council of Seattle to continue the development of power on the Skagit River. Several million dollars have already been spent in preliminary work on this project, which is situated more than 100 miles north of the city. The plans call for an initial installation of 30,000 kw. in two generating units, a tunnel, a crib dam and a single-circuit, 165,000-

volt transmission line to the city. Later it is planned to build a permanent concrete dam and raise the head so that 60,000 kw. may be obtained from the original units by changing the runners on the turbines. The third step in the development of the plant will probably be the addition of a third unit of 30,000 kw. rating, bringing the station to its ultimate capacity of 90,000 kw. It is not expected that the station will be in operation before two or three years.

S. Z. Mitchell Again Heads N. E. L. A. Public Policy Committee

PRESIDENT BUMP of the National Electric Light Association announced this week the acceptances of the following national committee chairmen:

Public policy committee—S. Z. Mitchell, president Electric Bond & Share Company, New York (re-appointed).

Customer ownership committee—John F. Gilchrist, vice-president Commonwealth Edison Company, Chicago (new committee).

Rural lines extension committee—G. C. Neff, general superintendent Wisconsin Power, Light & Heat Company, Madison, Wis. (new committee).

Rate research committee—Alex Dow, president Detroit Edison Company (reappointed).

Southern California and Cleveland Companies Issue New Bonds

SIX million dollars in general and refunding mortgage 6 per cent gold bonds of the Southern California Edison Company have been placed on the market at 88, to yield 7.07 per cent. These bonds are due Feb. 1, 1944, and are redeemable at 105 and interest on any interest-payment date up to and including Feb. 1, 1942, and at 102 and interest on any interest-payment date thereafter.

The Cleveland Electric Illuminating Company announces an issue on Aug. 1 of $5,000,000 twenty-year 7 per cent sinking-fund gold-debenture bonds at 95 and interest, to net about 7½ per cent. A sinking fund of 2½ per cent per annum of the total amount of debenture bonds issued is provided for their purchase in the market, if obtainable, up to 100 and interest.

Lackawanna Railroad Electrification Bids Rejected

ALL BIDS for supplying electrical equipment for the proposed electrification of some of the mileage of the Delaware, Lackawanna & Western Railroad have been rejected. Although the extent of the electrification has not been definitely decided, the initial installation would be that part of the Lackawanna system running through the anthracite coal region of which Scranton, Pa., is the center.

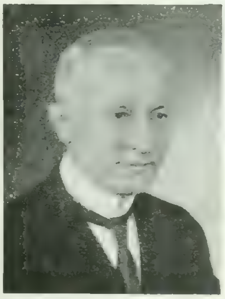
Friday, July 29, was the last day upon which bids could be submitted. All were found unsatisfactory. Gibbs & Hill, consulting engineers for the Lakawanna, received the bids, and it is understood that new offers probably will be advertised for in the near future. The General Electric Company and Westinghouse Electric & Manufacturing Company were the only companies that submitted bids for furnishing the heavier equipment.

D. H. Braymer Becomes Co-Editor of the "Electrical World"

WITH this issue Daniel H. Braymer, who since April, 1919, has been managing editor of the ELECTRICAL WORLD in charge of production and with supervision over the engineering phases of the paper, becomes co-editor with William H. Onken, Jr. By this appointment Mr. Onken is enabled to engage more fully in the study of national problems of economic importance to the electrical industry in addition to keeping actively in touch with the guiding forces of the national associations in the field.

Mr. Onken joined the editorial staff of the *American Electrician* in 1900, and in 1906, when it was absorbed by the ELECTRICAL WORLD, he became managing editor of the latter and ten years subsequently was made its editor.

Mr. Braymer first came on the ELECTRICAL WORLD staff in 1915 as engineering editor. Two years later he resigned to become editor of the *Electrical Record.* In 1919 he returned to the ELECTRICAL WORLD as managing editor. Mr. Braymer was born in Hebron, N. Y., in 1884 and was graduated with the degrees of A. B. and E. E. from Cornell in 1906. His first occupation after graduation was with the Electrical Testing Laboratories, New York City, in special work on alternating-current apparatus. He resigned to become factory inspector in the service and maintenance engineering department of the Western Electric Company at New York, later becoming special engineer for that company. Since 1910 he has devoted himself to editorial work in the electrical field. He was editor of *Electrical Engineering*, formerly the *Southern Electrician,* until 1915, when, as stated before, he joined the ELECTRICAL WORLD staff. He is author of "Armature Winding and Motor Repair" and joint author with W. T. Taylor of "American Hydro-Electric Practice."



W. H. ONKEN, JR.

D. H. BRAYMER

Oklahoma to Adopt Construction Rules

TENTATIVE printed construction rules have been issued for discussion by the Corporation Commission of Oklahoma. These cover overhead crossings, conflicts and inductive interference. The inductive interference rules follow the form of the California rules. Hearings were originally set for August but have been postponed to Sept. 13, when a public hearing will be held.

Crocker-Wheeler-Curtis Association Lasted Over Half a Century

IN PRESENTING in the issue of July 16 the appreciation by Dr. S. S. Wheeler of the accomplishments of the late Prof. F. B. Crocker it was erroneously stated that Professor Crocker, Dr. Wheeler and Charles G. Curtis had been "in almost constant contact about technical matters for forty years." The facts are that all three had been brought together as boys because of their great liking for technical studies. Young Wheeler was making a collection of chemicals and Crocker was introduced to him as a person from whom he could get certain chemicals that he had been unable to obtain anywhere else. Curtis was attracted to Wheeler because of certain mechanical devices the latter had made in school. Thus, as a matter of fact, it was more than fifty years ago when, as boys of about ten years, these men began their association from which so much of value to mankind was to result.

Cincinnati Gas & Electric to Increase Its Generating Capacity

BY THE flotation of $6,000,000 in gold notes, to which issue reference has already been made in the ELECTRICAL WORLD, the Cincinnati Gas & Electric Company has been enabled to enter upon a program of expansion and improvement of which the chief feature will be the installation of a fourth generating unit in its power house, bringing the total normal rating of the station to 100,000 kw., or 120,000 kw. under pressure. Other improvements scheduled are substations, transmission lines and extensions to the electric and gas properties.

The great growth of the electrical business of the company is shown in the figures for the years 1915 and 1920. In 1915 the peak of the company's electric load was 22,500 kw., while in 1920 it exceeded 70,000 kw. The three present turbine units have a normal capacity of 75,000 kw. Under a twenty-year contract recently made the company will supply the street-railway system with one-half of its electric power. This will be made possible about the first of September, when the fourth unit will be in operation.

The report recently distributed to the stockholders shows that the number of electrical consumers has increased by leaps and bounds under the presidency of W. W. Freeman. On Jan. 1, 1916, their total number was 23,663; at present they number more than 56,000.

Definite Steps Taken to Develop Electrified Furniture

JOSEPH F. BECKER, sales manager United Electric Light & Power Company, New York City, gave an interesting talk before the executive committee of the Commercial Section, N. E. L. A., at the Association Island meeting, on the subject of electrified furniture. The United company has appropriated $2,000 for the purchase and equipment of a complete set of residence furniture, as a practical demonstration of the benefits that will be derived from the installation of additional convenience outlets in the furniture itself, and Mr. Becker is devoting much time and attention to the development of this new idea.

The innovation comes as the outgrowth of a series of conferences which Mr. Becker has had with the New York Furniture Exchange, several furniture manufacturers and a number of large department stores. He reported the furniture people as enthusiastic over the idea and confident that it will have strong popular appeal. As the first step the United company proposes to produce an assortment of electrified furniture and place it on exhibition this fall at the New York Electric Show, the New York Furniture Show, in the furniture department of the John Wanamaker department store in New York, at the company's own salesroom and finally at the N. E. L. A. convention next summer.

Mr. Becker exhibited models of furniture and explained in general the plans for equipping the different pieces with convenience outlets. The matter of wiring methods, he said, has already been taken up with the Underwriters, and it is proposed to have a set of standard specifications drawn up by the Underwriters' Laboratories in Chicago for the guidance both of the furniture manufacturers and the electrical contractors who may be called upon to install receptacles in furniture already in use. Mr. Becker asked the Commercial Section to co-operate by providing the necessary funds for the development of the standard specifications, and an appropriation of $700 was voted to defray this expense.

Federal Power Commission Issues More Licenses and Permits

THE executive secretary of the Federal Power Commission has been authorized to issue the necessary supplemental instrument changing licenses issued prior to May 28 so as to make them subject to the regulations as amended on that date. Licenses have been issued by the commission to the Rock Creek Power Company, a Montana corporation, for a 1,060-hp. development on Rock Creek, in the Missoula National Forest; to Grace S. Eyre of Buena Vista, Col., covering a 560-hp. project on Chalk River, in the Leadville National Forest; to the Wisconsin-Minnesota Light & Power Company for a development on the Chippewa River, in Sawyer County, Wis., and to the Idaho Power Company covering a transmission line on the Fort Hall Indian Reservation designed to permit an exchange of power between the systems of the Idaho Power Company and the Utah Light & Power Company.

Preliminary permits have been issued to Reed A. Bingham for a 4,500-hp. project on the Perdido, Styx and Blackwater rivers in Alabama and Florida and to the Columbia Railway & Navigation Company for a project which involves the connection by canal of the Santee and Cooper rivers. A proposed power development by Union City, Mich., on the St. Joseph River in Branch County, Mich., has been found not to come under the jurisdiction of the Federal Power Commission because the river at that point is not navigable and the development does not affect interstate or foreign commerce.

Construction Rules Contemplated in Georgia

A BILL now before the Legislature authorizes the Railroad Commission of Georgia to establish overhead construction rules. Overhead crossings, conflicts and inductive interference are included in the bill in its present state. It is understood that the bill requires the adoption of rules within ninety days after the law becomes effective.

Chicopee to Buy Electricity for Fifteen Years More

A FIFTEEN-YEAR contract between the city of Chicopee, Mass., and the Turners Falls (Mass.) Power & Electric Company went into effect Aug. 1. The city has been purchasing electricity from the company for the last five years, and the new base rate represents an increase of slightly under 5 mills per kilowatt-hour. The municipal lighting department notified the city Water Department that its rates for electric pumping would be correspondingly increased.

The base rate in the new contract is 1.65 cents per kilowatt-hour. A coal clause is also embodied, with an added rate of 1.25 mills per dollar increase per gross ton in the average cost of coal stored at the company's Hampden steam plant above an eight-dollar base. If on the first of any month the cost of coal exceeds $8 at that point, the additional charge is computed as follows: The total kilowatt-hours taken by the city during the month is divided by the total permanent power billed to all customers of the company during that period, and the quotient is multiplied by the total number of kilowatt-hours generated by steam which is generated or purchased by the company during that month to supply its permanent load. This product equals the number of kilowatt-hours taking the added rate.

Unusual Activity in Inductive Interference Situation

UNUSUAL activity appears to characterize the inductive interference situation, particularly in the adoption of rules. The Ohio Legislature passed a law, effective Aug. 3, requiring the adoption of overhead construction rules, including regulations on inductive interference, within six months. The Georgia Legislature has a similar bill before it now. The Oklahoma Corporation Commission has issued tentative rules and set hearings for September.

In Illinois the Homer case was no sooner disposed of than the Lena case, involving the desirability of ground-return telephone circuits, came before the commission and attracted attention from both the telephone and the power interests. A similar case came before court at Worthington, Minn., two weeks ago, but was settled by a temporary agreement.

The chief engineer of a Middle Western commission who cannot be quoted told a representative of the ELECTRICAL WORLD that there was unusual activity in this matter in his state, no less than four cases requiring his immediate attention, though they had not as yet reached the stage of public hearings.

Agitation was started this spring in Wisconsin by a suggestion of an independent telephone representative to the Wisconsin Electrical Association for the appointment of an inductive interference joint committee. As yet the move has made no particular progress.

In addition to these moves that have become public there have been several cases in various parts of the country not made public in which temporary settlements have been made between the interests affected.

Heavy Light and Power Financing in July

THE demand for all high-grade investment issues has been extremely active because of the decided relaxation in monetary conditions. Accordingly the volume of investments offered by the electric light and power utilities during July was of large proportions. The twenty bond and note issues of the month, as listed in the table below, totaled $50,697,315, yielding on an average 7.51 per cent. Since the beginning of the year electric utility investment offerings aggregated $247,358,143. This figure, denoting an increase of about $50,000,000 over the corresponding total for the first seven months of 1920, is further evidence of the upward trend in utility financing.

This month's flotation is twice as large as that of July of last year, exceeds that of last month by over $30,000,000 and falls short of equaling the record set in May by only $5,000,000. Longer terms, larger single issues and lower rates of interest are the chief features to be noted. All but two of the issues are for a period of from fifteen to thirty years, and seven of them exceed $3,000,000 each. The decline in the past few months in the rate of return has been considerable and constant. In April the average yield was 7.78 per cent; this month it was 7.51 per cent.

The $7,000,000 issue by the Rochester Gas & Electric Corporation of twenty-five-year general mortgage gold bonds, selling at 96 to yield 7.35, constitutes the largest single offering.

Name of Company	Amount of Issue	Period	Class of Security	Purpose of Issue	Rate of Interest	Per Cent Yield	Offered At
Rochester Gas & Electric Corp	$7,000,000	25-yr.	General mortgage series B gold bonds	Refunding and extensions	7	7.35	96
Cincinnati Gas & Electric Co	6,000,000	1-yr. 5-mo.	Convertible gold notes, secured	Refunding and extensions	8	8.20	99.75
Commonwealth Edison Co.	6,000,000	22-yr.	First mortgage gold bond	Reimburse capital expenditures for new construction	6	6.75	91.5
Detroit Edison Co.	5,569,000	25-yr.	First and refunding mortgage bonds, series B of 1915	New construction	6	7.15	88
Cleveland Electric & Illuminating Co.	5,000,000	20-yr.	Sinking fund gold debentures	Additions to equipment	7	7.50	95
Detroit United Ry	4,000,000	1-yr. & 20-yr.	First mortgage collateral sinking fund gold bonds	Refunding	8	8.50 & 8.10	99.5 & 99
Central Maine Power Co	3,000,000	20-yr.	First and general mortgage bonds, series A	Refunding	7	7.45	95.5
Milwaukee Electric Ry. & Light Co.	3,000,000	.....	Cumulative preferred stock	.	8	8.00	100
Brooklyn Edison Co	3,000,000	20-yr.	General mortgage series D gold bonds	Additions and extensions.	7	7.15	98.5
New England Power Co	1,250,000	.....	Cumulative preferred stock			8.50 until 1931; 6.00 thereafter	
Shawinigan Water & Power Co.	1,875,000	29-yr.	First refunding mortgage sinking fund gold bonds	Floating debt and new construction	6	6.75	90.5
Adirondack Power & Light Corp	1,000,000	30-yr.	First and refunding mortgage gold bonds	Additions and extensions.	6	7.25	85
Iowa Ry. & Light Co	1,000,000	20-yr.	First and refunding mortgage gold bonds of 1912.	.....	8	8	100
Fitchburg Gas & Electric Co.	678,865	.....	Stock	Cancellation of obligations and additions		...	55
New Bedford Gas & Edison Light Co	572,000	17-yr.	First mortgage gold bonds, series C		6.5	6.05	104.65
Potomac Light & Power Co	550,000	1-yr.	Prior lien collateral trust notes	.....	8	8	100
Chicago, North Shore & Milwaukee Electric Railroad	500,000	5-yr.	Secured sinking fund gold notes, series B	Retirement of outstanding notes and additions	7	8.25	89.5
Central Arizona Light & Power Co	500,000	15-yr.	First and refunding mortgage gold bonds, series A	Refunding	8	8.10	99
Athens Railway & Electric Co	179,000	15-yr.	General mortgage and collateral trust bonds, series A	.....	8	8.20	98
[illegible] Light & Power Co	23,450		Stock				100
Total	$50,697,315						

Pacific Gas & Electric May Purchase Output of Hetch Hetchy Project

AN OFFER has been made by the Pacific Gas & Electric Comany through John A. Britton, vice-president and general manager, to purchase the entire output of electrical energy that will become available at the Hetch Hetchy water and power development of the city of San Francisco when this plant begins operating, which will not, however, be for two or three years. It has been reported that the city engineer, J. J. O'Shaugnessy, will recommend a wholesale disposition of all the power developed by the city as part of the Hetch Hetchy project, rather than the erection of a 150-mile transmission line into the city and an effort to dispose of the energy at retail in competition with the local companies. It is asserted that the city will have 66,000 hp. for sale when its first generating unit is completed.

Officials of the Pacific Gas & Electric Company are quoted as saying that if they can be assured of this large additional supply they can defer expensive development work for many years. The cost of labor and material is still high while rates of interest make it virtually prohibitive to undertake any but the most necessary construction at present.

United States Chamber of Commerce Formulates Taxation Program

AS A RESULT of a supplementary referendum just participated in by more than 500 business organizations the Chamber of Commerce of the United States has recommended to the ways and means committee of the House of Representatives a program of tax revision which includes a general turnover tax on all business transactions to bring in revenue which would be lost through the repeal, as also advocated, of the excess-profits taxes and the war excise taxes, both those on transportation and communication and those levied in relation to particular businesses.

Other recommendations of the Chamber of Commerce are for the decentralization of administration of income taxation, for the ascertainment by the government of any tax based on income before payment and for a court or courts of tax appeals to be entirely separate and independent of the Treasury Department. It is further proposed that net losses and inventory losses in any taxable year shall cause redetermination of taxation on the income of the previous year, that an exchange of property of a like or similar nature shall be considered merely as a replacement, that gains realized from the sale of capital assets shall be subject to lower rates than income received from business or other current activities, that income from any new issues of securities which lawfully may be made subject to federal tax shall be taxable, and that American citizens resident abroad shall be exempt from the American tax upon income derived in foreign countries and not remitted to the United States.

REPEAL OF WAR EXCISE TAXES FAVORED

A preliminary canvass of the returns received by the chamber from its member bodies shows that the most general demand, after a virtually unanimous demand in the previous referendum for repeal of the excess-profits tax, is for repeal of the taxes on freight and express charges, passenger fares and Pullman charges, and messages—that is, for an end to the war excise taxes on transportation and communication. For repeal of these excise taxes there were 1,443 votes to 290 votes against. The next largest vote was for repeal of war excise taxes levied, under the present law, in connection with particular businesses.

On the issue between an increase in the income tax for corporations and a sales tax, to take the place of the excess-profits tax, the voting was clear-cut in its indication of the point of view that prevails among the member organizations. Eleven hundred and seventy votes were cast for the sales tax to 108 for an increase in corporate income tax. On the form a sales tax should take, 1,142 votes were cast in favor of a tax on turnovers to 395 for a tax on retail sales. On the question as to which of two forms of turnover tax should be used, there were 824 votes for a tax on all turnovers to 366 for a tax on turnovers only of goods, wares and merchandise.

Electric Floodlighting a Tower of Strength in Pilgrim Pageant

ADVANCED equipment for floodlighting is a vital factor in the success of "The Pilgrim Spirit," a pageant by Prof. George P. Baker of Harvard University, which is being given at intervals this midsummer in celebration of the tercentenary of the landing of the Pilgrim Fathers at Plymouth, Mass. The pageant was viewed this week by President Harding. Thirteen hundred performers produce this spectacle by night beside the world-famous Plymouth Rock, aided by a connected lighting installation of 360 kw., which includes one of the most accurately designed installations of incandescent projectors ever achieved. Fifty "Pilgrim" type 1,000-watt floodlighting units, designed by Monroe R. Pevear of the Pevear Color Specialty Company, Boston, electrical director of the pageant, and forty-eight 1,500-watt General Electric "L-15" floodlamps are employed, with smaller gas-filled auxiliary lamps. All floodlights are operated in fixed positions, and by the use of two parabolic reflectors and an intermediate spherical reflector, forming a bell-shaped interior surface, the divergeance of rays in the "Pilgrim" units is reduced to less than 7 deg.

The wiring contractor was Charles A. Rounds of Boston, and the value of the electrical installation is about $30,000. The average height of the projector lamps is 50 ft. above the pageant field, and the total air-line distance from the supporting towers to the rear of the field is 450 ft., the width being 400 ft. Two switchboards were used in controlling the lighting service, and more than 15 miles of wire were required, with nearly 200 switches, 400 fuses and over 5,000 insulating knobs. Five incandescent searchlights are using laboratory lamps for the first practical demonstration of units requiring 100 amp. at 12 volts. The main installation is operated at 115 volts, energy being supplied by the Plymouth Electric Light Company. Nearly 10,000 persons can find seats in the stands provided for the use of spectators.

Current News and Notes

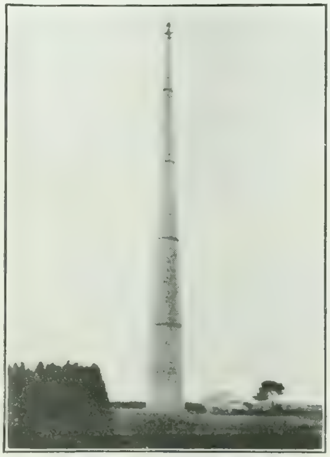
Timely items on electrical happenings throughout the world, together with brief notes of general interest

Clarksburg (W. Va.) Company Gets Increase in Rates.—As a result of valuation proceedings, the Public Service Commission of West Virginia has granted to the Clarksburg Gas & Electric Company an electric rate of 8 cents per kilowatt-hour for the first 100 kw.-hr. graded down to 2 cents for energy in excess of 5,000 kw.-hr., in order to raise an additional annual income of $30,000 to which it is declared entitled.

Flat Municipal Water-Heating Rate Proposed in Seattle.—A bill introduced into the Seattle (Wash.) City Council provides for a flat rate of $5.50 per 1,000 kw.-hr. for electricity used in household water heaters, energy consumed for this purpose being now charged for by the city at domestic lighting rates. The new rate proposed would allow the consumer to keep hot water on tap twenty hours a day for the monthly charge just stated. At present rates the same service costs $15.

Androscoggin Electric Company to Float Bonds.—A decision by the Public Utilities Commission of Maine authorizes the Androscoggin Electric Company to sell its 5 per cent mortgage bonds, dated Oct. 26, 1914, payable Oct. 1, 1934, of the aggregate par value of $415,000, at not less than 76 per cent and accrued interest, or to pledge them at not less than 70 per cent of the par value, or both, and to sell the bonds so pledged, when redeemed for the pledge, at not less than the first price. The proceeds are to be used in payment of the unfunded debt of the company and in reimbursement of its treasury for capital expenditures made since Oct. 26, 1914.

Improved Service in Easton, Pa.—In commenting on its application to the Pennsylvania state authorities for a charter of incorporation under the name Pennsylvania Edison Company, this utility, which was formerly known as the Pennsylvania Utilities Company, says: "When the present management took hold of the affairs of the company in 1917 the service to the public was almost intolerable. Many of Easton's largest industries were faced with the possibility of having to provide their own power plants. The trolley system was unable to get sufficient power to operate its cars properly, and the Board of Trade had a special committee to investigate the whole matter of power service. What has been accomplished is pretty well known. The improvement in service has been continued steadily until the service in Easton today is second to none in the country. What this has meant to the manufacturing industries in giving them an ample supply of power during their great volume of war business, and the consequent employing of large numbers of people, cannot be estimated in dollars, but it has been acknowledged by the citizens of Easton and vicinity in the spirit of fairness which they have shown by co-operating with the company during the trying times of the last four years."



High Radio Pole Made of Concrete.—There is shown here a 664-ft. concrete pole used at the 400-kva. wireless station at Havanomachi, Japan. Through this station direct communication between San Francisco and Japan is possible. The photograph was sent to T. C. Martin by Dr. R. Mitsuda of the Imperial Electrotechnical Bureau of Tokio.

Speed of Construction on Queenston-Chippawa Power House Is Slackened.—The Hydro-Electric Power Commission of Ontario has discontinued night work in the construction of the Queenston-Chippawa power development, and the entire night shift, numbering between 3,000 and 3,500 men, has been discharged or assigned to positions on the day force. Officials state, according to the *Canadian Manufacturer*, that the work at Niagara was overmachined and overmanned, from the viewpoint of strict economy in capital expenditure per horsepower developed, but that until recently it appeared absolutely necessary to complete the work by Sept. 1, in order to deliver power for the Toronto street railway system. Now the Electrical Development Company and Toronto Power Company are being purchased by the "Hydro" system, in accordance with the agreement reached some six months ago, and as a result there will be no difficulty in supplying all the power needed in Toronto, without unduly rushing the completion of the Queenston project.

Official Emblem for Indianapolis Electric Club.—A design has been accepted as the official emblem of the Electric Club of Indianapolis, which is in the form of a large circle with the words "The Electric Club of Indianapolis" around the outer edge. A white electric light bulb is shown in the center of the circle against a solid black background. Inside the outlines of the bulb is shown a figure of "Miss Indiana" holding aloft a burning brand, symbolic of illumination. The statue forms the filament in the globe. The Electric Club was organized to further the electrical industry in the city and is composed of dealers and others interested in the trade. It has a total membership of about 150. Plans are now under way for an industrial lighting exhibition of seven different electrical systems to be held in September. Charles L. Smith of the C. L. Smith Electric Company is president of the club; Roscoe W. Mercer of the General Electric Company, first vice-president; Thomas F. Hatfield of the Hatfield Electric Company, second-vice president; George L. Skillman of the Skillman Electric Company, secretary and treasurer, and T. A. Wynne of the Indianapolis Light & Heat Company, assistant secretary and treasurer.

Associations and Societies

Rocky Mountain Division, N. E. L. A.—The second annual convention of this geographic division of the National Electric Light Association, combined with the annual convention of the Colorado Electric Light, Power and Railway Association, will be held at the Hotel Colorado, Glenwood Springs, Sept 19, 20 and 21.

Metropolitan Section, A. S. M. E.—The following executive committee has been elected for the ensuing year: Chairman, W. S. Finlay, Jr., of the American Waterworks & Electric Company; secretary, G. I. Rhodes of Ford, Bacon & Davis; treasurer, Robert B. Wolf of R. B. Wolf & Company; F. T. Chapman of American Radiator Company, and Dr. H. G. Tyler of New York University.

Coming Meetings of Electrical and Other Technical Societies

Michigan Electric Light Association—Ottawa Beach, Mich., Aug. [illegible].
N. E. L. A., New England Division—New London, Conn., Sept. 6-9.
International Association of Municipal Electricians—Colorado Springs, Col., Sept. 6-10.
Pennsylvania Electric Association—Bedford Springs, Pa., Sept. 7-10.
N. E. L. A., Great Lakes Division—French Lick Springs, Sept. 11-16.
Association of Iron and Steel Electrical Engineers—Chicago, Sept. [illegible].
West Virginia-Kentucky Association of Mine, Mechanical and Electrical Engineers—Huntington, W. Va., Sept. 20-23.
Illuminating Engineering Society—Rochester, N. Y., Sept. [illegible]-30.
American Electrochemical Society—Lake Placid Club, N. Y., Sept. 29-Oct. 1.
American Electric Railway Association—Atlantic City, N. J., Oct. 3-7.
N. E. L. A., Southeastern Section—Chattanooga, Tenn., Oct. 18-20.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities

Segregation of Operations of Dual Utility.—The fact that a public utility company is the lessee and not the owner of an electric light plant does not affect the principle that profits earned in its electrical operations have no bearing in fixing gas rates, according to a decision of the New York Public Service Commission, Second District.

Value of Service and Fair Return.—The principle that a just rate must take into account the value of the service to the public cannot destroy the principle of fair return, said the Montana Public Service Commission in fixing rates for a street-railway company, and while the service may be worth nothing to a man who cannot pay, the utility cannot be compelled to meet his necessities.

Refusal to Render Unremunerative Service Permitted.—The Public Utilities Commission of Kansas has allowed the Kansas Gas & Electric Company to refuse to extend service to ninety would-be consumers of electrical energy and ten would-be consumers of gas in Wichita, Pittsburg, Arkansas City and seven other towns, on the ground that it would require more than 165 per cent of one year's revenue to install lines.

Exaction of Twenty-four-Hour Service Unjust to Small Utility.—A small electric utility rendering less than twenty-four-hour service to 127 consumers at an income about equal to expenses cannot, the Missouri Public Service Commission asserts, justly be required to give twenty-four-hour service unless a material reduction in operating cost be effected, such as might be had through the receipt of energy from a transmission line.

Water Rights as an Element in Valuation.—In passing upon an application from the Southern Nebraska Power Company for authority to issue securities, the Nebraska State Railway Commission approved the inclusion in the valuation of an item for water rights which was determined by ascertaining the reasonable saving by use of water power as compared with any substitute which would have to be used if water power were not available and capitalizing this item at 8 per cent. Only one-half of the value of water rights was added to the valuation, on the ground that the public should benefit in part from the saving by reason of the fact that it had loaned its water power to private parties for exploitation.

Increased Rates Granted by Commission in Preference to Fuel Clause.—Opposing the adoption of a fuel rider, the Missouri Public Service Commission permitted the Campbell Electric Light & Power Company, which had experienced an increase in the cost of coal threatening to bring about operation at an annual loss of nearly $8,000, to charge increased rates designed to yield approximately $6,000 in additional revenue.

Depreciation Fund as Necessary to Municipal as to Private Plant.—Asserting that the same necessity for a depreciation fund with which to make replacements exists in the case of a municipal plant as in that of a plant privately owned, the Missouri Public Service Commission allowed the municipal plant of Independence, which had been operating at a loss, to increase its rates so as to meet operating expenses and a 4 per cent allowance for depreciation on a total valuation of $104,989.

Justification for Fixing Future Rates.—"The commission is of the opinion that it is justified in anticipating, within reason, the future," said the Oregon Public Service Commission in fixing rates for a gas company. "Under normal conditions, rates are not fixed for a day, and a continually changing schedule is unsatisfactory and expensive both to the people and the utility. Stability of rates is to be desired, and only when appreciable injustice results, either to the patrons or the utility, should rate revisions, with their attendant confusion, be permitted."

Accrued Depreciation Not Provided for Cannot Figure in Valuation.—"If, as seems to be the case," the Indiana Public Service Commission said recently, in rate proceedings concerning the Richmond Heat, Light & Power Company, "no cash has been accumulated in the depreciation reserve and the earnings have been insufficient to provide for the accumulation of a depreciation reserve, petitioner has used up its property to the amount of the depreciation in furnishing service at a loss. During the period in which most of these losses were incurred the state did not exercise its regulatory power. If the rates actually charged were insufficient, it was due to competitive conditions. The principle behind the ruling that depreciation must be deducted unless the cash is present in the depreciation reserve is substantially the same as the principle that superseded and abandoned property cannot be included in the valuation. In both cases the investment was made but the property is no longer there. . . . If the rates in effect at the time such depreciation was accruing or such property was superseded or abandoned did not yield sufficient revenue for these purposes [building up a depreciation reserve], they were unreasonably low. But this does not warrant the commission in capitalizing such deficits and adding them to the value of the property which is now used and useful."

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies

Operation of Utility Department at a Loss Cannot Be Forced.—The Public Utilities Commission of Illinois in October, 1920, dismissed a petition of the Mount Carmel Utility & Service Company for permission to abandon its heating service, on the ground, in part, that, although the heating department was being operated at a loss, the whole business, which included electric and water departments, was being operated at a profit. The Illinois Supreme Court, in adjudicating an action brought by the company against the commission, has, however, reversed this decision and remanded the case, declaring that the state has no power to compel a corporation engaged in operating a public utility to serve the public without a reasonable compensation and that this principle extends to the operation of one branch of a business, even though its other branches may be profitable. (130 N. E. 693.)*

Tacoma Wins Victory in Condemnation Cases.—The riparian rights cases included in the condemnation suit of the city of Tacoma for lands needed in the development of the Lake Cushman power site closed in the Superior Court of Mason County with two verdicts of nominal damages of $10 each allowed the claimants. The verdicts were important victories for the city, as the claims filed had totaled $128,000. The verdicts settled the claim of the Olympia Door Company, which alleged that its timber, valued at $118,000, would be rendered valueless by reason of the reduction of the flow of waters in the Skokomish River and the impossibility of floating logs out, and the Rasmus Hanson case, involving a claim of $10,000 for other timber. The city emerged from the riparian rights cases, which included the claims of more than sixty defendants and intervenors, with a total of $41,600 of damages allowed against the municipality, more than double the amount it was estimated the settlement of all claims in the Skokomish River valley below the dam site would cost. An appeal will be taken on the legal point of whether lands which do not abut on the river have any claim to damages at all. Damages in these cases are presumably based on the factor of "fear and apprehension." The city contended that alleged fear of the breaking of the dam it intends putting in is not an element in a condemnation suit.

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*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel—Responsibilities and Association Appointments of Men Engaged in Professional, Executive, Operating and Commercial Branches of the Industry

W. S. Murray and **Henry Flood, Jr.**, have formed an engineering partnership under the firm name of Murray & Flood, with offices in the Grand Central Terminal, New York City. A consulting service will be furnished on general power engineering, public utility interconnections, power-plant engineering, both steam-electric and hydro-electric, and heavy-traction railroad and industrial electrifications. During the past year Mr. Murray has been engaged in a very interesting economic analysis of power requirements on the Atlantic seaboard as chairman of the Superpower Survey conducted by the United States Geological Survey, and Mr. Flood has been engineer-secretary of Mr. Murray's organization. This work was brought to a successful completion on July 1 of this year, at which time the new engineering firm was organized. Mr. Murray is a well-known consulting engineer with an extensive experience, particularly in the electrification of steam railroads. In 1905 he was appointed electrical engineer and later became consulting engineer for the New York, New Haven & Hartford Railroad Company to undertake the electrification of the New York division of that road, which he completed in 1915 at a cost of $25,000,000. In 1913 he formed a partnership with E. H. McHenry, past vice-president of the New York, New Haven & Hartford Railroad Company, and completed the New Haven electrification during this association. In 1917 Mr. Murray became president of the Housatonic Power Company, which owned water-power sites on that portion of the Housatonic River within the State of Connecticut. He was also chief engineer of the Connecticut Power Company, which purchased the company owning these powers. This latter company has recently completed the hydro-electric station on the Housatonic known as "Stevenson" plant, one installation of a chain of developments which, when completed, will make Connecticut's contribution to conservation the saving of 500,000 tons of coal annually. In 1919 Mr. Murray moved his engineering offices from New Haven, Conn., to New York City and took up general consulting work on electrical generation and transmission, railroad electrification and conservation of natural resources. Mr. Murray was born at Annapolis, Md., Aug. 4, 1873, and was graduated from Lehigh University in 1895 with the degree of electrical engineer.

W. S. MURRAY

Henry Flood, Jr., received his technical education at Cornell University and was for a number of years associated with the electric utility industry, starting with the Newburgh Light, Heat & Power Company as assistant to the manager of the electric department, serving subsequently with the Penn Central Light & Power Company as power engineer and for seven years with the Central Hudson Gas & Electric Company as chief engineer. Following this he was mechanical engineer for the American Smelting & Refining Company, after which he took up consulting practice in New York City. His more recent work consists of an association with Dr. John Price Jackson in conducting the power survey for interconnecting the electric utility companies of western Pennsylvania, eastern Ohio and northern West Virginia and in acting as engineer-secretary for the Superpower Survey, as stated above.

Henry R. Stevens, who for the past two years has been resident construction engineer on the Kerckhoff project of the San Joaquin Light & Power Corporation, has severed his connection with that company and is making his headquarters in San Francisco, where he will devote some time to the manufacture and sale of the new fused horn-gap cut-out and disconnecting switch recently perfected by himself and Harry L. Wood. Mr. Stevens is well known on the Pacific Coast, where he has been identified with projects in Oregon, Washington and California. He designed or installed the electrical installation in the transmission station at Snoqualmie Falls, the U. S. battleship Nebraska, the Nooksack Falls station, the Bellingham steam plant, the White Salmon (Wash.) station, the Big Creek (Cal.) No. 2 station, the Lake Washington canal locks at Ballard, Wash., and many other plants on the Pacific Coast.

T. Angus, who has been manager of the Northwestern Ohio Light Company's plant at Delphos, Ohio, has been made general manager of all branches.

Harry Chamberlain, formerly local superintendent of the Pennsylvania Power & Light Company, Freeland, Pa., has been appointed superintendent of the Shamokin district, succeeding J. A. Britton, who has been advanced to the position of superintendent of distribution. Mr. Chamberlain has been in charge of the company's operations in Freeland for a number of years.

HENRY FLOOD, JR.

Percy J. Wilson, power sales engineer of the Lowell (Mass.) Electric Light Corporation, has been appointed to the position of plant superintendent. Mr. Wilson succeeds John H. Collins.

J. A. Britton, formerly superintendent of the Pennsylvania Power & Light Company, Shamokin, Pa., has been advanced to the position of assistant to the superintendent of distribution, covering the entire properties of the company. Mr. Britton went to Shamokin in 1906 as superintendent of the Shamokin & Coal Township Light & Power Company. In 1907 when that company was merged with the Shamokin Light, Heat & Power Company he remained with the new organization. In 1910 the entire property of the lighting company was sold to the Pennsylvania Lighting Company. When the control was transferred to Philadelphia two years later, Mr. Britton became general manager of the local property. In June, 1920, the Pennsylvania Lighting Company merged with others into the present corporation covering a territory extending from Stroudsburg to Williamsport. Mr. Britton is succeeded in the Shamokin district by Harry Chamberlain of the Freeland (Pa.) district.

P. H. Smith has been appointed manager of the power division of the Atlanta office of the Westinghouse Electric & Manufacturing Company.

Dr. John Ambrose Fleming, F.R.S., to whom the Albert medal of the Royal Society of Arts was awarded this year, has been closely associated for the last forty-two years with the practical and scientific developments of electricity in Great Britain. As far back as 1879 he was the scientific adviser of the Edison Telephone Company in London. In 1882 and for twelve years after he held a similar scientific position in connection with the Edison Electric Light Company of London and later on with the Edison & Swan United Company and assisted the early progress of electric lighting in London. When practical wireless telegraphy was initiated by Marconi in 1899 Dr. Fleming gave scientific assistance in its development and directed some of the early constructional work in connection with the first long-distance wireless station at Poldhu. He invented in 1904 the first form of that remarkable appliance the thermionic valve or detector, which in the later improved forms due to subsequent inventors has effected such a revolution in wireless telegraphy and telephony. This is only one of many inventions Dr. Fleming has given to this and other branches of electrotechnics. On the scientific side of electrical science he has been a prolific contributor to the transactions of various learned societies, having communicated in the last forty-eight years about ninety scientific memoirs to the proceedings of the Royal Society, the Physical Society, the Institution of Electrical Engineers and the Royal Society of Arts. About twenty of these papers described important work on the electric and magnetic properties of matter at low temperatures, carried out in conjunction with Sir James Dewar at the Royal Institution of London. He read the first paper before the Physical Society of London at its inaugural meeting in March, 1874. A paper by him on "The Necessity for a Standardizing Laboratory for Electrical Instruments," read in 1885 to the Institution of Electrical Engineers, was the means of bringing into existence the Board of Trade Electrical Laboratory and gave an impetus to the movement which later on resulted in the establishment of the National Physical Laboratory. He is the author of sixteen textbooks or treatises on electrical subjects which have had a worldwide circulation. The best known of these are his books "The Principles of Electric Wave Telegraphy and Telephony," "The Alternate-Current Transformer" and "The Thermionic Valve and Its Developments in Wireless Telegraphy," For thirty-six years Dr. Fleming has held the chair of electrical engineering in University College of the University of London. In addition to the fellowship of the Royal Society in 1892, his scientific work has been recognized by the award in 1910 of the Hughes gold medal by the Royal Society, by the institution premium (twice, in 1903 and 1912) of the Institution of Electrical Engineers, by the Bernays prize of the Society of Engineers and by a silver medal from the Royal Society of Arts. He has recently completed a book entitled "Fifty Years of Electricity, the Memories of an Electrical Engineer" (to be published by the Wireless Press, Ltd.), in which he has described the chief notable achievements of electrotechnics in the last half century, with many of which he has been intimately connected. In addition to his scientific pursuits Dr. Fleming has taken an active part in promoting popular education. The Albert medal was awarded to Thomas Edison in 1892 and to Dr. Alexander Graham Bell in 1902.

W. S. FINLAY, JR.

W. S. Finlay, Jr., who has been elected chairman of the Metropolitan Section of the American Society of Mechanical Engineers, is vice-president of the American Water Works & Electric Company, a position he has held since May of last year. Previous to that he was superintendent of motive power for the Interborough Rapid Transit Company, taking up the work of the late H. G. Stott. Mr. Finlay has had extensive experience in steam-plant construction and operation and has done much experimental and research work that has resulted in improved station efficiency. Mr. Finlay has been active in the affairs of the A. S. M. E. for a number of years.

Edwin C. Butler has taken over the electrical contracting firm of Gagen & Butler, Inc., New York City, and is continuing the business under his personal direction as president, the name having been changed to E. C. Butler Electric Corporation. Mr. Butler has had wide and varied experience in the electrical field for the past fifteen years, both in practical work and engineering. Since 1913 he has been secretary and treasurer of Gagen & Butler, Inc., and before that he was employed in an engineering or construction capacity by the General Electric Company, electric railroads, testing laboratories, consulting engineers and electrical contracting firms.

Paul McJunkin, who was instrumental in bringing a number of the independent lamp manufacturers together in the formation of the United Lamp Manufacturers' Corporation, has been a consulting engineer since 1903, engaged largely in the development of equipment and processes for the manufacture of incandescent lamps. Mr. McJunkin was born Aug. 2, 1875, in Iowa. After graduating in 1898 from the Massachusetts Institute of Technology he took up post-graduate work in physics and chemistry at the University of Chicago and under the late Prof. Rowlands at Johns Hopkins. In 1899 he became associated with the Sawyer-Man Electric Company as supervisor of technical work. His work on incandescent lamps has led him into a thorough study of tungsten and its properties. In 1906 he brought back to the United States three tungsten lamps made by the Austrian scientist, Dr. Kuzet. It has been stated that these were the first pure tungsten-filament lamps which had been seen in this country.

F. H. Hardy, the newly appointed assistant district manager of the Redlands district of the Southern California Edison Company, has been with that company since 1906 and has obtained an extensive experience in both the operating and commercial departments. Mr. Hardy was born in Fitchburg, Mass., in 1874 and moved to California in 1898. In 1902 he entered the employ of the Redlands Street Railway Company, working up to the superintendency of the Redlands division, which position he held until he resigned to join the Edison organization. He has served successively as groundman, storekeeper and troubleman in the operating department, following which he went into the commercial department of the Redlands district and has filled all positions from meter reader to chief clerk.

Lewis H. Lee has been placed in charge of the public relations department of the Georgia Railway & Power Company, Atlanta, succeeding Charles Towne. Mr. Lee is a member of the publicity organization of Ivy L. Lee of New York, and has heretofore handled the public relations department of the Pennsylvania Railroad, the American Express Company and other companies. Mr. Lee will make his headquarters in Atlanta.

Arthur S. Hall, sales engineer with the industrial division of the Westinghouse Electric & Manufacturing Company, Providence, R. I., left that organization Aug. 1 to become head of the power department of the Lewis Electrical Supply Company, 117 Federal Street, Boston, agent jobbers for the Westinghouse company.

Thomas Brady has been placed in charge of the New York office of the Green Engineering Company, East Chicago, Ind.

Trade and Market Conditions

Business Reviews, Together with Market Letters from Important Trade Centers, on the Supply, Demand and Prevailing Prices of Electrical Apparatus and Supplies

Collections, While Not Satisfactory, Show Improvement

TO SAY that collections are easier might be considered as putting too optimistic a face on the problem. There is, however, a decidedly less pessimistic view taken of the situation by credit men in the electrical field and the general impression gained is that they see some improvement. All along the line accounts have been closely scrutinized and credit has been extended carefully. This, of course, has had a tendency to weed out undesirable credit risks, and as a consequence collections on current billings are easier.

In some quarters it is believed that there is an undue readiness to take advantage of the existing circumstances and to delay payments unnecessarily. Such cases are not frequent, however, and where investigation shows a bona fide cause for delinquency few creditors are inclined to resort to suit. On accounts that have lapsed for a period of ninety days many firms are taking time notes, extending the payment of the balance of an account over thirty, sixty or ninety days.

Use of trade acceptances is at this time exceptional as most collections run over thirty days. Buying is, of course, on a hand-to-mouth basis for current requirements, and payment for such material is made usually within sixty days.

The worst of the situation is naturally the quantity of so-called "frozen credit." Stocks in some instances are large and have been carried now for several months with little opportunity of moving them. In other cases industrial plants have purchased and installed equipment upon which payment has not been completed. The seriousness of this problem, however, is probably exaggerated, for, as one credit man said: "After we have had just one of these accounts on our books for a while it looms up larger than all the rest of our accounts put together, while as a matter of fact it is barely 1 per cent of the outstanding unpaid accounts."

Middle West Fan Season Unusually Successful

REPORTS from all parts of the Central States indicate that the season just past has been the most successful for several years for electric fan manufacturers, jobbers and dealers. It is variously estimated that final reports on the season, available about Sept. 1, will show an increase over 1920 business of from 75 per cent to 100 per cent. Although last year proved dull on account of cool weather, the increase is still worthy of note in view of the fact that business in rural communities was small and that industrial activity is noticeable for its absence.

At this time last year many jobbers and dealers had large overstocks on their shelves and were forced to carry them over to this season. This had a noticeable effect on demand last fall when 1921 contracts were made, but the oversupply was quickly cleared out by the hot spring weather, and since that time both jobbers and manufacturers have been little more than able to keep abreast of their orders. A shortage in alternating-current types has been particularly noticeable for several weeks. The largest retailer in Chicago, with one month of the season still ahead, had sold 5,000 fans, an increase of 100 per cent over 1920 sales, and was slightly ahead of the record for 1916, the previous most successful year. Chicago jobbers estimate the increase in their sales at 75 per cent, while the Chicago branch of a fan manufacturer will show an increase of more than 100 per cent.

Much of this demand is coming from Illinois, Indiana, Michigan and Wisconsin, states which have a number of large cities. In contrast there has been a small demand from rural states, such as Iowa, Nebraska and the Dakotas. This is explained by the fact that the farmers in those sections are still holding a large part of their 1920 crops and are short of money.

All types and sizes other than the 32-volt have proved good sellers, with the 10-in. fan most popular for residence use and the 16-in. fan gaining favor for commercial purposes. Restaurants particularly have found the 16-in. fan most suitable for their purposes. Sales of the 12-in. sizes were kept down somewhat, it is thought, by a price slightly out of line. Sales of the miniature type of fan were pushed in only a few quarters, but wherever this was done orders were satisfactory.

The total value of ventilating fan sales probably does not exceed that for 1920, but the number of units sold shows an increase of 15 to 20 per cent, due to the efforts of manufacturers and jobbers to concentrate on restaurant, residence and small-plant business.

The Metal Market Situation

THE position of copper shows no improvement. In fact, the market has sagged another ½ cent since last week. The metal is being offered by some dealers at 12 cents per pound delivered for near-by shipment. Some of the leading selling agencies are quoting nominally at 12¼ cents per pound, but it is reported that even the large interests have been making the 12-cent price when regular customers come to them with inquiries for near-by deliveries. The outside market is quoted at 12 cents for August and September deliveries. However, it is a question whether metal can be bought at this price for September deliveries from the big producers. Wire base is still quoted at 14 to 14.50 cents.

One encouraging feature is that the world's stocks of scrap brass today are probably not over 300,000 tons, whereas at the beginning of the year they were 500,000 tons in addition to the 600,000 tons of refined and blister copper carried at the beginning of the year.

Although making no official announcement of a new price schedule the United States Steel Corporation is meeting the new low prices quoted by independent producers and appears to be setting the pace in at least one product.

NEW YORK METAL MARKET PRICES

	July 26, 1921	Aug. 2, 1921
Copper	£ s d	£ s d
London, standard spot	70 0 0	70 5 0
	Cents per Pound	Cents per Pound
Prime Lake	12.50	12.25
Electrolytic	12.25	12.00 — 12.25
Casting	11.50	11.50
Wire base	14.00 — 14.50	14.00 — 14.50
Lead, trust price	4.40	4.40
Antimony	4.65	4.60
Nickel, ingot	41.00	41.00
Sheet zinc, f.o.b. smelter	10.00	10.00
Zinc, spot	4.75	4.70 — 4.75
Tin	26.00	25.75
Aluminum, 98 to 99 per cent	24.50	24.50

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	9.50 — 10.00	9.50 — 10.00
Brass, heavy	4.25 — 4.50	4.25 — 4.50
Brass, light	3.50 — 3.75	3.50 — 3.75
Lead, heavy	3.25 — 3.37½	3.25 — 3.37½
Zinc, old scrap	2.00 — 2.25	2.00 — 2.25

THE WEEK
IN TRADE

Prices When Quoted Are Those Prevailing at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

THERE are unmistakable signs of improvement in the electrical market. Stocks are not so large in local warehouses, and turnovers as a result are more frequent. Heavy automobile traffic and new laws have caused a very brisk market in a number of places for miniature lamps and flashlamps.

Better buying is noticed for the railroads, which is taken as a forerunner of a much greater demand from other large purchasers.

Troubled labor conditions in the building trades are preventing lower prices from bringing forth orders. Where this matter has been settled, however, there should be no occasion for holding back.

From the agricultural districts of the South the Central States and the Far West the fall is being looked forward to eagerly, as then harvest money is expected to open up the market.

NEW YORK

Some indications of slightly more active business were noticeable among the jobbers of this section during the past week. Considerable material for maintenance and repair work is moving, but orders are small, covering only the immediate needs. Contractors who have work in hand and under way are buying material only as required, and there seems to be no inclination to increase stocks. The demand for armored conductor, as reported last week, continues at about the same level and there has not been sufficient change either way to affect prices.

Another encouraging indication of more activity is the number of inquiries for materials and prices that are being received. Part of this is due to purchasing agents shopping around to obtain the best price, but there are many instances of inquiries covering large quantities of material and also heavy equipment which would be used only for new construction. Much of this business will materialize as soon as the present situation begins to clear.

Conduit.—Fairly good stocks of all sizes are the rule and prompt shipment can be made. Sales are in small quantities and are readily handled. In 2,500-ft. lots ½-in. black is quoted at $55 to $58; ¾-in., $72 to $78; 1-in., $105 to $112. On galvanized pipe, same sizes, quotations are $60 to $66, $81 to $85 and $116.96 to $123. There is virtually no change since last week, and prices are inclined to hold at these levels.

Flexible Armored Conductor.—Recent movement seems to continue, but does not increase and prices remain the same as last quoted. From $48 to $49.50 per 1,000 ft. is the current price for No. 14, two-wire single-strip.

Rubber-Covered Wire.—No. 14 single-braid in 10,000-ft. lots is quoted at $6.50 to $6.77 per 1,000 ft. Demand is only moderate and stocks are ample to large. There does not seem to be any intention of shading prices below the above quoted figures and if anything the price has stiffened somewhat.

Non-Metallic Flexible Conduit.—There is little demand for this material in the immediate territory and stocks are kept down as low as possible. In 1,000-ft. lots the following prices were quoted this week: 7/32-in. size, $21, ¼-in., $23, and ⅜-in., $36 per 1,000 ft.

Fans.—With cooler weather the first of the week and the end of the fan season in sight, sales were very light. Stocks are for the most part small, but the popular sizes and types can be supplied without delay.

Heating Appliances.—Of the heating devices only irons and toasters are moving. Some jobbers report an active demand for these devices. Stocks are fair to good. The recent drop in prices on heating devices has not stimulated buying, but it is believed that this is because of ample stocks carried by retail dealers.

Outlet Boxes.—Discounts range from 45 to 55 per cent on black boxes and 40 to 50 per cent on galvanized in lots of 100. Stocks are ample, but very little is moving.

Friction Tape.—Demand for friction and rubber tape is spotty and sales are in line with other materials. A nominal quotation this week was 36 cents for friction and 43 cents for rubber in 100-lb. lots.

Metal Molding.—No change in price since the recent drop of about 5 per cent. In 1,000-ft. lots the three-wire size is quoted at $5.92 to $6.40 per 100 ft. Stocks are fair and jobbers report a moderate demand but in small lots.

CHICAGO

Though business in electrical circles during the past week has shown only slight improvement, general conditions are bettering and the tone is one of hope. It is generally conceded that railroad buying will show the way to better times, and inquiries of this sort have come into the market within the last few days for car repairs from a number of roads. While conditions are still far from good, there are signs that the slump has passed its worst stage.

Electrical jobbers and contractor-dealers have almost given up hope for any considerable construction this season as a result of the failure of Judge Landis to accomplish anything as arbitrator in the building wage controversy. Suggested modifications to the uniform agreement have been opposed by both sides. As a result jobbers' sales remain small even though prices are off in several lines. Jobbers' report collections still long, but there is nothing in the situation to cause worry. Retail trade is quiet, a most successful fan season being almost over, while other appliances sell well only when special inducements are offered.

Wire.—Bare copper wire has dropped approximately a cent per pound, No. 8 being offered at 15½c. per pound in 1,000-lb. lots. Weatherproof is down also, No. 6 triple-braid being offered at from 15½ to 16 cents per pound in large quantities. These reductions have not resulted in many orders, though there have been numerous inquiries, indicating that some line construction is being contemplated. Rubber-covered wire is quoted at $6.50 per 1,000 ft. for No. 14 single-braid.

Conduit.—There is only a fair local demand for black pipe owing to the continued lethargy of the construction market. There is a lack of stable quotations, though the nominal price per 1,000 ft. for ½-in. black conduit is $55 in 5,000-ft. lots. Flexible conduit is selling reasonably well outside of Chicago and the 7/32-in. size is quoted at $24 per 1,000 ft. in 5,000-ft. lots.

Locknuts and Bushings.—In spite of curtailed construction there has been a slight increase in demand. This may possibly be accounted for by the number of rewiring jobs, both residence and industrial, that have come into the market. The ½-in. locknuts are quoted at 75 cents per 100 and at $1.10 per 100 for the ¾-in. size.

Ranges.—Considerably more electric ranges have been sold during the first seven months of 1921 by a leading Illinois utility than were sold during the same period in 1920, because of intensive sales effort. The campaign will be carried on indefinitely.

Motors.—Demand is spotty but better than thirty days ago. Orders have been received from the railroads but mainly for small sizes for shop work, and this is true of almost all orders. However, July proved better than May or June and inquiries are continuing to pick up. The 10 per cent reduction that went into effect July 12 has not affected demand much, buying being done only where necessary.

BOSTON

A better feeling is reflected in the trade, although conditions are still slow in mending. July bookings in two leading jobbers' houses hold up well in comparison with spring business. Collections are about the same, but are beginning to reflect the improved banking situation somewhat. Hand-to-mouth buying still marks jobbers' purchases, but there are indications that such orders are increasing in frequency. Inquiries are increasing somewhat. Engineering organizations are doing more report work. Prices were unsettled last week in closely competitive lines on the larger quantity purchasing. Building and engineering contracts in New England for the week ended July 26 totaled $5,000,000, compared with $6,403,000 a year ago, and were exceeded in only four corresponding weeks of the past twenty years. The metal industries in New England are quiet, operating at about one-third capacity. The paper industry is dull, with hampering labor troubles. Woolen mills are running actively, June operations having reached 75 to 95 per cent of capacity. Cotton mills average about 75 per cent of capacity, according to the Federal Reserve Bank of Boston, and the boot and shoe industry is producing at about 60 per cent of capacity.

Motors.—A slightly better tone to the market is evident from inquiries. The sale of integral horsepower motors is non-spectacular, but one prominent distributer reports sales 40 to 50 per cent as large as at this time last year and within 5 or 10 per cent of pre-war totals. Fractional-horsepower motors are very dull. Buying is very widely distributed and small-order business is dominant.

Wire.—Moderate movement is reported, with unsteady prices where large stocks are being liquidated. Rubber-covered, No. 14, sold Monday in Boston around $6.25 per 1,000 ft. in 5,000-ft. lots.

Flexible Armored Conductor.—A light demand is apparent, with No. 14 double-strip selling from $50 to $51 per 1,000 ft. in 2,500-ft. lots. Stocks are plentiful for current requirements.

Lamps.—Trade is extremely brisk in 21 cp. gas-filled incandescent lamps for automobile headlight service, in view of regulatory requirements effective Aug. 15. The demand is being satisfactorily met, however. General lighting business holds up well in response to vigorous sales work on the part of central stations and retailers.

Storage Batteries.—Improved business is noted, the demand for automobile and radio cells being quite good.

Sockets.—Pull sockets are fairly active and are selling at 37.5 cents net in standard packages. Keys and keyless, at 25 and 23 cents respectively, are not moving so fast. Small orders are being placed with manufacturers, according to a representative jobber.

Ranges.—Vigorous sales effort is being rewarded by well-distributed orders, although quantity purchases are scarce. Manufacturers are well "set" for greatly increased business, and present facilities are not running at a very high "load factor."

Rubber Matting for Switchboards.—This material, although not a standard electrical jobbing product, is running very low in stocks. Even the present light demand calls for considerable "shopping around" to fulfill.

ATLANTA

The general morale of the section is noticeably improved, particularly in the smaller towns that were very hard hit by the sharp break in the price of all agricultural products. A revival of activities is predicted in the early fall when the crops are harvested. The report of the Sixth Federal Reserve Bank shows that a larger volume of business is being done than at any time during the past year, though the money value is quite reduced. The wholesale hardware line is an exception to this rule, the volume being considerably reduced as compared with a year ago, purchases still being for small quantities for immediate delivery. The increase in building activity is reflected in the report of the Southern Pine Association for June, which shows that average orders have increased from 472,574 ft. to 518,600 ft., each week showing a healthy increase over the previous week.

Ornamental Lighting Equipment.—An unusual number of inquiries are being received for this specialty, particularly from large industrial plants maintaining mill villages. The small municipalities are also showing considerable interest. A slight decline in the price of metal posts is to be noted.

Electric Churns.—Jobbers received notice this week of a price reduction of approximately 20 per cent from manufacturers, which after being passed on to dealers stimulated sales to some extent. Activity in this line has been very weak for the past four or five months, but indications are that business will be a little better this fall.

Transformers.—A general reduction in price of 10 per cent is reported this week. Sales of distributing type are holding up fairly well owing to the demand from central stations for large numbers of new cut-ins to residences being constructed. Stocks are in very good shape. While the demand for power transformers is off considerably, there have been several good sales made in certain localities.

Armored Conductor.—Dealers appear to be buying actively from jobbers this week upon the strength of a price reduction of approximately 10 per cent. Stocks are in good shape, but it is not expected that the flurry this week will be sustained.

Commercial Lighting Fixtures.—Demand has been fairly good in the larger centers where buildings under way are being completed. Certain types have declined in price this week from 10 per cent to 15 per cent. Distributers' stocks are in excellent condition to handle the demand.

Flexible Conduit.—There has been very little demand for this item lately, the price drop of 5 per cent not affecting the situation to any extent. Stocks in this section are ample to take care of ordinary requirements.

Porcelain.—The demand for staple porcelain material is holding up very well under the circumstances, and a slight stimulation has been noted since the recent break in price. All jobbers' stocks are in good shape and prompt deliveries are being obtained from factory.

ST. LOUIS

The strike of electrical workers in the St. Louis industrial district was terminated the latter part of last week, following an agreement whereby the men will continue to receive $1.25 per hour.

The strike prevailing for the greater portion of the week greatly restricted the week's business, but the pre-strike basis now exists. Some are expecting a slight betterment of business this fall because of the effect of excellent agricultural conditions, particularly in the corn belts. In the South, too, because of crop diversity and the better movement of cotton, the situation promises to be better this fall. Credit conditions throughout the territory are improving and money is easier. Jobbers, however, still report a sixty-day collection basis.

Jobbers are actively endeavoring to increase turnover, and as a result prices are to a considerable extent competitive. Representative quotations are given here, though prices somewhat lower may be found in special cases where the size of the order warrants it.

Lamp Cord.—Prices are slightly easier, No. 18 twisted cotton selling at $13 per 1,000 ft. in 5,000-ft. lots. No. 18 twisted silk is still quoted at $23 to $25 per 1,000 ft. There is substantially no movement and stocks are inclined to be heavy.

Sockets.—Local jobbing stocks, it is claimed, are in good shape, but large stocks are in the hands of the manufacturers. Movement is very slow. Key sockets are selling at $26.40 per 100; keyless, $22.50; pull, $34.

Flexible Armored Conductor.—Owing to the electricians' strike the demand last week was quite low, but otherwise a reasonably good call exists. Stocks are now slightly heavy. Prices have recently declined, No. 14 two-conductor is now being quoted at $52.50 per 1,000 ft.

Switches.—Because of the lack of building, movement is very limited, but better demand from the smaller localities may be found this fall. Stocks are in good shape. Flush and snap switches are quoted at $27 per 100 in standard-package lots.

Fuses.—The demand holds steady for about all kinds and sizes. Stocks vary from good to large. Plug fuses are priced at $34 per 1,000 in standard packages. N. E. C. non-renewable cartridges, 3 amp. to 30 amp., sell for 13½ cents each, and 31 amp. to 60 amp. sell for 18 cents each. Renewable fuses, 3 amp. to 30 amp., are quoted at 29 cents each, and 31 amp. to 60 amp. at 58 cents each.

Metal Molding.—Stricter municipal wiring requirements have tended to increase the demand, but because of low construction work the call for some time has been very light, particularly while the electricians' strike was on. Stocks, however, are in good shape. Wire molding is priced at $4.95 per 100 ft.

SEATTLE—PORTLAND

Although a quiet condition still persists, business locally was somewhat stimulated by the Northwest merchants' convention held in Seattle during the past week. Orders were booked by out-of-town merchants in many lines considerably in excess of expectations. The local fruit and berry crop is good and is being disposed of at satisfactory prices. Labor is cheap and plentiful. Electrical jobbers in Seattle report a moderate but fairly steady demand for fans and other seasonal goods. The high gas rates as well as the excessive cost of coal which prevails locally have been a constant stimulus to the sale of electric ranges, a fair demand for which seems to exist at all times. Bank clearings for Seattle for July 30 show a falling off of about 10 per cent over similar figures for a year ago and are slightly in excess of those for a month ago.

Manufacturers' agents in the Portland region report that the volume of business is unchanged with little prospect for improvement before fall. Jobbing business continues about the same, some reporting a little greater activity. The sale of household appliances continues active. Flatirons are apparently leading. The reduction from $8 to $6.85 acting as a considerable incentive. The increasing number of automobiles and paved highways in this section has created a demand for flashlamps considerably greater than was expected. Stocks in all other lines, however, are in good shape, although there is no tendency toward an overstocked condition. Collections are not improved. The contractor-dealer business is in general not very active, the volume being less than it was a year ago. Cash sales are materially less than they were the first of the year, but this is considered merely a seasonal change. Small contracting work, such as residence wiring and repair work, is active. Fixture business is practically normal. Vacuum-cleaner sales are active.

The June building report for Portland shows an increase of 41.5 per cent over June, 1920. The electrical permits issued during June were the greatest in the history of the department. It is stated that this is due primarily to residence building activity and repair work.

A slight improvement in orders is reported by Spokane jobbers this week over last. Business, however, still continues quiet, with no considerable activity looked for until money from harvest gets into circulation. Lumber and mining, two of the large basic industries of this district, are inactive, with the result that dealers are focusing their hopes of better business on the excellent crops which are reported from almost everywhere throughout the district. Stocks are in good shape, deliveries prompt and collections fair. A comparatively good fall business is looked for.

Conduit.—Movement is still slow. Half-inch galvanized sells at $7.45, ¾-in. galvanized at $9.72. Corresponding figures for black are $6.98 and $9.10 per 100 ft. in carload lots

Wire.—The demand for rubber-covered is moderate. No. 14 sells at $7.20 per 1,000 ft. in lots of 5,000 ft. and less. Weatherproof is in steady demand but sales are light, No. 6 selling at $18.15 per 100 lb. in 1,000-lb. lots, while No. 8 is selling at $19.15.

SALT LAKE CITY—DENVER

The general merchandising and financial situation remains little changed in the Intermountain region. Although some profess to see distinct signs of improvement, the consensus of opinion is that business is merely marking time. However, there is little discouragement or pessimism manifest. Every one seems to believe that better times are just ahead. The feature of the week is the announcement by the Federal Reserve Bank of a lower rediscount rate, the rate falling from 6 to 5½ per cent. The demand for money continues with the usual restrictions as to loans, and country banks are still calling on the city banks for accommodation. The Anaconda Mining Company recently sold the Pacific Gas & Electric Company 10,000,000 lb. of copper wire in a single order. Three-fourths of this amount will go into the construction of a single high-tension line. A conservative estimate of the demand on the copper industry to supply the needs of electrical plants in the Intermountain and Western States during the next decade is 280,000,000 lb. It is this prospect that assures the owners of the vast porphyry plants that the present period of depression will be rather short-lived. The excess of labor supply over demand seems to have quieted pending disputes.

Miniature Lamps.—The call has been very encouraging. The reason for the augmented demand is the increased use of passenger cars. There has been no complaint of shortage of stocks.

Flashlamps.—These also have had a good run in the past two months. The extensive use of flashlamps by campers has created a seasonal demand.

Conduit.—Jobbers report stocks more than ample to meet a demand that is sluggish, to say the least. The dearth of big construction jobs is responsible for the slow movement. A 10 per cent reduction in price has not stimulated demand appreciably.

Washers.—Business thus far this summer has been characterized by few sales and small interest on the part of ultimate consumers. The high price continues a decisive barrier to better demand. Some jobbers would welcome a chance to unload excessive stocks. No recent price change has been ordered.

Cleaners.—The market is holding to a good average. Energetic dealers are reporting a splendid week to week movement. Vigorous salesmanship is required, however.

SAN FRANCISCO

During the past week the builders' strike took a turn for the worse and settlement is now apparently a long way off. At a special election the leaders who advised the strike were returned to power. The unions are now voting on calling a general strike, and it is reported that their sentiment has veered so that the majority is now in favor of such a strike.

Shipments from the East are now being made in large proportion by water via the Panama Canal at a saving of about one-fourth as compared with railroad rates. The time in transit is about three weeks longer than by rail, and the goods arrive in exceptionally good condition. The seamen's strike, it is reported, has been called off and withheld shipments can now be released.

Motors.—The recent price decrease of 10 per cent found nearly all dealers with heavy stocks on which they had to take a considerable loss. The motor business is much quieter now than during the spring irrigation season, and dealers in second-hand and repaired motors especially are experiencing quieter business than for several seasons.

Lamps.—Demand is very good considering the season, but slower sales are reported by jobbers because of their effort to cut down outstanding stocks on the dealers' shelves. A very careful survey has been made of this condition, with the result of causing an intensive campaign to provide dealers with sufficient fast-moving stock and bringing to light useless overstocks that had accumulated.

Farm Plants.—Pacific Coast stocks both in jobbers' warehouses and in those of their district dealers are very high and are moving poorly

Manufacturers' Activities

Devoted to the Business Side of Manufacturing, Distribution and Sales, News from Jobbers and Foreign Fields and a Record of New Devices and Trade Literature

National Conduit & Cable Company Not Insolvent

In the last issue of the ELECTRICAL WORLD a very regrettable error occurred in the heading of the article reading "National Conduit & Cable Company Not Solvent." The heading as written read "National Conduit & Cable Company Not Insolvent," and the change was due to a last-minute error of the typesetter which the proofreader failed to detect. The context as contained in the article itself clearly shows that the company is solvent.

The ELECTRICAL WORLD offers its sincere apologies to the company and to its receiver, Clarence G. Galston, for this error.

The receiver is authorized to continue the operations of the company and promptly took measures on July 15, the date of his appointment, to notify customers of the company accordingly.

James Magee, who has been connected with the company for the past twenty-five years, and who was formerly head of the copper department, has been made works manager.

Briefs Filed in Lamp Patent Suit

Briefs in the case of the General Electric Company versus the Alpha Laboratories were scheduled to be filed in the United States District Court on Monday of this week. This case, which is before Judge Meyer, involves both the Just and Hannaman and the Langmuir patents. Replies are to be filed by Aug. 8, and oral argument will be heard on Aug. 15 and 16.

Brown Instrument Company Opens Office in Cleveland

The Brown Instrument Company, Wayne and Roberts Avenues, Philadelphia, manufacturer of indicating and recording instruments, pyrometers and so forth, has opened a branch office in the Reliance Bank Building, 1634 Euclid Avenue, Cleveland.

Powers Electric Sales Company Adds New Line

The Powers Electric Sales Company, 1170 Broadway, New York City, has been appointed by the Liberty Machine Company, Wauwatosa, Wis., as its sales representative for the States of New York and New Jersey, as well as exporting agent for its lines of fixture fittings and castings. The Powers company also acts as representative in the same territory for the Fernando C. Mesa Company, Irvington, N. J.; the Federal Porcelain Company, Carey, Ohio; the Magic Electric Company, New York City, and the Wurdack Electric Manufacturing Company, St. Louis. Myron Kommel has joined the sales organization of the company and will serve the local trade. H. Dayton Ball is the New York State representative of the company.

Large Australian Tower Order Goes to Milliken

Milliken Brothers Manufacturing Company, Incorporated, of New York, has just secured through its London office a contract with the Electricity Commissioners at Melbourne, Australia, to furnish towers for a 112-mile, 132,000-volt transmission line in the Dominion of Victoria, Australia. The contract, which is based on furnishing 490 suspension towers, 40 strain towers, 14 terminal towers and 90 semi-anchor towers, will run in the neighborhood of $300,000.

J. E. Jennings, vice president of the company, who has been in Europe for the past six months, returned to New York last week and will sail for Australia from Vancouver, B. C. on Aug. 6 to go over the route of the line.

Sales Organization for Independent Lamps

Eleven Manufacturers Form Company to Take Over Sales and Supervise Production in Order to Secure Complete Line, Uniformly Packed and of Uniformly High Quality

Offices were opened and business started on Monday of this week by the United Lamp Manufacturers' Corporation, at 44 West Eighteenth Street, New York City. This company was formed by a number of independent lamp manufacturers as a selling, distributing, purchasing and manufacturing control organization. The purpose of the company primarily is to be able to supply a complete line of incandescent lamps in uniform packing and of uniformly high quality. This was something that none of the member companies could do alone, because none of them was so equipped. It is now planned that none of the factories will make a complete line of lamps, but each factory will be assigned to make certain parts of the complete line. In this way it is expected to obtain a high production and quality.

All lamps produced by member companies will be sent directly to the warehouse of the selling organization in New York, from which place they will be distributed to warehouses in different parts of the country to take care of local demands.

There is also being established at the central office a laboratory where all raw materials used by the manufacturing companies will be inspected and when found satisfactory sent directly to the factories.

The laboratory will also maintain lamp inspection, with inspectors in each factory. It is now planned to have visual inspection of one lamp out of every hundred and a life test given to one lamp out of every thousand. The company will not have branch offices, but all selling and billing will be done from New York and shipments made from the nearest warehouse.

It was stated at the offices of the company that a standard life and efficiency guarantee will go with the lamps. All lamps will be marketed under a trade name which has not been decided upon. There will also be a uniform packing. All sizes and types of incandescent lamps will be manufactured.

The companies were brought together largely through the efforts of Paul McJunkin, a consulting engineer who has been in the lamp industry for more than twenty years and who has been very greatly interested in developing means for bettering the quality of incandescent lamps.

The new company, which is capitalized at $75,000 all in stock, is owned by eleven contributing companies, to which stock has been apportioned in proportion to their volume of 1920 business. The total business done by these factories in 1920 amounted to $1,800,000.

Following is the list of member companies: Acme Lamp Works, Bedford Lamp Works, Bettalyte Incandescent Lamp Company, Continental Lamp Works, Daylyte Lamp Works, International Incandescent Lamp Works, Paragon Incandescent Lamp Works, Republic Electric Company, Thomas-Brown Company, Titan Miniature Lamp Company, Union Lamp Company. Others are expected to join the organization.

The officers of the company elected for the purpose of organization were: A. E. Weise, president; R. H. Herschman, secretary; T. P. Vilaghy, treasurer.

Lamp Manufacture Changes Company Name

The Electric Lamp & Products Company, 512-514 Paterson Plankroad, Jersey City, N. J., has changed its name to the Lhytan Electric Lamp Company. Officers and location of the factory remain unchanged. The company manufactures gas-filled lamps under license from the General Electric Company.

Crane Company Enlarges New York Works

The Crane Company, manufacturer of pipe, valves, fittings, steam fittings and so forth, is constructing a new one-story building, 100 ft. x 145 ft., adjoining its present works at 490 Cherry Street, New York City. The cost is estimated at $28,000. The new building will be used for assembling purposes and to provide storage space for material being held for export.

Trumbull Brings Out New and Revised Line of Switches

A new and revised line of externally operated entrance switches, two-pole and three-pole, 125 volts and 250 volts, for use with or without meter trims or back plate, has been brought out by the Trumbull Electric Manufacturing Company, Plainville, Conn. This, with the line of meter service switches announced a month or so ago, makes it possible to furnish an assortment to meet all requirements for 30-amp. entrance switches.

The new line replaces four members of top hinged entrance switches and boxes known as 5,741-43-51-53 and completes the 5,791 side-hinged line.

Consolidated Company Acquires Chicago Selling Agency

The Consolidated Electric Lamp Company, Inc., Danvers, Mass., has acquired the business of the Chicago Electric Lamp Company and will conduct its business of lamp distribution from the factory offices at Danvers.

Higher Selling Offsets Lower Manufacturing Costs

The August issue of *Royal Breezes*, published by the P. A. Geier Company of Cleveland, makers of the Royal electric cleaner, contains an analysis of price conditions by F. J. Gottron in which it is shown that the cost of appliance selling has increased more than the cost of appliance manufacturing has been reduced. Mr. Gottron suggests that as far as the public is concerned the small amount that might be saved by customers waiting for any reasonable price reduction is more than balanced by the time and labor lost through continuing wasteful methods of housekeeping.

Ansonia Electrical Company Expands Plant

The Ansonia (Conn.) Electrical Company has awarded to the Aberthaw Construction Company, Boston, a contract for the erection of three new factory buildings on the company's property on Division Street, Ansonia. The new buildings will be mainly one story in height and will add about 54,000 sq.ft. to the present facilities of the company. They will be of brick and steel construction and will consist of a 300-ft. x 75-ft. shop for the manufacture of magnet wire, a 190-ft. x 60-ft. shipping and stock house, and a 140-ft. x 75-ft. enameling wire building. A 40-ft. x 21-ft. steam plant building is also included. It is estimated that an increase in output of 40 to 50 per cent will be feasible through the completion of these buildings.

Republic Electric Enlarging Plant

The Republic Electric Company, Cleveland, wholesale distributer of electrical supplies, is reconstructing and adding to its present quarters. The portion of the building fronting on Chester Avenue will have three stories, which will contain its new offices, accounting department and salesroom. Additional floor space is also being added in the rear. When all improvements are completed (about Jan. 1) the floor space will be increased by 10,000 sq.ft., making a total floor space of 60,000 sq.ft. The location will then be known as Chester Avenue, corner of Eighteenth.

New York Appliance Business Picking Up

July billing by the New York office of the Edison Electric Appliance Company, according to W. B. Pierce, manager of the office, was a new record for the district. Ever since the beginning of the year New York billing from local stock has been on the increase. This, however, does not refer to billing from home office stock in Chicago. Larger business was booked and transacted last year, but much of this had to be shipped from Chicago stock.

Business is picking up, according to Mr. Pierce, who states that jobbers are ordering in better volume. Moreover, a most hopeful sign pointed out by Mr. Pierce is the greater rate of turnover by jobbers. From a turnover of three months last year jobbers, he said, are now moving heating appliances at the rate of eight to ten times a year.

First Annual Edition of "EMF Electrical Year Book" Issued

The first edition (1921) of the "EMF Electrical Year Book," issued by the Electrical Trade Publishing Company, Chicago, has made its appearance. The book contains 1.000 pages and comprises three leading features—compilations of facts and figures about each branch of the industry, definitions of electrical and allied terms, and a classification of products made and used by the industry with listings of their producers. All topics are entered alphabetically, the entire text being arranged as in an cyclopedia or dictionary. In the products and manufacturers' directory feature there are included over 2,900 classifications and sub-classifications of electrical and related products, each of which is first descriptively defined and followed by the list of its American and Canadian manufacturers. It is planned to revise the book completely each year and to add to it each year further industrial information, definitions, products and manufacturers' listings.

French Railway Places Order with Westinghouse

An order for electrical equipment amounting to $1,200,000 has been received by the Westinghouse Electric International Company from the Midi Railway of France, which operates an extensive system starting from Bordeaux, running through Tolouse to Cette, with many branches. The section on which the electrical equipment will be used extends from Pau to Tolouse, in the Pyrenees Mountains near the Spanish border and has a total length of over 100 miles. The order includes transformers, synchronous condensers, lightning arresters and other substation equipment.

Moloch Company Occupying New Plant

The Moloch Company, Kaukauna, Wis., manufacturer of "Mayer" power hammers and "Moloch" automatic underfeed stokers, is now established in its new plant at Kaukauna, consisting of a machnie shop, 80 ft. x 200 ft., and a foundry of the same dimensions. The floor space and capacity of the plant have been increased by approximately 300 per cent. While at present, the company states, it has not as much work as it could handle, prospects are more than encouraging. The Moloch company is a consolidation of the Moloch Stoker Company of Chicago and the Kaukauna Machine Works of Kaukauna.

Drew Electric & Manufacturing Company Resumes Operations

The Drew Electric & Manufacturing Company, Cleveland, Ohio, has resumed operations after a brief shutdown, during which time its plant was rearranged and the company refinanced and reorganized.

James H. Drew continues in the capacity of president and director of sales, and Walter D. Healy as district sales representative. New officers of the company are Elmer F. Flynn, vice-president and general manager, and John D. Williams, secretary and treasurer.

The Drew plant has been operating at full capacity since reorganization on April 1, 1921, and is now again serving the trade and filling orders promptly on line material, motor bearings, pole sleeves, pole-line hardware and other specialties.

Multiple Storage Battery Corporation Expands

The Multiple Storage Battery Corporation, 350 Madison Avenue, New York City, was recently incorporated with a capitalization of $150,000 preferred stock, 5,000 shares of class A and 3,500 shares of class B non-par-value common stock. The new corporation has taken over the business of the Multiple

Storage Battery Company and is erecting a large addition which will quadruple the capacity of its plant at Jamaica, Long Island. Herbert G. Clapper, recently vice-president of the Eagle-Picher Lead Company, has been elected president, Norman D. Sturges remains vice-president and general manager and Jasper Bayne is secretary.

In addition to continuing the manufacture of storage batteries for automobile starting and lighting, for farm lighting systems and other purposes, the Multiple Storage Battery Corporation will shortly commence the manufacture of an electric vehicle battery upon which development work has been conducted for the past fourteen years. Details of the new battery, it was stated, will be available in the near future.

The incorporation of the new company with increased capitalization and the enlarged manufacturing facilities have been necessary to take care of additional business. Orders have been taken recently by this company for future delivery, it was stated to a representative of the ELECTRICAL WORLD, which would very nearly equal its business of the past year.

Columbian Bronze Corporation to Make "C-Y-C" Generators

The Columbian Bronze Corporation, 522 Fifth Avenue, New York City, has acquired the manufacturing and sales rights of Carlton, Young & Catlin, Inc., Grand Central Palace, New York City, manufacturer of "C-Y-C" generating units of 1.5 kw. capacity. The Columbian Bronze Corporation is proceeding with the manufacture of these units at its factory at Freeport, Long Island. Lewis J. Hall is president and W. H. Young is vice-president of the company.

Sun-Ray Company Names McCarthy Company New England Agents

The Sun-Ray Manufacturing Company, Oshkosh, Wis., manufacturer of electric heating pads, has appointed the A. F. McCarthy Company, 10 High Street, Boston its exclusive representative in New England. A new jobber's sheet has lately appeared on this product. The McCarthy company is an active sales representative for a number of socket appliances, rigid conduit, transformers and wiring material.

Walworth Locates Executive Offices in Down-Town Boston

The Walworth Manufacturing Company, Boston, has transferred its general and executive offices from its factory, at First and O Streets, South Boston, to 88 Pearl Street, Boston. The engineering department and works purchasing force will continue at the factory, but the company's main activities apart from production will now be directed from the new quarters, which are in close touch with the financial and machinery selling districts.

Delta Equipment Announces Partnership Dissolution

The Delta Equipment Company, 148 North Third Street, Philadelphia, dealer in steam and electrical power equipment, etc., announces that the partnership heretofore existing between Andrew I. Mehan, Peter J. McBride and George B. McClennen, under the name of the Delta Equipment Company, has been dissolved by mutual consent by the withdrawal of Andrew I. Mehan. The business will be continued by Peter J. McBride and George B. McClennen under the same name and at the same location.

Foreign Trade Notes

THE CONTINENTAL ELECTRIC COMPANY, LTD., has recently been organized to manufacture and sell "Royal" electric cleaners in Canada. The new company has its headquarters at 507-511 King Street East Toronto, Ont.

THE ELECTRIC APPLIANCE COMPANY, LTD., Winnipeg, Canada, has been reorganized under the name of the Wheaton Electric Company, Ltd. Mr. Wheaton of Saskatoon, who has been associated with George E. Miles as partner and manager, has taken over the ownership of the business and appointed H. E. Kelly as manager. During the past year Mr. Kelly has been associated with the Wheaton Electric Company, Ltd., at Saskatoon, in the capacity of manager of retail sales. Mr. George E. Miles has accepted the position of sales engineer for the Canadian Westinghouse Company, Ltd., with headquarters at Calgary, Canada.

POWER DEVELOPMENT AT VICTORIA FALLS.—The project to develop the water power of Victoria Falls on the Zambesi River, South Africa, has been revived, and it is exceedingly likely that the construction of a 250,000-hp. plant will soon be under way. It has been under discussion for many years, but the proximity of cheap coal stood in the way. This fuel is now at such a price that there is a demand for hydro-electric power. Electricity developed at the falls will probably be transmitted to the Rand mines, 600 miles distant.

INTERNATIONAL G.E. ACQUIRES BELGIAN LAMP COMPANY.—In the annual report of the Procédés Thomson-Houston & Carels, of Belgium, it is stated that the Belgian Thomson-Houston & Carels Company, through its agreement with the International General Electric Company, has obtained control over the patents for the manufacture of incandescent lamps in Belgium and was now engaged in establishing that branch of manufacture. For that purpose an interest had been acquired in the Manufacture Belge de Lampes Electriques.

GERMAN GOVERNMENT ACQUIRING ELECTRICAL WORKS.—The German Government has acquired the entire capital stock of several large electrical enterprises, it is reported from Switzerland, including the Electroworks Limited, the Central-German Power Works, the Brigitta Power Works, the Niederlausitz Power Works and the Sachsenburg Power Works and Coal Mines. The State will operate these enterprises under the title of Electroworks, Limited, with a full paid capital of 250,000,000 marks.

DEMAND FOR ELECTRICAL APPLIANCES IN CHINA.—Most of the larger electrical plants of China are intending an extension of their plants. According to a report from Peking, in a number of large Chinese cities the electric light leaves very much to be desired, which fact is chiefly due to the wear and tear of the machinery and the steady overwork the plants are obliged to perform.

REPORT OF BRITISH CABLE INDUSTRY.—In a report on the electrical cable industry in England, made by a subcommittee of the standing committee on trusts, it is stated that the prosperity of the industry is thought to be due largely to the efforts of the Cable Makers' Association, which by its organization and [illegible] and has maintained a high standard quality of product. The report shows that in the prices quoted by association firms and non-association firms those quoted by the latter are generally lower by about 10 per cent. The percentage increase in the price of cables over pre-war prices is given as approximately 50 per cent in the case of certain cables for indoor use and approximately 100 per cent in the case of heavy underground cables. Comparing figures of early 1921 with those of the middle of 1914, copper increased 20 to 30 per cent, lead 30 to 50 per cent, steel wire 310 per cent, steel tape 410 per cent and paper 300 per cent. At the same time rubber decreased 50 per cent. Labor, however, one of the ruling factors determining cable prices, has increased approximately 200 per cent in this time.

MORE POWER FOR BERNE.—A powerful hydro-electric power station will be erected in the neighborhood of Oberhasle in the Swiss canton of Berne. The demand for electric current is steadily increasing not only for the electrified railroads and those to be electrified but also for light and industrial power purposes. It is expected that the Hasle power station will be ready for service in about six years. The Bernese Power Works is largely interested in the construction of the Hasle station. The supply of electric current for the light and power network of the canton of Berne rose from 132,366,514 kw.-hr. in 1919 to 151,699,868 kw.-hr. in 1920, an increase of about 15 per cent. Likewise increasing was the supply of electric energy for the railways, from 15,842,390 in 1919 to 23,178,920 kw.-hr. in 1920. New power stations will also be erected at Guttanen and at Innertkirchen.

INDUSTRIAL FAIR IN SWEDEN.—A large industrial fair will be held at Göteborg in Sweden in the near future. Special attention will be paid to electricity and nearly all electrical works of the country will exhibit their products.

ENLARGING STYRIA'S WATER POWER.—In order to exploit the water power in Styria, Austria, on a much larger scale than has hitherto been the case the Styrian Electric Works have just increased their capital from 20,000,000 to 600,000,000 crowns, and in addition new obligations to the amount of 300,000,000 crowns will be put forward. Work on the new power stations will soon be started.

THE SWISS FEDERAL COUNCIL some time ago decided on the installation of automatic telephone central stations at Geneva and Lausanne. Contracts for their construction have now been placed with the English Bell Company for the Geneva plant and with Siemens & Halske of Berlin for the installation at Lausanne. Both stations will cost about 6,000,000 francs. If those stations are giving good results their installation will be extended all over the country.

THE AMERICAN CHAMBER OF COMMERCE IN LONDON, 8 Waterloo Place, has issued a year book for 1921, in which are listed the names and addresses and business classification of about 1,000 American and British firms including electrical manufacturers interested in developing business between the two countries.

MANUFACTURE OF WIRE IN RUSSIA.—Work in connection with equipping the Northern railways of Russia for electrical operation has produced a large demand for small gage wire, the reserves of which are very small in Russia at the present time. In order to increase the supply the cable factory in Petrograd has been re-equipped and put into operation. This factory has an output of nearly 10,000 lb. of wire per day.

PLANT FOR MANUFACTURE OF ELECTRICAL APPLIANCES AT SYDNEY, AUSTRALIA.—Work has been started, according to the *Empire Mail*, on the construction of a plant at Sydney, Australia for the manufacture of alternating-current motors of both constant and variable-speed types, single and polyphase. Works have also been established near Sydney by an English firm of switchgear manufacturers which, it is said, will be capable of handling all [illegible]

PROPOSED HYDRO-ELECTRIC DEVELOPMENT IN INDIA.—Steps have been taken by the Government of Mysore, India, according to the [illegible] hydro-electric development at Gersoppa Falls which [illegible] the highest falls in India. The [illegible] for the construction of [illegible] about 120 ft. high [illegible] with a capacity of about 42,000,000 cubic feet. It is proposed to erect a power house about 153 ft. below the bottom of the tank so that a total drop of nearly 1,000 ft. would be secured, which, it is estimated, would develop about 100,000 hp. The cost of the project is estimated at about £3,000,000 sterling.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

A mercantile firm in Ireland (No. 35,275) desires to secure an agency for the sale of electrical goods, etc.

A mining company in Chile (No. 35,282) desires to secure catalogs illustrating mining machinery, oil engines, electrical machinery and appliances, etc.

A technical commission in Portugal (No. 35,284) desires to be placed in communication with firms in the United States engaged in undertakings such as the electrification of railways and transmission of electric power, and to secure literature and catalogs from manufacturers of material and accessories pertaining thereto.

New Apparatus and Publications

THE BEARDSLEE CHANDELIER MANUFACTURING COMPANY, Chicago, has recently published a sixteen-page catalog, No. G-S-1, containing illustrations of 126 different patterns of illuminating glassware and prices on 200 sizes.

CUT-OUT.—Schweitzer & Conrad, Inc., Chicago, have put on the market a new 2,200/6,600-volt primary fuse cut-out under the trade name "Type Ejector" cut-out. It is described in their bulletin 103-A.

BOILER SETTINGS.—The Green Engineering Company, East Chicago, Ind., has placed on the market its Green sidewall waterboxes for furnace settings.

POWDERED FUEL.—The Combustion Engineering Corporation, 43 Broad Street, New York City, has put out a forty-one-page pamphlet entitled "The Use of Powdered Fuel Under Steam Boilers."

HIGH-FREQUENCY METER.—The Jewell Electrical Instrument Company, Chicago, has developed and placed on the market a 6-in. thermocouple instrument to measure high-frequency currents, for use mainly in electro-therapeutic work.

INSTRUMENT.—The Jewell Electrical Instrument Company, Chicago, has placed on the market a miniature instrument for alternating-current work, which can be supplied either as a voltmeter or an ammeter.

INDEXES.—The General Electric Company, Schenectady, N. Y., has issued indexes to its descriptive bulletins and sheets and supply part bulletins, dated July, 1921.

STOKERS AND POWER HAMMERS.—The Moloch Company, Kaukauna, Wis., is dsitributing a booklet describing the "Moloch" stoker, type H. The company has also issued bulletins EG-1 and ABD-1, covering the "Mayer" power hammers for both belt and motor drive.

ELECTRIC LAMPS.—A new standard price schedule book has been issued by the Hygrade Lamp Company, Salem, Mass., in which it describes and illustrates its different types of incandescent lamps.

SMALL TOOLS.—The Greenfield Tap & Die Corporation, Greenfield, Mass., is distributing catalog No. 46, covering its small tools and pipe tools.

SPOTLIGHTS.—The F. W. Wakefield Brass Company, Vermilion, Ohio, is distributing a leaflet covering its "Red Spot" line of spotlights. Attention is called to its most recent model, the Wakefield "Silver Lining" or inner shell.

RESISTANCE ALLOY.—The Electrical Alloy Company, Morristown, N. J., has issued a bulletin on "Karma," a pure nickel-chrome alloy for use in electric ranges, furnaces, ovens, etc., where extremely high and continuous temperatures are required.

GEARS.—A new product for manufacturing cloth gears known as "Textoil" has recently been developed by the General Electric Company, Schenectady, N. Y.

STEAM ENGINES.—The Fitchburg Steam Engine Company, Fitchburg, Mass., has issued a forty-page catalog covering its different types of steam engines.

BLOW TORCHES.—The Turner Brass Works, Sycamore, Ill., is distributing Bulletin No. 5 covering its "New Line" torches, and also a four-page leaflet describing the "Turner" gasoline-kerosene torch.

PLUG ATTACHMENT.—Robert J. Ward & Company, 203 South Thirteenth Street, Philadelphia, has recently developed and will soon place on the market a new device known as a "tassel plug" for placing at the bottom of a chandelier for a plug attachment, for use where an extra attachment is desired.

RESISTOR UNITS.—The Ward Leonard Electric Company, Mount Vernon, N. Y., has issued a booklet describing its "vitrohm" (vitreous enameled) resistor units.

New Incorporations

THE CONNER-KELTNER ELECTRIC COMPANY, Enid, Okla., has been chartered with a capital of $75,000 by C. L. Conner and Y. S. Keltner.

THE KENTUCKY POWER COMPANY, Brooksville, Ky., has been incorporated with a capital of $15,000 by Barret Waters, S. B. Water and A. B. Walker, all of Cincinnati.

THE MEMPHIS (IND.) ELECTRIC LIGHT & POWER COMPANY has been organized by L. C. Malott, P. R. Carr, R. G. Hostettler, Otis Mayfield and J. W. Carter, all of Memphis. The company plans to supply several small communities in the vicinity of Memphis with electricity for light, heat and power.

THE G. E. FIXTURE COMPANY, New York, N. Y., has been incorporated with a capital of $25,000 to manufacture gas and electric fixtures. The incorporators are H. Firman, J. N. Chamkin and J. Moscoff. H. Solomon, 332 Broadway, is attorney.

THE CRESCENT ELECTRIC COMPANY, Boston, Mass., has been organized to manufacture electrical specialties. John A. Rein, 722 Hyde Park Avenue, is interested in the company.

THE APEX CHANDELIER COMPANY, New York, N. Y., has been incorporated with a capital of $20,000 to manufacture electrical fixtures. The incorporators are H. Tepfer, L. C. Kurchenoff and L. Sacks, 50 Court Street, Brooklyn.

THE VANLUE (OHIO) ELECTRIC LIGHT COMPANY has been incorporated with a capital of $15,000 by Guy F. Burnap, Harry J. Morehart, J. J. Herman, J. M. Bright and E. L. Plotts.

THE BUFFALO (OKLA.) LIGHT & POWER COMPANY has been incorporated with a capital of $20,000 by E. H. George and S. R. Woodward.

THE WINTER HARBOR (ME.) LIGHT & POWER COMPANY has been organized with a capital of $5,000 to generate and distribute electricity and gas for heating, lighting and manufacturing in Winter Harbor. The directors are S. P. Wetherell, president, Philadelphia; Samuel J. Anderson, treasurer, Media, Pa., and George C. Blance, clerk, Winter Harbor, Me.

THE MODEL ELECTRIC MANUFACTURING COMPANY, Pittsburgh, Pa., has been incorporated with a capital of $25,000 to manufacture electrical products. T. H. Heuber, 1104 Bushton Avenue, is treasurer.

THE ELECTRO THERMO COMPANY, New York, N. Y., has been incorporated by C. C. Trautmann, W. L. Strauss and P. Becker. The company is capitalized at $100,000 and proposes to manufacture electrically operated washing machines. C. A. Oberwager, 233 Broadway, represents the company.

THE SEAMWELD EQUIPMENT COMPANY, 511 Winnebago Street, Milwaukee, Wis., has been formed to manufacture welding equipment, transformers and electrodes under the Fay patent. The directors of the company are Fred Pabst, president; Harry W. Marsh, vice-president and Treasurer; P. C. McNulty, Jr., vice-president and general manager, and Joseph W. Fay, vice-president and chief engineer.

THE GENERATOR CORPORATION, Poseyville, Ind., has been incorporated by Otto E. Caudell, Valentine Bender and U. M. Caudell, Evansville; E. D. Fletcher, P. H. Anyle, George Nix and Joseph L. Schafer, Poseyville. The company is capitalized at $100,000 and proposes to manufacture lighting plants, galvanized tanks, troughs and other farm equipment.

THE McFARLAND-CLUM CORPORATION, Brooklyn, N. Y., has been incorporated with a capital of $75,000 to manufacture electric devices for automobiles and similar products. The incorporators are G. T. McFarland, R. V. Clum and J. G. [illegible]

Record of Electrical Patents

Notes on United States Patents

(Issued July 19, 1921)

1,385,066. RADIO-RECEIVING SYSTEM; John Mills, Wyoming, N. J. App. filed Feb. 19, 1916. Apparatus for neutralizing effect of impulsive disturbances.

1,385,091. SIGNALING; John Mills, Wyoming, N. J. App. filed Sept. 25, 1916. For minimizing production of false signals.

1,385,100. CONTACT SHOE; Wellington B. Sullivan, Baltimore, Md. App. filed Oct. 25, 1919. Collectors for transmitting electrical energy to vehicles.

1,385,121. ARC-RADIO-OSCILLATION GENERATOR; Harold F. Elliott, Palo Alto, Cal. App. filed March 23, 1920. New construction and arrangement of electrodes.

1,385,151. ELECTRIC BATTERY AND METHOD OF PREPARING MANGANESE MATERIAL THEREFOR; Otto E. Ruhoff, Madison, Wis. App. filed Feb. 26, 1919. Depolarizing material of such character that battery will deliver maximum amount of energy.

1,385,170. METHOD OF AND MEANS FOR REGULATING A SYSTEM SUBJECT TO LARGE INTERMITTENT LOADS; Alfred Herz, Chicago, Ill. App. filed Nov. 26, 1915. For regulating constant-potential system of current distribution.

1,385,222. COMBINATION SPARK-PLUG-TESTING AND GAP-ADJUSTING DEVICE; Joseph C. Miller, North St. Paul, Minn. App. filed Jan. 16, 1920.

1,385,286. TELEPHONE; John S. Timmons, New York, N. Y. App. filed March [illegible], 1919. Receiver magnifies sound.

1,385,305. STORAGE-BATTERY ELECTROLYTE; Fred D. Cheney, Gypsum, Kan. App. filed March 21, 1921. Consisting of water, sulphuric acid and sodium phosphate.

1,385,347. AUTOMATIC TELEPHONE SYSTEM; John Wicks, Chicago, Ill. App. filed Feb. 4, 1918. Trunk line between operators in two exchanges.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

AUGUSTA, ME.—Arrangements have been made by the Central Maine Power Company to issue $3,000,000 in bonds for extensions, improvements, etc. Harvey D. Eaton, Waterville, is president.

FARMINGTON FALLS, ME.—The Public Utilities Commission has granted the Farmington Falls Company permission to purchase the local electric plant owned by George A. [illegible]

CONCORD, N. H.—The city has voted to extend the lighting precinct of the city to the Hopkinton line.

MERRIMACK, N. H.—The Amoskeag Manufacturing Company is having surveys made of the recently acquired Moore's Falls in Merrimack to determine its power possibilities. The company contemplates the development of water power at Moore's Falls [illegible] Amoskeag Falls

MIDDLEBURY, VT. — The Middlebury Electric Company contemplates the installation of generators in its power plant.

GREAT BARRINGTON, MASS.—The Southern Berkshire Power & Light Company contemplates the construction of a dam on the Housatonic River to cost about $150,000.

MANSFIELD, MASS.—At a recent meeting of the Board of Selectmen and town manager it was voted to extend the lighting system on Pine, West, Gilbert and Balcom Streets to Greenwood Lake.

SOUTHWICK, MASS. — At a special town meeting held recently it was voted to make extensions to the electric lighting system.

WESTFIELD, MASS.—Steps have been taken to secure the extension of the street-lighting system from the end of Franklin Street to Lloyd's Hill

PAWTUCKET, R. I.—A movement has been started by the retail merchants' division of the Chamber of Commerce to secure the installation of 63 street-lamps in the business section of the city. William K. Toole is chairman.

WOONSOCKET, R. I.—Extension of the ornamental lighting system on North Main Street from the railroad crossing to the end of the street is under consideration.

Middle Atlantic States

AMSTERDAM, N. Y. — The Fownes Brothers Company, 108 South Main Street, is considering the construction of a one-story addition to its power house, to cost about $15,000.

BUFFALO, N. Y.—The City Council has instructed Commissioner Graves to obtain estimates in connection with the establishment of a municipal electric power plant now being projected.

CANANDAIGUA, N. Y.—The proposition to install a lighting system in the business section of Main Street was carried at a recent special election.

CONCORD, N. Y.—Plans are being prepared by the Iroquois Utilities, Inc., City Bank Building, Syracuse, for the construction of an addition to its electric power plant at Concord. The company has applied to the Public Service Commission for permission to make the extension.

GLENS FALLS, N. Y.—The Adirondack Power & Light Corporation has been granted permission by the Public Service Commission to acquire the capital stock of the Glens Falls Gas & Electric Company, the Consolidated Light & Power Company, Whitehall, and the United Gas, Electric Light & Power Company of Fort Edward and Sandy Hill. These properties were formerly operated by the Utica Gas & Electric Company.

ROME, N. Y. — The commissioner of Public Works has granted petitions for the installation of 100-cp. electric lamps on Earl Street between Linden and Locust Streets and on Fifth Street near the East Rome playground.

TARRYTOWN, N. Y.—The installation of an ornamental lighting system on Lower Main Street is under consideration. The Weschester Lighting Company supplies electrical energy for the town.

WILLIAMSON, N. Y.—The Public Improvements Committee is considering the feasibility of replacing the carbon street-lamps now in use with 32-cp. lamps with reflectors.

BUTLER, N. J. — The Public Utilities Commission has authorized an issue of $10,000 in bonds, the proceeds to be used for alterations and extensions to the municipal electric lighting plant.

JERSEY CITY, N. J.—Swift & Company, 154 Ninth Street, are considering the construction of an addition to the power house at their local packing plant to cost about $25,000.

LINDEN, N. J.—The local works of the Warner-Quinlan Asphalt Company, 79 Wall Street, New York City, was badly damaged by fire recently, causing a loss of about $3,500,000. The machine shops, power plant, laboratory and other buildings were destroyed. The plant, it is understood, will be rebuilt. Charles Almquist is superintendent.

TRENTON, N. J.—The City Commission has approved recommendation in report submitted by Prof. C. E. Clewell for improvements to the street-lighting system in the center of the city and out-lying districts. The system installed in the Sixth and Eleventh Wards will be used.

VERONA, N. J.—The Essex Falls (N. J.) Water Company is considering the installation of an electrically-operated pump at its plant at Verona, also the construction of a 350,000-gal. reservoir.

WEST ORANGE, N. J. — Thomas A. Edison, Inc., it is reported, is considering the construction of an addition to its power house.

READING, PA.—Bonds to the amount of $125,000 have been sold by the Pennsylvania Edison Company, the proceeds to be used for improvements and extensions to its electric plant and system, etc.

WILKES-BARRE, PA. — The Wilkes-Barre Company is considering changing its system from direct-current operation to alternating current. New equipment, it is understood, will be required.

NEW CASTLE, DEL.—Reconstruction of the electric lighting system in New Castle is under consideration. The cost of the proposed improvements is estimated at about $10,000.

WHEELING, W. VA. — The Wheeling Electric Company has purchased property on Sixteenth Street between Chapline and Eoff Streets.

ROANOKE, VA.—The Roamoke-Vinton Ice Company is considering the construction of a new ice-manufacturing and cold storage plant to cost about $100,000. T. B. Witt is manager.

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing the following: Until Aug. 12, Mare Island and Puget Sound, Schedule 8560—4,100 enclosed fuses of miscellaneous fuse element, 150 lb. insulating fibre, 500 link fuses, 100 lb. plate mica, 1,000 lb. attachment plugs, etc. Until Aug. 16, Mare Island, Schedule 8539—3,000 ft. steel conduit. Until Aug. 19, Puget Sound, Schedule 8564—electric cable and lamp cord.

North Central States

GUTHRIE, KY.—The Davidson Light & Power Company, Guthrie, recently organized, is installing distribution systems in Goodlettsville, Hendersonville and Madison, Tenn. A. F. Trimble is vice-president and general manager.

CARLISLE, IND.—The Knox and Sullivan Counties Light & Power Company, recently organized at Carlisle with a capital stock of $75,000 contemplates equipping a plant for furnishing electricity for heat and power. Murray Owen is interested in the company.

LOGANSPORT, IND. — Bids are being received by the City of Logansport until Aug. 10 for furnishing lamps, standards, conduits, wires, etc., necessary for the installation of a street-lighting system.

NEENAH, WIS.—The Valley Paper Mill Company, recently organized with a capital of $300,000, has engaged E. A. Wettengel, architect, Appleton, to prepare plans for the construction of a one- and two-story mill and power plant, 100 ft. x 300 ft., to cost with equipment, about $150,000. Albert C. Ehlman, 114 Grand Avenue, Milwaukee, is president.

ELIZABETH, MINN.—The Oscar Electric Company is considering the erection of an 11-mile transmission line to cost about $25,000. H. H. Haldorson is president.

HIBBING, MINN.—At a recent election the proposition to construct a new municipal power plant in Hibbing was carried.

EDINA, MO.—The Edina Light Company having recently completed lines to Baring, Novelty, Knox City and Hurdland, contemplates extensions to the system from Hurdland to Brashear and from the latter town to Gibbs. R. V. Bartow is president.

MONROE, S. D.—Bonds to the amount of $9,000 have been voted, the proceeds to be used to erect a high-tension transmission line to connect with the Bridgewater-Wall Lake line. The Northern States Power Company, Chicago, Ill., it is understood, will supply electricity for the proposed system.

ABILENE, KAN.—The Union Light and Power System, Abilene, and the Pawnee Power & Water Company, Larned, it is reported, has been consolidated under the name of the Union Light and Power System. In addition to supplying electricity to 103 towns the company, it is said, will supply current to many large ranches for irrigation purposes, etc.

Southern States

GREENVILLE, N. C.—The installation of an ornamental lighting system in Greenville is under consideration.

DONALDS, S. C.—The construction of an electric light plant in Donalds, to cost about $12,000 is under consideration.

PARIS, TENN.—The Louisville & Nashville Railroad Company, Louisville, Ky., it is reported, will start work immediately on the construction of an electrical power plant at Paris, Tenn. W. H. Courtenay is chief engineer.

WETUMPKA, ALA.—A company is being organized by E. G. Edwards and others to construct a cold storage and ice-manufacturing plant in Wetumpka, for which plans are being prepared.

POTEET, TEXAS.—A new company has been recently organized by C. C. Shotts and O. G. Barrow to install an electric lighting system. The plans provide for an initial installation of 1,250 kw

Pacific and Mountain States

SPOKANE, WASH. — The Washington Water Power Company has applied to the Federal Power Commission for permission to develop power on the Columbia River at Kettle Falls in Stevens County. The project will be developed in three principal stages: First, a dam 35 ft. high will be constructed across the minor channel; second, a dam 69 ft. high across the main channel and the dam at the minor channel to be raised to 60 ft.; third, the two dams to be raised to a height of 75 ft. by adding gates to the crest of the concrete dam. The plans provide for the development of 153,000 hp.

CARMICHAEL, CAL.—The question of issuing $30,000 in bonds for the installation of an electric lighting system in Carmichael is under consideration.

FRESNO, CAL.—Surveys are being made for the remapping of the entire city for the installation of a more complete and modern lighting system. H. W. Stitt is city electrician. About 200 lamps, it is estimated, will be required.

LOS ANGELES, CAL.—The Los Angeles Railway Corporation contemplates the development of extensive improvements which include the establishment of four or five automatic substations, the first of which is under way and will be equipped with a 1,000-kw. synchronous convertor, costing $58,000; the construction of high-tension lines and additional feeder cable will cost an additional $20,000. The second unit includes a substation in the Garvanza district near Avenue Fifty-six and York Boulevard, to serve Eagle Rock Valley and the Garvanza line. G. J. Kuhrts is general manager.

LOS ANGELES, CAL. — Arrangements have been made for the installation of electric lamps on Rossmore Avenue and Van Nuys Boulevard.

SAN LEANDRO, CAL.—The question of installing an electric lighting system in the Broadmoor section is under consideration. The plans provide for 400 electroliers to cost about $60,000.

UKIAH, CAL. — The Snow Mountain Water & Power Company has made arrangements with Stone & Webster, contractors, for the completion of its dam across Eel River in Gravely Valley. The total cost of the dam is estimated at $1,500,000.

Canada

ALBION, TOWNSHIP, ONT. — The Hydro-Electric Power Commission of Ontario has submitted a report to W. A. Irwin, township clerk, relative to furnishing electricity for light and power service in the township.

DORCHESTER, ONT.—Plans are under consideration for the installation of a hydro lighting system in Dorchester with branch lines to supply power and light to the villages of Belmont and Harrietsville. For further information address S. Shaw, Dorchester.

Directory of Electrical Associations

Printed in the First Issue of Each Month

Alabama Light and Traction Association. Secretary-treasurer, J. P. Ross, Birmingham Railway, Light & Power Co.

American Association of Engineers. Secretary, C. E. Drayer, 63 East Adams St., Chicago, Ill.

American Electric Railway Association. Secretary, E. B. Burritt, 8 West 40th St., New York City. Annual convention, Atlantic City, N. J., Oct. 3-7.

American Electrochemical Society. Secretary, Prof. J. W. Richards, Lehigh University, Bethlehem, Pa. Annual meeting, Lake Placid, N. Y., Sept. 29-Oct. 1.

American Engineering Standards Committee. Secretary, P. G. Agnew, 29 W. 39th St., New York City.

American Institute of Consulting Engineers, Inc. Secretary, F. A. Molitor, 35 Nassau St., New York City.

American Institute of Electrical Engineers. Secretary, F. L. Hutchinson, 33 West 39th St., New York City. Board of directors meets monthly. Sections and branches in the principal electrical centers throughout the country.

American Physical Society. Secretary, Dayton C. Miller, Case School of Applied Science, Cleveland, Ohio.

American Society for Testing Materials. Secretary-treasurer, C. L. Warwick, 1315 Spruce St., Philadelphia, Pa.

American Welding Society. Secretary, H. C. Forbes, 29 W. 39th St., New York City.

Arkansas Utilities Association. Secretary, S. E. Dillon, Hot Springs, Ark.

Associated Manufacturers of Electrical Supplies. General secretary, C. E. Dustin, 30 East 42d St., New York City.

Association of Edison Illuminating Companies. Secretary, Preston S. Millar, Electrical Testing Laboratories, New York.

Association of Iron and Steel Electrical Engineers. Secretary, John F. Kelly, Empire Building, Pittsburgh, Pa. Annual convention, Chicago, Ill., Sept. 19-24.

Association of Municipal Electrical Utilities of Ontario. Secretary, S. R. A. Clement 190 University Ave., Toronto.

Association of Railway Electrical Engineers. Secretary-treasurer, Joseph A. Andreucetti, Chicago & Northwestern Railway, Chicago, Ill.

British Columbia Association of Electrical Contractors and Dealers. Secretary-treasurer, Capt. W. J. Conway, 406 Yorkshire Building, Vancouver, B. C.

Canadian Electrical Association, affiliated with N. E. L. A. Secretary-treasurer, Eugene Vinet, Shawinigan Water & Power Co., Montreal, Canada.

Colorado Electric Light, Power and Railway Association. Secretary-treasurer, M. B. W. Baker, Denver, Col. Annual convention, Glenwood Springs, Col., Sept. 19, 20 and 21.

Conference Club. Secretary, Sullivan W. Jones, 19 West 44th St., New York City.

Eastern New York Section, N. E. L. A. Secretary, J. L. Hemphill, General Electric Co., Schenectady, N. Y.

Electric Hoist Manufacturers' Association. Secretary-treasurer, E. Donald Tolles, 52 Broadway, New York City.

Electric Furnace Association. Secretary, Dr. C. G. Schluederberg, Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.

Electrical Manufacturers' Club. Secretary, F. L. Bishop, Hartford Faience Co., Hartford, Conn.

Electrical Manufacturers' Council. Executive secretary, Frederic Nicholas, 522 5th Ave., New York City.

Electrical Safety Council. Secretary, Dana Pierce, 25 City Hall Place, New York City.

Electrical Supply Jobbers' Association. General secretary, Franklin Overbaugh, 411 South Clinton St., Chicago, Ill.

Electrical Supply Jobbers' Association, Atlantic Division. Secretary, E. Donald Tolles, 52 Broadway, New York City.

Electrical Supply Jobbers' Association, Pacific Coast Division. Secretary, Albert H. Elliot, 502 Flatiron Building, San Francisco, Cal.

Electrical Trade Association of Canada. Secretary, William R. Stavely, Royal Insurance Building, Montreal, Canada.

Electric Power Club. Secretary, C. H. Roth, 1410 West Adams St., Chicago, Ill.

Empire State Gas and Electrical Association. Secretary, Charles H. B. Chapin, Grand Central Terminal Building, New York City.

Florida Engineering Society. Secretary, J. R. Benton, Gainesville, Fla.

Great Lakes Division, N. E. L. A. Secretary, R. V. Prather, 305 De Witt Smith Bldg., Springfield, Ill.

Illinois State Electric Association. Secretary-treasurer, R. V. Prather, Springfield, Ill.

Illuminating Engineering Society. General secretary, Clarence L. Law. Sections in New York, Philadelphia, Pittsburgh, Cleveland, Chicago and Boston. Annual convention, Rochester, N. Y., Sept. 26-29.

Indiana Electric Light Association. Secretary, Thomas Donohue, Lafayette, Ind.

Industrial Electric Heating Association. Secretary, Homer Kunz, Toledo Railways & Light Co., Toledo, Ohio.

Institute of Radio Engineers. Secretary, Alfred N. Goldsmith, College City of New York, New York.

International Association of Municipal Electricians. Secretary, C. R. George, Houston, Tex. Annual convention, Colorado Springs, Col., Sept. 6-10.

International Electrotechnical Commission (international body representing various national electrical engineering societies contributing to its support). General secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England.

Iowa Section, N. E. L. A. Secretary-treasurer, M. G. Linn, Des Moines, Iowa.

Jovian Order. Jupiter (president), Arthur J. Binz, Houston, Tex.

Kansas Public Service Association. Secretary-treasurer, W. W. Austin, Cottonwood Falls, Kan.

Michigan Section, N. E. L. A. Secretary, Herbert Silvester, Ann Arbor, Mich.

Mississippi Electric Association, affiliated with the N. E. L. A. Secretary, E. S. Myers, Vicksburg, Miss.

Missouri Association of Public Utilities. Secretary-treasurer, F. D. Beardslee, 315 N. 12th St., St. Louis, Mo.

National Association of Electrical Contractors and Dealers. Secretary, W. H. Morton, 110 West 40th St., New York City, N. Y. State associations in Alabama, Arkansas, Connecticut, Georgia, Kansas, Illinois, Indiana, Iowa, Louisiana, Maryland, Massachusetts, Michigan, Minnesota, Missouri, New Jersey, New York, Ohio, Oregon, Pennsylvania, Tennessee and Wisconsin.

National Council of Lighting Fixture Manufacturers. Secretary, C. W. Hoffrichter, 8410 Lake Ave., Cleveland, Ohio.

National Association of Electrical Inspectors. Secretary-treasurer, William L. Smith, Northeastern College, Boston, Mass.

National Association of Railway and Utility Commissioners. Secretary, James B. Walker, Public Service Commission of the State of New York.

National Electric Light Association. Executive manager, M. H. Aylesworth, 29 West 39th St., New York City.

National Electrical Credit Association. Secretary, Frederic P. Vose, 1350 Marquette Building, Chicago, Ill.

National Fire Protection Association. Secretary of electrical committee, Ralph Sweetland, 141 Milk St., Boston, Mass.

Nebraska Section, N. E. L. A. Secretary-treasurer, H. M. Davis, Brandeis Theatre Bldg., Omaha, Neb.

New England Electrical Credit Association. Secretary, Alton F. Tupper, 15 State St., Boston, Mass.

New England Geographic Division, N. E. L. A. Secretary, Miss O. A. Bursiel, 149 Tremont St., Boston, Mass. Annual meeting, New London, Conn., Sept. 6-9.

New Mexico Electrical Association Secretary-treasurer, Charles E. Twogood, Albuquerque, N. M.

New York Electrical Credit Association. Secretary, W. J. Kreger, 47 W. 34th St., New York City.

New York Electrical Society. Secretary, George H. Guy, 29 West 39th St., New York City.

North Central Geographic Division, N. E. L. A. Secretary, H. E. Young, Minneapolis General Electric Co., Minneapolis.

Northwest Geographic Division, N. E. L. A. Secretary-treasurer, Stacy Hamilton, Portland Railway Light & Power Co., Portland, Ore.

Ohio Electric Light Association. Secretary, D. L. Gaskill, Greenville, Ohio.

Ohio Society of Mechanical, Electrical and Steam Engineers. Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus.

Oklahoma Utilities Association. Secretary, H. A. Lane, 611 State National Bank Building, Oklahoma City.

Pacific Coast Geographic Division, N. E. L. A. Secretary, S. H. Taylor, Electric Railway & Manufacturers' Supply Co., San Francisco, Cal.

Pennsylvania Electric Association, State Section N. E. L. A. Secretary, H. M. Stine, 211 Locust St., Harrisburg, Pa. Annual convention, Bedford Springs, Pa., Sept. 7-10.

Public Service Association of Virginia. Secretary, R. M. Booker, Newport News & Hampton Railway, Gas & Electric Co., Hampton, Va.

Public Utilities Association of West Virginia. Secretary, A. Bliss McCrum, Charleston, W. Va.

Radio Club of America. Secretary, T J Styles, 1112 S. Curtis Ave., Richmond Hill, Queens Borough, N. Y.

Rocky Mountain Geographic Division, N. E. L. A. Secretary, A. C. Cornell, Denver, Col. Annual convention, Glenwood Springs, Col., Sept. 19, 20 and 21.

Society for Electrical Development, Inc. Assistant to the president, W. L. Goodwin, Guaranty Building, 522 5th Ave., New York City.

Society for the Promotion of Engineering Education. Secretary, Dean F. L. Bishop, University of Pittsburgh, Pittsburgh, Pa.

Southeastern Geographic Division N. E. L. A. Secretary-treasurer, Charles A. Collier, Georgia Railway & Power Co., Atlanta, Ga. Annual convention, Chattanooga, Tenn., Oct. 18, 19 and 20.

Southwestern Geographic Division N. E. L. A. Secretary, H. A. Lane, Oklahoma Utilities Association, Oklahoma City, Okla.

Southern California Electrical Contractors and Dealers' Association. Secretary-treasurer, J. E. Wilson, 425 Consolidated Realty Building, Los Angeles, Cal.

Southwestern Electrical and Gas Association. Secretary, H. S. Cooper, 403-4 Slaughter Building, Dallas, Tex.

Southwestern Society of Engineers Secretary, C. E. Barglebaugh, 721 First National Bank Building, El Paso, Tex.

Toronto Electrical Contractors' Association. Secretary, E. F. W. Salisbury, 615 Yonge St., Toronto, Ont.

Tri-State Water and Light Association. Secretary-treasurer, W. F. Steiglitz, Columbia, S. C.

Vermont Electrical Association. Secretary-treasurer, A. B. Marsden, Rutland, Vermont.

Western Association of Electrical Inspectors. Secretary, W. S. Boyd, 175 West Jackson Blvd., Chicago, Ill.

Western Society of Engineers, Electrical Section. Secretary, E. S. Nethercut, 1735 Monadnock Block, Chicago, Ill.

Wisconsin Electrical Association. Secretary, J. P. Pulliam, 1408 First National Bank Building, Milwaukee, Wis.

Wyoming Utilities Association. Secretary, C. Luscombe, Cheyenne Light, Fuel & Power Co., Cheyenne, Wyo.

Electrical World

New York, Saturday, August 13, 1921

A Parable of Motor Cars and Business

ONCE upon a time a certain manufacturer of motor cars—we'll call him Henry Ford—was short of cash. He had $20.000.000 in the banks. But he owed $58.000.000 which had to be paid in ninety days. And he had 93,000 cars on hand. And people were not buying motor cars. What could he do?

The first thing that this manufacturer did was to notify each of his 17,000 agents that he was shipping them one, two or more carloads of automobiles and drawing on them at sight in full. At the same time he announced a price reduction. The dealers tore their hair, went to their banks and asked for loans, but found that money was tight and not to be borrowed. There was just one way out—if they were not to lose the agency—to get busy and sell more cars. And so they sold them quick, to pay the bill, found business picking up and ordered more. It started up a new demand.

The manufacturer shipped out his cars, converted his stocks into cash and boosted his production to a maximum. He raised $87,300,000 *by selling* before the time was up, paid off his debts with $30,000,000 cash left over, and in the meantime by new efficiencies reduced his force and cut his costs. But, best of all, he melted up all frozen stocks and started business going.

Here is a parable—all facts—that ought to mean something to electrical men. For our manufacturers' warehouses are also loaded up. Orders are small. Selling is slow. Income is greatly reduced. And the only way to overcome this stagnated condition is to get appliances of every kind upon the lines and start the natural following demand for more materials and equipment. We must clear up the economic jam and get our business moving.

The way? A matter of co-operation. If manufacturers and jobbers would push these goods onto the market at the lowest consistent price—if central stations would start a "post-war stock-clearing campaign," co-operating with local dealers, and present the idea to the public in a frank and fearless way—*it could be done.* It worked with motor cars. It can be worked as well with flatirons, lamps, grills, motors and the rest.

The ELECTRICAL WORLD believes that the electrical industry should act right now to set the wheels moving faster. This parable of motor cars perhaps points a way.

Charles Russell Huntley

Whose active association with the electric lighting and power industry of Buffalo, N. Y., as executive and entrepreneur for the past thirty-three years embraces noteworthy electrical progress in that city

ON the fourteenth of last month, when the Buffalo (N. Y.) General Electric Company celebrated its fortieth anniversary, an opportunity was presented to pay honor to its chief executive, who has been associated with public utility work in that city since 1888. The first public use of electrical energy in Buffalo was in the operation of seven arc lamps in Ganson Street on July 14, 1881, from the plant of the Brush Electric Light Company. In the late eighties C. R. Huntley was made general manager of that company. When the Buffalo General Electric Company was organized in 1892 and took over the business of the Brush Electric Light Company, the Thomson-Houston Company of Buffalo and the U. S. Electric Light Company of Buffalo and became the sole electric distributing company in that city, he was elected its president. In 1896 the Cataract Power & Conduit Company was formed to distribute energy from Niagara Falls in Buffalo, and until its absorption by the Buffalo General Electric Company in 1915 Mr. Huntley was its vice-president and general manager. To his broad vision and aggressive management is due much of the industrial development of the Niagara frontier, in which electric service has played a prominent part. This is exemplified by his decision when confronted with a shortage of power early in the World War to build a large steam plant in Buffalo. The speedy construction of this plant prevented nothing short of an industrial depression in that section.

Mr. Huntley was born at Ilion, N. Y., Oct. 12, 1854. After graduation from the high school in Utica his first employment was in his father's store. He then obtained a position with the Remington Arms Company at Ilion and later became a representative of the Standard Oil Company at Bradford, Pa. While there he decided to enter the new field of electric lighting and accordingly returned to Buffalo and became identified with the Brush Electric Light Company. At that time this company was operating the second earliest alternating-current central station in the United States. Today the Buffalo company operates a system with a plant rating of 95,000 kw., which in 1920 distributed 544,293,410 kw.-hr., ranking eighteenth among the seventy-one light and power companies in the United States and Canada producing more than 100,000,000 kw.-hr.

Mr. Huntley is a past-president of the National Electric Light Association, having served in that capacity in 1890-91; he has been a member of the American Institute of Electrical Engineers since 1895 and director of several banks and trust companies and of the International Railway Company and General Railway Signal Company of Rochester.

From his employees Mr. Huntley's charming personality and fair treatment have won a loyalty of an unusual order. Among his business associates his keen observation, his good judgment and power of quick analysis have inspired a confidence and respect that make his council eagerly sought.

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Active Distribution Channels Needed for Appliances

MANUFACTURERS of electrical appliances naturally prefer to market their wares through electrical channels, and so long as these are ample the manufacturers are not inclined to seek other outlets. However, appliance stocks must be kept moving. Manufacturers need the sales and the electric light and power companies welcome the appliance load. If, therefore, the trade is to remain in the hands of electrical men, they must get out and hustle for business. Times have changed. We are now in a buyers' market when customers must be sought. The conditions of overload under which electric companies have operated in the last few years have eased materially so that their commercial departments may once more solicit new business and push the sale of appliances. This task they should undertake energetically and in a businesslike way. Jobbers, dealers and contractors must also bestir themselves in co-operation with the local central-station company so that with the combination of electrical interests all the business in sight may be secured. Opportunities for sales abound, and if the determination to sell is pitched high, manufacturers can find no ground for complaint. However, their goods must move—on that they are insistent—and move they will if the sales forces in the industry will only make the effort.

Shall the United States Become a Nation of Capitalists?

THE recent visit to the United States of the publisher of our London contemporary the *Electrician* and a prominent member of his organization has led to the publication in that journal of some eminently fair-minded comments of more than ordinary interest on American industrial conditions. One of these gentlemen, for instance, said that the deepest impression of America he had received was that it was a nation of capitalists. This transference from the hands of the "big people" into the hands of the many was, he added, being welcomed by the leaders of industry, who saw in it a bulwark for civic and industrial stability. Our British friend has, perhaps, unconsciously exaggerated the extent to which this happy condition has been achieved in America, but he has made no error in pointing to it as the most promising sign of the times. The surest method of progress is not through strife and idleness but through thrift and investment. The acquisition of a house and lot has converted many a communist into a conservative. The purchase of a "car" has imbued with a new sense of dignity many an erstwhile humble pedestrian and hanger on straps. The ownership of two or three shares in the business for which he works or of which he is a customer has given a new point of view to many a railer against corporations, and right here many electric light and power companies have played an important rôle by virtually taking their customers into partnership through the sale of company securities to them.

Duplication in Engineering Societies' Activities

OUR national engineering societies are experiencing the pinch of necessity and are casting about for ways and means of making incomes and expenses balance without curtailment of essential activities. The administration problems are the most serious confronting the associations at this time and are giving the newly elected officers much concern. Possibly nothing short of a readjustment in dues to yield a greater income will suffice, but no administration cares to make such a change until every means for effecting economies has been exhausted. There is a possibility of relief through more active co-operation between the associations so as to avoid duplication of work. For instance, reports on the characteristics and performances of steam turbines, waterwheels, boilers, engines, etc., should emanate from the American Society of Mechanical Engineers; but its committees should have on them representatives of the American Institute of Electrical Engineers, the National Electric Light Association and others interested and capable of contributing something of value. Similarly, engineering reports on electrical apparatus should originate with the American Institute of Electrical Engineers, and its committees should be made up of professional engineers as well as members of the N. E. L. A., the Electric Power Club and others. This may not result in great monetary saving to any particular association, but it will mean nevertheless a considerable saving in time and expense to manufacturing and operating companies whose representatves serve on such committees. It would also mean a considerable saving in printing expense and, last but not least, a saving in effort on the part of those who wish to keep informed on engineering matters and still have a little time left for their regular pursuits.

Factors Influencing Business Are More Favorable

IN SPITE of the pessimism that prevails in certain industrial centers there are growing indications of general improvement in business that mean much to the optimist. With the year now more than half consumed, official and semi-official crop reports are coming in and emphasizing the importance of agriculture as a basic industry in this country. These returns, while possessing the usual elements of speculation, indicate with some certainty that in the Middle West and Northwest, despite the hot wave of July, there will be a good average crop of all grains. In North Dakota and Montana, where crops were poor last year, average or better production is shown for this year. The corn crop looks good in that section also, and while the yield of all grains will not show a big profit to the growers, it will go far in liquidating debts and putting business on a healthy basis. Figures for cotton from the Department of Agriculture and in Hester's statistics on the carrying over of that staple are both below expectations and offer hopes for higher prices for cotton, which is the key to better business in the South. In the Pacific Coast States there has been a relief this year from the shortage of water experienced in 1920, so that the grape and citrus fruit crops are in a better condition.

In discussing other general conditions on which business normally improves or declines, a New York City investment house divides the governing influences into seven favorable and six unfavorable ones. The favorable factors are "less demand for capital, cheaper money, decline in commodity prices, decline of labor costs, decline of costs in railroad and public utility operation, probability of good crops, the fact that except in a few commodities the surplus has been entirely consumed." Unfavorable factors are given as "inequality of values between the different classes of goods, uncertainty about taxation, the present handicaps on foreign business, high ocean freights, high taxes, social and political agitation."

With the railroads now practically assured of government aid through refunding their obligations for a period of ten years to the extent of $500,000,000, which is one-third more than the financing done by the roads since Jan. 1, there may be expected an improved demand for the equipment and materials they have needed so long. This will effect all industries favorably, and if financial history may be expected to repeat itself, even somewhat subnormal buying by the railroads will act as a strong tonic to business everywhere. All in all, it is not so difficult to be an optimist now as some two or three months ago.

Some Uses of Radio Little Considered

IN THE development of any great and novel art it is the sensational accomplishments which attract most attention—telephoning across the Atlantic, sending radio messages half around the world, and the ever-increasing details of hairbreadth escapes due to the vigilance of wireless operators. We wonder how far it is generally realized that the old methods of obtaining time by observation of the heavenly bodies have gone by the board. Here in the United States observatories, industrial works and private individuals set their watches from Washington, Mare Island or some other convenient point, when, indeed, there is no ambitious attempt to pick up time from the Eiffel tower. Nobody worries about longitudes in these days. The wireless signals reach from one observing center to another, and anybody afloat or ashore within reach can pick up his longitude with great precision by taking the trouble to get his transit or sextant out, get his local time, and tie in with the most convenient wireless station. Arlington sings the necessary data all over the eastern United States and Atlantic.

Transmission of wireless signals also has a very important bearing on other branches of research, lessening labor enormously and making it possible to obtain information of things heretofore unknown. For example, Dr. Donald McMillan sailed recently for a couple of years in the Far North near the magnetic pole. He will have a wireless outfit adequate to reach civilization at many points, and can not only cheerfully keep in touch with everything that is doing, from Balkan wars to football scores, but can obtain scientific information of great importance. For example, if a magnetic storm starts up he can at once be informed of the exact moment of the first fling of the needle elsewhere, and will be in position to check the simultaneity of the onset of the storm and its exact correlation with the magnetic elements close to the north magnetic pole. With good luck he can get more information about the earth's magnetism and its correlation with solar disturbances in the next two years than has been obtained in the last two hundred. These are but a few of the ways in which the wireless art is pressed into service of science as well as into that of commerce.

Invisible Signaling for the Chemical Eye

WE ARE glad to be able to give our readers in this issue of the ELECTRICAL WORLD an authoritative account of the ultra-violet signaling system to which some publicity, perhaps indiscreet, was given soon after the armistice, at a time when matters of this character might better have gone undisclosed. It turns out to have been the invention of two very well-known engineers and the result of investigations running back to a period considerably before the United States entered the war. The peculiarity of the system described is that it utilizes not the radiations of very short wave lengths known academically as the ultra-violet, but rather a part of the spectrum to which relatively very little attention has been paid—that portion which lies between the extreme visible violet and the point at which radiation is strongly absorbed by glass. Very powerful radiation in this region, which roughly lies between 400 $\mu\mu$ and 350 $\mu\mu$, can be obtained from divers sources like the carbon arc, the mercury arc and the magnetite arc, but—what is here of great importance—the incandescent lamp, particularly hard pushed, yields very excellent results. Rays in this region are of extremely low visibility, so low as to be virtually invisible under all working conditions, and yet they have the power of exciting the "chemical eye" of fluorescence with somewhat astonishing efficiency.

Perhaps the most remarkable thing about the Bell-Marshall signaling system is the extremely small quantity of energy required to operate it, less than 20 watts total output being ample for ordinary front-line work and 100 watts or so for distance signaling. Bearing in mind the fact that even this small amount of energy is filtered through half an inch of dark glass, the extraordinary sensitiveness of a properly organized "chemical eye" becomes strikingly evident. The retina itself, for visible rays, responds to amounts of energy so small as to be hardly imaginable, but the photochemical process of fluorescence, if photochemical it be, seems not to fall far behind. The pity is in this particular case that the system was not put into use on a considerable scale at an earlier period of the war, when it might have been of considerable value at the front and for use with convoys where ordinary lights were forbidden. The delays seem to have been quite analogous to those encountered in other cases where valuable time was sacrificed in the attempt to secure well-meant but wholly unimportant improvements. When a device worked out by experienced investigators comes to light it is pretty sound policy to get it into action first and study it with view to improvement later.

Why Not Profit from Work Already Done by Others?

UNSUSPECTED duplication of work that has already been wholly or partly done by some one else seems a common failing of human nature. One of the latest examples is in connection with contracts and specifications for the joint use of poles. Several years ago the engineering committee of the Pennsylvania Electrical Association undertook with the telephone interests the preparation of a joint-use contract and specifications for overhead-line construction based on the National Electrical Safety Code. The committee conducted its work for more than three years with the possible influence of its action on the national situation constantly in mind. The consideration of the national viewpoint was, purely from a state viewpoint, a distinctly retarding influence in the settlement of the problems, but there was a clear realization that it was more than a state matter and could not be settled solely with regard to state considerations. Last September at Bedford Springs, before the state convention, the committee made its report, showing that certain material advances in the handling of the problem had been made, though other things yet remained to be done. The report will never become a standard in the sense of universal enforced use, but it does represent a valuable contribution toward the solution of the problem, and those called upon to consider joint use of poles and the drafting of suitable contracts and specifications as standards of practice can get much guidance from the difficulties and differences of opinion that were overcome in Pennsylvania.

The work of that committee is, after three years, unfinished; but it would be foolish for power men in other parts of the United States to enter into the consideration of possible standard joint-use contracts and specifications without first carefully studying the Pennsylvania work. To do so would mean the unnecessary performance of work a second time.

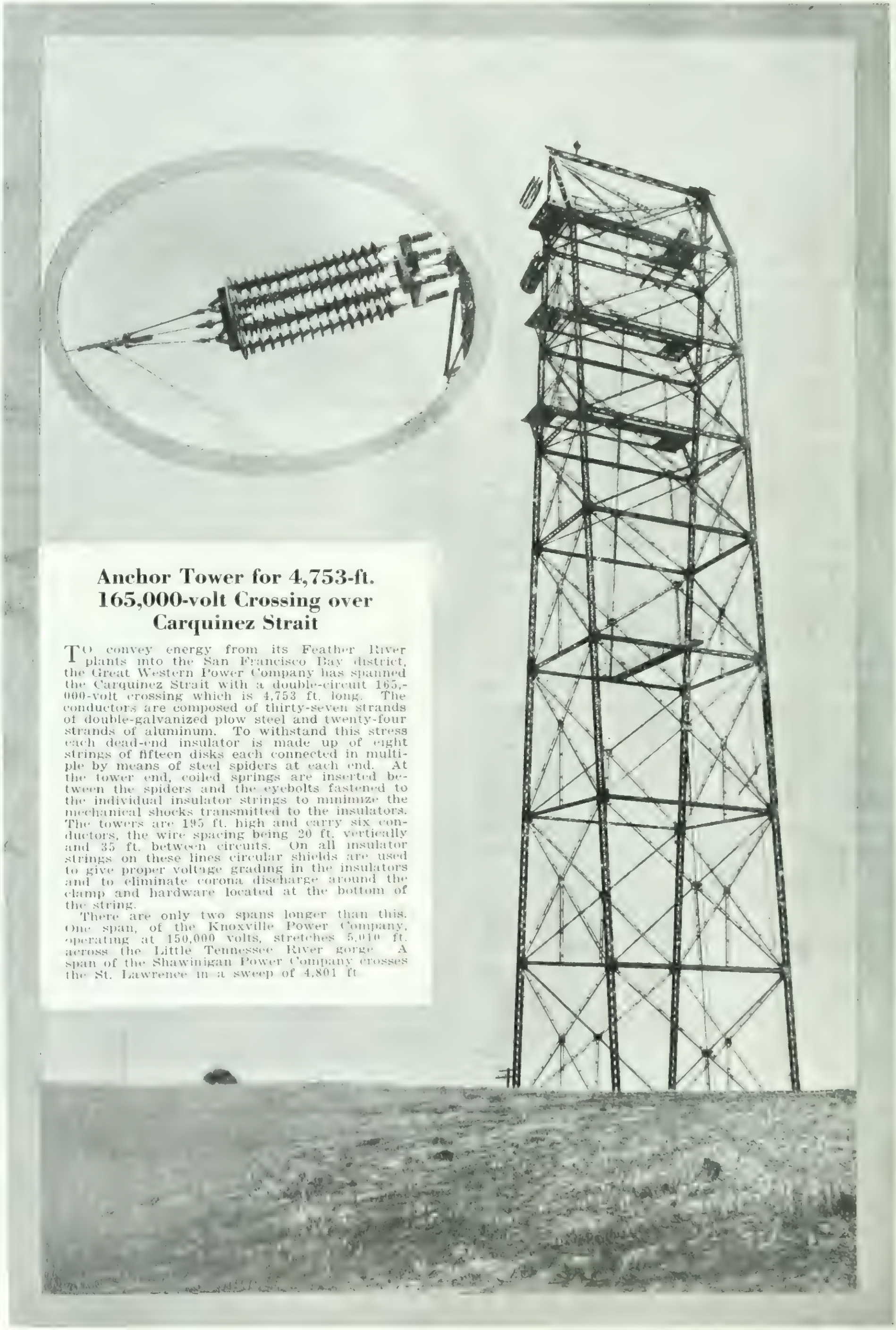
Temperature Measurement by Electrical Methods

THE use of electric power in crucibles, ovens, furnaces and other processes involving heat treatment is extending rapidly, largely owing to improvement in control offered by electrical methods. With this expansion there has been a corresponding demand for means of accurate measurement of temperature and so a great stimulus has been given to the manufacture of precision temperature instruments. Consequently, despite the fact that measurement of temperatures far removed from atmospheric values has always been a matter of more or less difficulty, the whole range of temperature from minus 40 deg. C. upward can now be measured by means of the resistance thermometer, the thermocouple, or the optical and radiation pyrometers. It is now possible to obtain high-grade instruments not only for the accurate measurement of temperatures up to 2,000 deg. C., but in certain ranges instruments for recording and even controlling the temperatures. The refinements in design and construction which enter into this new class of equipment have been made possible only by careful study and experiment. Whereas the word "pyrometry" required definition for the average engineer not more than a few years ago, today it is assuming the proportions of a major division of the engineering profession.

The present status of the art of pyrometry is admirably set forth in a current number of the Technologic Papers of the Bureau of Standards. While it is devoted to present practice in temperature measurement of all kinds, it is bristling with electrical principles and devices from start to finish. Perhaps the most striking improvements indicated are the appreciation of the importance of a high-resistance recording instrument in direct-reading thermo-electric measurements and the development of the combination of thermocouple and potentiometer for the automatic recording and control of temperature. The volume in question, with its complete assembly of material and data, numerous illustrations and description of electrical methods, should prove a powerful stimulus to the still further expansion of those industries taking advantage of the electrical methods for applying and measuring temperature.

Building Hydro-Electric Plants for the Future

DESPITE the rating and number of hydro-electric developments which have been put into service and the increasing tendency toward interconnection in various ways it is still a fact that the country's resources are growing in somewhat piecemeal fashion, certainly without a comprehensive plan which looks to the future. A paper by L. A. Whitsit which we publish this week lays emphasis on certain considerations which those in charge of power developments would do well to take to heart. It is common knowledge in engineering that interconnection gives an opportunity for the development of valuable diversity factor, but there is one feature of this situation which deserves more attention than it has yet received. That is the kind of diversity factor which involves the question of the relative storage capacities of streams. The case which Mr. Whitsit considers is that of streams, very likely on the same watershed, or having the same general periods of maximum and minimum flow, but differing greatly in storage capacity. The stream with large storage cannot yield full output and store at the same time unless for brief periods of very abnormal flow. On the other hand, the stream without storage and of quick run-off wastes an enormous amount of extremely valuable power at times of high water, unless abnormally fortunate in a market for secondary, and very temporary, power. Such market does not generally exist and cannot be expected, but if the stream without storage is developed in such a way that its secondary power can be used to meet the demands of another plant which possesses large storage, then there is a regular and extremely useful market for the temporary power that would otherwise be wasted. It goes to tide over the time of filling the reservoir for future periods of scant hydraulic resources. Of course to make the most of such a situation the differences in storage capacity should really be very marked, but even if the foregoing principle be used in small degree it still may save valuable power.



Anchor Tower for 4,753-ft. 165,000-volt Crossing over Carquinez Strait

TO convey energy from its Feather River plants into the San Francisco Bay district, the Great Western Power Company has spanned the Carquinez Strait with a double-circuit 165,000-volt crossing which is 4,753 ft. long. The conductors are composed of thirty-seven strands of double-galvanized plow steel and twenty-four strands of aluminum. To withstand this stress each dead-end insulator is made up of eight strings of fifteen disks each connected in multiple by means of steel spiders at each end. At the tower end, coiled springs are inserted between the spiders and the eyebolts fastened to the individual insulator strings to minimize the mechanical shocks transmitted to the insulators. The towers are 195 ft. high and carry six conductors, the wire spacing being 20 ft. vertically and 35 ft. between circuits. On all insulator strings on these lines circular shields are used to give proper voltage grading in the insulators and to eliminate corona discharge around the clamp and hardware located at the bottom of the string.

There are only two spans longer than this. One span, of the Knoxville Power Company, operating at 150,000 volts, stretches 5,010 ft. across the Little Tennessee River gorge. A span of the Shawinigan Power Company crosses the St. Lawrence in a sweep of 4,801 ft.

Signaling by Invisible Rays

Selective Transmission and Detection of Ultra-Violet Radiations from the Incandescent Lamp Marks Notable Achievement of American Engineers—Method Constitutes a Valuable Contribution to Military Art

IN THE RECENT war great difficulties were encountered in keeping ordinary methods of communication going in the face of intensive gunfire, and the need of better signaling methods was demonstrated early in the conflict. Many months before the United States entered the struggle Dr. Louis Bell and Norman Marshall of Boston attacked this problem, and their success in utilizing ultra-violet rays in this connection followed a brilliant series of researches which was concluded in time to give the apparatus a test on the western front and led to an order from General Pershing for the construction of 100 sets for field service. The fulfillment of this order was delayed in various governmental channels beyond the control of the inventors until the signing of the armistice put an end to hostilities.

Soon after the armistice considerable newspaper and other unauthorized publicity was given to signaling by invisible rays, and in particular to signaling by ultra-violet radiations received by a so-called "chemical eye." Very little regarding the origin or detail of the invention was given, but an issue from the Patent Office a few days ago "let the cat out of the bag," both as regards methods and those who developed them. Dr. Bell and Mr. Marshall were immediately interviewed by a representative of the ELECTRICAL WORLD, and the following account of the circumstances which led up to the production of the necessary apparatus and its development for field service was obtained through their courtesy.

In the past there have been several attempts to signal by rays normally invisible, but all previous efforts had been either with the extreme ultra-violet, using the carbon or mercury arc or even sparks between metallic electrodes as a source, or else they had drifted toward the infra-red in the belief that the ultra-violet was so quickly absorbed by the atmosphere and so difficult to obtain in quantity as to be impracticable for portable service and even less attainable in suitable transmitting apparatus. So far as Messrs. Bell and Marshall could ascertain, every previous attempt to utilize the ultra-violet had employed quartz apparatus, this, of course, being utterly impracticable for production in quantity as required for military use.

Messrs. Bell and Marshall at the outset abandoned the traditional ultra-violet, which has been persistently championed in some academic circles. They turned to the region just beyond the visible spectrum, hitherto neglected, and immediate and striking success resulted.

Instead of working with quartz lenses, the experimenters used ordinary Mangin mirrors, which by tradition were entirely incapable of dealing with the ultra-violet without vital absorption for the region now used ($400\ \mu\mu$ to $350\ \mu\mu$). The Mangin mirror proved excellent for the work, and it was found possible to obtain a powerful beam in this part of the spectrum from an ordinary gas-filled lamp of the type used for automobile headlamps.

The matter of a suitable screen to cut out the visible spectrum gave the investigators a large amount of trouble, owing to the fact that nearly everything in the way of an absorbing medium is permeable to the red of the spectrum, of low visibility by day but conspicuous by night. The problem in cutting out the visible spectrum was to leave the nearer part of the ultra-violet and to transmit it with considerable freedom. Traditional screens failed utterly. Messrs. Bell and Marshall tested virtually the entire range of dyed films and liquid-absorbing media, literally in hundreds of combinations, before success was achieved. The screen finally settled upon as the most practicable was a combination of glasses produced by the ingenious efforts of Dr. H. P. Gage of the Corning (N. Y.) Glass Works, working on the specified requirements as to wave-length limits. Still more persistent investigation was required in the discovery of the "chemical eye" which should finally render visible the radiation passed by the incandescent lamp through the necessary screens. Many substances which responded strongly to the ultra-violet radiation as commonly understood failed utterly when used in the particular region which the investigators had found best suited to their use. Other substances responded by fluorescing in some color of low visibility, or responded quickly, or proved to be most efficient in detecting the visible violet rays. To reach success it was necessary to have a receiving screen which should be very sensitive to the one particular region of the spectrum supplied and should fluoresce with the color of the maximum luminosity value for very weak stimuli. Even when the best substance was finally found it proved to be a rather difficult art to prepare it in the sensitive films necessary for use.

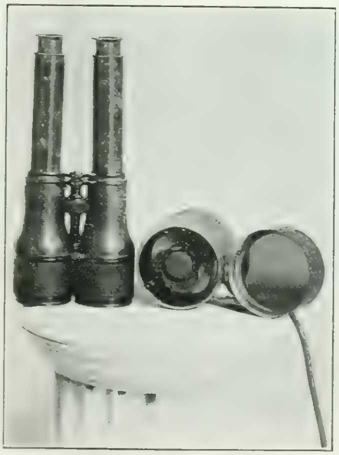


FIG. 1—APPARATUS FOR SIGNALING WITH INVISIBLE RAYS WHICH WAS TESTED AT FRONT IN THE RECENT WORLD WAR

Receiving telescope is shown at left. At right is the transmitter with the filter swung open disclosing the shielded lamp in front of a Mangin mirror.

The investigators had particularly in mind the production of a very light and effective signaling set which had maximum portability so that it could be taken if necessary on a soldier's belt into "No Man's Land" and used in signaling back to the front lines. The first complete apparatus turned out was in fact no bigger than a quart dipper, consuming less than 20 watts derived from a dry battery carried on the belt and was capable of signaling probably over 1 km. or 2 km. In the receiving apparatus again all traditions of the ultra-violet were violated, for the "chemical eye" was fixed to an ordinary prism field glass where the rays had to pass through two cemented lenses and 6 cm. or 8 cm. of glass. Glass, in fact, is quite transparent to the particular radiations employed, and ordinary field glasses form as good a receptive device as could be desired.

Using a little more energy, but still within range of an easily portable battery, greater and greater distances were covered. Messrs. Bell and Marshall used most generally Mangin mirrors to produce the direct beam, although they tried a lens lamp similar to that used by Alexander Graham Bell many years before in his photophone experiments. After the apparatus had reached the stage where it was actually reproducible for signaling purposes, Messrs. Bell and Marshall took their invention to Washington and laid it before the navy and General George O. Squier of the Signal Corps of the army. Both departments took interest in the matter and General Squier referred the device to the research department, of which Col. R. A. Millikan is in charge.

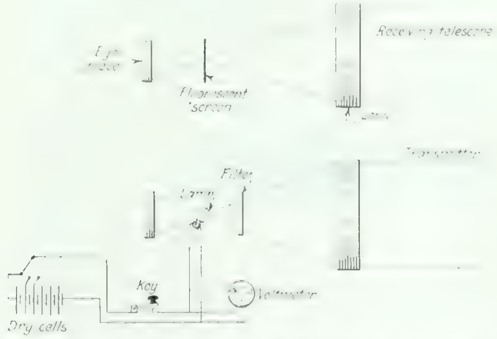


FIG. 2—MOST DEVELOPED FORM OF TELESCOPE, EMBODYING BOTH TRANSMITTER AND RECEIVER

The apparatus was received with great interest, but there were innumerable delays before it found adoption owing to United States Army routine. Finally, to accelerate operations, Messrs. Bell and Marshall offered to build 100 sets of signaling apparatus within thirty days of the date ordered. Two finished sets were made quickly and put together in Mr. Marshall's shop as types of what the quantity production should be. The whole outfit, with combined sending and receiving apparatus, battery and tripod mount, weighed but 30 lb. (13.6 kg.) and was capable of working over 6 km. or 8 km., using only about 25 watts in the lamps. It gave a singularly narrow and sharply defined beam, appearing in the receiving glass as a little green moon blinking a code unseen through the darkness. Whether the hundred sets which were ordered actually got to the front, or whether they reached France at all, Messrs. Bell and Marshall cannot officially say.

It is worth noting that the signaling with this particular kind of ultra-violet proves successful even in face of a drizzling rain or a snow squall. The absorption by the atmosphere did not appear to be at all severe, and the apparatus was extraordinarily compact and portable, particularly suited for front-line work since the rays were utterly invisible to the naked eye even at short range.

A few details of the apparatus employed may be given in conclusion. Fig. 1 shows the transmitting equipment which was tested at the front, with a receiving telescope. The former consisted of a metal cylinder only 5¼ in. (13.3 cm.) long by 3⅜ in. (13.6 cm.) diameter, containing a 6-volt, 2-amp. gas-filled incandescent lamp made by the General Electric Company, the lamp being set adjustably in the focus of a Mangin mirror and between the mirror and a filter 10 mm. thick mounted near the outer end of the cylinder. This cylinder weighed but 1¾ lb. (0.79 kg.). In the battery and lamp circuit was included a key for interrupting the lamp current to form code signals. A circular shield was placed between the lamp and the filter to prevent the intersction of rays. To obtain the required ultra-violet rays it was necessary to burn the lamp at excess voltage, but this shortening of its life is not of much importance under military conditions.

The field glass shown was provided with a barium-platinum-cyanide fluorescent screen mounted near one eyepiece. In practice the distance between the transmitter and receiving apparatus ranges from a few feet (adapted for work in "No Man's Land") to, say, 10 km.

The type of equipment developed for regular field service can be carried, including tripod, six dry cells, switchboard to maintain excess voltage on the lamp as the cells weaken, telegraph key, sending and receiving telescopes, in a case only 24¾ in. (62.8 cm.) high, 14 in. (36.8 cm.) wide and 4½ in. (11.3 cm.) deep, with shoulder straps as shown. In the most developed form two telescopes are used side by side. One is used in transmitting and the other in receiving signals. In the former are mounted duplicate lamps, the filter, eyepiece and transmitting lens. The latter contains a condensing lens, with the fluorescent screen at its focus, and an eyepiece. Clear glass was used in these lenses. A diagram of this relationship is shown in Fig. 2.

Power Survey of Oregon Industrial Plants

THERE are 342 industrial plants in Oregon using more than 100 hp., according to a report recently prepared by the State Labor Commission. Of the total requirements, according to the report, 85,330 hp. is developed by electricity, 105,809 hp. is developed by steam and 19,375 hp. is developed by water.

The number of industries using more than 100-hp. and the kind of power used are as follows:

		Rating in Horsepower		
Kind of Plant	Number	Electrical	Steam	Water
Lumber	204	[illegible]	[illegible]	[illegible]
Flour, feed and cereal	25	[illegible]	[illegible]	[illegible]
Mining and quartz	14	[illegible]	860	2,155
Packing, canning and cold storage	26	[illegible]	[illegible]	....
Sand, gravel and rock crushers	4	[illegible]	190	....
Foundries and machine shops	19	6,110	205	....
Miscellaneous	50	[illegible]	[illegible]	[illegible]
Total	342	85,330	105,809	19,375

Automatic Substation Justifies Its Use for Low Load Densities

In Territories Where Such Conditions Exist Labor Is an Important Expense Item That Can Be Eliminated by Automatic Electrical Control—Economic and Engineering Problems

By C. M. GILT
Lighting Engineering Department General Electric Company

ANY change from tried practice must justify itself by increased economy or better service. The automatic substation justifies itself on both grounds. This must not be taken to mean that it would be economical to make every substation automatic, for there are large substations in regions of high load densities in the larger cities in which the cost of labor would not pay the fixed charges on the additional investment and the economies effected by a redistribution of substation apparatus would not pay for the cost of making the changes. The necessity for large storage-battery reserves and copper to handle the output during times of emergency further modifies to some extent the most economical system arrangement. However, as a general statement, it is true that the elimination of labor charges makes possible a greater number of smaller stations and a reduction in the amount of low-tension copper and losses. A new balance must be struck between the fixed charges of substations and distributing copper and losses. In general, a load can be fed by a number of relatively small stations at a materially lower cost than can be done by larger stations with operators.

Certain studies have been made that indicate that the saving in distributing copper on Edison network made possible by automatic stations near the load centers will more than pay for the additional investment in the substation equipment. If the assumption is made that the investment required by the additional automatic features and the use of a greater number of smaller machines just offsets any saving in feeding copper when installed on the basis of current-carrying capacity, the elimination of the regular labor item and the reduction in feeder losses is a clear gain.

If the copper is installed on the basis of current-carrying capacity, the saving in feeder losses is approximately in direct proportion to the saving in copper. The saving would be in direct proportion were it not for the fact that under light load conditions with some machines idle the feeder copper is not utilized most effectively. Fig. 4 indicates the saving in copper and losses that may be obtained by feeding a territory from three stations rather than from one station centrally located. In both cases every junction box is served by one feeder, with the exception that the multiple station layout serves each of two junction boxes with two feeders, thereby giving a direct tie between stations. In this layout the total length of feeders is reduced to two-thirds of that required by a single station. If the load and territory conditions are such as to make more economical a greater subdivision of units, the saving will be greater and may even amount to 50 per cent of the feeder copper. The reduction in losses means that a smaller voltage regulation is allowable at the substation buses, making possible the use of the field-controlled type of converter, with its lower losses, and a smaller unit capacity due to the lower voltage.

In addition to the savings just mentioned, consideration must be given to the quicker restoration of service following a loss of the substation voltage. Because of the automatic starting and control features, in conjunction with the load-limiting equipment, each

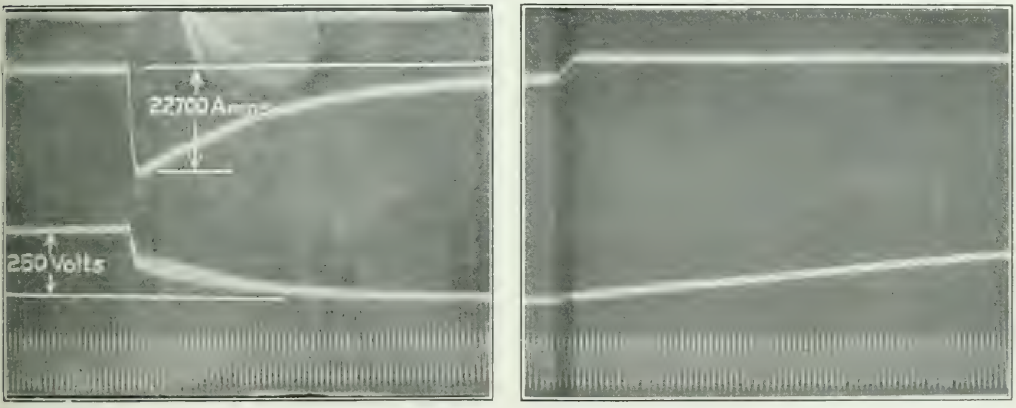


FIG. 1—SHORT-CIRCUIT CURVES OF 1,000-KW. GENERATOR WITH LIMITED MAXIMUM OUTPUT

machine will feed current into the network up to its capacity just as soon as it receives a suitable alternating-current supply and will continue to do so regardless of what other machines do until normal service is restored or the machine overheats. By this method direct-current service can be restored without damage to the machines just as quickly as alternating-current power is available, and the time involved is much less than is required for hand operation, particularly if there are no storage batteries or if they have been drained by the outage. A portion of this advantage can be capitalized in terms of storage-battery capacity required to maintain service during the difference in time taken in building up the system by the two methods. The prompt restoration of service after a voltage loss has other obvious advantages that cannot so easily be capitalized.

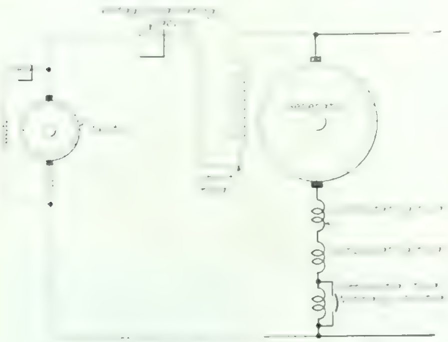


FIG. 2—CONNECTIONS FOR GENERATOR WITH LIMITED MAXIMUM OUTPUT

To obtain the most complete benefits of automatic operation, the whole system should be laid out with this in view. Such an ideal arrangement is rarely possible because new direct-current distributing systems are not being established and central stations are restraining the growth of their direct-current areas as vigorously as is consistent with maintaining adequate service.

Occasionally, opportunities for the complete revamping of a system may arise, making possible the installation of automatic stations located most economically, considering both the ideal low-voltage distribution and the copper already installed. Such an opportunity may arise if a central station changes its frequency, requiring new equipments for conversion, or if the load grows and shifts to such an extent that a radical change in the Edison distribution is made necessary.

Such radical and complete alterations occur seldom, so that the placing of a system on the automatic basis will in the majority of cases be a gradual process. Probably the most frequent application of automatic equipment will be to new installations with some addition of automatic control to old machines. The larger systems in particular have substations on their outskirts for feeding particular localized loads that afford excellent opportunities for the installation of the automatic features. Smaller systems in which the load density is not so great may easily make a considerable portion, or even all, of their system automatic economically.

Public utilities will find they have a large field for automatic stations in furnishing direct current to large customers who are not in a direct-current area. Automatic control may be applied either to stations feeding into an Edison system or isolated loads.

AUTOMATIC ALTERNATING-CURRENT FEEDER STATIONS

No less important than the automatic direct-current substation is the automatic transforming and switching substation. It is less spectacular than a station containing rotating machinery with no guardian except the untiring relays and is simpler in its layout and functions, but performs a duty as important and offers an opportunity for fully as great a saving.

The increase in power requires the use of higher transmitting and primary distributing voltages and a shortening of the secondary 2,300-volt or 6,600-volt distribution lines. Automatic distributing substations, by eliminating operators' wages, make it possible to reduce the size and increase the number of these substations, thereby shortening the secondary lines and improving the efficiency and regulation.

The operation of the substations may approximate in efficiency those in which there are regular attendants. When a feeder trips out it automatically recloses and tries out the circuit. If it is tripped immediately, it tries it again, but if the breaker trips out the third time in immediate succession, indicating that the fault is not a swinging ground that has cleared itself, the breaker remains open until the fault is repaired and the breaker reclosed by hand. One operation of the relays does not effect the subsequent sequence unless others follow in rapid succession. In an overhead distributing system, a large number of the faults are temporary in nature and the circuit breaker when reclosed does not open again. If operating conditions make it worth while to the central station, indications may be carried to a station in which there are operators that a breaker has tripped out requiring hand reclosing.

Series alternating-current lighting systems may be fed from the same substation, turning on and off the lights by means of a time switch. If it is the practice to test out the circuits frequently, the testing may be done by an inspector as part of his duties.

If the high-tension distribution is over cables and the secondary distribution is short, it will frequently be possible to avoid the use of feeder regulators. In other cases in which the high-tension distribution is overhead or there is otherwise considerable reactance up to the secondary bus in the substation, an automatic synchronous condenser may be made to correct power factor and regulate the secondary voltage. If the bus voltage is held constant, it will frequently be found

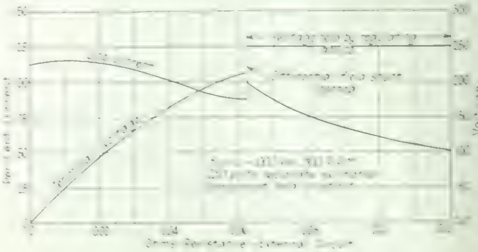


FIG. 3—CHARACTERISTICS OF GENERATOR WITH LIMITED MAXIMUM OUTPUT

unnecessary to supply feeder regulators, particularly with the short feeders practicable where relatively small automatic stations are installed.

There are two principal fields for such substations. One is in large cities where power is transmitted to various sections of the cities at relatively high voltages and there stepped down to a voltage that is economical for feeding the small lighting transformers and industrial customers. Another opportunity is afforded in connection with transmission lines feeding many small towns. The substations feeding these towns can often be made automatic and need no regular operators. The cost of equipment required to make such substations automatic is so low that the saving in operators' wages will often pay for the additional investment in one year.

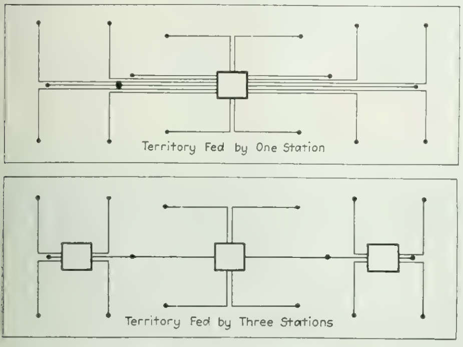


FIG. 4—ABOUT 33⅓ PER CENT CAN BE SAVED IN FEEDER COPPER AND LOSSES BY USING THREE SUBSTATIONS INSTEAD OF ONE

The fundamental requirements for the automatic control of converters for Edison service are to place the converter on the bus when needed, to supply the load demands up to the capacity of the machine, to shut it down when not required, and at all times to provide adequate protection against damage to the equipment. Such being the case, the essential features of the control for the Edison machine follow the well-tried lines of the railway equipment, involving only such changes as are necessary to provide for the heavier currents and the more exacting requirements for voltage control and continuity of service.

The most popular converting equipment is the synchronous converter with the synchronous booster, recently of the shunt-wound, field-controlled type. The latter machine, obtaining its voltage control by means of reactive current through high-reactance transformers, is rapidly growing in popularity where a wide range of voltage for a single machine, without change of transformer taps, is not essential, because of its lower first cost, higher actual operating efficiency and smaller floor space.

Motor-generator sets must also have careful consideration because of their greater stability and possibilities of power-factor correction. Converters are more sensitive to voltage and frequency fluctuations than motor-generators and will trip off during alternating-current disturbances that a motor-generator may be made to ride through without difficulty. This increased stability is especially valuable on systems in which the alternating-current supply is highly variable or subject to disturbances of considerable magnitude.

There has been developed a method by means of which the generator is practically self-protected against overload or external short circuit. Fig. 2 shows the wiring diagram of a generator thus protected. The series winding opposes the shunt winding and is normally shunted by a circuit breaker. Under overload conditions the breaker opens and the full effect of the series winding is available to reduce the voltage. In series with the shunt winding is a small exciter, providing sufficient separate excitation in addition to the shunt excitation, so that at short circuit the generator will deliver slightly above normal current. In case of a sudden rise in voltage on the system from other machines, following the clearing of the overloaded conditions, the separate excitation assists in the rapid building up of generator voltage and the series winding causes the generator to act as a compound-wound motor, still further hastening the restoration of normal voltage. The characteristic curve of the generator with the excitation varied to maintain constant voltage up to full load is shown in Fig. 3. Beyond this load the generator approximates a constant-current device. When a short circuit is thrown onto the generator there is a momentary increase in current and a subsequent decrease to slightly above the normal value, as shown by Fig. 1. It also shows the momentary reversal and motor action when the short circuit was removed and current was fed into the machine from another generator. The driving motor and its control may be designed to ride through momentary disturbances in the alternating-current supply so that the set will not trip off and have to be started again.

Reducing Dust Explosions and Fire From Electric Lamps

A BULLETIN just issued by the United States Department of Agriculture asserts that all electric lamps in places where explosive dusts are present should be equipped with vapor-proof globes protected by heavy guards to prevent breakage. Dangerous practices, such as the use of open wiring, drop cords and unprotected lights, are condemned. The bulletin says that explosions have occurred as a result of lowering into a bin an unprotected electric lamp attached to a cord. The lamp may swing against the side of the bin, and if the globe is broken the hot filament in the lamp is exposed for an instant and the surrounding dust cloud ignites.

It is believed that any combustible dust will ignite if allowed to collect on the lamp in sufficiently thick layers and remain long enough. The ignition of the dust is probably due to the fact, the department's specialists say, that the very chaffy dusts collected on the globe, where they form a blanket which prevents radiation of the heat generated in the lamp and raises the temperature of the bulb to the ignition temperature of the dust. Some of the dusts seem to melt or congeal and form on the globe a crust which does not burn readily. During a recent campaign to prevent dust explosion about twenty cases were reported where explosions or fire was supposed to have been started by the ignition of dust which had settled on the lamp or by the accidental breaking of the electric lamp in a dusty atmosphere.

Under ordinary conditions, with the small lamps commonly used in industrial plants and with free circulation of air about the globe, the specialists believe it unlikely that fire will start readily. They recommend, however, as just stated, that all electric lamps be equipped with vapor-proof globes.

Comprehensive Water-Power Development Basis for Economical Operation

Transmission Lines Required for Hydro Plants May Serve as Nucleus for Interconnection of Systems for Bulk Power Transmission—Storage Possibilities of Some Rivers and Interconnection with Large Steam Plants Would Effect Far-Reaching Economies

By LYLE A. WHITSIT
Formerly Assistant Engineer Power and Transmission, Superpower Survey

POWER SITES ON THE SUSQUEHANNA AND POTOMAC RIVERS. THE LATTER, WITH EXTENSIVE STORAGE RESERVOIRS, MAKES POSSIBLE
THE SUSQUEHANNA HAS NO STORAGE CAPACITY, BUT THE POTOMAC AND DELAWA

MANY water powers in the country are so located with reference to the load that they may not offer opportunity for economical development individually, but they offer good opportunities for development considered as a part of a large interconnected system. With such relations some rivers possessing good storage possibilities would permit the development of others without storage for operation on the base load. The interoperation of these hydro-electric plants with large steam stations would also make possible large savings in operating expense and give the advantage of diversity in the several systems. Moreover, the transmission lines commonly required for hydro-electric stations might form the basis for a transmission network required for interoperation. A study of rivers in the middle Eastern section of the United States serves to illustrate these points, but the opportunity for such study of possible power development sites exists in other parts of the country as well and advantage of it should be taken.

For economic results, a chain of water developments should be constructed simultaneously and placed in operation in a short period of time instead of dragging over the usual long term of years that add ruinous accrued interest charges to investment cost. The Delaware developments contain extensive reservoirs which are absolutely essential to the regulation of its stream flow. Their cost must be distributed pro rata over the proposed power plants which are to use its stored waters. If the total chain is built piecemeal, one development at a time, the early investment costs are prohibitive. The successful operation of hydraulic developments requires quick construction and quick use, a point often overlooked. The accrued interest up to the time the project is earning full income soon becomes a large part of the fixed charge.

Transmission Lines from Hydro Plants Available for Interconnection

There is an important factor which favors the creation of an interconnected system and which is bound to bring it ultimately into being. A steam station may be built almost anywhere where there is a load for it. Probably 80 per cent of the steam capacity is reasonably close to its load centers. On the other hand water power is generally distant from largely settled communities and therefore requires a transmission line to market its power. Interconnection offers a means by which distantly located water powers may be interoperated for maximum economy. Such a connecting system would take advantage of the diversity in the stream flow of different rivers and, of more importance, it makes possible the utilization of the storage capacity of one stream in connection with another having no storage.

The value of the interoperation of hydro-electric systems is exemplified by the favorable interoperation of the Potomac, Susquehanna and Delaware Rivers. The Potomac and Delaware Rivers contain extensive storage resources, but the Susquehanna River does not. If the power systems of the three rivers are operated independently of each other, the storage on the Potomac would be so used as to produce a uniform amount of power throughout the year for its own load. In like manner the storage on the Delaware River would be used to produce a uniform amount of power throughout the year for its load requirements. The output of the Susquehanna, however, because of a lack of storage, would have a low constant power output due to the low-water conditions of each year, but for all other periods of the year it would be able to generate an amount of power greatly in excess of this value. In an average year the Potomac will maintain its primary power without storage for 45 per cent of the time, requiring storage for 55 per cent. The Delaware will do likewise for 35 per cent of the time and requires storage for 65 per cent of the time.

MORE INTENSIVE DEVELOPMENT OF THE SUSQUEHANNA WHEN THE TWO RIVERS ARE USED WITHIN A SINGLE INTERCONNECTED SYSTEM. WHICH MAY ALSO BE CONNECTED TO THE SYSTEM. HAVE GOOD STORAGE.

Working Rivers Without Storage Reservoirs

If now the three systems of hydro-electric developments are interconnected electrically by transmission lines, and if the resources of the three systems are used to meet the load requirements of an interoperated transmission system, then it is possible to use the secondary power in the Susquehanna in excess of its primary power to assist in carrying the load of the two other systems, which, in the independently operated systems, would have had to be furnished by means of storage.

The natural flow of the three rivers will furnish a combined larger amount of primary power for 55 per cent of the time as compared to the 45 per cent and 35 per cent above mentioned and will require storage power for only 45 per cent of the time. The use of the excess power in the Susquehanna River makes possible the conserving of the storage resources in the Delaware and the Potomac systems in order that they may in turn be used when the Susquehanna River is in low water stages. The use of storage power will thus be required for a shorter length of time than in the case of the independent operation of the system, and as they are used for a shorter length of time the kilowatt-hour output per day from the storage will be increased very materially. With diversity in stream flow it is, therefore, possible through interoperation to increase the combined total amount of prime or constant power that the hydro-electric systems can continuously turn out.

Hydro Plants Economical for Peak Loads

The cost of carrying peak loads by steam plants is extremely expensive and usually more than it is by hydro plants. The capital cost of a hydro-electric development may be divided into two parts, one that is independent of the amount of the kilowatt capacity that is installed in the power plant and the other that is directly proportionate to this capacity. The first would embrace the cost of hydraulic structures such as dams, water rights, railroad relocation, etc. The latter would include all generating and switching equipment, conduits, headgates, penstocks, tailrace excavation, etc. As a general rule, the former is usually the greater proportion of the total cost, and at the present time the latter may be taken as approximately $50 per kilowatt.

Kilowatt for kilowatt, the peak capacity carries its pro rata increase in the capital investments required A new steam peak plant will cost about $110 per kw. and will have debited against it its full fixed charges on the basis of the cost per kilowatt, which distributed over a low kilowatt-hour output makes a high cost per kilowatt-hour. On the other hand, if the hydro-electric development is designed with a nominal amount of forebay capacity, it will permit the retention of the stream flow during the night, in order that it may all be used during the day. The additional capacity does not require an increase in operating expenses, moreover, although this is quite the reverse in a steam plant. The only operation required in a hydro plant is the shutting down of gates to retain the water during the night, but in a steam plant it is necessary to keep boilers hot under banked fires, an operation requiring both labor and a certain amount of coal, but which does not produce kilowatt-hours.

A hydro development may be designed to take base load power only, in which case the load would be continuous throughout the twenty-four hours of each day and the amount of capacity that would be installed would be equivalent to that necessary to utilize the total amount of water during the low-water period of the year. Should, however, the development contain forebay capacity sufficient to retain the stream flow during the night for use during the day the power plant may be operated on peak load. It would readily be seen that the additional capital investment in the latter case would be only that necessary to furnish the excess generating equipment as compared with that which is required for a continuous twenty-four-hour power load.

Such a superpower system makes possible the interoperation of steam plants with hydro-electric plants and the utilization of what is termed secondary water power. Primary water power is the power which is available twenty-four hours of the day throughout the year, whereas secondary power may be considered as an assistance to steam power and operates only to save coal and operating expenses during that part of the year when the stream flow is high and when it would otherwise be wasted. The existence of secondary power in the system permits the shutting down of an equivalent amount of steam power. Utilization of secondary power is made possible without any additional operating expense for hydro-electric plants to be installed on the Potomac and Delaware Rivers. In the case of the Susquehanna River, which has no storage, its secondary power is determined by the economic balance between the yearly fixed and operating costs of the extra hydro-generating and transmission equipment and the operating expenses necessary with a steam plant of equivalent capacity.

PROVISION FOR OVERHAULING STEAM PLANTS

There is another advantage in the operation of such power streams as the Susquehanna in an extensive system, a stream in which the power varies from small values to large values. Whenever the stream flow is sufficient to operate the total capacity of the plant throughout the twenty-four hours of a day, such a power plant would be operated on base load, as otherwise the water would be wasted over the dam during the night. It costs nothing to utilize the water. Such plants operate on base load for a period of two or three months in an average year and replace steam plants which would otherwise work on base loads throughout the entire year. It would be desirable to operate the steam plants continuously at high load factors, but this would not permit the necessary time for their maintenance. With hydro-electric plants, such as those to be constructed on the Susquehanna, furnishing base load for two or three months, equivalent to the capacity of the new super steam plants, periods will be automatically provided when the steam plants can be overhauled and placed in condition for the high-capacity-factor twenty-four-hour operation.

The advantage of the interoperation of steam any hydro plants, is in the insurance which the steam capacity furnishes. When it is known that there is no steam capacity to fall back upon, a more reserved use of the water storage is necessary during the approach of the low water conditions and a less complete use of the water results. Take, for instance, the condition of low water on the Potomac River when supplying energy in that vicinity. If the water is running low during the summer it would be preferable not to use the normal rate from storage, but rather to retain the water, supplying the necessary power by steam capacity in order that the storage water, together with the very high installation in the water power plants, may be used in December for the purpose of carrying the annual peak load.

Budget System Used to Determine Material Stocks Needed

Departmental Estimates Are Prepared in Advance for Operation, Construction, Reconstruction and Maintenance—Supplies Bought Accordingly

BY F. R. COATES
President Toledo (Ohio) Railways & Light Company

ONE of the most difficult problems any manager has to face is to determine the stock of material which should be carried in order to handle maintenance work, new construction and reconstruction. Many things enter into a proper determination of the problem, such as conditions of the material market, deliveries, the urging of work ahead, the price to be paid for working capital and other local conditions. It is a comparatively easy matter to estimate the ordinary operating supplies for a period of six months in advance, but when plant construction or additions to the distribution system are contemplated it becomes more complicated.

Each piece of construction, extraordinary maintenance or reconstruction must be considered as a separate unit and material, labor and other expenditures compiled for each unit. In this way the material or stock requirement may be ascertained months in advance, and stock to be used for a particular job will be purchased and on hand by the time the job is started. By this exact method of recording stock requirements the amount of stock on hand will be reduced to a minimum and capital conserved.

In order to avoid interruptions due to mechanical accidents it is advisable to carry duplicate parts, both mechanical and electrical, to insure continuous operation. Such a practice will require more stock than would ordinarily be carried on hand, but the saving of time in correcting mechanical trouble by having extra parts on hand is worth a great deal more than the carrying charge of this additional stock. It is simple insurance that every prudent and far-seeing manager takes out to protect his property.

ESTIMATES ARE PREPARED NINE MONTHS IN ADVANCE

In order to control material estimates and purchases, the Toledo Railways & Light Company is operated on a budget system. Estimates are prepared for operation, construction, reconstruction and extraordinary maintenance and for the stock of materials and supplies needed for this work. Each estimate receives very careful consideration from the superintendent in charge of a department, and each detail is worked out on forms provided for the purpose for a period of from six to nine months in advance.

In the case of operating supplies, the requirements are based on past operation and on estimated output. Each stock is carefully analyzed, and the amount required in the operation is set up by months. The purchases are naturally based upon the amount of material required as well as that on hand, and this material is provided by the manager of stores as it is needed.

In the case of construction, reconstruction and extraordinary maintenance, each job or piece of work is considered as a unit, and a detailed estimate is made for each. The class and quantity of material are tabulated for each job, and in this way the requirement is figured in advance, and through the co-operation of the stores department and the cost department the manager of stores is enabled to have the special material on hand when needed.

Through the medium of progress reports a weekly analysis is made and the accounting and financial departments are notified of any change from the original estimates. This enables the management at all times to be familiar with the entire operation of the property and with all work in progress.

Not only are estimates made six months in advance of the expense of operation, construction, etc., but just as careful estimates are made on the probable income, and it is surprising how close many of the estimates are. It means that the heads of the different departments have carefully gone over with the men under them the needs of the future and its probable production of revenue as well, with the result that the property can be operated much more economically and efficiently, and each department has as a result of this careful study a much stronger grasp of the workings of the company even to the details.

In normal times the tendency is always to overstock. Men naturally like the new things, and if a careful check is not made, it is surprising how quickly stock mounts up to astounding totals. To guard against this it has been found advantageous to have an inventory taken at quite frequent intervals and then furnish to every department head a list of those things in stock that he most frequently uses. In this way much old stock is used up which ordinarily would be allowed to lie in the stockroom until it became so obsolete as to have only junk value. There are few companies where, if a careful inventory were taken, it would not be found that there were many such things in their stockrooms that could be used if the need of saving money were put up squarely to department heads.

Graphic Meter Records—A Necessity

Checking Continuity and Uniformity of Service, Determining Maximum Demands and Power Factors and Detecting Causes of System Troubles Are Functions That May Be Performed with Graphic Meters

By **E. G. RALSTON**
Chief Electrical Engineer Indianapolis Light & Heat Company, Indianapolis, Ind.

NECESSITY of certain indicating and integrating meters in connection with electrical operation has always been observed, but it is questionable whether there are not many companies that have failed to recognize the benefits of using graphic meters more extensively. The expense of investing in additional instruments that are not absolutely essential is probably the chief excuse. However, when it is considered that system expenses may often be reduced by the judicious use of graphic meters it is worth while balancing their cost against possible benefit before passing them up as unnecessary. Of course, the value of graphic meters, like any instruments, depends on their records being interpreted and utilized so that all prospective users should resolve to enforce regular interpretation of results if benefits are to be expected. To indicate how others may benefit some services in which graphic meters have been particularly helpful to the writer will be cited.

In general, graphic instruments will be of value on

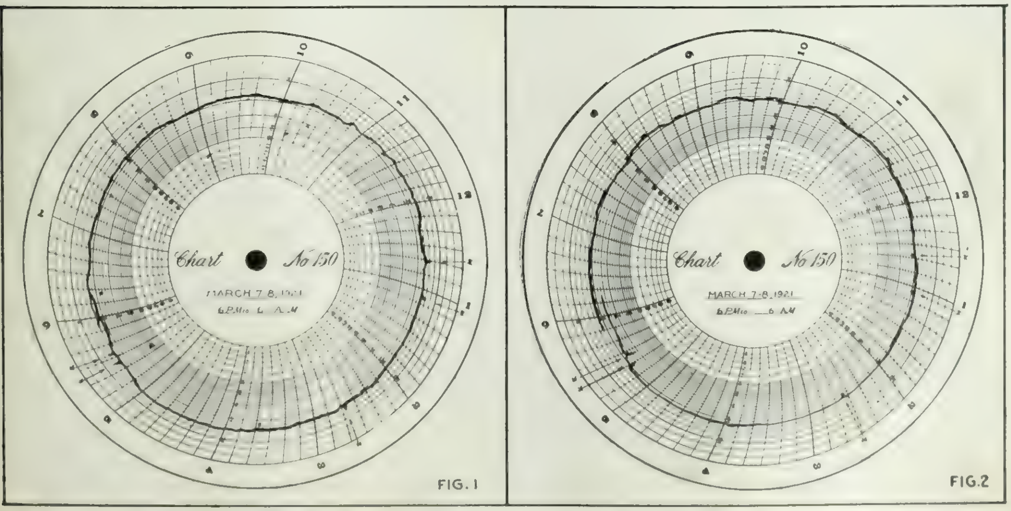


FIG. 1 FIG. 2

FIGS. 1 AND 2—SIMULTANEOUS DIPPING AND RISING OF VOLTAGE ON POSITIVE AND NEGATIVE CABLES OF EDISON SYSTEM INDICATED STARTING OF TROUBLE ON POSITIVE CABLE

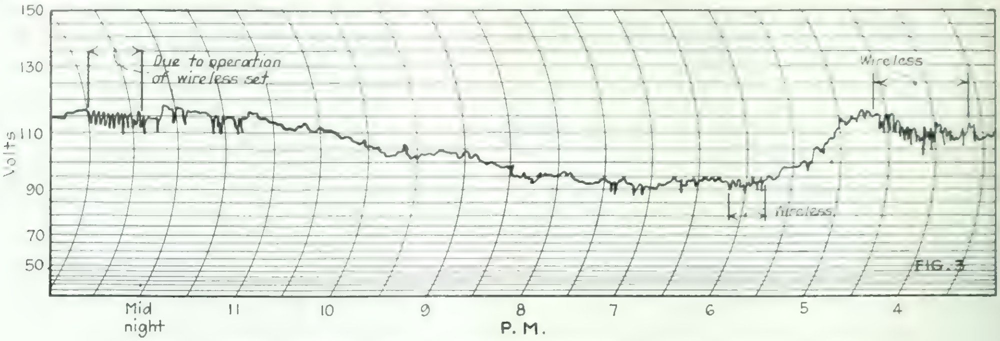


FIG. 3—GRAPHIC VOLTMETER CHART FURNISHED THE CLUES TO CAUSE OF FLICKERING LAMPS ON CIRCUIT WITH AMATEUR RADIO OUTFIT

an electric-service system for checking continuity and uniformity of service, determining maximum demands and objectionable power factors and for detecting causes of system troubles. Since service is the only basis on which a public-utility company can build its business, the first and last named applications are extremely important. To the companies which are worrying about the relation of income to operating expense the second named application should be of considerable interest, even if it isn't to the others.

Checking Continuity and Uniformity of Service

In the generating station the most important graphic instrument is the recording voltmeter. It gives the net operating record of the station and shows the regularity of service, the time of interruptions and besides is an invaluable guide in determining and locating the cause of trouble.

Graphic voltmeters installed at the different substations and connected to the positive and negative sides of a three-wire underground Edison system are especially useful in detecting the starting of underground cable trouble. Thus, if a positive cable has a slight ground occurring occasionally on it, the record on the positive voltmeter (Figs. 1 and 2) nearest the location of the trouble will dip down, while the negative will show instantaneous peaks, as shown by the arrows on the charts. It has been our experience that the records of graphic voltmeters so installed will usually give sufficient warning of coming cable trouble to enable it to be found and remedied before serious results occur.

If street lighting circuits are supplied, graphic ammeters installed on them will usually settle any argument regarding the continuity and quality of service on these circuits. Moreover, it is becoming the practice now for cities to specify the installation of graphic meters in all street-lighting circuits when new contracts are let.

In the future graphic ammeters will, in the writer's opinion, be installed on all important circuits leading away from the station to assist in determining the cause of trouble and for recording the length of interruptions taking place. A graphic wattmeter or a graphic ammeter should also be connected in the leads of all large generators to check the load being carried and also to determine the action of the generator when any trouble occurs in the power house or on the distributing system.

If a customer's voltage is uniform within proper limits and the interruption of service (voltage) is within proper limits a substantial portion of the utility's duty to the customers has been rendered. It is almost needless to say that the most satisfactory way to keep a check on voltage being delivered at different points on a distribution system is by means of graphic voltmeters. Other methods, such as waiting for complaints to develop, taking 1-minute reading or readings at other intervals by means of indicating instruments are extremely unsatisfactory.

The results of an investigation of a vigorous voltage

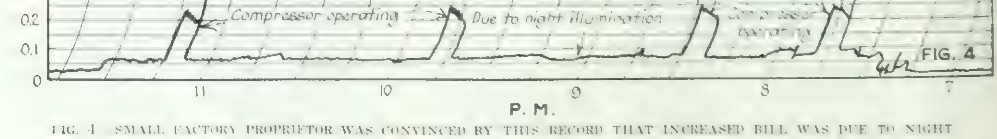


FIG. 4—SMALL FACTORY PROPRIETOR WAS CONVINCED BY THIS RECORD THAT INCREASED BILL WAS DUE TO NIGHT ILLUMINATION AND UNNECESSARY USE OF COMPRESSOR

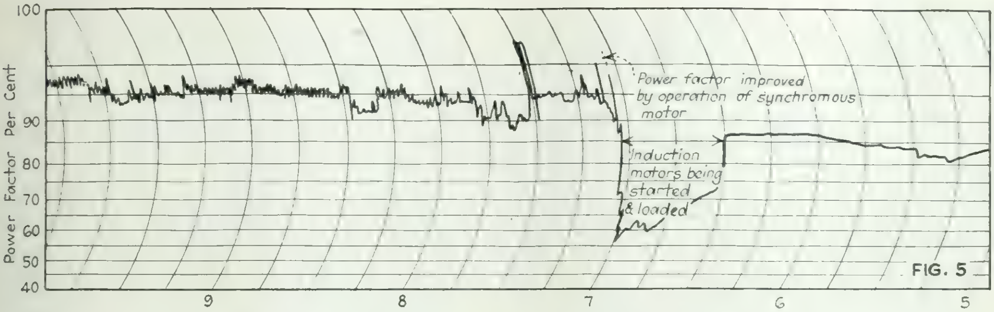


FIG. 5—POWER FACTOR DROPPED WHEN INDUCTION MOTORS WERE STARTED AND LOADED, BUT IMPROVED WHEN SYNCHRONOUS MOTOR WAS OPERATED

complaint, which, by the way, was well justified, is illustrated in Fig. 3. The customers claimed that their lights were dim every evening and also flickering badly. The flickering was found to be due to a boy connecting a wireless sending outfit to the same circuit without permission from the company, consequently the usual precautions had not been taken to guard against this irregularity of service. It would have been hard to secure satisfactory investigation of this flickering by means of indicated voltmeter tests.

In another case a large automobile company complained that the service voltage fluctuated so badly during the morning that it was impossible to use an electric enameling oven successfully. A graphic record of the voltage was shown to the superintendent, with the result that he was immediately convinced that his trouble was elsewhere.

In general it will be found to be a paying investment for the distribution department to have a number of portable graphic voltmeters in use at all times to keep close check on the voltage condition in different districts being served. A graphic voltmeter record is the quickest and most effective way of settling a dispute with a customer who is blaming the voltage for his troubles. This is particularly true in settling complaints concerning the heating qualities of various forms of electric ovens which are so rapidly coming into use and which are very sensitive to voltage fluctuations. Graphic voltage records are also invaluable for use as evidence in court cases and hearings before public service commissions. If reasonable proof is given that the instruments are calibrated accurately the records will in almost all cases be taken as *prima facie* evidence. On the other hand, indicated readings taken by a company's representatives are usually very hard to sustain.

CALCULATING MAXIMUM DEMAND

Since practically all rate schedules are based upon some form of demand and energy charges, it is obviously necessary to measure the maximum load. This can be done in general, first, by taking indicated wattmeter readings during the customers' peak-load hours; second, by some form of demand meter that gives an indicated reading of the maximum load occurring since it was last reset to zero; or, third, by some form of graphic demand meter that records the load of the customer continuously. Needless to say, the last is the only practical form of meter to use on the loads of large consumers. The objection to the second form of demand meter mentioned is that no record is obtained of the time of the occurrence of the demand recorded. This may lead to serious difficulties and misunderstandings between the consumer and the company, since the consumer may not be able to figure out what part of his apparatus caused the demand in question. In a case of this kind it is extremely hard to arrive at a fair basis of settlement. The extra cost of the graphic form of demand meter is such a small portion of a large consumer's demand charge that there can be no legitimate argument against its use.

If permanent demand meters are installed on customers' premises the readings can generally be used for checking the kva. load on the service transformers

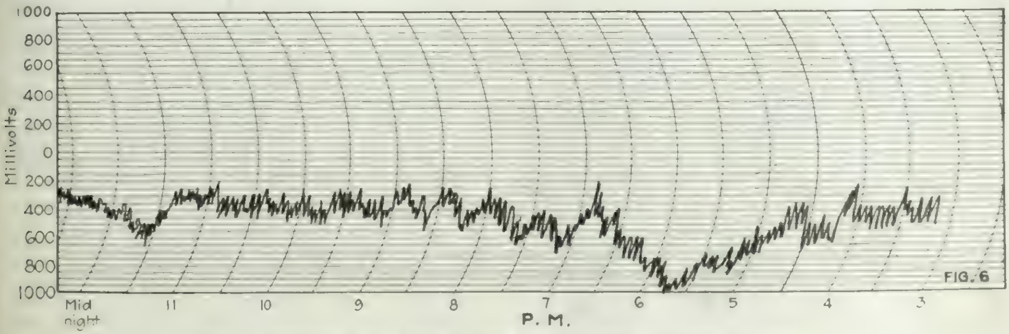


FIG. 6—CURRENT IN LEAD SHEATH FROM STREET RAILWAY CIRCUIT IS USUALLY CHARACTERIZED BY IRREGULAR CURVE

by assuming the power factor. For checking other transformers the graphic ammeter and split-core current transformers are the most useful combination. One man can easily handle an equipment of this kind. If he is furnished with a motorcycle or automobile he can easily keep several of these outfits in service. The results obtained should easily be worth the cost of securing these records. In fact, if it has been the custom of providing one kva. of transformer capacity for each horsepower of connected load, it will usually be found that quite a surplus of transformer rating can be listed for future load growth.

Another exceptional good use to which a graphic load instrument can be applied is in connection with the settling of complaints of consumers regarding high bills caused by a high consumption of kilowatt-hours. The first thing a customer usually blames is, of course, the company's watt-hour meter. A graphic load instrument installed for a short period is the best way to convince the customer that he is using the energy being billed to him. Usually the operation of each machine in a small factory can be followed and analyzed from the record of such an instrument.

The wattmeter curve in Fig. 4 was taken on a small factory's light and power circuit. The customer had complained that his kilowatt-hour consumption as billed had been gradually increasing during the last three months without any cause. A rereading of the watt-hour meter and a check on its accuracy failed to satisfy him. However, a graphic curve of the load immediately convinced this customer that his night force was using entirely too much light and power for the work being done and further that an air compressor was being used at nights unnecessarily.

DETERMINATION OF POWER FACTOR

At present no electrical problem is giving utilities more study than the regulation of power factor. It is being found that with proper regulations or inducements customers will improve their power factor, thus allowing the utilities to load up their installed apparatus and lines to a much greater degree. For determining average power factor, however, graphic meters should not be specified. Power factor determined in this way means nothing. The average power factor should be determined by a kilowatt-hour meter and a wattless-component meter. From the meter readings a true average power factor can be calculated.

On the other hand, a graphic power-factor meter is extremely useful to a utility contemplating the installation of a power-factor penalty clause or to a utility already having one in effect. In the former case the utility should make a complete investigation of its lines and customers to see just what its power-factor conditions are and the causes before they attempt to write the power-factor clause. In the second case, a power-factor meter when connected on a customer's load will show him just what his poor operating condition is doing to the utility and will further serve to check his penalty payment in a way he can understand. The curves in Fig. 5 illustrate these applications.

Electrolysis is usually considered as being caused by the stray street-car currents, but this is not always the case by any means. For example, if the positive cable of a three-wire direct-current Edison system with a grounded neutral leaks slightly through its insulation to the lead covering this cable will be subject to electrolysis action, and probably to a very severe extent. Moreover, suppose the lead sheath of the cables of a similar system are bonded in an approved manner at a certain location to the uninsulated grounded neutral and are also bonded poorly to the neutral in the vicinity of a substation where balancers are located. It is evident under these conditions, that the lead armor helps to carry a portion of the neutral current and that a very bad electrolytic condition may be created in the vicinity of the station if the flow of current is such as to cause the sheath to be positive to the earth.

For investigating such trouble a graphic electrolysis meter of the dotting milli-voltmeter type is very useful. The curve obtained will practically always indicate whether the condition is caused by returning street-car currents or by the condition of the Edison system itself. For example, returning street-car currents will cause an irregular curve (Fig. 6) and the amount of voltage from the conductor to the ground will vary during the day due to the different number of cars being operated. On the other hand a leak from the cable itself to the sheath will give a more regular voltage line on the electrolysis chart. When a street-car system is fed from several different sources in varying amounts at different times of day the electrolysis condition on underground systems may become rather complicated. In cases like this it is usually necessary to take twenty-four-hour readings in the worst locations, to determine the electrolytic action. If periodic readings are taken from indicating instruments it is an expensive piece of work, with rather uncertain results unless dependable men are taking the readings. It can be done easier and cheaper by a machine. After satisfactory conditions have been established the best method of maintaining them is to make arrangements for shifting a graphic electrolysis meter over the district in a regular schedule.

Steam Power Plant in Mydlovary, Czechoslovakia

By Prof. F. Pietsch

A LIGNITE deposit about 4 sq.km. in extent has been discovered in southern Bohemia near Budweis, lying from 5 m. to 19 m. beneath the surface and of a thickness varying from 3 m. to 5 m. A company has been formed for the utilization of this coal with a capital of 10,000,000 crowns, of which the state, the county and public utilities subscribed 60 per cent and the rest was furnished by banks. Excellent clay was found on top of the coal, for the use of which a large brickyard was built, its kilns being fired with coal gas. A part of this gas is burned under two boilers of 260 sq.m. heating surface, which feed two 600-hp. turbo-generators. This power plant is tied in with a nearby hydro-electric plant of 1,500 hp., and their combined energy will be transmitted to Pisek, Tabor and the mining town of Pribram. In the near future a steam power station rated at 20,000 kw. will be erected at this mine.

The heat effect of the wet lignite is about 2,000 calories, but the mining of the coal is so simple and inexpensive that this heat is 50 per cent cheaper than, for example, that produced by the high-grade coal of Brüx. Judging from 300 sample drillings, a total of 20,000,000 tons of this lignite is available, which will be sufficient for the operation of the new power plant for from eighty to a hundred years. The brickyard will turn out 5,000,000 bricks per year.

Production Costs in Medium-Sized Central Stations

Outlays for Fuel Are Still the Dominating Factors in the Operating Situation—Load Factors Show Benefit of Careful Management

THE analysis of central-station operating expenses should be interesting under most circumstances, but especially so in periods of economic change. Plants dependent chiefly upon coal or oil burning are still struggling with the handicaps of high fuel cost resulting from the war, and each year's computation of the expenses of delivering a "home-made" kilowatt-hour to the station bus emphasizes the tremendous effect which the great conflict had upon station cost sheets. The advance of interconnection also introduces a new factor into the situation. The analysis of plant operation is still important, but in making plant comparisons one must remember that the final test of efficiency in delivering energy to the buses is that of over-all net cost, and that a plant making a relatively poor showing in individual production may serve a central-station system admirably through its co-ordination with other sources of electrical supply.

The operations of the generating plants of the Edison Electric Illuminating Company of Brockton, the Fitchburg Gas & Electric Light Company, the Haverhill Electric Company, the Pittsfield Electric Company and the Salem Electric Lighting Company, all of Massachusetts, during the fiscal year 1920 illustrate the influence of high fuel costs upon plant expenses. The accompanying table summarizes these on the basis of energy generated locally and shows the major items of production cost *in toto* and per kilowatt-hour. Data were taken from the returns of these companies to the Massachusetts Department of Public Utilities.

In general, these plants are equipped with water-tube boilers and turbo-generating units of moderate capacity, although three engine-driven units continue in service at Fitchburg. They range in size from about 5,500 kva. to 23,150 kva., the stations at Brockton and Salem being roughly of the 20,000-kva. class, those at Fitchburg and Pittsfield in about the 6,000-kva. class and the Haverhill plant being rated at about 16,000 kva. The average cost of fuel per ton used and accounted for in these plants for the year was: Brockton, $10.25; Fitchburg, $7.90 (including coke); Haverhill, $10.27; Pittsfield, $6.50 (including steam-heating fuel); Salem, $9.47. The substantial steam-heating load at Pittsfield makes fuel comparisons from these data difficult. The Salem station is a tidewater plant, the rest being inland, with necessary dependence upon river or pond water for condensation.

STATION PRODUCTION COSTS (CENTS OMITTED), FISCAL YEAR 1920

	Brockton		Fitchburg		Haverhill		Pittsfield		Salem	
	Total Expense	Cents per Kw.-Hr.	Total Expense	Cents per Kw.-Hr.	Total Expense	Cents per Kw.-Hr.	Total Expense	Cents per Kw.-Hr.	Total Expense	Cents per Kw.-Hr.
OPERATION:										
Fuel	$376,290	0.922	$162,254	*1.275	$145,075	1.232	$162,064	0.91	$357,232	0.82
Oil, waste and packing	1,311	.....	1,354	.....	1,131	.....	692	..	2,382	.....
Water	572	.....	3,114	.....	0	..	3,276		4,280	
Wages at station	59,908	0.147	42,590	0.314	38,161	0.32	53,403	0.3	58,729	0.135
Station supplies, etc.	6,899	.....	5,226	.....	5,804	....	3,859	....	6,916	....
Total	$444,980	1.09	$214,538	1.58	$190,171	1.62	$223,294	1.25	$429,539	0.985
MAINTENANCE	36,859	0.09	17,979	0.135	16,155	0.13	11,732	0.07	61,823	0.145
Station buildings	5,232	.....	751	...	2,543	...	1,126		13,848	..
Steam equipment	25,622	0.065	16,571	0.122	12,769	0.11	8,241	0.05	45,563	0.104
Electrical equipment	6,005	.....	657	.....	843	....	2,365	....	2,412	....
Total (production)	$481,839	1.18	$232,517	1.715	$206,326	1.75	$235,026	1.32	$491,362	1.13
MISCELLANEOUS:										
Kw.-hr. generated	40,841,740	.....	13,586,000	.....	11,757,890	....	17,761,570		43,576,750	.
Maximum demand (kw.)	12,000	.....	4,090	.....	4,800	....	4,200		12,500	.
Average load at generating station (kw.)	4,660	.....	1,550	.....	1,340	....	2,020	.	4,970	.
Load factor (per cent)	39	.....	38	.....	28	....	48.3	.	39.8	..
Coal per kw.-hr. (lb.)	1.98	.....	3.6	.....	2.69	...	†		1.94	..

* Per kilowatt-hour steam-generated. † Large steam-heating load.

Important manufacturing plant loads are supplied by these plants, with well-developed power business in proportion to total sales of energy. The load factors for the year ranged from 28 to 48.3 per cent, four of the five plants exceeding 37 per cent. This indicates a desirable advance over earlier medium-sized Massachusetts plant practice through the development of diversified business and long-hour customers, coupled with substantial lighting sales. At Brockton, Fitchburg, Pittsfield and Salem the total connected power load now exceeds the connected lighting load, and among the five companies the power sales ranged during the year from nearly 6,000,000 kw.-hr. to almost 18,000,000 kw.-hr.

What the fuel expense means even to a plant of moderate size as compared with a metropolitan station appears from the Salem and Brockton requirements of virtually $1,000 a day each for coal alone. From 8 mills to 12 mills per kilowatt-hour is expended for fuel under present costs in this group of five stations, and their ability to produce a kilowatt-hour at the bus in their own plants at less than 1.25 cents in the larger stations and at about 1.75 cents in the others, omitting Pittsfield for the reason before indicated, may be contrasted with pre-war costs of from 4 mills to 8 mills less, under the lower fuel prices then prevailing.

The Fitchburg plant purchased 2,304,309 kw.-hr. from the New England Power Company during the year at a cost of $34,435. The total energy delivery to the Fitchburg system was therefore 15,890,309 kw.-hr., and the cost per unit was about 1.69 cents. Through interconnection with the wholesaler, this local company thus obtained energy at a lower average cost than the net production figures of its own station indicate. Interconnection furnishes a load of over 17,000,000 kw.-hr. a year at Salem, but very little energy is purchased by the Salem station, one of the most efficient in eastern New England.

Continued close attention to operating detail and to the cultivation of substantial and diversified business, if coupled with more favorable fuel costs, will result in decided further gains in plant economy, and the close relationship between the commercial departments and the operating results of plants may well be considered in checking performance from time to time.

Readers' Views and Comments

This is a readers' forum. Comments on questions before the electrical industry presenting economic, financial, engineering or commercial aspects and new or supplementary viewpoints on published articles are cordially invited

German Propaganda Through a New Engineering Journal

To the Editors of the Electrical World:

There is some far-reaching propaganda emanating from Germany having origin in the pre-war pan-German group that I think American manufacturers and consumers of engineering products would be interested in understanding. I refer to the monthly journal called *Engineering Progress*, printed in English, which has lately made its appearance in English-speaking countries.

The paper is published by the Auslandsverlag G.m.b. H., an organization formed for industrial propaganda in foreign countries, which is strongly backed by what is called here the "heavy industry," by which is chiefly understood the Rhenish iron and steel industry. The financiers are firms like Krupp and a number of Rhenish-Westphalian steel magnates. The editorial part is worked in close conjunction with the Society of German Engineers. The Auslandsverlag is a part of a large organization initiated during the war for the purpose of export propaganda for German industry. The first enterprise started was the Ala G.m.b. H., a company formed for the purpose of centralizing the placing of advertisements in foreign journals. It aimed at securing in that way an influence in foreign publications and thus an amount of favorable publicity. This company has agencies and representatives in most foreign countries. By acquiring all shares of the Hassenstein & Vogler Advertising Agency it has taken firm root in the advertising field. It is conducted not so much as a commercial enterprise as along the lines of a propaganda institution. Large funds are at the disposal of the company. The activity of this enterprise has caused rather unfavorable comments, not only abroad, but also in Germany—in the latter country for the reason that it plays an important part in the movement to bring the German press under the influence of the iron and steel industry. Already a section of this press has been bought up by this industry, and a large number of papers are financially dependent on it. During the war, for instance, it was the practice to give large advertising orders to papers in exchange for favorable publicity of an entirely nondescript kind which could do the advertiser no good, such as for war material, for instance, of which there was only one buyer, the state. Those advertisements bore the hallmark of bribery, and thus the object was perfectly obvious. A number of other institutions, like the Mosse papers, did their best as far as was permissible at that time to expose such practices, and since then the organization has become a little more careful. Still the practice continues, and there is probably no idea abroad how strong the influence is which the iron and steel industry has managed to obtain over the German press.

Another enterprise from the same source is the Uberseedienst, or Overseas Service. This organization publishes trade news of all more or less important countries for the purpose of guiding and assisting the German manufacturer. The foreign organizations of the Ala serve at the same time as news agencies for the Overseas Service. There are a number of other branches, like two shipping journals, a motion-picture company, the Deutsches Archiv G.m.b. H. (serving for the collection of trade news from Germany), the *Echo* and the *German Export Review*, the two last named being purely export papers. The whole concern may be described as a central organization for giving publicity to German industries. I omit here purposely the words "iron and steel," because by now the initiators of the scheme have received a following in almost all branches of the industry, more especially the machine-building industry. As far as I am aware, the electrical industry has kept aloof, but since the Siemens concern has come under the influence of Stinnes and the A. E. G. has also connections with the iron and steel industry, I am not sure whether this statement still holds good. I believe that the organization has received a sufficient amount of attention abroad, but I doubt whether the full import of it and the part it plays in Germany's economical and political life is quite realized yet.

As far as *Engineering Progress* is concerned, it is purely a propaganda paper. In its heading the publishers are stated to be the Society of German Engineers, the Association of German Steel Manufacturers and the Society of German Electrical Engineers. Those societies, however, have no financial interest in the matter, the real publisher being the Auslandsverlag already mentioned. The societies give solely their moral support and establish the connection with the various branches of industry. The editor is Professor Matchoss, one of the directors of the Society of German Engineers. The paper is published in German under the name *Industry und Technik*, in English as *Engineering Progress*, and in Russian and in Spanish, while a French edition is also contemplated.

The methods by which these publications have been financed are peculiar. Industrial firms have been solicited, some pressure being used, by the industrial organizations to subscribe to a number of copies and to pay the subscription fee for several years in advance. A large amount of money was in that way received. Krupps, for instance, are said to have subscribed to several hundred copies for four years. All these firms have the right to direct that the copies subscribed for be mailed to foreign firms of their choice. It was hoped that the papers would receive also a large amount of advertising, but as far as I can judge the advertising has remained behind expectations. The papers are, however, more or less independent of advertising.

I have gone so fully into the matter because I believe that the whole structure of this enterprise would be of interest. The men back of it are the same crowd of aggressive expansionists that in pre-war times caused unpleasant attention abroad. Politically they belong to that group of German nationalists called the German People's Party, with a strong leaning toward Chauvinism. Nearly all German engineering associations are now more or less affiliated with this organization.

A Correspondent.

Berlin, Germany.

Apportioning Power Costs

To the Editors of the ELECTRICAL WORLD:

In the ELECTRICAL WORLD for June 25, on page 1495, was an article under my signature entitled "Apportioning Power Cost Among Various Classes of Consumers" from which there was lost in editing a paragraph giving credit to Hugo E. Eisenmenger for originating the principle upon which the method of cost analysis was based. In all fairness to Mr. Eisenmenger I think you should publish this paragraph, as follows:

"In an effort to meet the need of the industry for a rational basis of determining cost of service, H. E. Eisenmenger in 1914 evolved the principle embodied in the method of apportionment about to be described and in 1919 published in the *Electrical Review* a series of articles including a development of his principle. This has not received the attention it deserves, and it is in the hope that the somewhat modified and simpler method used by the writer for some years past will enlist interest in what is believed to be an important principle that this paper is offered."

Puget Sound Power & Light Co. G. E. QUINAN,
Seattle, Wash. Chief Electrical Engineer.

To the Editors of the ELECTRICAL WORLD:

I have read with interest G. E. Quinan's article on "Apportioning Power Cost Among Various Classes of Consumers" in your issue of June 25. Mr. Quinan arrives at exactly the same results for allocating the so-called "fixed costs" as I do by a method which I devised in 1913-14. After having discussed this method with various men of the industry and having had it tried out, I included a description of it in my serial on central-station rates (*Electrical Review,* Aug. 2, 1919, page 184 *et seq.*). It will also be published in Appendix VI of my book on "Central Station Rates in Theory and Practice," which is coming on the market soon.

Whereas I analyze the load curves first into vertical elements and then horizontally, Mr. Quinan chooses the reverse order of procedure, which has certain advantages. The principles applied are fundamentally the same in both cases.

The trouble with these methods, or rather with the nature of the problem, is that it is theoretically necessary to know the entire load curves of both the central station and the respective class of consumers. Whereas we have as a rule no difficulty in obtaining the former, it is frequently impossible to get without prohibitive cost a record of the aggregate load of a certain group of consumers during the entire off-peak time. Where we want to get a composite load curve of a group composed of a large number of consumers, we are lucky if we can obtain a fairly representative curve extending over three or four daily hours of the central station's peak load. The nature of the load during the rest of the day (or year, respectively) is indicated only by the kilowatt-hour consumption during that time. It is desirable, therefore, that a method be developed to determine the maximum amount which the error can reach if the consumers' load curve is known for only a certain given percentage of the time during the central station's peak-load period, and if the consumers' load curve is estimated for the remainder of the time, for instance, as a straight horizontal line of such height as to result in the same total number of kilowatt-hours as the meter readings indicate.

I have been studying this problem for some time, and I hope that I shall be able to present a solution of this question in the near future.

Mount Vernon, N. Y. H. E. EISENMENGER.

Puncturing of Wood Poles Not Harmful

To the Editors of the ELECTRICAL WORLD:

In your May 14 issue Page Golson alluded to the disadvantages of notching poles for the purpose of increasing the penetration of pole-impregnating compounds, laying particular stress on the weakening of the wood fibers by notching. Since some users of poles may have inferred that puncturing of poles has the same disadvantage, I should like to deny any such effect most emphatically. Puncturing of poles by which the wood fibers are merely separated and not severed cannot weaken them. In fact, every one knows that fiber strength can be increased where the fibers are compressed as is the case where the puncturing is done with the proper apparatus. Such apparatus is used by the Western Red Cedar Association in subjecting its poles to the Pentrex process, as illustrated above.

MACHINE FOR PUNCTURING WESTERN RED CEDAR POLES

In general the Pentrex machine consists of two rolls for supporting the pole butt to be punctured and a group of forty-two iron bars provided with wedge-shaped points for spreading the fibers. The bars, which are raised by cams and drop by gravity, separate the fibers and do not sever them. Each bar being independent of all the others, the puncturing die conforms with the irregularities of the pole surface when it strikes—another preventive of injury to the sap wood. Still another precaution is provided by using rolls of such diameter and width that the bearing surface is ample.

No strength tests of "Pentrexed" poles have yet been made, but theoretically every sound pole over 30 ft. long will break above the ground line so that if the sapwood at the ground line were damaged by puncturing, which is not admitted, it would not reduce the strength of the pole so much as would the decay of sapwood in an untreated pole in two or three years.

Every pole subjected to the Pentrex process is issued with the guarantee that the impregnation of the punctured section is not less than ⅜ in. thick or more. When the sapwood is thinner the penetration is not less than the thickness of the sapwood—enough to prevent exposure of untreated wood by checking or abrasion.

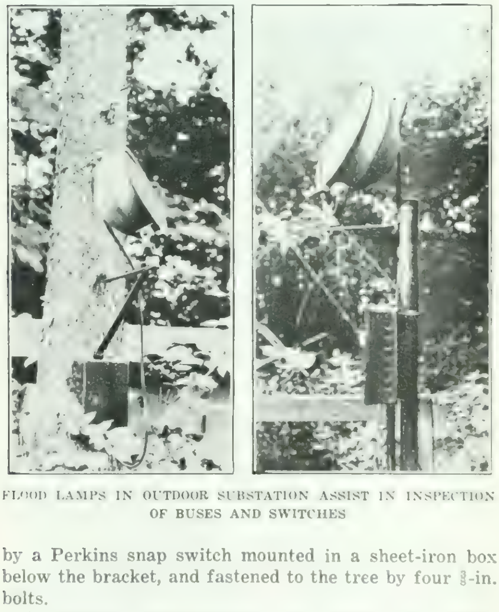
Western Red Cedar Association, G. A. CLARK,
Spokane, Wash. Secretary.

Station and Operating Practice

A Department Devoted to Problems of Installation,
Operation and Maintenance of Equipment for Economical Generation and
Distribution of Electrical Energy

Floodlights Make High-Tension Bus Inspection Easier

TO FACILITATE inspection of the high-tension lines and switches at the Hopkinton substation of the Edison Electric Illuminating Company of Boston, Mass., floodlights have been installed in the yard below the steel structure carrying the 66,000-volt buses. These lamps are of the 500-watt Davis Western Electric type, and the mountings are illustrated herewith. At the left is a lamp carried on a home-made tree bracket in the rear of the yard, the bracket being 1¼-in. by 1¼-in. strap iron fastened to the tree by ½-in. bolts. The horizontal arm of the bracket is 21 in. long and the diagonal brace 24 in. in length, the vertical distance between tree bolts being 13½ in. The lamp is controlled by a Perkins snap switch mounted in a sheet-iron box below the bracket, and fastened to the tree by four ⅜-in. bolts.



FLOOD LAMPS IN OUTDOOR SUBSTATION ASSIST IN INSPECTION OF BUSES AND SWITCHES

A flexible weatherproof cable serves the floodlamp, which is mounted on a trunnion at the end of the bracket to facilitate turning in all directions and in different planes. A run of ⅜-in. rigid conduit supplies 110-volt energy to the unit, the pipe being laid underground and fed from within the substation building. Battery current is available for emergency service. At the rear of the floodlamp a hooded wooden casing open on one side is provided to house ladders for use in overhead work.

Another type of mounting shown at the right employs a 1¼-in. by $\frac{3}{16}$-in. strap-iron bracket fastened to a 2-in. stand of pipe about 5 ft. high. Below the lamp is an appropriate switch box clamped to the vertical pipe, the latter being terminated in a foundation below the surface. FIELD EDITOR ELECTRICAL WORLD.

Boston, Mass.

Repairing Winding and Laminations of 20,000-Kva., 11-Kv. Generator

EXTENSIVE repairs were made recently on the windings and laminations of a 20,000-kva., 11,000-volt, three-phase, 60-cycle generator of the Narragansett Electric Light Company, Providence, R. I. A short circuit in the stator winding had damaged several coils and burned a large hole in a section of the laminations. The arc from the short circuit, fed also from a 45,000-kva. generator, resulted in a melted mass of copper, iron and brass. If this mass had been left and the damaged coils repaired a heavy current would have been set up in the iron surrounding the damaged section, which would have caused a hot spot. Therefore it was decided to replace the damaged iron, which meant removing the armature coils and turning the stator, which weighs 60 tons, on end.

In order to remove the iron after the stator was turned on end, it was necessary to replace the sixteen through-bolts with 1½-in. x 8-ft. rods threaded on both ends. They were put in one at a time, tightened up, and the keys which hold the end ring in the stator frame were taken out. The pressure was eased off on the rods gradually, and these were removed, after which the end ring, which weighs about 1½ tons, was lifted out. The eight finger-plate sections which held in place the end ring were then removed, leaving the laminations free. These were taken out one at a time until the damaged iron was reached at about the center of the stator. With the iron torn down to this point, it was considered advisable to remove all the iron and return it to the factory for annealing and reinsulating. It was decided to install at this time a later design of air vent, which required changing the electrical specifications somewhat.

After the 40 tons of iron had been treated it was necessary to lay the 20,000 laminations in the frame one at a time. Next to the bottom end ring come the finger plates, which are for stiffening the laminations between the slots. On top of the finger plates three layers of cement paper are placed to insulate the laminations from the stator frame, and next to the paper come the laminations, eight to a circle, each layer lapping the joints of the preceding one. Every tenth layer consists of express paper, and every two inches cement paper is placed. Great precaution is used to insulate the laminations from each other to prevent eddy currents flowing through the iron.

In the process of stacking it is necessary to compress and gage the iron about every 6 in. to insure accurate slots when completed. If this were not done, it would be necessary to file the slots to get the proper size; but this is objectionable as it bridges the laminations and may create hot spots. Temperatures may run very high in a generator or motor if the laminations are not properly insulated from each other.

After the stator was completed and turned back into place on the bedplate it was ready for the coils. The coils are connected on both sides to facilitate handling them. They weigh about 85 lb. per half coil and are factory-insulated through the slot with micarta folium. Placing the coils in the slots requires care to prevent injuring the insulation. Using a stiff board as long as the slot placed on the coil and then pressing the coil into place by two jacks prevents springing or damaging the coils. After the coils were all in place a laminated wedge, $2\frac{3}{4}$ in. long, insulated from the other laminations was slid into the groove in the slot, and under this was driven a fiber wedge $\frac{1}{8}$ in. thick to hold the armature coil rigid. The coils were then tested for 32,000 volts to ground, thereby insuring against any possible danger from a weak coil having been overlooked.

Coil-support brackets were placed on the ends and bolted fast to the end rings. To these the coils were clamped by means of well-insulated brass bolts through maple blocks.

The coils were connected at each end with eight sleeves, two conductors in each, each conductor insulated from all others throughout the group and all the conductors per coil connected together at each end of each group. There are four coils per group, four groups per phase, twelve groups total. Each neutral lead is brought out through a current transformer and then to star connection. The three current transformers are connected to three current transformers on the main leads, bucking each other, so that in case of internal trouble the transformers will unbalance, allowing current to flow through a relay which trips the main switch, cutting the machine out of service and automatically opening the field switch.

Before building the generator up to voltage the windings were dried by running the machine on short circuit. The generator was run up to speed, the armature short-circuited through current transformers so the current could be determined, and sufficient field current put on to bring the armature current high enough to give about 80 deg. C. This temperature is maintained until a megger reading of about 1 megohm to a 1,000-volt rating is reached. To determine the temperature thermocouples were placed in the slots between the coils, six couples being placed at the hottest points on the coils which are spaced equal distances apart around the stator.

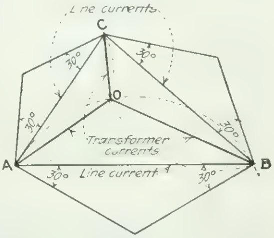
Soldering 900 joints in the winding was done by an electrical soldering device which proved a great time saver. Three current transformers rated 300 amp. to 5 amp. were used by connecting the three heavy-current coils in series and the low-current windings in parallel on 110 volts alternating current. The heating elements consisted of two $\frac{3}{4}$-in. x $1\frac{1}{4}$-in. hard carbon brushes arranged to be held against the connector being soldered. The number of current transformers used depends upon the potential wanted at the carbons to give a good glow as the heat is derived from the contact and not from the amount of current flowing.

A. J. LONG,
Service Engineer.

Westinghouse Electric & Manufacturing Company,
East Pittsburgh, Pa.

Current Division in Delta-Connected Transformer Bank

WHERE a distribution system consisting largely of single-phase loads is fed by a bank of delta-connected transformers, the load is more or less unbalanced. In the case of unbalanced load it is of considerable importance to determine the amount of load on each transformer. The information generally available consists of the current readings taken in the line wires. The current division in the transformer windings is often incorrectly assumed to be proportional to the line currents. If the power factor of the load is the same on all the transformers the current flowing in each transformer can be easily determined by the following method: To any convenient scale, form a triangle with sides *AB*, *BC*, and *CA* proportional to the measured line currents. On each side of the triangle thus formed erect an isosceles triangle with base angles of 30 deg. With the apexes of these isosceles triangles as centers, and their sides as radii, describe arcs of circles. These arcs intersect at a point *O*. The distances *OA*, *OB*, and *OC* will then represent the currents in the transformer windings. It may be proved by geometry that the angles *AOB*, *BOC*, and *COA* are each equal to 120 deg., hence the current *AB* equals the vector sum of *OA* and *OB*, *BC* the vector sum of *OB* and *OC*, and *CA* the vector sum of *OC* and *OA*.



CURRENTS IN DELTA-CONNECTED BANK WITH UNBALANCED LOAD

As an example, a bank of three 200-kva., 2,300/7,500-volt transformers are connected delta on the 2,300-volt side with ammeters in the 2,300-volt line leads. With a balanced load of 600-kva. the ammeter readings will be 150. Assume an unbalanced load such that the readings are 150, 150 and 113. By the method outlined the currents flowing in the transformer windings are found to be 106, 64 and 64 amp. The full-load current of each transformer is 87 amp., thus it is seen that one transformer is carrying 122 per cent and the other two 74 per cent of full-load current. This shows the importance of keeping a check on the load of each transformer, because when the load is unbalanced one transformer may be seriously overloaded and damaged without the meters registering more than normal full-load current. This method is strictly correct only when the power factor is the same on the loads of all three transformers, but it is still practically correct for most distribution systems.

WILLIAM L. CONE,
Engineering Department.

Utah Power & Light Co.
Salt Lake City, Utah.

Fused Horn-Gap Cut-Out and Disconnecting Switch

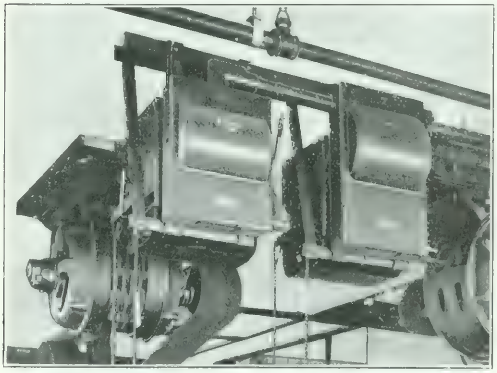
IN DESCRIBING a primary cut-out for construction work in the ELECTRICAL WORLD for June 18, page 1429, no mention was made of the fact that a patent on the switch had been applied for. Such an application, however, has been made by Harry L. Wood, whose name follows the item published.

Industrial Applications

The Economical Utilization of Electrical Energy
in Mills and Factories, Together with Practical Details of Installation, Control,
Testing and Repair of Equipment Required

Starters and Motors Mounted Overhead on Concrete Ceiling

A METHOD used in mounting auto-starters and induction motors on the ceiling of a reinforced-concrete building is shown in the accompanying illustration. The ceilings in this plant have inserts on 3-ft. 4-in. centers which take a standard ¾-in. bolt head. The starters are fastened on two ½-in. x 2-in. steel strap drilled and tapped for ½-in. bolts for mounting the starter on one side and ¼-in. machine screws for mounting a safety switch on the opposite side. The steel straps are bolted to the sides of 6-in. channel iron supported by the inserts in the ceiling. Across the lower end of the steel straps is a piece of ½-in. x 1½-in. steel bolted to the straps and extending beyond the starter 2 in. on the side on which the operating handle is placed. To this extension is bolted a ¼-in. x 1½-in. brace which extends to the opposite side of the channel iron on the ceiling. This makes the mounting very rigid and prevents any movement when the starter is being operated. On the opposite side of the steel straps on which the starter is hung a safety switch is mounted. This switch protects the starter and makes it easy for repair men to cut the power off when making inspections and repairs. For a starter rated at 20 hp. to 30 hp. a 100-amp. switch is used. On 10-hp. to 15-hp. starters a 60-amp. switch is mounted.



MOTOR, STARTER AND SAFETY SWITCH ALL MOUNTED OUT OF THE WAY ON THE CEILING

The 6-in. channel irons are prepared in the electric shop of the company and are drilled and tapped for mounting two starters and switches. Usually only one starter is installed except in cases where two motors are mounted close together. All the ½-in. x 2½-in. mounting straps are drilled and tapped to take both sizes of starters and switches and also for mounting a smaller type of starting switch which is used on all three-phase motors mounted on the ceiling up to and including 7½ hp.

The regular operating handles are removed from the starters and a cast-iron rocker arm 11 in. long is substituted. This has a hole in each end to which is fastened a sash chain with a heavy wooden handle attached for operating the starters. The starting and stopping handle is marked to distinguish it from the running handle.

All the feed lines are run in conduit to the switch, and the switch and starter connections are in conduit. If the motor is more than 2 ft. away from the starter, the leads are run in conduit; but if less than 2 ft., they are run without any protection from the starter to the motor.

The motors are mounted on slide rails, which are bolted to 6-in. channel irons running in the same direction as the pull of the belt. These irons are in turn bolted to two pieces of 6-in. channel, which are bolted to the insert in the ceiling. F. W. McGRAW.

Swissvale, Pa.

Ordinary Star-Star Transformer Connection Not Applicable to Furnace

A QUESTION of obtaining higher voltage for starting conditions on an electric arc furnace recently came to the writer's attention. This was a three-phase furnace supplied through three single-phase transformers connected in star on the high-voltage side and in delta on the low side. Probably the first thought for obtaining a higher secondary voltage would be to connect the low-tension side of the transformers in star. However, there is always some danger in operating transformers that have no delta-connected winding, and this danger is particularly great in operating a cold arc furnace, as high frequency is liable to be generated in arcing conditions in a furnace, and these high frequencies may be of such periodicity as to produce very abnormal voltages on the windings of the transformers due to resonant conditions.

A higher voltage can be obtained with safety, however, by connecting half or more of the secondary winding in star for starting purposes, leaving the remaining half connected in delta and for the time being idle. This will give 1.73 times the voltage obtained from the delta connection and will provide a tertiary independent delta circuit which will assist in damping out vacillating currents. Of course, the windings must be such that they can be separated into two sections suitable for this purpose. It is always advisable to consult the maker of the transformer before attempting to separate the windings in this manner. WALTER S. MOODY,

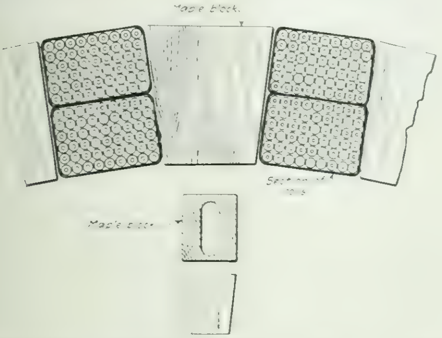
Engineer Transformer Department.

General Electric Company,

Pittsfield, Mass.

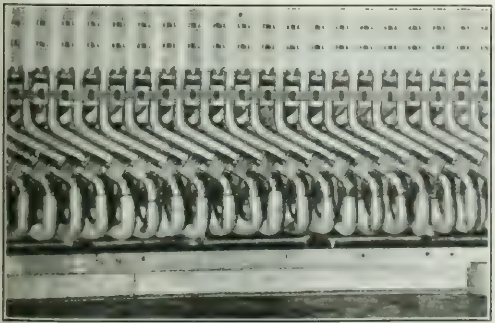
Bracing Coil Ends Prevents Grounding to Core

TROUBLE was recently experienced with the coils of a synchronous motor repeatedly grounding to the core at the points where the coils leave the slots. To prevent such grounding it was necessary to brace the coils by special lacing and special blocking, as described in the paragraphs following: This motor was a 6,600-volt, three-phase, 60-cycle, synchronous machine. After starting it would operate satisfactorily until full voltage was thrown on, then a few coils would immediately ground. The first time it happened the trouble was laid to either defective insulation or careless winding. But after new coils had been put in to replace the grounded ones and the winding tested to ground, the motor was again started and when full voltage was applied, some more coils went out, not the new ones, nor were they in the section that had been lifted up, *i.e.*, throw coils.



MAPLE BLOCKS WERE TIED BETWEEN COIL ENDS TO PREVENT MOVEMENT AND CONSEQUENT GROUNDING

On investigating it was found that the grounds occurred at the end of the slot section of the stator core, and only on the top half of the coil. When the coil was removed from the machine it was noticed that the cell on the coil was cracked on one side and the side opposite had a mark across the coil, like the mark left on a soft coil that is pressed in a vise. The cause of the trouble was consequently thought to be the magnetic pull on the coil ends. The coils were rather light and hence easily bent. They were braced only by an iron ring around the winding and fastened to the bottom section of the coils. This left the top section free and the coils were bent enough to crack the mica cell on the slot section of the coil, so that when full voltage was applied it jumped to ground.



COIL ENDS BRACED BY WOOD BLOCKS BETWEEN THEM AND BY LACING ONE TO ANOTHER

To overcome this trouble some hard maple blocks were cut to the shape shown in the drawing, tapered to fit between the coils sides and just long enough to come flush with the top and bottom of the coils. The thickness and taper must be just right so that the blocks touch all parts of the coil sides. A slot was cut through each block as shown. The blocks were put in from the bottom, *i.e.*, pushed up through the winding, and were tied in place with twelve turns of heavy, tough cord passed through the slots in the blocks. The blocks should fill the space between the finger plates and the end of the short cell.

After the blocks were put in the ends were laced as shown by tying each coil end to the next with the heavy cord. Since this treatment was applied the motor has been operating without any trouble. A. C. ROE.

Detroit, Mich.

Safety Rules Aid Electrical Department at Industrial Plant

TO INSURE safe operation and maintenance work on the large electrical installation at the Amoskeag Manufacturing Company's factory in Manchester, N. H., which includes many 2,300-volt motors, with much control equipment and wiring, a fifty-five-page instruction book has been prepared by the electrical department for staff use. The booklet, which is only about 4 in. x 5¾ in. in dimensions, was compiled with the co-operation of the factory safety committee, and a copy is given to every employee of the electrical department upon entering the company's service, a receipt being returned to the company for the booklet.

The booklet contains sections devoted to general precautions, general operation, handling live equipment, killing supply equipment and lines, killing moving parts, making protective grounds, power-plant, switchboard, overhead-line, arc-lamp, underground and meter operation, testing, identification of circuits, signal-line operation and procedure in case of accident.

A specially interesting section is that devoted to circuit indentification. Near junction boxes, switch cabinets, etc., various color schemes are applied to conduit and other wiring, the intermediate runs not being marked as a rule. Bands of color 2 in. long are used on all circuits except on arc-lighting, telephone and signal lines, where sections 6 in. long are employed. Extracts from these rules are printed below, with acknowledgments to Frank L. Clark, chief electrical engineer of the Amoskeag Company, for the information supplied.

GENERAL OPERATION

1. *Duties of Foremen.*—Each foreman in charge of work shall see that the safety rules are observed by the employees under his direction. He shall make all the records required, reporting to the division foreman. He shall permit only authorized persons to approach the point where work is being done.

2. *Control of Electrical Supply Circuits.*—Employees shall secure special authorization from the division foreman before closing circuits or starting equipment, and before opening circuits or stopping equipment, during running hours.

Exceptions.—In emergencies, to protect life and property, any employee may open circuits and stop moving equipment without special authorization if he is sure that his action will promote safety, but the division foreman must be notified immediately of his action with the reasons therefor. To maintain service any employee may also reclose circuits opened by automatic cut-outs, subject to the provisions of Rule 6.

3. *Authorization for Work.*—Special authorization from the division foreman shall be secured before work is begun on or about the equipment or lines, and a report shall be made to him when such work ceases. When there is more than one workman at any location, the foreman locally in charge shall secure the authorization.

Exception.—In emergencies, to protect life or property, or when communication with the division foreman is impossible, owing to storms or other causes, any employee may make repairs on or about equipment or lines without special authorization if he is sure that his action will promote safety and that the trouble is such as he can promptly clear with the help available, in compliance with these rules. The division foreman must thereafter be notified as soon as possible of the action taken.

4. *Reporting Clear.*—No instructions for making alive equipment or lines which have been killed to protect workmen shall be issued by the division foreman until all workmen have reported clear. When there is more than one workman at a location, the foreman locally in charge of such dead equipment or lines shall report clear for all his workmen only after all have reported clear to him. If there is more than one gang, each foreman shall separately report clear to the division foreman.

5. *Maintaining Service.*—When circuits above 750 volts automatically open they shall be disconnected until they have been found clear by proper test. When circuits at which men are known to be at work are opened autommatically, they shall be disconnected until the division foreman has ascertained that the workmen are safe and he has given proper authorization. When circuits feeding supply lines become accidentally grounded, by indication of ground detectors at stations, they shall be opened, and if upon trial closing the ground still exists the lines shall be disconnected until they have been found clear by proper tests.

6. *Tagging Electrical Supply Circuits.* — Before work is done on or about any equipment or lines, either dead or alive, the division foreman shall have tags attached at all points where such equipment or lines can be manually controlleld, to plainly identify them.

7. *Reports.*—Division foremen will immediately report to chief electrical engineer after having given orders applying to rules under general operation.

Handling Live Equipment

(Note.—Signal equipment and lines are excluded except where made live by leakage from power equipment or lines.)

1. *Touching Live Parts.* — No employee shall touch two parts of different potentials at the same time. Employees shall not touch any exposed ungrounded live parts at any voltage unless insulated from floors and other conducting surfaces by approved insulating covers, mats or platforms. If permanent devices are not provided, portable ones shall be used. Concrete, masonry, earth and the wet surface of wood piles, platforms and other structures are conducting surfaces.

2. *High Potentials.* — No employee shall come or bring any conducting object within a foot of any exposed ungrounded live part whose potential exceeds 150 volts in underground construction, or 750 volts in stations, testing rooms or overhead construction. In dry locations this distance may be reduced if approved insulating or grounded metal devices are placed between the person and the part or object. This distance may also be reduced if approved insulating barriers are placed between the person and ground, as well as between the person and all other conducting surfaces which he could accidentally touch at the same time. In all damp or dark locations, or where grounded surfaces are exposed, unless grounded metal barrier devices are employed, insulating devices must be used both between the person and the live parts and between him and all other conducting surfaces. Where greater space cannot be secured by use of the special insulating tools and appliances furnished or as an additional safeguard, properly tested insulating gloves and sleeves may serve as portable insulating devices between the person and live part below 7,500 volts. Insulating gloves shall never be used to handle sharp edges, especially in making wire splices.

3. *Exposure to Higher Voltages.*—Each employee working on or about equipment or lines exposed in overhead construction to higher voltages shall treat such lines as of the higher voltage, unless they are positively known to be free from leakage or the parts worked on or about are effectively grounded.

4. *Two Workmen.* — No employee shall work within the distances specified in Rule 2 of this section from any exposed live lines or apparatus above 150 volts in underground construction or 750 volts in stations, test rooms or overhead construction, unless another person is present.

5. *Wire Insulation.* — Employees must not place dependence for their safety on the insulating covering of wires. An insulated wire should never be touched without observing all the precautions for handling live equipment or lines.

6. *Work from Below.* — Employees must not work from above on exposed live parts or equipment or lines when work can be done from below. Employees should avoid working on equipment or lines from any position by reason of which a shock or slip will tend to bring the body toward exposed live parts.

7. *Opening and Closing Switches.* — No employee shall open a switch not designed for interrupting a loaded circuit unless the circuit has first been interrupted at a proper circuit breaker. Manual cut-outs shall always be opened or closed by a single unhesitating motion and, if possible, with one hand.

8. *Loose Wires.* — Loose conductors should never be brought near exposed live parts except those to which they are to be immediately connected.

9. *Handling Connecting Wires.* — In connecting dead equipment or lines to a live circuit by means of a connecting wire or device, employees shall first apply the wire to the dead part before attaching it to the circuit. When disconnecting, the live end shall be removed first.

10. *Never Open Series Circuits.* — Series circuits or secondaries of current transformers shall never be opened. A jumper must always be connected across any device inserted in such a circuit before working on the device.

11. *Applying Grounds.* — In applying a grounding device to normally live parts the device must be grounded before bringing it near the parts and must be removed from the live parts before removing it from the ground connection.

12. *Stringing Lines.* — In stringing wires near live lines the wires being handled should be treated as alive unless they are effectively grounded by approved devices.

13. *Protection Against Arcs.* — Employees must keep all parts of their bodies as distant as possible from brushes, commutators, switches, circuit breakers or other parts at which arcing can occur during operation or handling. If the hands must be used near such parts, they must be protected by insulating gloves. If the eyes are not otherwise shielded from possible arcing, they must be protected by insulating goggles with suitable lenses.

Killing Supply Equipment and Lines

1. *Ascertain if Parts Are Dead.* — No employee shall approach any exposed ungrounded part, normally alive, within the distances specified in paragraph 2 of previous section except as allowed in those rules, unless he has first assured himself of his own safety and that of those working under his direction by taking the following precautionary measures in the order given:

2. *Division Foreman's Request.* — The division foreman shall request from the chief electrical engineer permission to have the particular section killed.

3. *Chief Electrical Engineer's Acknowledgment.* — The chief electrical engineer shall, at his discretion, advise the division foreman that the particular section will be killed and that instructions will be given him when he can safely proceed. The above rule applies only during running hours.

4. *Opening Disconnectors and Tagging.* — The chief electrical engineer shall direct the proper person to open all

disconnectors through which electrical energy may be supplied to the particular section to be killed and shall require that operator to tag the same, and each tag shall state in large letters, "Men at work." The person shall, when placing the tag, record thereon the time of disconnection, his own name and who requested the disconnection. Where equipment or lines can be made alive from two or more sources, all such sources must be disconnected. This will apply to work on lines with more than one station, also to transformers in banks, motor-generators, switches and such other equipment.

5. *Permission to Work.* — Upon receipt of information from operators that disconnectors are open and tagged the chief electrical lengineer may advise the foreman that he may proceed to work, considering the specified lines or equipment dead.

6. *Division Foreman's Record.* — The division foreman shall record on a card for the purpose the time lines or equipment are reported dead, the particular lines or equipment specified, the name of the foreman in charge, name of employee disconnecting the line and time service was restored, and shall send same to the chief electrical engineer's office.

7. *Proceed with Work.*—After the section has been killed the division foreman and those under his direction may proceed with work on or about the dead section without necessarily complying with the rules under the section devoted to handling live equipment.

8. *Reporting Clear.* — Each division foreman upon completion of his work, and after assuring himself that all men under his direction are in safe positions, shall report to the chief electrical engineer that all tags protecting him may be removed and record the time of such report on his record card.

9. *Reporting Removal of Tags.*—The removal of any tag from any disconnector shall be reported immediately to the chief electrical engineer by the person removing it. Upon the removal of any tag there shall be added to its record the names of the division foreman, the time of removal, who requested removal and the signature of the person removing the tag. The tag shall then be filed at the chief electrical engineer's office.

10. *Restoring Service.* — Only after all protecting tags have been removed by the above procedure from all disconnectors shall the chief electrical engineer, at his discretion, direct the closing of any or all disconnectors.

Killing Moving Parts

1. *Ascertain if Parts Are Dead.*—No employee shall work on or about any part of equipment which is at rest, but which normally moves, unless he has first assured himself that no movement endangering him or others working with him can occur, by taking the following precautionary measures in the order given:

2. *Foreman's Request.*—The foreman shall request from the division foreman permission to have the particular moving parts killed.

3. *Division Foreman's Acknowledgment.* — The division foreman shall, at his discretion, advise the foreman that the particular parts will be killed and that instructions will be given the foreman when he can safely proceed.

4. *Permission to Work.* — Upon receipt of information from all persons operating moving machinery, like shafting or other devices, the division foreman may advise the foreman that he may proceed to work, considering the specified moving parts dead.

5. *Foreman's Record.* — The foreman shall record on a card for the purpose the time he is authorized to proceed with work, the particular part specified, the names of division foremen and his own signature. He may then proceed to work.

6. *Reporting Clear.* — Each foreman upon completion of his work, and after assuring himself that all men under his direction are in safe positions, shall report to the division foreman that his tag may be removed from each starting device and record the time of such report on his record card.

7. *Reporting Removal of Tags.*—The removal of any tag from any starting devices such as engines and waterwheels which would control shafting shall be immediately reported to the division foreman by the person removing it, who shall record on the tag time of removal, who requested the tag and his own signature. The tag shall then be filed with the division foreman.

Making Protective Grounds

The frames and bed plates of all generating machines, motors and transformers should be sufficiently grounded. It is advisable also to surround such machines with insulated matting either of cork or rubber for use of workmen while working about them.

Transformer-case holes for the passage of conductors should be effectively lined or bushed with non-conducting material. Conductors within transformer chambers should be effectively guarded with insulating material.

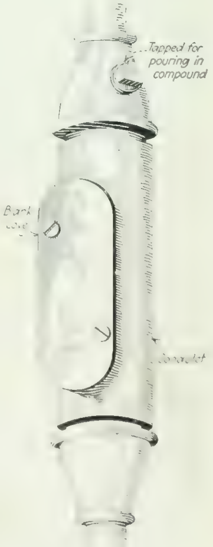
Identification

All electrical supply equipment and circuits shall be adequately identified by the following color combinations:

2,500-volt circuits, 2-in. red, 2-in. black, 2-in. red bands.
550-volt circuits, 2-in. black, 2-in. red, 2-in. black bands.
220-volt circuits, 2-in. yellow, 2-in. dark green, 2-in. yellow bands.
110-volt circuits, 2-in. yellow, 2-in. black, 2-in. red bands.
Arc lighting circuits, 6-in. red band.
Telephone and signal lines, 6-in. yellow band.

Condulet Used as Pothead for Small Cable

THERE are many conditions on low-voltage systems (440 volts or less) where small wires are used, and where it is necessary to terminate a lead-covered wire in some sort of sealing box but where the cost of a standard pothead is not warranted. A very satisfactory way of meeting this condition is to use a condulet with a blank cover for making the splice in the wires. On each end provide a nipple on which may be screwed standard reducing couplings. This provides for continuing the run with either rigid conduit or flexible armored cable. The upper reducer is drilled and tapped to provide a means of filling the condulet with hot compound after the splice has been made. Then an iron plug may be screwed into the tapped hole. To prevent the compound from running down into the lower conduit it is previously packed with jute between the cable and the conduit.



CONDULET USED AS POTHEAD FOR SMALL CABLE

This has been used in a number of cases under the writer's direction and has proved effective, economical and flexible, since by varying the design of the condulet, right-angle turns may be made without extra work.

D. E. Hayner,
Electrical Engineer.
Harry M. Hope Engineering Company,
Boston, Mass.

Central Station Service

A Department Devoted to Commercial Policy and Management Topics, Including Methods of Increasing the Use of Electric Light, Power and Heat

Advantages and Disadvantages of Interconnection Compared

ALTHOUGH the many advantages of interconnection have been thoroughly established, there are several important points which should be carefully analyzed when considering the connection of one system with another. In a discussion before a recent meeting of the transmission and distribution committee of the Ohio Electric Light Association, Major John C. Damon, engineer of the West Penn Power Company, made an interesting comparison of the advantages and disadvantages of interconnection of transmission systems. Defining interconnection as "the tying together of central stations and their loads or groups of stations and loads through substantial connections of sufficient capacity to interchange relatively effective amounts of power," he pointed out that where only such connections are made as to permit the transfer of certain customers from one system to another this was not interconnection but "exchange of loads." A 2300-volt line capable of carrying 3,000 kw. would be an interconnection between a 5,000-kw. and a 10,000-kw. system, but it would not be an interconnection between a 40,000-kw. and a 70,000-kw. system. In the accompanying tabulation the advantages and disadvantages of interconnection are compared.

RELATIVE ADVANTAGES AND DISADVANTAGES OF INTERCONNECTION

ADVANTAGES	DISADVANTAGES
[illegible]	The strain on every piece of apparatus is increased.
[illegible] shutdown from disaster.	[illegible] failure is increased.
	Any trouble causing a complete shutdown affects more people.
[illegible]	Disturbances are communicated between systems tending to increase the total number.
[illegible] are relatively less, giving better governing.	Surges occur oftener and are more violent, requiring better insulation.
Less proportionate investment for spares.	[illegible]
Diversity factor improved, allowing more output from same investment in machinery.	
[illegible] less investment per kilowatt are suitable on the larger system.	
Lower proportionate overhead cost of operation.	The complications in switching and [illegible]
Diversity of industries steadies income.	
Uniform rates, service and policy reduce political "kicks."	Accusations of monopoly with loss of public good will are increased

Major Damon continued:

"While several of the points in the tabulation are self-evident, some comments will be pertinent. When a small system connects with a large one, the reliability of supply on the small system is greatly increased, but the strains on insulation, and especially on switches, may be so increased that until replacements are made the service may be worse than before. Proper strengthening of the system must be figured in the cost of interconnection.

"There is a great deal to be gained on moderate-sized and small systems in reducing relatively the fluctuations of load by interconnection. Improvement in diversity factor should always be carefully scrutinized, especially for interconnection of systems having high load factors or systems serving similar industries. At this time of depression all can realize what an advantage it is to have some industries on the lines not affected, and the greater the territory connected up the more chance there is of this advantage.

"When interconnection is made and all parts of the interconnected system are brought under one ownership and management, the advantages become so great that there is usually no question as to when interconnection pays. When, however, interconnection is between separately owned systems and each party wishes to maintain its own control, management, rates and policy, there arises another series of problems. They cannot properly be called disadvantages of interconnection, but they must be rightly solved before interconnection can be made to realize its full advantages or even sufficient advantages to pay under otherwise most favorable conditions. Interconnection of separately owned systems is like a three-legged race—everything is lovely as far as you work together, but what a mix-up when you don't!

IMPORTANCE OF RATE

"Therefore, the first requirement, after ascertaining that interconnection can be a benefit to both parties, is to make an agreement which will justly divide the benefit, be sufficiently definite to administer and make it an object for each party to help the other. The most vital element is the rate charged, and this should be enough to pay the full cost to the party supplying it with some profit, so that there will be no unwillingness to supply power. The profit should be kept down so that the parties will feel free to use interchanged power, but not so low as to induce either party to 'lay down' on the other. This means that the rate must vary according to whether power is used on or off peak hours and with the power-factor or wattless component, as these influence the cost of supply and the value to the user. This matter of rate requires and deserves much thought, and probably any agreement should provide for a readjustment after some experience. Since the voltages of the two systems are interrelated, a definite arrangement must be made as to the voltages to be maintained. Just limits must be set on the extremes of power to be interchanged and the frequency to be maintained.

"Even with a just and definite agreement, there is always a chance for some operator actuated by a not very broad-minded spirit sometimes to force the sale of power on the other party by screwing up his governor a little, or to exchange unasked wattless current by notching up the voltage, or to take power beyond what he is entitled to by letting the frequency go down. The adjustment of such difficulties is largely a matter of personnel. The best way to avoid difficulties from this source is for the two systems to select one conscientious man responsible to both systems, not removable by either alone, who knows operating, and give him direct control over the dispatchers of both systems.

INVESTMENT REQUIRED FOR INTERCONNECTION

"Now, when does interconnection pay? Of course, when it will increase the dividends. When interconnection seems worth investigating it will be found usually that a considerable investment is necessary for lines, possibly transformers, or even frequency changers, for switches, meters, synchronizing equipment, lightning arresters and other apparatus. There may also be needed switches of higher rupturing capacity at various points, synchronous condensers to regulate the voltage, additional telephone service, and so on. None of these things produce any power and there are some losses in them; therefore the interest on the investment, maintenance, repairs, depreciation and operation of them constitute the charge which must at least be paid for by the advantages of interconnection. Estimates will show how much the interconnection will permit shutting down inefficient units and operating more efficient ones with attendant savings. Sometimes on a system where the interconnections are adequate spare generating equipment equivalent to the largest unit will do for the whole system, while without interconnections each power station ought to have spare generating equipment which is equivalent to the largest unit in it.

In any case some saving can be made in spare equipment. This saving in investment should be considered as a credit offsetting the same investment for interconnections. In like manner all the items which can be calculated should be set down as a charge or credit against interconnection. The case will be clear if the credits exceed the charges, but not necessarily settled if the charges exceed the credits, for there are numerous advantages which cannot be directly calculated; for instance, increased reliability of service, better governing and regulation, etc. These must be evaluated by the judgment of the heads of each system with due regard to the kind of patrons served and the commercial situation.

ADVANTAGES INCREASE AS TIME GOES ON

"The experience of many systems has shown that the advantages of interconnection increase as time goes on and the disadvantages are more easily overcome. During the war many companies that would not have previously considered either exchange of load or interconnection arranged for one or the other or for both at the request of the Power Section of the War Industries Board. Some of them immediately went back to their old ways as soon as the armistice was signed, but a notable number, taking the country over, have continued or extended the co-operation which they then started from purely patriotic motives and against their commercial judgment at the time. That this co-operation has proved very beneficial is evidenced by the fact that some who entered into it reluctantly have since expressed their gratitude to those who helped to bring it about.

"There will be many cases where it clearly does not pay to interconnect, but these experiences lead me to say, when in doubt interconnect."

Service Department Replaces Former Trouble Department

FOLLOWING a prize-winning suggestion in an employees' suggestion contest, the Oklahoma Gas & Electric Company, Oklahoma City, has issued orders that the former "trouble department" shall henceforth be known as the "service department." The line of reasoning followed by the company is that this department is the one charged with the duty of seeing that customers receive service at all times and that in a great majority of cases the interruption is not due to trouble on the lines of the company.

It is believed that the change of name will materially assist the company in its attempt to convince customers that the commodity furnished is primarily service and secondarily electricity. The policy of the company has been that the degree of satisfaction derived by individual customers is influenced by continuity and quality of service rather than by the mere use of the commercial product supplied.

In accordance with this change of department name is the revised schedule for following up calls for service put into effect by the company. The initial call for service is routed through the information switchboard, where a notation is made of the time and location of the call. When the service man reports back from a call the customer is immediately telephoned to by the person in charge of the information desk to ascertain whether or not the call has been answered satisfactorily and to assure the customer that the company is truly interested in carrying out its slogan, "Personal attention to every customer." In selecting an employee to take charge of this work consideration was given to the personal qualities of diplomacy and energy, while thorough information concerning the functions of the various departments of the company was another decisive factor.

Commonwealth Edison's Safety Work Not Limited to Employees

IN ADDITION to the work performed by its own safety bureau the Commonwealth Edison Company of Chicago is taking an active interest in safety work throughout the city. At present it is supporting the Chicago Safety Council, a division of the Chicago Association of Commerce, in its task of conserving life and property by way of accident prevention and promoting interest in health and sanitation. The Chicago Safety Council is operating through the homes, schools, churches, railroads, public utilities, civic organizations, automobile clubs and every other available avenue of approach.

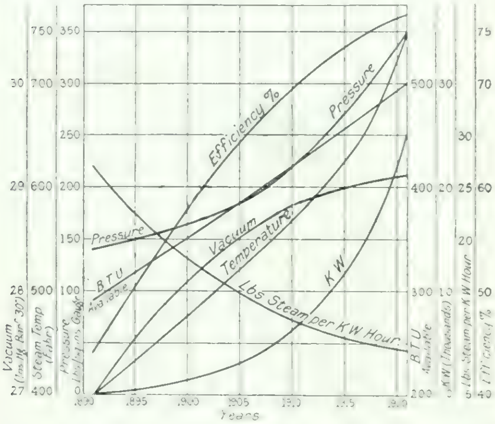
Formerly most of the safety work fostered by the company has been confined to its own organization, but the new project has opened up a newer and larger field of accident prevention in which every citizen of Chicago—man or women—can participate.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
of the World

Generation, Transmission and Distribution

Recent Advances in Steam-Turbine Design.—GERALD STONEY.—During the past thirty years the size of turbine usually installed has increased from 150 kw. to 25,000 kw. and more, while the steam consumption per kilowatt-hour has been reduced from about 27 lb. to well under 10 lb. This, the author states, is due not only to increased efficiency of the machines but also to the increased temperature rise brought about by increasing steam pressure and vacuum. He discusses improvement in design, showing difficulties that have been overcome. Curves showing this improvement in performance within thirty years are reproduced.—London *Electrician*, June 24, 1921.



IMPROVEMENTS IN TURBINE PERFORMANCE IN LAST 30 YEARS

Load Equalization.—F. L. STONE and T. W. KENNEDY. The authors take up the problem of holding down peak loads on central-station systems and use as an example a typical mining installation in which several methods are discussed for smoothing off the peak demand.—*General Electric Review*, June, 1921.

Extension of Electric Power Service Into the Oil Fields.—W. G. TAYLOR.—The extent to which electrical energy is used in the oil fields in California, Kansas, Texas and Alabama in particular is discussed by the writer, with a discussion of the load characteristics of these wells.—*General Electric Review*, June, 1921.

The Lignite Mines of Zillingsdorf and the Power Plant of Ebenfurth for the Supply of Vienna—I.—R. BERON.—Located about 80 km. from Vienna is a large deposit of low-grade brown coal, which has been worked in a haphazard method for the last twenty years. The city of Vienna has recently acquired the prospecting rights. The caloric heat effect of the lignite varies from a lowest of 2,034 to a highest of 3,200 heat units (metric) per kilogram. The coal appears on the surface and is mined with inclined bucket dredges (scrapers). In a few cases the coal vein runs downward on an incline to a depth of 100 m. The city erected at this coal field a power plant, finishing the first installation in 1915. This comprised four high-power steam boilers of 500 sq.m. heating surface each, supplying two 8,000-hp. turbo-generators, giving 5,000 to 5,500 volts, three-phase energy. The collapse of the Austrian monarchy in 1918 entailed the utter lack of coal in the Vienna municipal power plant. It was therefore decided to enlarge as rapidly as possible the Ebenfurth generating station. Four new boilers of the size of the existing ones and two new turbo-generators of 12,000 hp. each were installed in record time. All boilers had to be equipped with a firing system suitable for coal of such low grade. Very large grates and a deep fire were necessary. The high water content of the coal called for specially designed fire arches. Only an automatic staircase-grate stoker system gave full satisfaction. An under draft of 21 mm. water column is maintained by a fan for each boiler. Chimneys of reinforced concrete were used. A five-hour test run of the plant showed a boiler efficiency of 77.1 per cent.—*Elektrotechnik und Maschinenbau*, June 5, 1921.

Traction

Trolley Freight and Motor-Truck Customers.—The trolley-freight systems of the Springfield-Worcester-Boston area hold their own through adverse times because of the reliability, frequency of service and low cost of the system.—*Electric Railway Journal*, July 9, 1921.

Efficiency and Operating Tests on the North Shore Automatic Substations.—CASSIUS M. DAVIS.—A critical analysis of the automatic substation is given in this review of tests conducted on three typical substations of the Chicago, North Shore & Milwaukee Railroad. Machines of three different capacities, including both commutating and non-commutating pole types, were tested. Stations were so selected as to give three different types of duty—(1) practically continuous service with occasional sustained overloads, (2) frequent shutdowns with long periods of no-load demand and heavy loads when running, and (3) an intermediate condition. These operating tests are said to have shown the apparatus to advantage.—*General Electric Review*, July, 1921.

Automatic Substation Experience on the Aurora, Elgin & Chicago Railroad.—S. E. JOHNSON.—Experience on this system centered about a single automatic substation in which regular operators or repair men must perform inspection work. These inspection periods are seven days apart, and the control equipment is adjusted to furnish the maximum possible amount of power throughout the twenty-four hours. The object of this method of operation is to obtain improved voltage conditions which assist in maintaining heavy schedules with three-car to six-car trains. A unique signaling system operating over the dispatcher's telephone line warns the dispatcher of any failure of the substation.—*General Electric Review*, July, 1921.

Installations, Systems and Appliances

Automatic Electric Bake Oven.—JOHN M. STRAIT and J. C. WOODSON.—The baking industry, the authors contend, has been one of the last to take advantage of the inherent qualities of electric heat. Characteristics of the electric ovens with automatic control are discussed. *Electric Journal*, July, 1921.

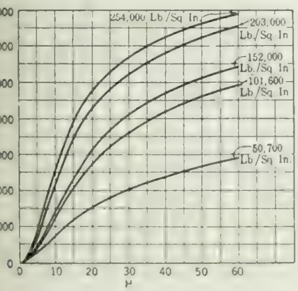
Pulverized Coal Versus Stoker Firing.—F. P. COFFIN.—The underfeed mechanical stoker has much improved the efficiency of the boiler furnace, but it still has its limitations, according to the author, especially when burning low-grade fuel. With the development of efficient methods of handling and burning pulverized coal the power-station engineer is said to have another method at his disposal for solving his fuel problems.—*Power*, July 21, 1921.

Electric Drive for Flour and Grist Mills.—W. T. EDGELL, JR.—It is estimated that the power required by the milling industry in the production of flour-mill and grist-mill products in the United States is approximately 900,000 hp. Only 15 per cent of this power is applied by electric motors, but approximately 50 to 60 per cent of the total milling capacity is within easy reach of central-station service. The various processes in the flour mill to which electric power could be advantageously applied are outlined by the author.—*General Electric Review*, June, 1921.

Electrically Operated Grain Car Unloaders.—R. T. KINTZING.—A description of the car-loading equipment of the Northern Central grain elevator of the Pennsylvania Railroad at Baltimore, which is said to have a higher grain-handling capacity than any other elevator.—*Electric Journal*, July, 1921.

Electrophysics and Magnetism

Magnetic Properties of Compressed Powdered Iron.—BUCKNER SPEED and G. W. ELMEN.—This paper describes a new magnetic material which is peculiarly suited to the construction of cores in small inductance coils and transformers such as are used in a telephone plant. The requirements which were to be met involved a core material which should have a constant permeability, a small hysteresis loss and a small eddy current loss, within the range of magnetizing forces and frequencies which are met in telephonic operation. The material which was developed to meet these requirements is formed by fine grains of powdered iron insulated and compressed. There are described the circumstances and experiments which led to this development and also the method of commercial production. Tables and curves are given showing the magnetic, electrical and mechanical properties of the material.—*Journal A. I. E. E.*, July, 1921.

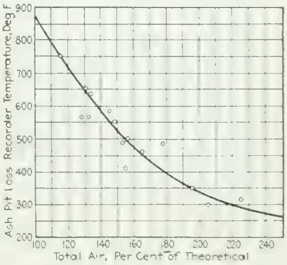


THE EFFECT OF PRESSURE ON MAGNETIZATION CURVES FOR ANNEALED UNINSULATED IRON POWDER

Units, Measurements and Instruments

Recording Ash-Pit Loss from Chain-Grate Stokers.—E. G. BAILEY.—The paper presents preliminary data obtained from a device developed to record the ash-pit loss from chain-grate stokers and thus enables the foreman to effectively control this factor. Records of ash-pit loss, excess air, unburned gas, flue-gas temperature and boiler rating make it possible to plot characteristic performance curves for stokers showing the losses due to unburned combustible, unburned gases and excess air, and to determine the proper amount of excess air to be maintained and also the most efficient capacity. These curves can be used to compare relative efficiencies of different types of stokers, the suitability of different kinds of coal and the effectiveness of the control by the fireman.—*Mechanical Engineering*, June, 1921.

ASH-PIT-LOSS RECORDER APPLIED TO FORCED-DRAFT, CHAIN-GRATE STOKER



Electricity Meters Versus Current Limiters.—E. H. MILLER.—The author discusses the use of current limiters in cases where the expense of installing meters is not justified.—London *Electrician*, July 1, 1921.

Telegraphy, Telephony and Signals

Some Operating Characteristics of Electron Tubes.—W. C. WHITE.—The author states that the discussion is not of the fundamental theories of electron tubes, but rather to give information concerning the tubes which is not generally known, such as precautions to be taker in application and operation.—*Wireless Age*, July, 1921.

Wind Pressures and the Design of Radio and High Transmission Towers.—S. P. WING.—In the design of a 750-ft. (230-m.) wireless mast the author found difficulty in getting sufficient data from which to assume the wind loads. His conclusions may be summed up as follows: (1) At a locality where elevation is close to sea level the wind velocity increases considerably with the increase in elevation above ground and has not reached the limit of its increase at 500 ft. (150 m.). (2) The increase is limited by the gradient wind, and it appears that it will probably not exceed 15 per cent of that reached at 500 ft. (3) The extreme variation in wind velocity at 750 ft. is between 140 and 170 per cent of the ground velocity. (4) An approximation to the actual pressures within a probable error of not more than 15 per cent is given in the following formula:

$$P = (0.00126h + 1.16)\,P_g.$$

P = pressure in pounds per square foot at point h feet above ground.

P_g = pressure per square foot at ground level.

—London *Electrician*, July 1, 1921.

Books of Technical and Industrial Interest

Hydro-Electric Development in Ontario. By E. B. Biggar. 202 pages, maps and illustrations. Toronto, Canada: The Biggar Press.

A carefully compiled history of the greatest water-power system of the world, which began as an insignificant distributer of electrical energy and has grown in twenty years to the largest generator and distributer of hydro-electric power in existence. The book tells of the almost unlimited power resources of Ontario, mentioning the varied power problems and the projected development of the St. Lawrence River. The whole subject is treated in twenty main chapters, with an appendix of five sections.

Schaltungsschemata Elektrischer Starkstrom Anlagen. By Prof. Dr. J. Teichmüller. Vol. 1: Direct-Current Diagrams. Second edition. 131 pages, 27 plates. Munich and Berlin: R. Oldenbourg.

This is primarily a textbook for the student, containing the description and connection diagrams of about 250 different direct-current systems for varied purposes and twenty-five diagrams of existing direct-current power stations. Several pages are devoted to the series high-voltage direct-current Thury system. All the many diagrams are drawn uniformly, using the standard symbols authorized in Germany. The author has endeavored to make even the most complex diagrams clear. To the engineer who has to lay out the diagram for direct-current power plants this book should give many valuable suggestions.

Connecting Induction Motors. By A. M. Dudley. New York: McGraw-Hill Book Company, Inc. 252 pages, 289 illustrations.

Several good books have been written covering the theory of the induction motor, but none of these has presented the interpretation of the theory of winding designs in as practical a way as Mr. Dudley has done. The book is, therefore, a valuable addition to the technical literature of the asynchronous motor. The first seven chapters deal with the rotating magnetic field, types of windings, chording the windings, and the effects of voltage phase and frequency on windings. The remaining seven chapters, which occupy about half the text, deal with the practical considerations in modifying windings to suit new conditions and in rewinding old cores. A valuable feature of these practical discussions of winding designs is the section devoted to standard group diagrams for windings of from two to fourteen poles, of which there are eighty, showing the proper connections of coil groups for the various series and parallel combinations of star and delta connections. These diagrams are for the windings ordinarily used on stators. In the last chapter wave diagrams for the windings of wound rotors are discussed and eleven diagrams shown. The book reflects a wide experience in induction-motor design to meet the varying conditions of service and gives the student and practical man a very comprehensive and useful fund of information on the changes that can be made in induction-motor windings as found on standard machines. To the motor designer it is also equally valuable as a reference source on technically accurate details covering the layout and connection of induction-motor windings.

Die Transformatoren. By Dr. Milan Vidmar. Berlin: Julius Springer. 700 pages, 297 illustrations.

Books on transformers are few and far between, and there has really been no modern up-to-date book on this subject known at all. If ever a book filled a badly felt gap, therefore, it is Vidmar's work on transformers. The author's name is well known to electrical engineers because of a great many practical articles by him which appeared in Austrian and German electrical papers. He is one of a few gifted men who know how to explain in simple words or equations the most intricate physical problems which the designer of electrical apparatus has to face in his daily work. It is a safe assumption that this book would become the companion of every transformer designer if an English translation of it were available. In fourteen chapters the author deals with the individual parts of a transformer, like the core, the winding, the tank, the leads, the heating problem, the price and the general dimensions. He then devotes separate chapters to the small transformer, the dry type, the oil-immersed type and the large power type and describes finally the parallel operation, phase transformation and measurements. The book shows not only the best and quickest way to design each of the important elements of a transformer, but goes a step further and, by the introduction of many practical examples of actually built machines, translates the mathematical results immediately into concrete values. It is these many practical examples which will make the book appeal to every designer. Two transformers, a 16,000-kva., 56,000-volt, three-phase machine and a 3,000-kva., 60,000-amp. single-phase furnace type, are described, with complete calculations in all details of parts and assembly drawings and photographs. Much original work is contained in the chapter on heat dissipation. The whole book is based entirely on European experiences, which in a number of instances differ considerably from our American standards. A striking deviation is found, for example, in the water-cooling systems recommended. An addition of American and English methods and experiences in the art of the design of transformers would be a valuable amendment to this otherwise splendid work.

Books Received

The Welding Encyclopedia. Compiled and edited by L. B. Mackenzie and H. S. Card. Chicago: The Welding Engineer Publishing Company. 326 pages, illustrated.

Radiotelegraphisches Praktikum. By Dr. H. Rein and Dr. K. Wirtz. Berlin, Germany: Julius Springer. 558 pages, 432 illustrations.

"The Electrician" Electrical Trades Directory and Handbook, 1921. London: Benn Brothers, Ltd. 1,300 pages.

Central Station Rates in Theory and Practice. By H. E. Eisenmenger. Chicago: Frederick J. Drake Company. 382 pages, illustrated.

The Engineering Index, 1920. New York: The American Society of Mechanical Engineers. 586 pages.

Electrical Rates. By G. P. Watkins. New York: D. Van Nostrand Company. 228 pages, illustrated.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

Northwest Superpower Survey Under Way

THE committee which has been organized to study the need or desirability of working toward a superpower transmission system in the Northwest will send out soon to the utilities and industries in that section a questionnaire from the responses to which data will be compiled. It is not expected that steps toward actual construction will be taken for several years as the immediate needs of the territory are being satisfactorily taken care of by the existing organizations and transmission systems. Until the industrial expansion exceeds the capacities of the present systems and the available minor power sites are all developed there appears unlikely to be any economic pressure which will force the development of the major power sites at which energy can feasibly be developed only in large blocks. In this territory the primary basis for the development of a superpower transmission system is not the saving of fuel but the expansion of industry and agriculture through the use of the large hydro-electric resources as yet virtually untouched.

Securities Totaling $5,000,000 Offered by Electric Companies This Week

OFFERINGS of securities of electric light and power companies this week have included $3,000,000 first mortgage 7 per cent gold bonds, series D, of the West Penn Power Company, due March 1, 1946, and non-callable to Aug. 1, 1926, and $500,000 first and refunding mortgage 7 per cent sinking-fund gold bonds, series B, of the Great Western Power Company of California, due Aug. 1, 1950. The price of the issue first named is 98¼ and interest, to yield 7.15 per cent, and the price of the other issue is 96 and interest, to yield 7.33 per cent.

The Middle West Utilities Company announces an issue of $1,500,000 in twenty-year 8 per cent secured gold notes, series C. They will be offered in denominations of $100, $500 and $1,000 at 95¼ and interest and will yield 8½ per cent.

Establishment of a Coal Exchange Finds Advocate in Senate

MEETING an attack on the cotton exchanges, Senator Ransdell of Louisiana declared the other day that there is favor in the administration for a coal exchange as a step necessary to the reduction of fluctuations in price and to the general stabilization of the coal industry. His information is that a proposal to establish a coal exchange will soon be made and that producers of coal very generally favor the idea. In this connection it develops that the matter has been the subject of discussion within the American Wholesale Coal Association and that its managing director, George H. Cushing, has gone on record as a firm believer in a coal exchange. "The establishment of an exchange," he is quoted as saying, "must be predicated on the possibility of first grading the coal and then inspecting it. To work this out will take time. Any revolution within an industry requires patient work, but the benefits which would come to the industry will be such as to justify the effort that its establishment will entail."

Mexican Power Shortage Requires New Plant to Meet Demand

TO MEET the acute shortage of power in and around Mexico City the Mexican Light & Power Company has been granted a concession contract by the Mexican Minister of Agriculture and Development covering the construction of an additional plant of approximately 40,000 hp. on the Necaxa River below its present hydro-electric plant of 53,600 kw. capacity. An additional 10,000-kw. unit is now being added to this plant and approximately 5,000 kw. of additional capacity will be added to the company's steam plant in Mexico City.

The shortage which has resulted in the company's restricting the use of power to an extent of about 20 per cent among its customers while aggravated by drought conditions is really due to the increased demand for electric energy. The population of Mexico City has increased rapidly since the revolution and some estimates place the present population between 750,000 and 1,000,000 as compared with 345,000 in 1912. There has also been a great demand for power from mining companies which are resuming operations on a large scale, and the company feels that it will find a ready market for its additional capacity as soon as it is installed.

Los Angeles Sells Bonds to Buy Edison System

THE City Council of Los Angeles has authorized the sale of $13,500,000 of 5 per cent bonds for $11,965,000 in order to purchase the distribution system of the Southern California Edison Company within the city limits. In 1917 the city brought suit to condemn this property but was not satisfied with the price set by the California Railroad Commission and therefore did not acquire it. Later an operating agreement was entered into under which the company agreed to sell the property for approximately $11,000,000 plus the cost of extensions and betterments made between then and the time of transfer. This agreement was extended until March 1, 1922, but the city officials have expressed their opinion that the company would be willing to transfer the property sooner in order to have the money available for its construction program. This the company apparently is unwilling to do, it having been stated by

R. H. Ballard, vice-president and general manager, that his company must plan its financing far in advance, the conclusion being therefore drawn that the company will not accept payment at this time. Should the city sell the bonds now, it has been pointed out that a loss would accrue representing the difference between the interest paid on them and that received from bank deposits of the cash. A suit was immediately filed by a taxpayer to test the validity of the sale.

Joint Receivership for Two Utilities Ends Fifteen-Year Competition

WITH the resignation of Roy Rushton as receiver of the Montgomery (Ala.) Light & Traction Company and the appointment of S. B. Irelan, who has been receiver for the Montgomery Light & Water Power Company, as receiver for both companies, the way has finally been cleared for a settlement of one of the most long-drawn-out instances of public utility competition in the history of the industry. For the past fifteen years these companies have competed for the electric light and power business in Montgomery, the light and traction company, as the name indicates, operating electric and street railway departments and the light and water power company operating electric and gas departments.

The competition was of a cut-throat nature, involving much duplication of lines and equipment, and rates for service were not sufficient to provide a return on the investment. As a result of these conditions the Montgomery Light & Traction Company was thrown into the hands of a receiver in 1918. Efforts were made by the receiver to obtain an increased fare on the traction system in order to put the company on its feet. Some increases were allowed, but they were not sufficient. In March, 1920, the Montgomery Light & Water Power Company, which is operated by the Doherty organization, was also put in the hands of a receiver.

The Doherty company has now acquired a controlling interest in the traction company, and the appointment of Mr. Irelan as receiver for both companies is preliminary to a complete reorganization and consolidation of the two. It was stated at the New York office of Henry L. Doherty & Company that full details of the reorganization have not yet been worked out.

Southern Power Granted Rate Increase with Standard Schedule

AFTER hearings extending over a period of six months before the corporation commission of North Carolina the Southern Power Company was granted permission to increase its rates approximately 20 per cent. The increase allowed gives the company about one-half the amount sought in its petition, and the order, which went into effect Aug. 1, will produce additional revenue of about $750,000 per annum.

Opposing the Southern Power Company in its petition for increased rates were the cotton mill owners, municipalities and other users of power who denied the authority of the corporation commission to fix rates for power. An attempt was also made in the State Legislature to pass a measure which in intent would restrain the corporation commission from interfering with established power rates. This bill was given favorable action by the Senate but failed in the House by one vote.

The order as handed down carries the commission's denial of the contention of the power users that the fixing of rates is a matter for the Interstate Commerce Commission and places the Southern Power Company under the regulation of the commission. The rates declared supersede all existing individual contracts, and in the place of a variable rate the commission established a fixed and standardized rate for each of the nine different classifications into which all consumers are divided.

Both the Southern Power Company as petitioner and the power users as respondents have filed exceptions to the order and while the exceptions may not be argued in court neither the petitioner nor respondents wish to be put in the position of acquiescence in the order. It is not expected that further action, if any, will be taken until after the first bills under the new rates have been rendered, which will be about Sept. 1.

Pacific Coast Companies Gain Through Oil Price Reduction

ANNOUNCEMENT that the Standard Oil Company of California has reduced the price of crude oil another 25 cents a barrel was received with gladness by the public utilities on the Pacific Coast. The reduction affects all of the Pacific Coast States and comes on top of a similar reduction which went into effect on May 15, making a drop in the price of oil so far this year of 50 cents a barrel. Many companies which are tied up with contracts for fuel oil will not, of course, benefit immediately, but buying for some time has been on a hand-to-mouth basis. Many million barrels of oil are consumed in the steam reserve stations of the electric light and power companies so that the reduction in price will make a marked showing in operating expenses. A year ago the electric light and power companies of California alone had to burn more than 2,000,000 barrels of oil in excess of usual requirements because of drought, and while similar conditions do not obtain this year, the saving nevertheless will not fall far short of $1,000,000.

Three States Discuss Development of Power on Colorado River

WAYS and means of developing power on the Colorado River were the subject of a series of conferences held last week in Los Angeles between city officials, representatives of the state engineering departments of Nevada and Arizona, and officials of various irrigation districts and cities of southern California. The city officials of Los Angeles have indicated a desire for that city to undertake a large share in the development of power at the Boulder Canyon dam site, which is on the Colorado River near the junction of California, Nevada and Arizona. This expression of view was in answer to an inquiry made by Director Davis of the Reclamation Service. The irrigation districts are interested in the probable cost to them of the flood protection resulting from the building of the dam, and the municipalities are interested in power which they may obtain. The latter has been estimated at 700,000 hp. and the cost at $55,000,000. It is understood that Arizona and Nevada are desirous of seeing active development work begin but wish to be assured that it will be done by agencies which will pay taxes and be under regulation.

New Ornamental Street-Lighting System for Twin Falls

INSTALLATION of a new street-lighting system, to include erection of 108 ornamental curb lights along Main Avenue and Shoshone Street, has been authorized by the Twin Falls (Idaho) City Council, and the revised contract with the Idaho Power Company covering the work has been approved. The power company is to install the system under the supervision of R. E. Bobier, supervising foreman of operations for the city. The equipment has been on hand for some time.

Kansas City Contracts for Uniform Street-Lighting System

A UNIFORM street-lighting system has been adopted by Kansas City, which has just contracted with the Kansas City Light & Power Company for the installation of approximately 7,000 lamps. It is expected that by the time they are installed the number will be doubled in order to keep step with the progress of the city, the residential districts of which are rapidly expanding. An initial order for 2,000 "Novalux" units has already been placed with the General Electric Company, and additional orders will follow as the work progresses.

At present the business district has a "bright way" consisting of 1,200 trolley poles equipped with four 100-watt multiple lamps, each in an individual globe. Between the business district and the residential section 4-amp. magnetite-arc lamps of the pendent type and 600-cp. lamps with band refractors in "Novalux" fixtures are installed. The residential section is lighted by gas.

The present street lamps will be replaced by 952 600-cp. series lamps in the downtown district and 300 400-cp. series lamps in the outlying business district. To replace gas lighting on streets, boulevards and parks 1,080 600-cp. lamps on standards will be used. Twelve of the city's parks will be lighted with 357 units of the same type. The total number of new street lamps covered by the contract is 6,980. These replace 5,421 which were in use April 1.

Salt Lake City Adding to Its "White Way" System

INSTEAD of one there will be four "white ways" in Salt Lake City's business district by the middle of September when the three new lighting systems now being installed are completed.

The new lighting systems which the city is installing under contract let to the Utah Power & Light Company, at a cost of $85,800, will be almost identical with the one on Main Street, which is considered to be one of the best illuminated streets in the country. The plans call for fourteen standards on a block, seven on each side of the street, with three 6.6-amp. arc lamps on each standard. The standards are ornamental casings of cast iron and are 25 ft. 10 in. in height. The arc lamps are arranged in triangular form, the lower lamp being 18 ft. above the sidewalk. The State Street system will comprise fifty-six standards, having sixteen all-night lamps and 152 which will burn up to midnight. The cost of installation of this system is $43,000. The system on Third South Street will have twelve all-night lamps and 144 midnight lamps on forty-two standards. The cost of installation is $32,000, The system on Fourth South Street will include fourteen standards having thirty-eight midnight lamps and four all-night lamps. The cost of installation is $10,000. Work on the new lighting systems was begun June 24 and has progressed steadily since.

Power Board Urged to Use N. E. L. A. Accounting Classification

HENRY J. PIERCE, representing Franklin T. Griffith, chairman of the water-power committee of the National Electric Light Association, and a committee from the Accounting Section of the association, with H. M. Edwards as chairman, conferred this week with Executive Secretary Merrill of the Federal Power Commission in support of the N. E. L. A. uniform classification of accounts. It was urged that while the accounting rules of the commission will not be applicable in states where public service commissions already have prescribed accounting rules, the N. E. L. A. classification should be adopted by the commission for use in other states. The committee pointed out the value of such procedure since state commissions are working toward a uniform classification of accounts virtually the same as those of the N. E. L. A. After the conference the committee was requested to prepare and file a brief on or before Oct. 1.

Promising Signs Discerned on Industrial Horizon

A SLIGHT improvement in the business situation is reported by Archer Wall Douglas, chairman of the committee on statistics and standards of the United States Chamber of Commerce, in his monthly statement, just issued. Retail merchants, he says, are actually buying goods again instead of having them sold altogether by the traveling salesman; there has been an increase in the working forces of some railroads, and the nation is in the initial stages of emergence from the long depression.

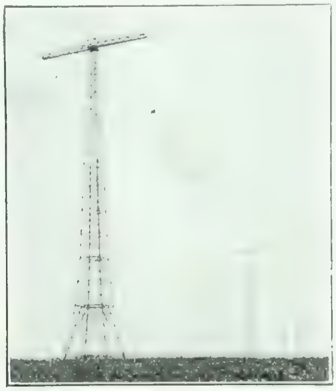
"One of the serious handicaps of business," Mr. Douglas avers, "lies in the difficulty in obtaining a living profit, because the cost of doing business has not yet been adjusted to the still high prices of necessary supplies and the expense of many of the operating methods. Moreover, the prime need is to make sales so as to preserve some reasonable relation between the values of output and the cost of operation. In order to do this care must always be taken that the prices made are not out of line and apparently too high, and any attempt to make sales beyond the immediate wants of the purchaser must only too frequently be accompanied by some inducement in price."

The flood of winter wheat that came upon the market in June indicated the belief of farmers that prevailing prices should be taken advantage of, the release of frozen credits in the country banks as the farmers procured currency from their sales, and the probable slow improvement in business upon the countryside as the summer wanes. Exports of wheat have been much larger than for a number of years. Exports of meat products, on the other hand, are below those of war time, but improvement is looked for.

World's Largest Radio Station to Be in Operation Soon

THE largest and most powerful radio plant in the world, the new central station of the Radio Corporation of America on Long Island, N. Y., will be formally opened for service in the latter part of August or early in September. Two of the wings or spokes of the wheel-like arrangement of the antenna towers are complete. Twelve steel towers, each 400 ft. high, compose the two wings or one operating unit. When the entire station is complete there will be twelve of these.

The total distance between the first and twelfth towers of the complete unit is approximately 3 miles. In the center of these twelve towers is the central power house, which is now completed, and two of the 200-kw. Alexanderson high-frequency alternators have been installed and are ready for operation.



NEW RADIO PLANT ON LONG ISLAND, N. Y.

The receiving station designed to operate in connection with "Radio Central" is at Riverhead, L. I., about 17 miles away. This receiving center is capable of intercepting six different messages simultaneously. The control system is so arranged that there are no actual receiving operators present. The aërials pick up the signals, special apparatus in turn directs these to a regular land wire, and finally the messages are received in New York City.

Excess Profits Taxes and High Surtaxes May Be Repealed

BY CUTTING down governmental expenditures and by refunding operations the administration hopes to avoid the levying of any new taxes and to avoid increasing any existing tax except the income tax on corporations. The ways and means committee agrees to recommend an increase of 5 per cent in the income tax of corporations, bringing it up to 15 per cent, instead of the 2½ per cent increase which had been expected. If present plans go through it will be unnecessary to levy a tax on bank checks and automobiles, and they will make unnecessary any increase in the rate of first-class postage. It also will be possible to repeal the excess profits tax, the transportation tax, certain of the luxury taxes and surtaxes above 32 per cent, and to double the dependent-person exemption.

The government's requirements for the current fiscal year will be slightly in excess of $4,000,000,000. It is the consensus of opinion in Washington that that amount can be provided by the plan now taking shape. The bill providing for such a program is expected to go to the House next week.

The excess profits tax was being relied upon to furnish $450,000,000 in revenue during the current fiscal year. This will be more than offset by the $350,000,000 reduction in federal expenditures and by the influx of an additional $125,000,000 from the increased tax on corporations. There has been an almost universal demand on the part of business to bring the levying on excess profits to an end, and the same is equally true of the very high surtaxes.

With surtaxes ranging up to 65 per cent on top of an 8 per cent normal tax it is not difficult to see why so much capital is seeking tax-exempted securities. To the electrical industry this has been a real menace because it limited the money available for the development of light and power properties and consequently meant a loss of business to manufacturers.

There has also been a strong demand from many quarters for a sales tax as a method of raising money. There has developed, however, on the part of Republican leaders in the House a strong antipathy to this means of taxation.

Illuminating Engineering Society Announces Partial Program

A PARTIAL program for its annual convention, to be held at the Powers Hotel, Rochester, N. Y., on Sept. 26-29, has been announced by the Illuminating Engineering Society as follows:

MONDAY, SEPT. 26

Afternoon.—Presidential address, Gen. George H. Harries; report of council, Clarence L. Law; "The Past Year's Progress in Illuminating Engineering," committee on progress (F. E. Cady, chairman); "Further Standardization of Nomenclature," committee on nomenclature and standards (A. E. Kennelly, chairman); "Code of Lighting Factories, Mills and Other Workplaces," committee on lighting legislation (L. B. Marks, chairman).

TUESDAY, SEPT. 27

Morning.—"Effects of Radiation on the Eye," Louis Bell and F. H. Verhoeff; "The Effect of Variations of Visual Angle and Intensity and Composition of Light on Important Ocular Functions," C. E. Ferree and Gertrude Rand; "Speed, Accuracy and Constancy of Visual Response as Influenced by Distributions of Brightnesses," H. M. Johnson; "Eye Fatigue in Industry," Max Poser.

Afternoon.—"Sky Brightness and Daylight Illumination Measurements," committee on sky brightness (H. H. Kimball, chairman); "The Quality of Light and the Brightness of Various Illuminants as Determined from Their Color Temperature," E. P. Hyde and W. E. Forsythe; "A Low-Voltage, Self-Starting Neon-Tungsten Arc-Incandescent Lamp," D. McFarlan Moore; "Incandescent Lamp Temperatures as Related to Modern Lighting Practice," Chester L. Dows; "The Code of Fixture Design and Installation," committee to co-operate with fixture manufacturers (M. Luckiesh, chairman).

Evening.—"Animal Light," E. Newton Harvey; "Luminescence as a Factor in Artificial Lighting," E. L. Nichols.

WEDNESDAY, SEPT. 28

Morning.—"A Determination by Various Drivers of the Desired Road Illumination from Automobile Headlamps," H. H. Madgsick and R. N. Falge; "Motor Vehicle Headlighting in Massachusetts," A. W. Devine; "The Theory of the

Flicker Photometer Paints for Integrating Spheres," A. H. Taylor; "Interlaboratory Photometric Measurements of Gas-Filled Tungsten Lamps," F. E. Cady and W. E. Forsythe.

THURSDAY, SEPT. 29

Morning.—"Illuminating Engineering Factors in Electric Sign Design," C. A. Atherton; "Illumination and Traffic Accidents—Statistics from Thirty-two Cities," E. A. Anderson and O. F. Haas; "Application of Illuminating Engineering Principles in Merchandising," W. L. Goodwin.

Afternoon.—"The Lighting of Clothing Factories," A. B. Oday and R. W. Peden; induction of president-elect, Dr. George S. Crampton of Philadelphia, Pa.

Additions to the program and the entertainment features of the convention will be announced later.

Government Moving Slowly on Muscle Shoals Offers

ADVICES from Washington indicate that no action will be taken on the offer of Henry Ford for the developments at Muscle Shoals, Ala., until consideration is given to other offers now in the hands of the War Department. Secretary Weeks has just returned from a ten deys' vacation with the President, and it is expected that he will soon take up among other things the details of the much-exploited offer of Mr. Ford.

It is pointed out by some in close touch with legislation at Washington that one of the first questions the Secretary of War will have to consider is whether Congress would be willing to appropriate a large amount of new money to comply with the terms of the contract Mr. Ford asks for. The idea that Mr. Ford is offering to spend his own money in order to relieve the government of its white elephant at Muscle Shoals is ridiculed by many conversant with the facts.

According to competent engineers, to deliver Muscle Shoals in the shape demanded by Mr. Ford the government will have to complete the Wilson dam, install 600,000 hp. of equipment there, build dam No. 3 and install 250,000 hp. of electrical equipment, purchase or condemn certain rights-of-way, transmission lines, patents, etc., and encounter other expenses, including the cancellation of certain outstanding contracts. To do all these things it is estimated the government will have to expend not less than $60,000,000 additional money.

Before recommending the acceptance of any offer calling for further expenditures Secretary Weeks will probably confer with leaders in Congress about appropriations, and, judging from discussions now going on before Congress, any request for additional funds is hardly likely to receive encouragement since new appropriations will mean new taxes at a time when the country is clamoring for tax reductions.

As legislative authority will have to be obtained, it will also be necessary for the Secretary of War to ascertain whether Congress is ready to reverse itself on water-power matters. Mr. Ford asks for a virtually perpetual franchise at Muscle Shoals—one extending 100 years with an automatic renewal at the end of that period. The water-power act passed a year ago declared the policy of the United States to limit all water-power grants to fifty years. It may be that Congress will not be willing to change about so rapidly, especially since the water-power law was adopted after prolonged discussion on this point.

In view of the wide interest in the Muscle Shoals development caused by the offer of Henry Ford, an engineering analysis has been made of his proposals in connection with the total outlay of the government necessary to the completion of the projects. The gist of this analysis is given in tabular form herewith. It indicates a total loss to the government at the end of the hundred-year period of more than a billion dollars.

Massachusetts Rate and Capitalization Hearings Postponed Until Fall

EARLY this fall the Massachusetts Department of Public Utilities will resume hearings upon important rate and capitalization matters already discussed before the board in a preliminary way. And initial hearing was held a few days ago upon the capitalization of electric and gas companies, following the failure of the last Legislature to pass a law sponsored by the Massachusetts Gas and Electric Association which permitted the capitalization of premiums. At the last session the Legislature ordered the commission to conduct a thorough inquiry into capitalization matters and to report its conclusions, with recommendations for legislation, to the Legislature of 1921. At the initial hearing A. E. Pillsbury, counsel for the Massachusetts Gas Association, suggested that the whole question of capitalizing premiums be postponed until a more favorable attitude on the part of the General Court could be expected. H. I. Harriman, president New England Power Company, Boston, urged the commission by telegraphic communication to continue the hearing until fall. The commission postponed the hearing to Sept. 13.

ANALYSIS OF HENRY FORD'S PROPOSAL ON MUSCLE SHOALS

Showing capital expenditures of government; payments of interest, maintenance and sinking fund by Mr. Ford, interest charges of government and total outlay of government on plan proposed, over period of 100 years.

ASSUME:	(a) Construction of Dam No. 2 completed in 1925 and 100-year lease beginning Jan. 1, 1926;	
	(b) 100,000 hp. installed and ready for service, Dam No. 2, by Jan. 1, 1926;	
	(c) Construction Dam No. 3 completed in 1929 and 100-year lease beginning Jan. 1, 1930;	
	(d) 80,000 hp. installed and ready for service, Dam No. 3, by Jan. 1, 1920;	
	(e) Capital expenditure by government for completing Dam No. 2 and installing 600,000 hp. at $33,000,000, as per estimate government engineers.	
	(f) Capital expenditure by government for completing Dam No. 3 and installing 250,000 hp. at $25,000,000.	
RESULT:	Additional capital outlay by government for completing Dam No. 2 and constructing Dam No. 3	$58,000,000
	Annual interest at 4 per cent for 100 years	233,600,000
	Total outlay by government in 100 years........	$291,600,000
	Less interest payments by Mr. Ford in 100 years	169,415,418
	Net outlay by government in 100 years over and above Mr. Ford's payment	$122,184,582
	Mr. Ford fails each year to meet government interest requirements on new capital outlay, which deficit, compounded at 4 per cent, in 100 years equals	$1,153,027,689
	Mr. Ford proposes to compound certain annual payments which at end of 100 years will equal	48,000,000
	Total net loss compounded over 100 years	$1,105,027,689
	To which should be added $104,346,897 cost to government for property turned over to Mr. Ford (including $17,000,000 heretofore spent on Dam No. 2), less $5,000,000 to be paid by Mr. Ford	98,346,897
TOTAL COST OF FORD PROPOSITION TO GOVERNMENT		$1,203,374,586

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Water-Power Promotion in Utah.—The Commercial Club of Salt Lake City has appointed a water-power development committee of which Lafayette Hanchett, president Utah Power & Light Company, is chairman. The duties of this committee will be to study applications for power sites and to encourage proper development of the water-power resources of Utah.

Lynn Gas & Electric Reduces Rates.—A reduction in gas and electric rates was put into effect by the Lynn (Mass.) Gas & Electric Company on Aug. 1. Lighting rates are one-half cent a kilowatt-hour less than before, and power rates are decreased 15 per cent, or to the level that existed before the increase made effective last October. Reduced costs of coal and iron have made the reductions possible.

Ohio Northern Voluntarily Reduces Rates.—The Ohio Northern Public Service Company of Bowling Green, Ohio, lately filed with the Public Utilities Commission of that state a new rate schedule that reduced its former charges approximately 9 per cent, effective July 30. The commissioners are said to think that the period of applications for increased rates is over and that other companies will follow the example of the Ohio Northern.

Capacity of Enid (Okla.) Plant to Be Increased 150 per Cent.—Work has been started on improvements at the Enid electric plant of the Oklahoma Gas & Electric Company which will increase the capacity of that division 150 per cent—an undertaking made necessary by rapidly growing business. Chief among the improvements, which will cost about $130,000, is the installation of a new 2,000-hp. steam turbine which will raise the rating of the station to 3,350 hp.

Chicago Wireless Telephone System Opened.—The Chicago municipal wireless telephone system, constructed under the supervision of W. G. Keith, city Commissioner of Electricity, to connect all police and fire stations, has been put in operation. Initial tests proved satisfactory. The main sending and receiving station is on the roof of the City Hall. Commissioner Keith stated that ultimately there would be receiving stations on all beats to enable policemen to receive messages from stations or from headquarters.

Invasion of Territory Charged.—The Vallejo Electric Light & Power Company in a complaint to the California Railroad Commission has charged the Great Western Power Company of California with an invasion of territory contiguous to the city of Vallejo now served by the complainant. The Vallejo company recites that it is operating under a county ordinance approved by the Railroad Commission, that its service is adequate and its rates reasonable, and that it is ready to supply all future demands made upon it for electric service. The Vallejo company asserts that a distribution system which the Great Western is now building from its transmission line through the district will duplicate complainant's system and that the duplication will work to the detriment of consumers of electricity in the district and to the injury of the serving company.

Sweden's Electrical Power Grows.—According to D. I. Murphy, United States Consul-General at Stockholm, the total income from the Swedish electric power stations in 1920 was about 15,070,000 crowns ($3,063,008 at the average rate of exchange for that year), while that for 1919 was 12,370,000 crowns. The length of the lines in the towns and villages has been increased from 1,840 miles to 2,130 miles.

Rate Reduction at Washington, D. C.—A reduction of 5 per cent in the schedule of the Potomac Electric Lighting Company has been ordered by the Public Utilities Commission of the District of Columbia, making the charge approximately 8 cents a kilowatt-hour instead of 8½ cents as previously. The new rate, which becomes effective on Sept. 1, was subject to approval by the courts. Consumers who are now paying 10 cents for electricity will continue to pay that amount, the courts determining what part of the charge is to be impounded pending a final determination of the rate.

Electric Drive for Lake and River Vessels.—A 5-ft. completely equipped model of an electric ship designed to operate on the Great Lakes and inland rivers and canals is being exhibited in Cleveland, Ohio, by shipping interests of that city. The full-size dimensions of the freighter are: Beam, 36 ft.; molded depth, 13 ft.; over-all length, 256 ft. The boat would be equipped with two 300-hp. full Diesel engines directly connected to generators and two 500-hp. high-speed motors directly connected to the propeller shaft. The cargo capacity would be 1,100 tons with a draft of 9 ft.

Pueblo People Get New Viewpoint on Utilities.—The great flood of last June at Pueblo, Col., served one useful purpose in giving to the dwellers in that city an object lesson on the dependence of modern communities upon the public utility companies that serve them. The Pueblo *Star-Journal* expressed editorially the appreciation felt by the citizens of the rapid restoration of service by these formerly much-criticised companies. The electric service supplied by the Arkansas Valley Railway, Light & Power Company was, by arrangement with the Colorado Fuel & Iron Company, restored immediately after the flood had subsided, the Arkansas Valley company thus becoming the first utility to resume service.

Inventors Are Active Despite Industrial Depression.—Applications for patents during the first six months of 1921 broke all records, numbering 45,005. This is nearly 300 more applications than for the best previous half-year period. During the same period there were 8,369 applications for trademarks, which is also a new record. With the demands on the Patent Office increasing, the capacity of the office is limited to the volume of business of twenty years ago. There is pending in Congress a bill providing for additions to the force and for some increases in salaries. This bill probably will pass in the near future, but it is held that it will not meet the exigencies of the situation and that applications will continue to accumulate until the pressure becomes sufficiently great to induce adequate legislative relief.

Associations and Societies

Empire State Gas and Electric Association.—The annual convention of this association will be held at the Lake Placid Club, Lake Placid, N. Y., on Thursday and Friday, Oct. 6 and 7. Three addresses under the general topic of public relations will be made. It is announced that the nominating committee has made the following nominations: For president, E. H. Rosenquest, Bronx Gas & Electric Company; first vice-president, E. H. Beals, Buffalo; second vice-president, S. J. Magee, New York Gas & Electric Corporation; treasurer, W. J. Welsh, New York & Richmond Gas Company; secretary, C. H. B. Chapin; executive committee, to serve three years: M. J. Brayton, H. W. Peck, F. A. Stoughton and W. J. Welsh; to serve two years: C. E. Bennett.

Coming Meetings of Electrical and Other Technical Societies

Michigan Electric Light Association — Ottawa Beach, Mich., Aug. [illegible]

N. E. L. A., New England Division—New London, Conn., Sept. 6-9.

International Association of Municipal Electricians—Colorado Springs, Col., Sept. 6-10.

Pennsylvania Electric Association—Bedford Springs, Pa., Sept. 7-10.

N. E. L. A., Nebraska Section — Omaha, Sept. 14 and 15.

N. E. L. A., Great Lakes Division, and Indiana Electric Light Association—French Lick Springs, Sept. 14-16.

Association of Iron and Steel Electrical Engineers—Chicago, Sept. 19-24.

N. E. L. A., Rocky Mountain Division, and Colorado Electric Light, Power and Railway Association—Glenwood Springs, Sept. 19-21.

West Virginia-Kentucky Association of Mine, Mechanical and Electrical Engineers—Huntington, W. Va., Sept. [illegible]-23.

Illuminating Engineering Society—Rochester, N. Y., Sept. 26-29.

American Electrochemical Society—Lake Placid Club, N. Y., Sept. 29-Oct. 1.

American Electric Railway Association—Atlantic City, N. J., Oct. 3-7.

Empire State Gas and Electric Association—Lake Placid, N. Y., Oct. 6 and 7.

N. E. L. A., Southeastern Section—Chattanooga, Tenn., Oct. 18-20.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities

Powers of Michigan Commission.—Overruling a motion to dismiss for lack of jurisdiction a petition to obtain a modification of an operating contract between the Muskegon Traction & Lighting Company and the Grand Rapids, Grand Haven & Muskegon Railway Company, the Michigan Public Utilities Commission declared that a contract of this nature did not fall under the constitutional provision against impairment of contracts and was within the jurisdiction of the commission, since such a contract affects operating income.

Small Utility Permitted to Abandon Service with Consent of Municipality.—The Missouri Public Service Commission granted permission to the St. James Ice, Electric Light & Power Company to abandon its service in St. James, a place of 1,100 population, the municipality consenting on condition that the company surrender its franchise. In this instance an increase of rates to 17 cents a kilowatt-hour with a service charge of 75 cents a month had previously been granted to the company, which was also allowed to limit its service to the hours between sundown and midnight. Notwithstanding these concessions, it still incurred a heavy deficit.

Increase in Rates Denied.—In refusing a further increase in gas rates to the Utah Gas & Coke Company the Public Utilities Commission of Utah said: "Admittedly, the recent past has been a time of abnormal conditions. Both revenues and expenses are subject to such diverse influences and uncertainties that only the actual result following the adoption of particular rate schedules can determine the rate of return they will yield. The past year has been subject to reconstruction uncertainties, and these will almost certainly continue. Costs entering into the giving of this particular service may or may not decline sharply, but our belief is that there will shortly be some decline, and the best that can be or should be done at this time is to find reasonable rate schedules and put such in effect, in order to give them the determinative effect of actual experience. The commission can determine average costs and fair average rates to reflect these costs, but will not undertake to fix a precise mathematical rate of return to the utility. We believe this impossible, not only on account of the uncertainty of the economic situation, but for the further reason that something should be left to the utility itself to do in the way of achieving and maintaining operating economy, in the giving of proper and efficient service to the public."

Donations Not a Proper Charge to Operating Expense—A Discriminatory Charge.—In a hearing on the application of the Empire District Electric Company for increased rates, the Missouri Public Service Commission declared that contributions for war work, the Y. M. C. A. and road building had been wrongly charged to operating expense, they being contributions by the stockholders, which must not be assessed against consumers. The commission also asserted that to assess the totals of increased revenue necessary to meet increased costs of fuel on classes of consumers using only 61.6 per cent of the total energy sold was discriminatory, they being properly chargeable only with 61.6 per cent of the necessary increase.

Value of Service as It Affects Return.—The Public Service Commission of Pennsylvania, in dealing with the rate of return, has declared that the problem relates to "not what rate will pay a fair return, in the statutory meaning of that term, but rather what is the reasonable rate which a respondent may charge for service that it may properly function and perform its public duty, so long as it remains a public utility, securing thereby the maximum revenue it is able to collect to pay operating costs, and any balance that remains to be applied as a fair return. . . . Rate regulation does not include a guaranty of return on fair value unless such return can be properly earned." In formulating its rates, the commission asserts, a company is bound to take into consideration the extent of territory and population of the community it serves, and the needs, convenience and necessities of its patrons are also factors to be considered.

Louisiana Commission Favors 8 per Cent Rate of Return.—In approving a recent increase in the rates of the Cumberland Telephone & Telegraph Company, the Louisiana Railroad Commission had these comments to make: "It was shown that the prevailing rate of interest is 8 per cent. Commissions and courts of this country have held that a fair rate of return on the investment should equal the interest rate prevailing. The banks of the country, its insurance companies and most private businesses pay a much larger percentage, and unless a fair rate of return is allowed on the investment in public utilities, they will be unable to get new capital and will cease to function, with disastrous results to the public which depends on them for service. It must be borne in mind that for several years past property not devoted to public use has in many instances enjoyed abnormally profitable returns without restraint, whereas the owners of public utilities have made such meager returns that they are on the verge of bankruptcy all over the country."

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies

Power to Fix Rates Not Affected by Injunction.—In City of Dallas vs. Dallas Telephone Company the United States Circuit Court of Appeals held that a preliminary injunction against the enforcement of telephone rates because confiscatory, pending the determination of just and reasonable rates, did not prevent the city from exercising its charter power to prescribe equitable rates. (272 Fed. 410.)[*]

What Constitutes a Public Utility?—In Clear Creek Oil & Gas Company vs. Fort Smith Spelter Company the question of the jurisdiction of the Arkansas Corporation Commission was at issue. Asserting that it is not within the power of the Legislature to declare the operation of a business private in its nature to be public service, the Supreme Court of Arkansas declared in its decision that a company not a public utility could not impair a business not subject to state contract entered into by it by subsequently engaging in the operation of a business subject to the state's con. trol. Where a company was chartered to operate as a public utility but was not limited to such operation and was not bound so to operate, it had a right to exercise its powers to operate as a utility or not to do so, and if it elected not to do so, it could enter into preferential private contracts not subject to public regulation. (230 S. W. 897.)

No Damages Recoverable for Injury to Person Climbing Pole Without Knowledge of Company.—Where a man employed to help decorate a town climbed a pole used by an electric power company and was injured because of defective insulation, there could be, the Supreme Court of New Hampshire held, in Lambert vs. Devry Electric Company, no damages against the company, it having had no notification that an inexperienced person was to climb the pole, even though it might have been aware of the intention of those decorating the streets to use the transmission-line poles in this work or even have given permission to the company employing the injured man to make such use of the poles. Evidence showed that experienced wiremen climbed the poles without injury. The alleged fact that the poles were not located in accordance with statutory requirements was held not to affect the case. (113 At. 793.)

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[*] The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel—Responsibilities and Association Appointments of Men Engaged in Professional, Executive, Operating and Commercial Branches of the Industry

B. E. MORROW

B. E. Morrow, manager of the production and transmission department of the Consumers' Power Company, Jackson, Mich., has been elected as associate member of the Edison Pioneers. Mr. Morrow's connection with the electrical industry has been a long and honorable one. He first became connected with the Edison Electric Company at Schenectady in 1888, assisting Mr. Edison personally in the work of developing an electric railway for buildings. He was in the testing department of the General Electric Company when the first alternator was built by the Edison Machine Works and assisted Mr. Edison and Dr. A. E. Kennelly in the test on this first machine in old Building 12. Mr. Morrow was in the testing department until 1902 and for several years had charge of the student testing force. In 1902 he resigned from the General Electric Company, with which a year or so prior the Edison Electric Company had been consolidated, and took charge of the operating department of the Hudson River Power Transmission Company. This company, with others, was later merged into the Hudson River Electric Power Company, with hydroelectric plants at Spiers Falls, Mechanicsville and Schoharie Falls, N. Y., and a 6,000-kw. steam plant at Utica, N. Y. While connected with this company Mr. Morrow took an extended trip, in company with Dr. Steinmetz, Professor Creighton and other prominent engineers, through the Middle West and Canada to inspect lightning arresters on high-tension transmission lines. That was before the advent of aluminum-cell arresters, and the multi-gap arresters then in use were the cause of much anxiety to engineers. In 1910-11 he was chairman of the N. E. L. A. committee on protection from lightning and other static disturbances, and he has served on a number of other important committees also. In 1915 he left the Hudson River Electric Power Company and was appointed to his present position with the Consumers' Power Company. In addition to the duties of his department he has had charge of all accident prevention work for the company. He has always been an ardent advocate of safety work and has been active in its promotion for a number of years. In 1917 he was elected a director of the National Safety Council for a term of three years. He has also been a member of the committee on dangerous machinery appointed by the Department of Labor, New York City; a member of the committee on accident prevention of the N. E. L. A., and chairman of the safety practice committee of the public utilities section of the National Safety Council.

L. M. Klauber, who has been appointed chairman of the overhead systems committee of the N. E. L. A., is general superintendent of the San Diego (Cal.) Consolidated Gas & Electric Company. He has served in the past as vice-chairman of the overhead systems committee, as a member of the electrical apparatus committee and chairman of the Pacific Coast engineering committee. He has also been prominent in national technical societies. Mr. Klauber is a native of San Diego and was graduated from Stanford University. From 1908 to 1910 he was associated with the Westinghouse Electric & Manufacturing Company. His first position with the San Diego company was that of new-business solicitor, after which he served as engineer in charge of record department, superintendent of electrical department and assistant to general superintendent.

L. M. KLAUBER

Charles F. Scott, chairman of the department of engineering of Yale University, has been elected president of the Society for the Promotion of Engineering Education. Professor Scott gave a great deal of attention to engineering education long before he actively entered this field. Before taking the chair of electrical engineering at Yale in 1911 he was associated with the Westinghouse Electric & Manufacturing Company in a consulting engineering capacity. Born in 1864 at Athens, Ohio, he was graduated in 1885 from the Ohio State University and subsequently took a post-graduate course at Johns Hopkins University, at the same time teaching in the Baltimore & Ohio Railroad apprentice school. He was employed by the Westinghouse company in 1888 in the testing department, going from there to the laboratory, where he assisted Nikola Tesla in his world-renowned work on alternating-current motors. Later he took charge of the experimental work on the Tesla motor and from that work was promoted to be assistant electrical engineer. In 1897 he became chief electrical engineer of the company and continued as such until 1904, when he was made consulting engineer for the company. Last year Professor Scott spent three months in Italy, representing the Western Electric Company in a matter concerning the location of communication cables. Professor Scott has always been interested in association activities. He is a vice-president of the American Institute of Electrical Engineers and of the Engineers' Society of Western Pennsylvania. He has also taken an active interest in the formation of the Federated American Engineering Societies and is a member of the American Engineering Council, the governing body of that association.

PROF. C. F. SCOTT

R. H. Barber, formerly president and general manager of the Empire Electric & Manufacturing Company, Kansas City, Mo., has been appointed general sales manager of the Roth Brothers Manufacturing Company, Chicago. Mr. Barber has had a long and varied experience in the electrical industry, beginning in 1900 when he entered Armour Institute, Chicago. He left school to enter the employment of the Chicago Bell Telephone Company and afterward was with the Tristate Telephone & Telegraph Company of Minneapolis, his positions with these two companies ranging from installer to wire chief. Later he was connected with the Stromberg-Carlson Company of Rochester, N. Y. He was chief electrician of the bridge and building department of the Chicago, Milwaukee & Puget Sound Railway during the preliminary stages of extending its line to Seattle. He returned to school later and obtained the degree of M. E. at Lewis Institute in 1910. Upon graduation he engaged in sales work in Kansas City for the Century Electric Manufacturing Company and the Cutler-Hammer Manufacturing Company. In 1915 he was made president and general manager of the Empire Electric & Manufacturing Company and remained in that position until this year, when the plant of that company burned, after which he took his present position. He will be in charge of advertising as well as sales for the company. During the war Mr. Barber was one of the five members of the executive committee of the isolated-plant industry, working with the War Industries Board.

R. H. BARBER

L. E. Dickinson, who has been general superintendent of the Mississippi River Power Company, Keokuk, Iowa, since 1918, has had extended experience in the construction and operation of hydro-electric properties. He was born in Chicago in 1880. After a common-school education and general work in machine shops and foundries, he went further west in 1898 and became connected in construction and maintenance work with the Seattle-Tacoma Power Company. A few years later he joined the forces of the Snoqualmie Falls Power Company, leaving this company in 1912 to enter into construction work on the Keokuk project, which was then under way. In 1913 he was made superintendent of operation and construction of the Mississippi River Power Company, and in 1918 he was appointed its general superintendent.

Robert Lindsay, formerly vice-president and general manager of the Cleveland Electric Illuminating Company, was recently elected president of that company.

William L. Goodwin, who is now in charge of the Society for Electrical Development, was presented with a large loving cup as a token of honor by the Independent Electrical Contractors of Greater New York at the outing-dinner of the Independent Associated Contractor-Dealers on July 30, last. He was also signally honored at the Buffalo convention of the National Association of Electrical Contractors and Dealers through the presentation of a gold-embossed, hand-illuminated testimonial containing tributes from the officers, executive committee and 1,800 members of that body. This testimonial to Goodwin "as a man and a leader of men" is a mark of the esteem, good will and affection which he has earned through his untiring and unselfish efforts to establish the business side of the electrical industry on a more stable and profitable basis.

Major George A. Davis, assistant to the vice-president of the Oklahoma Gas & Electric Company, Oklahoma City, was selected by the American Legion to represent the State of Oklahoma in the delegation, consisting of one soldier from each state, which will assist at the unveiling of the monument to the American dead at St. Mihiel, France. The delegation sailed from New York on Aug. 3. Major Davis is in charge of public relations and publicity matters for the Oklahoma Gas & Electric Company.

William Burgess, who for some years has been tariff adviser of the Associated Manufacturers of Electrical Supplies and the Electric Power Club, was recently appointed by President Harding as a member of the United States Tariff Commission. Mr. Burgess is a man of wide experience, whose activities fit him for the service he is undertaking. At the suggestion of President McKinley he was sent to Stoke-on-Trent, England, the greatest pottery center in the world, as United States Consul. Since then he has made five confidential investigations into trade conditions in Europe for the Treasury Department. He visited England, France, Belgium, Holland, Germany, Austria and Italy, and his findings resulted in the collection of large amounts of additional revenues through increased customs valuations. In 1919 he made similar investigations in the Orient, visiting Japan, Korea and China. During the past seventeen years he has been in close touch and active co-operation with the government in the administration of the customs laws, and in 1908 he made an exhaustive investigation for the Taft Tariff Board into comparative cost of production and the conditions surrounding the manufacture of china and pottery ware in European countries and the United States.

Walter W. Templin, formerly specialty sales manager of the Western Electric Company, New York City, has been elected vice-president of the Manhattan Electrical Supply Company with headquarters at its executive offices in New York City. Mr. Templin has been engaged in sales work for the Western Electric Company for more than sixteen years and at various periods has represented the company in the cities of Chicago, Detroit, St. Louis and New York.

WALTER W. TEMPLIN

In recent years Mr. Templin, as specialty sales manager, has had general direction of the Western Electric Company's sales of washing machines, vacuum cleaners, ironing machines, electric ranges, dishwashers, sewing machines and other devices.

Theophilus Johnson, Jr., formerly connected with the General Electric Company, has been appointed general manager of the Wireless Specialty Apparatus Company, Boston.

Paul C. Bandy, who formerly handled the sales work in the industrial heating department of the Cutler-Hammer Manufacturing Company in the western district, has been made manager of the industrial heating department of the Russell Electric Company of Chicago. This company has recently entered the industrial heating field in an extensive way.

F. J. Bartlett, formerly of the Westinghouse Electric & Manufacturing Company, Boston and East Pittsburgh, has been selected as vice-president of the Carolina Electric & Repair Company, Inc., Greensboro, N. C. His duties will include sales work and engineering. Mr. Bartlett was at one time manager of the Boston office of the Electric Machinery Company.

Trade and Market Conditions

Business Reviews, Together with Market Letters
from Important Trade Centers, on the Supply, Demand and Prevailing Prices of
Electrical Apparatus and Supplies

Makers of One-Design Lighting Fixture Plug and Receptacle

THE Electric Outlet Company, 8 West Fortieth Street, New York City; the Arrow Electric Company, the Benjamin Electric Manufacturing Company, the Bryant Electric Company, the Cutler-Hammer Manufacturing Company, the Economy Fuse & Manufacturing Company, the General Electric Company, the Hart & Hegeman Manufacturing Company, Harvey Hubbell, Inc., the H. T. Paiste Company, Pass & Seymour, and the Weber Electric Company are the manufacturers who will make and sell the "Elexit" receptacles and plugs which have been standardized for lighting fixture attachment use, according to an announcement from the first-mentioned company. This standardization was described on page 91 of the July 9 issue of the ELECTRICAL WORLD. These manufacturers have entered into an interlicensing agreement providing for the manufacture of "Elexit" receptacles and plugs to the same master gages.

Sale of Flatirons Stimulated by Price Reductions

WITH the recession in the price schedule of socket heating appliances announced the middle of June opinions differed as to how much buying would be stimulated thereby. Apparently the result has been to increase buying of these devices according to the reports that are received from the different sections of the country. Flatirons have reacted most favorably of all the items and the buying public has accepted with confidence the dollar cut on the household type of iron. Toasters are next in line, with the remainder of the list trailing behind. The New York territory records activity in irons and toasters, New England adds percolators to the list, St. Louis reports on irons particularly, while Chicago shows activity in all three. In the Intermountain district, too, irons have moved well. Several cities have run very successful iron campaigns and have been aided in this by recourse to premiums.

Wire and Cable Market on Road to Improvement

MANUFACTURERS on the whole are of the opinion that conditions in the wire and cable market have reached, if they have not already passed, the turning point. Although the general tendency of sales and production has been downward since the first of the year, there are several indications that there will soon be an upturn in demand and prices. It is believed by most of the wire and cable manufacturers that prices for their products have decreased, proportionately, more than almost every other line. Present prices show an average decrease of between 40 and 45 per cent, as compared with the highest point since 1914. Because of the inactivity during the past six months there has been a certain amount of price cutting resorted to in some quarters in an effort to move large stocks.

This condition appears to be passing, and there is a noticeable tendency toward stiffening prices. Factors contributing to more stable prices are the recent increases in rubber and cotton quotations, and the copper market also seems to be firmer at the present level than at any time during its recession. Among the manufacturers there is a strong sentiment that present quotations are too low, and jobbers whose stocks are depleted are taking advantage of this market.

The demand is principally for rubber-covered wire of the smaller sizes, and those companies equipped to turn out telephone cable are able to keep this department of their plants fairly active on this work. There is but a slight demand for underground cable, although the government has asked for bids on a large quantity of submarine cable.

It is interesting to note that requests for quotations on material for transmission lines and underground distribution cable are being received. These requests for the most part call for a specified quantity of wire or cable, indicating that the material is to be used in construction work which has been carefully planned as to details and should materialize just as soon as a little more confidence is gained. Manufacturers are agreed that an improvement will be seen within two or three months. Along some lines there is already a better tone to the market.

Production of rubber-covered and weather-proof wire at the beginning of the second half of this year, according to some representative manufacturers, was ranging from 20 per cent to 50 per cent lower than at the first of the year, and was from 40 to 60 per cent of plant capacity.

Metal Market Situation

THE copper market last week fell to the lowest point reached in seven years when a price of 11.87 cents a pound was taken for electrolytic in an exceptional sale. Relatively little metal changed hands, however. The ruling price offered by most producers now is 12 cents for August, delivered. At this price it would seem unnecessary to comment on the desirability of purchasing because already the market shows a firmer feeling. The outside market has little copper in its stocks and must depend for the most part on producers for its supplies. There is little interest in copper beyond the present month, and in fact consumers are not getting in each other's way to buy for August delivery at 12 cents.

Considerable interest is shown in copper for export, and this will be helped by the reduction in freight rates to European ports. These rates now are in the neighborhood of $5 per ton. Export copper is being delivered at 12 cents f.a.s., but it is probable that this price will not stay at this level for long.

The Copper & Brass Research Association has been formed to stimulate by co-operative effort the use of copper, brass and copper alloy products.

NEW YORK METAL MARKET PRICES

	Aug. 2, 1921	Aug. 9, 1921
Copper	£ s d	£ s d
London, standard spot	70 5 0	70 0 0
	Cents per Pound	Cents per Pound
Prime Lake	12.00	12.00
Electrolytic	12.00—12.25	12.00
Casting	11.50	11.37½
Wire base	14.00—14.50	13.50—14.00
Lead, trust price	4.40	4.40
Antimony	4.60	4.60
Nickel, ingot	41.00	41.00
Sheet zinc, f. o. b. smelter	10.00	10.00
Zinc, spot	4.70—4.75	4.75
Tin	26.75	27.75
Aluminum, 98 to 99 per cent	24.50	24.50

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	9.50—10.00	9.50—9.75
Brass, heavy	4.25—4.50	4.25—4.50
Brass, light	3.50—3.75	3.50—3.75
Lead, heavy	3.25—3.37½	3.25—3.37½
Zinc, old scrap	2.00—2.25	2.00—2.25

THE WEEK
IN TRADE

Prices When Quoted Are Those Prevailing at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

FROM most sections of the country reports show little advance in trade in electrical supplies, but in the New York territory the increase in trade noted last week seems to be continuing. That the improvement is noticeable is encouraging. Much of the increase is in materials used for residential construction. In this respect, too, Atlanta stands in the front rank, July permits in that city making a high record. Industries are more active there, too. Fans continue to sell well in the South, but in other places the heavy part of the season is thought to be about over.

Building in the Chicago district in spite of the unsettled labor situation is better than last year, but the jobbing movement is rather slow. Boston trade is quiet, but inquiries are better. The latter assertion holds in New York also. In the San Francisco region building is progressing in spite of strikes. Construction continues well in the Northwest. A business revival is reported in Kansas City. Portland jobbers see a slight improvement, and excellent crop prospects in Washington point to a better season. Money is easier in the Intermountain region.

Price reductions have been announced recently on some porcelain wiring material and on repulsion single-phase motors.

NEW YORK

Business continued the past week with about the same degree of activity as previously reported. Improvement in the electrical market has now continued for two weeks and most jobbers feel that the turning point has been passed. Although it is too early to predict a return to normal conditions, there has been a noticeable increase in the demand for material used in residential work.

There has been an increased demand for irons and toasters and a temporary shortage has been reported. This has passed, however. Sales of other heating appliances have not been increased by the recent reduction in prices, but renewed activity is looked for within the next two months.

Inquiries for material and prices continue to come in, and it is evident that a large quantity of work is contemplated as conditions improve.

Conduit.—Stocks for the most part are not large but ample to meet the present demand, which is chiefly for the smaller sizes and in small lots. In 2,500-ft. lots ½-in. black is quoted at $54 to $58; ¾-in., $74 to $76; 1-in., $106.76. For galvanized pipe in the same sizes quotations are $62.75, $81.50 and $116.96. A few sales of the larger sizes for industrial work have been reported.

Flexible Armored Conductor.—The price for No. 14, two-wire, single-strip, holds at $48 per 1,000 ft. A fair demand for this material for residential wiring is reported and stocks are good.

Rubber-Covered Wire.—Prices from $6.25 to $6.50 per 1,000 ft. in 10,000-ft. lots were quoted this week. Demand continues moderate and stocks are good. Some advantage is being taken of present prices in the belief that higher levels will prevail in the near future.

Non-Metallic Flexible Conduit.—Sales of this material are comparatively few and stocks accordingly are kept low. In 1,000-ft. lots the following prices were quoted this week: 7/32-in. size, $20 to $22; ¼-in., $22 to $24, and ⅜-in., $36.

Metal Molding.—No price changes are reported this week. The three-wire size is quoted at $5.92 per 100 ft. in 1,000-ft. lots. Demand is spotty and stocks as a rule are small.

Fans.—Fewer sales were reported this week, and it is believed that this year's season is nearly over. Careful buying has kept stocks down and few jobbers expect to carry over much stock.

Heating Appliances.—With the exception of irons and toasters, the heating devices are moving slowly. Price reductions have not stimulated sales, but it is expected that the next six weeks or two months will bring revived activity in this line.

CHICAGO

In spite of a number of price changes, electrical jobbers report slow movement in virtually all lines. The tendency is due more to the prevalent policy of buying only what is immediately necessary rather than to any dissatisfaction with prices. This fact is demonstrated by the small demand for wire, though prices are lower than at any time since 1914. The "Pageant of Progress" has failed to improve retail trade and not much of an upturn is looked for until late in the fall. Washing-machine sales are small, particularly in the sections populated by industrial workers. Sales of floor lamps were somewhat improved during the last month, but this class of business is not large enough to create much optimism.

Settlement of the building wage controversy still hangs fire and signatures to $20,000,000 worth of contracts are being withheld on this account, according to figures given out by the Building Employers' Association. However, even though the dispute may be settled during the next week, it is doubtful whether much building will be started before next spring on account of the lateness of the season. In spite of the tie-up, local building permits for the week ended Aug. 4 were 156 greater with 3,868 ft. more frontage than for the similar week a year ago. Their money value is $1,703,450, as compared with $905,600 a year ago. However, the average contract is 37 per cent smaller than it was the previous year, indicating more residence and less industrial construction.

A reduction of 10 to 15 per cent in wages of bar-iron workers was agreed to by representatives of the iron, steel and tin workers and the Western Bar Iron Association. The cut is effective at once and affects 40,000 men.

Lamp Cord.—Small sales to appliance and fixture manufacturers rule the market. Jobbers have plenty of stock and are doing little ordering. Price reductions have had no effect on demand. A drop of 5 per cent has made $13.50 per 1,000 ft. a representative price for No. 18 twisted cotton cord, while silk cord in the same size may be had at $25.50 to $26.

Wire.—Bare copper wire is quoted at a new low base of 15 cents per pound in 1,000-lb. lots. There have been no changes in rubber-covered and weatherproof wire prices, and demand for all lines remains very slow.

Outlet Boxes.—Jobbers report some sales, though it is doubtful whether the decrease in price has had much to do with it. Quotations are: Black, 4-in., $11.50 per 100; 3½-in., $9 per 100; galvanized, 4-in., $12.50 per 100; 3½-in., $10 per 100.

Safety Switches.—Demand is very light, though the knife switch, according to local inspection regulations, is a thing of the past in Chicago. Several manufacturers have made price reductions of 20 per cent effective at once.

Knobs and Tubes.—Price reductions are in effect here also but sales are small. Jobbers are plentifully stocked. There is some demand in territory outside of Chicago but almost none locally. "Nail-it" knobs are quoted at $16 per 1,000 in barrel lots. Tubes of the 3-in. size are $8 per 1,000, with other prices in proportion.

Tape.—Prices have been reduced on both friction and rubber tape. Ordinary friction tape is quoted at 34 cents per pound, while the same quality of rubber tape is 35 cents. There is only a fair movement.

BOSTON

Trade continues quiet, although inquiries are more healthy and a slow development of business toward greater volumes appears to be in progress. There were further price reductions last week in porcelain material. The construction of new residences in the suburban district is looking somewhat better, though expansion is still on a small scale. Buying by contractor-dealers and jobbers continues hand-to-mouth, but in some quarters the turnover is picking up in speed. Collections are holding their own and the stronger banking situation is an undisputed factor in the better feeling as regards credits. Jobbers' stocks are slowly being liquidated and little buying for stock is apparent at the moment.

Lamps.—Business in 21-cp. gas-filled lamps for automobile headlight service is rushing on account of the new regulations of the state authorities.

Fans.—Stocks were sharply reduced by recent warm weather and oscillating fans are pretty well cleaned out of the market. It now looks as if the 1921 carry-over would be light, requiring substantial initial orders for next year.

Porcelain.—A drop in the price of 3-in. tubes from $9.50 to $6.35 per thousand in barrel lots featured the market last week. In barrel lots 4-in. tubes now bring $8.20 per 1,000 and 6-in. tubes $17.50. "Nail-it" knobs fell from $21 to $19 per 1,000 in barrel lots, and two-wire and three-wire unglazed cleats dropped from $22.50 to $16.25. Sales are moderate.

Flexible Armored Conductor.—This material is moving poorly, with some tendency toward price weakness under close competition. In 1,000-ft. lots, No. 14 double-strip can be purchased from $49 to $51 per 1,000 ft. Above this quantity prices are open.

Appliances.—Recent price reductions are beginning to tell in increased sales, it is stated. The movement of irons, toasters, percolators, washers and cleaners is distinctly better in some quarters than it was in the late spring. A very promising fall business on socket devices is expected. Attachment plugs eased slightly in price last week, a representative manufacturer cutting out his 5,000-lot price and adopting an intermediate figure for lots of 1,000.

Wire.—Light demand features the wire market. Rubber-covered No. 14 moves in Boston around $5.85 to $6.50 in 5,000-ft. lots, and weatherproof, No. 6, can be had at 14.5 cents to 15 cents per pound in 200-lb. lots.

Motors.—Reductions of the order of 10 per cent were announced last week by two representative manufacturers on single-phase motors of the repulsion type rated at ¾ hp. and over. The former discounts apply. Stocks are adequate for the present, and moderate sales feature the market.

Storage Batteries.—Starting and lighting batteries are fairly active.

Dry Cells.—Flashlamp business is good both on new purchases and replacements. No. 6 dry cells are moving pretty well, being quoted at $30.35 per 100 in barrel lots. Igniters sell at $31.35 in the same quantity.

ATLANTA

There has been little change in business conditions in this territory during the past week, though there is a marked evidence of continued improvement in underlying conditions. A number of financial institutions are preparing to take advantage of the government's willingness to assist in financing agricultural products, and this is receiving wide publicity throughout the section, with a resultant feeling that better times are near at hand. Banking institutions, however, report a marked tendency on the part of the small-town merchants to ask for renewal of trade acceptances and other obligations as they mature, and this, of course, is delaying the process of liquidation. This condition, however, should be materially bettered as the crops are harvested. Heavy construction of residences and small apartments is reported from all sections, the volume showing a large increase from month to month. Building permits in Atlanta for the month of July are the heaviest in its history, totaling 343 and being valued at $1,948,322.

There is a noticeable activity in industrial lines, four large companies having begun construction of new plants during the past two weeks. This building activity is reflected in the contractor and jobber business in lines going into this class of construction, though jobbers state that July volume did not equal that of June because of the falling off in fan sales.

Flexible Armored Conductor.—Apartment-house construction is responsible for a fair movement of this line, particularly in the large centers. Stocks are fair to good, with the price steady at $62 per 1,000 ft. in lots of 5,000 ft. or more.

Motors.—Following recent reductions no great activity is noted and business is merely in the nature of a pick-up from sections that are actually in need of this equipment for extensions or new construction. Manufacturers' stocks in this section are well filled and prompt deliveries are being offered.

Non-Metallic Flexible Conduit.—Retailers took advantage of the price break in this line and stocked up quite heavily a few weeks back, with the result that jobbers report little activity now. It will be several weeks before contractors' stocks are sufficiently reduced to call for reorders. Price, ¼-in., $20 per 1,000 ft.; 7/32-in., $18.

Interphones.—Builders of apartment houses are economizing in construction cost, with the result that interphones are not keeping pace with other electrical specialties. Anticipation of this condition enabled jobbers to reduce stocks to a very low figure.

Fans.—Desk fans continue to go better than expected, orders for fair quantities still being received, and the prospect is that there will be only a small carry-over this season. Ceiling fans are just the opposite and the carry-over in this line probably will be heavy.

Wire.—Rubber-covered in popular sizes is moving quite well, but weatherproof is reported not so good. Stocks in both types are in excellent shape, with prices on the 15-cent and 16-cent base respectively.

Outlet Boxes.—There is a brisk market for this line in the large centers, particularly Atlanta, but few if any sales are being made to the small towns because of the class of electrical wiring permitted. Local stocks are in fair condition with no new change in price reported.

ST. LOUIS

Opinions differ greatly as to whether business is improving or declining. As far as the jobbers are concerned it is probably true that no change in the situation generally was experienced last week and that indications point to a slight improvement this fall. The fan business is about at a close but is offset by increased call for heating appliances and washing machines. Motor sales show some increase. The market for wiring materials is very dull.

In St. Louis there is a tendency to curtailment in nearly all manufacturing lines except shoes, which show increased activity, an actual shortage of shoeworkers being reported. The metal trades are extremely quiet. In Kansas City, with wheat receipts breaking all records, increased activity in the packing industry, additional construction and absorption of most of the surplus labor in harvest work, it is reported that business is enjoying a genuine revival. According to the Department of Labor statistics, non-employment in St. Louis increased 6.9 per cent in July over June, and in Kansas City employment increased 3.01 per cent. Coal mines in Illinois are reported to be operating rather steadily. Very little buying is being done by the railways. Opportune rains have materially aided the corn crop in Missouri and Illinois.

Stocks of most of the jobbers and dealers are about liquidated, heavy items being found only occasionally. Collections remain on a basis averaging sixty days.

Motors.—Shoe manufacturers and coal mines are buying motors on an increased scale, sizes as a rule being from 5 hp. to 50 hp. Municipalities are making increased purchases of motor-driven pumps for water systems. Otherwise there is very little movement. Fractional-horsepower motors are exceptionally quiet. The Century Electric Company announces a 10 per cent reduction in the net retail prices of repulsion induction motors that prevailed on June 1, the reduction being effective Aug. 2. Discounts remain unchanged.

Wire.—Lower prices are reported. The present base for bare and weatherproof is generally quoted at 15½ cents. No. 14 rubber-covered in 5,000-ft. lots is quoted at $6.50 per 1,000 ft. The price on No. 6 double-braid stranded is $35 per 1,000 ft. in 5,000-ft. lots. Both manufacturers and jobbers report movement as being very slow, and purchases when made are for comparatively small amounts.

Poles.—Except for occasional orders from the smaller utilities, particularly in the Southern States, there is very little business. The 35-ft., 7-in. Northern white cedar poles are priced at $15.85 in carload lots, f.o.b. St. Louis, and Western red cedar of the same size is priced at $11.70. Odd lots can at times be picked up at prices around 10 per cent lower.

Farm-Lighting Plants.—Improved sales are reported in Missouri and Illinois, usually being on the time-payment plan. The 10 per cent price reduction announced about July 1 has added slight stimulus to sales.

Fans.—The season's business is about finished and jobbers have begun to store their stocks. The carry-over will not be very heavy and is expected to be principally in the larger sizes. The 12-in. oscillator and smaller fans had an exceptionally good call and comparatively few were left on hand.

Insulators.—Demand for porcelain insulators is very quiet except for occasional orders from the smaller utilities and particularly the municipal plants. Immediate shipment can be made on most orders and up to forty days on special orders.

Heating Appliances.—The retail and wholesale demands show some improvement, particularly for flatirons. Recent price reductions have stimulated buying.

Meters.—Increased business is reported, coming principally from the smaller municipalities of Tennessee, Mississippi and Arkansas.

SAN FRANCISCO

Two weeks ago the builders' strike seemed to be in the way of a prompt and favorable settlement for all concerned, but unfortunately the radical element has regained control of the unions with the result that under their influence the rank and file not only have defied local and international officers, who have endeavored to prevent a general strike, but also have formed committees to visit workers now on the job and have even sought to have the Alameda County unions go out again in a sympathy strike. Delegates from the various unions are declared to have voted on this general strike in San Francisco in the proportion of seven for to one against. So far the Oakland unions have refused to strike. Employers say that more and more men are being put back to work, and it is a fact that a great deal more building activity has been displayed during the past two weeks. The value of building permits issued during July is as follows: San Francisco, $1,240,000 (estimated); Oakland, $1,162,628; Los Angeles, $5,503,663; San Diego, $385,138. The corresponding values for July, 1920, were: San Francisco, $3,723,623; Oakland, $1,374,005; Los Angeles, $5,121,060; San Diego, $261,327.

Bells and Buzzers.—There has been a sharp drop in the prices of iron box bells and buzzers of about 20 per cent. Local stocks are high and few quantity sales are recorded.

Conduit.—Rigid iron conduit has dropped about 7½ per cent, the new 10,000-lb. prices being based on a price of approximately $7.50 per 100 ft. for ½-in. white and $7.10 per 100 ft. black. Because of the strike few quantity sales are being made, although the increase of building in Oakland has resulted in several 10,000-lb.-lot sales.

Wire.—Rubber-covered wire, No. 14, is now selling for close to $7 per 1,000 ft. in coil lots, with a 5 per cent further inducement for 5,000-ft. quantities. Weatherproof wire is still constant at 19½ cents per pound, three-braid base sizes.

SEATTLE—PORTLAND

Comparative inactivity still prevails in Washington, but signs of better headway are not entirely lacking. The coal-mining industry in Washington continues in a bad way. A miners' strike which started on March 16 still continues with no prospect of immediate settlement, and out of about sixty major properties only eight are operating. Coal from British Columbia now supplies most of the off-shore as well as domestic demand. It is expected, however, that some of the mines now closed will soon open up on the open-shop basis.

The excellence of the crops throughout this section, together with greatly lowered production costs as compared with a year ago, assure increased buying power among the farmers. Inquiries looking toward fall purchases are beginning to come in. Building permits issued in Seattle during July reached a total of $2,217,270, as compared with $1,500,620 for July a year ago. This increase, however, is due principally to a few large buildings. The permits for the first seven months of 1921 total slightly less than the corresponding figure for 1920.

The reports from manufacturers' agents in Oregon state that business continues fairly steady with future prospects somewhat brighter. Jobbers report business slightly improved, the principal activity being from the country. There is a continuous downward trend in prices. Conduit prices were lowered slightly. Prices on weatherproof and rubber-covered wire were reduced, and there is a downward trend indicated in tools and hardware. Credit is still tight. Collections are slow, running about forty-seven days for July, as compared with approximately fifty days for June and forty-seven days for May.

Retail business continues about the same, with a little more hopeful tone for the near future. Activity in electrical fixtures is good. Bids are being called for more than $800,000 in school buildings, and the activity in small business buildings is slightly improved.

SALT LAKE CITY—DENVER

Jobbers report stocks complete in nearly all lines of electrical merchandise. Dealers are still ordering from hand to mouth, keeping just enough stock to meet current needs. Orders reaching jobbing firms now are not more than half so large as they were in normal times, indicating a proportionate drop in consumer demand.

Excessive freight rates are the bane of business in the Intermountain region. They are conducive to high-priced merchandise on the one hand and low prices for farm products on the other. There are indications, however, that farmers will liquidate their crops at prevailing prices and that money will circulate more freely during the fall months than it has during the summer. A slight easing of the money market has been noted in the past week. Money is available at better rates and is more plentiful for what are regarded as legitimate operations. The country banks are hard put to it for liquid capital on which to run and are making constant appeals to city banks for aid.

Retailers are vigorously advertising appliances, and they report a better market on most cooking and heating appliances as a result of a recession in the prices. Looking forward to the fall business jobbers are laying plans in the way of holding salesmen's conventions and getting their stocks in order. Aside from school buildings in course of erection there are few large construction jobs under way at the present time. The housing problem is being partly solved by the building of hundreds of new homes in the large cities.

Manufacturers' Activities

Devoted to the Business Side of Manufacturing, Distribution and Sales, News fromJobbers and Foreign Fields and a Record of New Devices and Trade Literature

Better Business Expected in Motor-Driven Appliances

Manufacturers of motor-driven appliances and machinery report little activity but are hopeful of better business late in the fall, according to R. H. Barber, general sales manager of Roth Brothers & Company, motor manufacturers, Chicago, who has recently returned from a trip of a month, embracing the principal cities of the country. Mr. Barber found that most manufacturers in these lines are spending more than the usual amount of money on developing and improving their products and their methods of production. He also reported that sales efforts are being intensified in all parts of the country.

Modern Equipment Company Has New Sales Agency

The Eaton Electric Furnace Company, Taunton, Mass., has been organized as the sales agency for the Modern Equipment Company of that city, manufacturer of electric tempering ovens. Harry B. Eaton is president of both companies. The Modern company now manufactures ovens of about fifty different sizes up to a maximum of about 150 kw. and reported a few days ago to a representative of the ELECTRICAL WORLD that inquiries are increasing, being well distributed, and that actual sales are showing up fairly well to industrial plants interested in economic applications of electric heating.

Westinghouse to Transfer Manufacture of Arc Lamps to South Bend

The Westinghouse Electric & Manufacturing Company announces that the manufacture of arc lamps, arc-lamp repair parts and copper "Luxsolite" fixtures has been transferred from the Newark works to South Bend, Ind. Arrangements have been made so that service will be insured during the transfer of equipment to the South Bend works.

New Plant for Electric Furnace Manufacturers

The George J. Hagen Company, Pittsburgh, engaged in furnace and combustion engineering, has recently completed a steel factory building adjacent to its foundry at Orrville, Ohio. This building is to be used for construction and development work on all types of furnaces and furnace equipments. The company has recently secured a contract from the Mutual Enamel Ware Company, Chattanooga, Tenn., for one twin-chamber electric furnace to be used for enameling bathtubs. It also has received an order from the Illinois Watch Company, Springfield, Ill., for a special rotary electric furnace to be used for enameling high-grade watch dials.

Consolidation of Insulation Companies in New York

The A. O. Schoonmaker Insulation Company is the name taken on the consolidation of the A. O. Schoonmaker Company, 88 Park Place, and the Insulation Sales Company, 145 Lafayette Street, New York City, and the new company will operate from 88 Park Place. The personnel of the two companies also has been consolidated and no change will be made in service policies. Complete stocks will be carried at the above address of cut and uncut mica of all descriptions for insulation use besides stocks of varnished tapes and cloths, woven tapes and webbings, sleevings, cotton tapes, asbestos tape, fiber materials and pressboard and paper materials. The company imports and cuts mica.

Lighting Products Company Established in New Plant

The Lighting Products Company, Milwaukee, Wis., recently incorporated with a capital stock of $25,000, is located at Thirty-fifth and Clybourn Streets, where it has a floor space of 7,500 sq.ft. The company manufactures electric light fixtures. The officers of the company are: Nathan Berger, president; Clarence Ullman, vice-president; William F. Zack, secretary, and Milton Karger, treasurer.

Milwaukee to Have Fixture Convention in January

At a recent meeting of representatives of the National Council of Lighting Fixture Manufacturers, the Fixture Dealers' Association and the Glassware Guild plans were laid to hold the annual conventions of the three organizations jointly in Milwaukee from Jan. 30 to Feb. 4, 1922. The annual fixture market will be held in conjunction with the joint convention, and arrangements have been completed for a local "Better Lighting Week" campaign to be pushed at the same time.

Milwaukee Auditorium has been engaged for the market and convention, and the municipal authorities, who control the building, have promised to coöperate with the convention committee in arranging for exhibits. The main exhibition room is wired for both alternating and direct current, and this feature is expected to attract a number of exhibitors who otherwise could not display their products. A feature of the convention will be a pageant showing the stages in lighting from the flaring torches of the primitive ages to the most scientific and artistic achievements of today.

New Company to Represent H. S. B. W.-Cochrane in New England

The Cochrane Steam Specialty Company of Massachusetts has been organized to represent in New England a number of well-known manufacturers of power-plant equipment, including the H. S. B. W.-Cochrane Corporation, manufacturer of feed-water heaters, steam and oil separators, hot and cold process water softeners, flow meters, precision meters, etc.; the Steam Motors Company, Inc., manufacturer of steam turbines for driving generators, pumps, fans, etc., and the D. Connelly Boiler Company, builder of water-tube steam boilers. The office, which is in charge of Elliott Greene, is in the Oliver Building, Boston.

Ilg Official Corrects Statement Regarding Johnson Fan & Blower

Announcement has been received from the vice-president of the Ilg Electric Ventilating Company, 2850 North Crawford Avenue, Chicago, that A. J. Johnson, whose selection as president of the newly formed Johnson Fan & Blower Company, 115 South Clinton Street, Chicago, was noticed on page 968 of the April 23 issue of the ELECTRICAL WORLD, had not at any time been assistant general manager of the Ilg Electric Ventilating Company, as stated in the report, but had held the position of credit man during the tenure of his stay in that company.

Edison Electric Perfecting Servicing Idea

Development of the service station for electric heating devices is being pushed by the Edison Electric Appliance Company of Chicago. To explain these facilities and the company's policy a service manual has just been issued. Not only does the company service the devices it now makes, but also the electrical heating devices formerly manufactured by the Hughes Electric Heating Company, the Hotpoint Heating Company and the domestic device department of the General Electric Company.

Under the supervision of J. F. Roche, advertising manager of the company and service station supervisor, who established most of the stations and organized the personnel, the function of the stations has been widened, so that each station maintains a complete display of all devices manufactured by the company. It is the ideal of the company to make each service station a model store from which dealers can gain ideas for window display and store layout.

Service stations are located at Atlanta. Boston, Chicago (factory), Chicago (local), Dallas, Los Angeles, New Orleans, New York City, Ontario (Cal.), Portland, San Francisco, Salt Lake City, St. Louis and Seattle. The company plans to establish other stations from time to time.

An American Manufacturer Sees Large Hydro-Electric Developments in Europe

J. E. Jennings, vice-president of Milliken Brothers Manufacturing Company, New York, who recently returned to that city after spending six months in Europe, and who sailed for Australia last Saturday, reported unusual activity in hydro-electric development in most European countries.

During the war and latterly labor troubles have forcibly impressed the public and governments of these countries with the necessity of developing their water-power resources. In Norway the national government in conjunction with the municipalities has already undertaken the development of several water-power projects. This country further proposes to develop its mineral resources and thus provide a market in which to dispose of its surplus power.

France, Italy and Spain all have comprehensive hydro-electric programs involving extensive railroad electrification. Construction work is already under way and still more work will be done as financing becomes easier.

In England hydro-electric development in the British Isles is being agitated, and in all of the British possessions a policy looking to the early harnessing of their water powers has been adopted.

Much of the apparatus and equipment going into the new projects is manufactured in England or Belgium. Existing rates of exchange and cheaper labor work against the American manufacturer in the European market. Germany, while an active bidder, has not as yet been very successful in obtaining foreign orders.

Bakelite Patents Upheld

General Insulate Company Held to Be Infringer in Using Product of Redmanol Company

The General Bakelite Company has obtained a verdict in its suit in the United States District Court against the General Insulate Company for infringement of three Bakelite patents. The patents in suit, Nos. 942,699, 942,852 and 939,966, commonly designated as the "heat and pressure patent," the "fibrous materials or indurated patent" and the "comminuted mixture or molding patent," were all sustained and declared infringed.

The defendant in its business of molding uses synthetic gums produced by the Redmanol Chemical Products Company. Because the latter, a Chicago company, had no office in New York the indirect action was taken. The record shows, however, that the Redmanol company stood behind the defendant and presented its evidence on the question of invention as freely as if it had been the defendant.

The decision, which was written by Judge Thomas I. Chatfield, goes into considerable detail regarding all prior patents for synthetic gums and demonstrates that none invalidates Baekeland's patents. The discovery of the use of hexa by Redman was shown to be antedated by Baekeland's writings and patent specifications. The court ruled:

"If the defendant makes use of the process patented by Baekeland . . . it cannot escape the charge of infringement by showing that this material was produced by the Redmanol company with hexa, instead of formaldehyde and ammonia separately. In other words, hexa is but an equivalent for formaldehyde and ammonia, and the defendant company is using this equivalent material in carrying out the process of the Baekeland patent."

The General Bakelite Company is conducting another patent suit against the Wappler Electric Company, New York, because of its use of "formica," a material made with certain products of the Redmanol Chemical Products Company. The trial in this suit had temporarily been postponed pending the decision in the General Insulate case, but the attorneys of the General Bakelite Company have now taken steps to restore this suit to the calendar for trial.

G. E. Pays Over Million in Half-Year Extra Compensation

According to an announcement from the General Electric Company, supplementary compensation for the six months ending June 30, given by the General Electric Company to employees in its service for five years or more, has been paid to 24,809 employees and the total amount paid was $1,067,989.14. Of this amount approximately 11,130 employees in the works and general offices at Schenectady received $463,716.76, or nearly one-half the total. The remainder was divided among other works of the company, district offices, etc.

Payments were made, as recently announced, in the form of employees' 7 per cent investment bonds. All employees of the company, the announcement continues, who had been laid off on account of slack work during the past six months and who prior to June 30 of this year had completed a service period of five years will receive the 5 per cent supplementary compensation. All such employees will be paid upon presentation at the payroll department.

Steady Increase in Sales of Electric Boilers

A regular and steady increase in sales is reported by the Electric Boiler Corporation, Cambridge, Mass., manufacturer of an automatic electrically heated hot-water storage system, under the trade name of the "Electric Boilerette." To a representative of the ELECTRICAL WORLD F. D. Goode, sales manager, said last week that although the production of this apparatus has been under way but a year, the sales curve has shown a steady upward movement. Inquiries have been received from all over the world and some very satisfactory accounts have been opened by correspondence. A large percentage of the company's business up to Aug. 1 was for domestic heating installations, but the field of this equipment is also broadening in connection with barber shops, garages, office buildings, first-aid stations, etc. The company is affiliated with the Riverside Boiler Works of Cambridge, builders of a long-established kitchen range boiler.

Definite arrangements will be made this fall for distribution in all sections of the United States through the established electrical merchandising channels. The initial sales work of the company has purposely been confined to New England, and many of the central stations in that district carry stocks of these equipments or have sold them. "Our mental attitude is one of healthy discontent and is far from being pessimistic," declared Mr. Goode in discussing market conditions.

New Quarters for the Electric Installation Company

The New York Electric Installation Company, formerly at 147 West Thirty-fifth Street, New York City, has moved into a four-story building, 26 ft. x 100 ft., at 71 Eighth Avenue. The new location will permit the company to enlarge its plant. This company specializes in the installation of electric elevators and wiring for power purposes, and N. Ruby, secretary of the company, says that work along these lines is very active and the company has a number of good-sized jobs under way.

Ford, Bacon & Davis, 115 Broadway, New York City, engineers, have established an office at 1421 Chestnut Street, Philadelphia.

The McPhilben Lighting Fixture Company, 264 Fulton Street, Jamaica, N. Y., has filed notice of increase in stock from $45,000 to $95,000.

The Maring Wire Company, Muskegon, Mich., has appointed R. W. Van Pelt as its sales representative for Missouri and the surrounding states west of the Mississippi River, with headquarters at 926 Century Building, St. Louis. He will handle the company's line of enameled, cotton and silk-covered magnet wires. Mr. Van Pelt also handles for the Collyer Insulated Wire Company, Pawtucket, R. I., its line of weatherproof, rubber-covered, lamp, portable, annunciator and office wires.

Foreign Trade Notes

THE ELECTRICAL ASSOCIATION OF NOVA SCOTIA will hold its first convention in Halifax on Aug. 16 and 17. W. Murdock, manager of the Maritime branch of the Northern Electric Company, is president of the association and E. A. Saunders is secretary.

NEW CITY RAILWAY IN SYDNEY, AUSTRALIA.—Plans are under way for the construction of a new city railway in Sydney, Australia, partly underground, to cost about £8,000,000. In addition to this the suburban railways will be equipped for electrical operation and extended so that a loop will be formed around the city. From the extension, lines will lead to the eastern and western suburbs.

A NEW ELECTRIC COMPANY FORMED IN SPAIN.—A new company, to be known as the Sociedad Iberica de Construcciones Electricas (S. I. C. E.) has been organized, with main office in Madrid, Spain. This company has taken over the International General Electric Company's representation for Spain, Portugal and colonies, which was formerly in the hands of the Compagnie Française Thomson-Houston.

PROPOSED HYDRO-ELECTRIC PLANT FOR IVERNESS, ENGLAND. — A report has been submitted to the Town Council of Iverness according to *The Electrician* by Buchan & Partners on the proposal to establish a hydro-electric plant to supply electricity covering an area from Strathpeffer and Dingwell to Iverness and Nairn, and possibly to Invergordon, Tain, Elgin and Lossiemouth. The cost of the initial installation is estimated at about £230,000 and the output about 8,800,000 units per annum.

PROPOSED HYDRO-ELECTRIC PROJECT IN SPAIN. — A company has been formed, according to *Electrical Industries*, at Granada, Spain, to be known as the Sociedad Anonima Fuerzas Motrices del Valle de Lecrin, with a capital stock of 5,000,000 pesetas, for the purpose of constructing and operating hydro-electric power plants in the Valle de Lecrin. It is proposed to erect the first station on the Durcal River, where 4,000 hp. will be developed. In addition to the capital above mention, most of which has been subscribed by the Banco Hispano Suizo para Empresas Electricas, it is proposed to issue preference shares of 1,000,000 pesetas additional.

THE EMPRESA FORCA E LUZ DE RIBEIRAO PRETO, with headquarters in the city of Sao Paulo, Brazil, has published the announcement of a public loan of 6,000,000 milreis, the proceeds to be used for installing and operating an electric light service in Ribeirao Preto; to install and operate a calcium carbide factory; to obtain contracts and privileges in the neighboring municipalities for operating light and power service, together with water and sewer service, and to participate in industry in that zone, which may require a large amount of electrical energy; and also to install and operate a complete irrigation system, either for its own account or for third parties. The Empresa Forca e Luz de Ribeirao Preto has the exclusive privilege of furnishing light and power in the following municipalities: Ribeirao Preto, Cravinhos, Sertaozinho, Jardinopolis, Orlandia, Brodowski, Sao Joaquin, Ituverava and Igarapava.

Foreign Trade Opportunities

POSSIBLE DEMAND FOR ELECTRIC REFRIGERATORS IN AUSTRALIA.—The State Electricity Commission of Victoria, Australia, is interested in the various applications of electricity to domestic uses, and, it is understood, is desirous of getting in touch with American agents who handle such appliances as electrically operated refrigerators, and to obtain full descriptions and price lists.

CONVEYING MACHINERY FOR FACTORIES AND MINES IN INDIA.—McLeod & Company, 44 Whitehall Street, New York City, importers and exporters, have a request from India for printed matter and estimated prices for export on conveying machinery for use in factories, warehouses and mines. The Burma Finance & Mining Company, Ltd., Hermyingi, India, is planning to erect a small crushing and concentrating mill to treat from 150 to 200 tons of ore per day.

EQUIPMENT FOR ELECTRIC PLANT AT BELFAST, IRELAND.—The Belfast Corporation, Belfast, Ireland, will receive tenders until Aug. 22 for furnishing and installing at the new harbor power station the following equipment: One 12,500-kw. turbo-alternator with condenser plant and auxiliaries, four water-tube boilers with superheaters and forced-draft fans, four fuel economizers, two steel chimneys with four electrically driven suction-draft fans, and one electrically driven centrifugal pump of 18,000 gal. per minute capacity. Specifications may be obtained on application to Preece, Cardew & Rider, 8 Queen Anne's Gate, Westminster, S.W.1, or to T. W. Bloxam, city electrical engineer, Belfast, Ireland. Tenders to be addressed to R. Meyer, town clerk, City Hall, Belfast.

ELECTRICALLY OPERATED PUMPS FOR TRANSVAAL, SOUTH AFRICA.—Tenders will be received by the Rand Water Board, Transvaal, South Africa, until Sept. 28, for furnishing and erecting at Vereeniging the following equipment: Two vertical spindle centrifugal pumps, directly connected to electric motors, with all accessories; one 10-ton traveling crane, and also two horizontal spindle centrifugal pumps, directly connected to electric motors, with all accessories. Particulars may be seen at Room 50, Department of Overseas Trade, 35 Old Queen Street, S.W.1, London, England.

AUXILIARY ELECTRIC PLANT FOR ROTORUA, NEW ZEALAND. — Tenders are invited by the secretary of the New Zealand Tender Board, Wellington, New Zealand, until Nov. 1 for furnishing and installing a new or second-hand auxiliary plant for the Rotorua electric supply as follows: One oil engine (200 b.hp. to 250 b.hp.) and one 190-kw., three-phase, 50-cycle alternator, with exciter and switchgear. Specifications may be obtained at the Department of Overseas Trade, 35 Old Queen Street, S.W.1, London, England.

STEEL PIPE LINES FOR MANGAHAO (NEW ZEALAND) POWER PLANT.—New tenders are being asked for by Nov. 1 by the New Zealand Public Works Department, Wellington, New Zealand, for the supply and erection of steel-pipe lines and fittings required in connection with the Mangahao power plant. While quantities, etc., are substantially the same as those specified in the original tenders, some of the conditions have apparently been modified. Specifications may be seen at the Department of Overseas Trade, 35 Old Queen Street, S.W.1, London, England.

New Apparatus and Publications

EJECTOR CUT-OUTS. — Schweitzer & Conrad, Chicago, are issuing Bulletin 103A, describing "Ejector" cut-outs, type E, and bulletin 106A, "Simplified Protective Combinations," for small substation work.

AIR-BREAK SWITCHES. — The Delta-Star Electric Company, 2433 Fulton Street, Chicago, has ready for distribution a forty-eight page bulletin, No. 36, on its complete line of new air-break high-voltage switches.

CHRISTMAS TREE LIGHTING. — The Peerless Light Company, 663 West Washington Boulevard, Chicago, has placed on the market a new eight-light Christmas tree lighting outfit under the name of "Add-A-Set."

RECEPTACLES. — The Metropolitan Electric Manufacturing Company, Boulevard and Fourteenth Street, Long Island City, N. Y., is distributing a pamphlet covering its new line of receptacles, together with a separable plug and cap.

PLUG RHEOSTATS. — The Ward Leonard Electric Company, Mount Vernon, N. Y., is distributing a four-leaf pamphlet covering its "Vitrohm" plug rheostats for laboratory and college use.

ELECTRIC RANGES.—The Edison Electric Appliance Company, Inc., 5600 West Taylor Street, Chicago, manufacturer of the Hughes and Edison electric ranges, has recently placed an entire new line of ranges on the market. There are seven new models of the "Hotpoint-Hughes" ranges varying in size from a three-burner to a large six-unit type.

OIL CIRCUIT BREAKERS.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has issued special publication 1643, describing its oil circuit breakers.

REFLECTOR SOCKET. — A reflector socket has been developed by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., to meet the requirements when lock sockets are desired.

DRY-BATTERY OUTFIT.—The Columbia dry-battery lighting outfit is the newest product to be marketed by the National Carbon Company, Inc., Cleveland. This outfit consists of a 6-volt, 2-cp. "Mazda" lamp, 12-ft. of lamp cord, combination switch and socket and a sliding hook to hang the lamp.

WIRING DEVICES.—The Bryant Electric Company, Bridgeport, Conn., has issued its "Revised Index of Prices and Listings" to its 1921 catalog, giving the new prices below those effective June 15, 1921.

WIRING TABLES AND ILLUMINATION DATA.—The George Cutter Works of the Westinghouse Electric & Manufacturing Company, South Bend, Ind., have issued a booklet containing handy wiring tables and illumination data.

DIRECT SERVICE WATER SYSTEM.—The Western Electric Company, 195 Broadway, New York City, has recently developed a direct-service water system to meet a special class of domestic service where only a limited storage capacity is necessary.

CHARGING APPARATUS.—A new device, known as the "Homecharger," for charging automobile lighting and ignition batteries has recently been placed on the market by the Automatic Electrical Devices Company, 120 West Third Street, Cincinnati. Catalog 928 issued by the company describes this charger in detail.

LIGHTING FIXTURES.—A new booklet known as catalog C-1 has been issued by the Beardslee Chandelier Manufacturing Company, 216 South Jefferson Street, Chicago, describing its home lighting fixtures.

New Companies

THE SUPER CLARION CORPORATION, New York, N. Y., has been incorporated by G. Fleck, J. Platzman and L. W. Dinkelspiel. The company is capitalized at $5,000 to manufacture lamps and machinery. L. W. Dinkelspiel, 5 Beekman Street, is attorney.

THE BASS LAKE (IND.) ELECTRIC LIGHT & POWER COMPANY has been incorporated with a capital of $10,000 by H. R. Zellers, Henry Emigh and Elmer C. Hewitt.

THE POINT ELECTRIC COMPANY, Whitney's Point, N. Y., has been incorporated by P. H. Landers, H. J. Walters and E. B. Jenks. The company is capitalized at $15,000 and proposes to operate a light and power system in Whitney's Point.

THE MERRITT ISLAND LIGHT & POWER COMPANY, Merritt, Fla., has been organized with a capital of [illegible] O. R. Grosse, Merritt, is president.

THE OCONTO (WIS.) LIGHT & POWER COMPANY has been chartered with a capital of $25,000 by A. F. Pamperin, V. J. O'Kelliner and Carl O. Neuman.

THE ACME ELECTRIC HEATING COMPANY, Boston, Mass., has been incorporated with a capital of $10,000 to manufacture electric heating equipment and appliances. George A. Rice is president and Harry Price, 32 Clifford Street, is treasurer.

THE GENERAL HEATING APPLIANCE COMPANY, Wilmington, Del., has been incorporated by T. L. Croteau, C. H. Maxwell and M. A. Bruce. The company is capitalized at $200,000 and proposes to manufacture electric heating appliances etc.

THE ROGEL LIGHTING FIXTURE MANUFACTURING COMPANY, New York, N. Y., has been incorporated with a capital of $6,000 by C. G. Robin, L. and I. Gelfand. I. T. [illegible] Broadway, is attorney for the company.

THE BIGLERVILLE (PA.) ELECTRIC LIGHT & POWER COMPANY has been incorporated with a capital of $5,000. S. E. Musselman, Orrtanna, is interested in the company.

THE KINSWAY ELECTRICAL SUPPLY COMPANY, Brooklyn, N. Y., has been incorporated by G. E. Cameron, F. and C. W. Johnson. The company is capitalized at $20,000 and proposes to manufacture and deal in electrical specialties. A. Marshall, 215 Montague Street, represents the company.

THE LAKEWOOD (N. J.) ELECTRICAL APPLIANCE COMPANY has been incorporated with a capital of $25,000 to manufacture and deal in electrical supplies. The incorporators are George T. [illegible], William T. Pettit and Leonard K. Thompson.

THE ELECTRO-MAGNETIC WAVE-BATH CORPORATION, Newark, N. J., has been incorporated to manufacture electrical instruments and equipment. The incorporators are William S. Benson, Frank B. Schanne and James B. Reilly, 31 Clinton Street.

THE SHRADER BATTERY COMPANY, New Albany, Ind., has been incorporated by Daniel and W. A. Shrader and Julius Maier, New Albany, to manufacture electric storage batteries and affiliated equipment.

THE MILLER AUTO ELECTRIC MANUFACTURING COMPANY, Los Angeles, Cal., has been incorporated by Robert C. Camp, J. F. Nelson and L. T. Mayhew, 338 Byrne Building. The company is capitalized at $100,000 and proposes to manufacture electrical equipment for automotive service.

THE PIGNOLIT INSTRUMENT COMPANY, New York, N. Y., has been incorporated by L. M. Pignolit, W. F. and C. F. Hessel. The company is capitalized at $20,000 and proposes to manufacture wireless equipment. Straley & Hasbrouck, 257 Broadway, represent the company.

THE E. M. F. ELECTRIC COMPANY, 196 North Fifteenth Street, Ampere, N. J., has been organized to manufacture and deal in electrical specialties. William Henderson is interested in the company.

THE ORIENTAL ELECTRIC FIXTURE COMPANY, Wilmington, Del., has been incorporated with a capital stock of $50,000 to manufacture lighting fixtures. The incorporators are M. E. and Franklin Mettler and P. M. Gilkey, all of Wilmington.

THE GIBSLAND (LA.) ELECTRIC LIGHT & POWER COMPANY has been incorporated with a capital of $10,000. The directors of the company are E. W. Merritt, president, and J. H. Houck, secretary and treasurer. The company contemplates the construction of an electric power plant.

THE RANDOLPH, SUFFIELD & ST. JOSEPH ELECTRIC LIGHT & POWER COMPANY, Randolph, Ohio, has been incorporated with a capital of $30,000 by W. Biles, C. J. Lang, L. J. Huth, J. C. Rogers and B. H. Allen.

Record of Electrical Patents

Notes on United States Patents

(Issued July 26, 1921)

1,385,376. ELECTRIC HEATER; Lee P. Hynes, Albany, N. Y. App. filed March 19, 1920. Good air circulation.

1,385,379. ELECTRICAL CONDENSER AND METHOD OF MAKING IT; Franz Kratz, Stuttgart, Germany. App. filed Jan. 26, 1917. Winding two bands of conductive material with insulation between.

1,385,411. ELECTRIC FURNACE; Carl H. Von Baur, Douglaston, N. Y. App. filed Dec. 30, 1918. Uniform distribution of current.

1,385,441. ELECTRIC FLUID-HEATING APPARATUS; Edward Fredriksen, Christiania, Norway. App. filed Jan. 29, 1920. Fluid perpetually flows through apparatus.

1,385,507. BATTERY PLATE; Thomas W. Thomson, Los Angeles, Cal. App. filed Nov. 3, 1919. Improvement in grids.

1,385,527. HAND WARM OR GRIP FOR STEERING WHEELS; Solon Duer, St. Paris, Ohio. App. filed Feb. 11, 1920. For warming hands of operator.

1,385,564. HEATER FOR FLUIDS; Daniel M. Luehrs, Cleveland, Ohio. App. filed Oct. 7, 1920. For heating fluids in transit.

1,385,566. CONNECTING MEANS FOR INDUCTION COILS USED IN RADIO AND IGNITION SYSTEMS; Samuel C. McKeown, East Orange, N. J. App. filed Oct. 19, 1917. Lead held firmly in place yet quickly detached and removed.

1,385,608. INCANDESCENT LAMP; William A. Darrah, Swissvale, Pa. App. filed Nov. 23, 1914. Surrounding electrical conductor with infusible, inert, solid insulating material, even when raised to temperature near boiling point of carbon.

1,385,624. INDUCTION-COIL HEAT-DISSIPATING STRUCTURE; Arthur A. Kent, Ardmore, Pa. App. filed Feb. 17, 1920. Parts of good heat conductivity adjacent to or embracing winding.

1,385,639. TESTING DEVICE FOR TRANSMISSION-LINE INSULATORS; Frank Moore, Los Angeles, Cal. App. filed March 21, 1919. For detecting electrical seepage.

1,385,650. TERMINAL FITTING FOR ELECTRICAL INSTALLATIONS; Wheeler H. Vibber, New London, Conn. App. filed Aug. 9, 1920. To lead service wires out of conduit.

1,385,655. ELECTROLYTIC CELL; Gervais Baillio, Philadelphia, Pa. App. filed Oct. 25, 1920. Cheap and readily assembled.

1,385,656. MEMORY CLOCK; Harry Bates, New York, N. Y. App. filed March 2, 1918. Signals at set times.

1,385,657. METHOD OF AND APPARATUS FOR UTILIZATION OF OBSERVABLE RADIATIONS; Louis Bell and Norman Marshall, West Newton, Mass. App. filed March 4, 1918. Signaling, observation and the like by rays ordinarily invisible.

1,385,678. TROLLEY; Joseph L. Gutweiler and Frederick W. Kublin, St. Louis, Mo. App. filed June 4, 1920. Has even wear.

1,385,696. METHOD AND APPARATUS FOR UTILIZATION OF OBSERVABLE RADIATIONS; Norman Marshall and Louis Bell, West Newton, Mass. App. filed Feb. 1, 1919. Signaling, observation and similar actions by rays ordinarily invisible.

1,385,698. SUSPENSION CLAMP; Walter S. Mayer, Philadelphia, Pa. App. filed Sept. 22, 1919. For suspending electric trolley wires.

1,385,720. MAGNETO; Frank H. Schryer, Wauwatosa, Wis. App. filed Sept. 25, 1919. For internal-combustion engine.

1,385,777. GRID CIRCUITS FOR ELECTRON TUBES; Alva B. Clark, Brooklyn, N. Y. App. filed May 20, 1919. Grids of all repeater tubes excited from common battery.

1,385,807. TRAFFIC SIGNAL SYSTEM; Ralph E. Wetter, Dallas, Tex. App. filed Nov. 23, 1918. For controlling street and highway traffic.

1,385,818. RADIO TRANSMITTER; Clair L. Farrand, Elizabeth, N. J. App. filed June 14, 1919. Total electron emission of filament utilized at all times.

1,385,829. WAFFLE MOLD; Willie L. Holbrook, Seaside, Ore. App. filed Jan. 22, 1920. To cook waffles by electricity.

1,385,838. SHORT-CIRCUITING MECHANISM; George H. Leland, Dayton, Ohio. App. filed June 16, 1919. For starting single-phase induction motor.

1,385,844. CLUSTER LAMP SOCKET; Edward G. Schattle, Auburn, N. Y. App. filed July 29, 1919. Compact and rigid.

1,385,862. TELEPHONE MOUTHPIECE; Van Conomos, Blairsville, Pa. App. filed May 25, 1921. Cannot be broken.

1,385,873. ELECTRON DISCHARGE APPARATUS; Albert W. Hull, Schenectady, N. Y. App. filed June 5, 1916. Has negative resistance characteristic.

1,385,881. TROLLEY WHEEL; Shaverksha D. Master, Bombay, India. App. filed July 2, 1920. Easy passage of cross wires.

1,385,886. HOT-WATER ELECTRIC INCUBATOR; James L. Nungester, Pocatello, Idaho. App. filed Jan. 3, 1920. Uniform and efficient temperature.

1,385,895. ELECTRICITY TRANSFORMING AND CONVERTING APPARATUS; Charles W. Stone and Henry M. Hobart, Schenectady, N. Y. App. filed Sept. 6, 1916. Receiving high-pressure polyphase alternating current and delivering low-pressure direct current.

1,385,928. WIRE TERMINAL; Edward Schwartz, New York, N. Y. App. filed Jan. 27, 1919. For batteries, switches, etc.

1,385,967. APPARATUS FOR APPLYING COVERING OF SHEET MATERIAL; James P. A. McCoy, Milwaukee, Wis. App. filed July 9, 1917. Insulating motor coils.

1,385,974. CURRENT REGULATOR FOR ELECTRIC FURNACES; Sidney Burrowes, Niagara Falls, Ontario, Canada. App. filed Oct. 26, 1920. Length of regulating impulse may be adjusted.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

HAMPTON BEACH, N. H.—An organization to be known as the Hampton Beach Park Corporation is planning to establish an amusement park at Hampton Beach, to cost about $500,000. The plans provide for the installation of an electric power station to furnish energy for lighting the park. Harry E. Blackwell, Lowell, Mass., is interested in the company.

EVERETT, MASS.—The Malden Electric Company, Malden, is considering the construction of an addition, 68 ft. x 70 ft., to its power station at Broadway and Oakland Avenue, Everett.

FALL RIVER, MASS.—Bids will be received for the construction of a tuberculosis hospital, power house, tunnel to connect different buildings, etc., in Fall River, for which plans have been prepared by Edward M. Corbett. The sum of $725,000 is available for this work.

TAUNTON, MASS. — The question of placing wires underground on Main Street is under consideration.

WEBSTER, MASS.—The installation of an ornamental lighting system in Webster is under consideration. The Webster-Southbridge Electric Company furnishes electrical energy in the town.

Middle Atlantic States

NEW YORK, N. Y.—Arrangements have been made by the Brooklyn Edison Company, 360 Pearl Street, for an issue of $3,000,000 in bonds for extensions, improvements, etc. M. S. Sloan is president.

OSSINING, N. Y.—Bids will be received by Charles F. Rattigan, superintendent of State Prisons, Capitol, Albany, until Aug. 16 for the construction of an addition to the power house at Sing Sing Prison, Ossining. L. F. Pilcher, Capitol, Albany, is state architect.

POUGHKEEPSIE, N. Y.—William Ritchie contemplates the construction of a textile mill on Wappingers Creek at Roachdale, a suburb of Poughkeepsie. The masonry dam at Roachdale will be rebuilt to develop power for manufacturing and lighting purposes.

SOLSVILLE, N. Y.—The Madison County Power Company, Inc., has applied to the Public Service Commission for permission to construct an electric light and power plant with distributing system in Solsville.

DOVER, N. J.—The New Jersey Power & Light Company has applied to the Board of Public Utility Commissioners for permission to acquire the property of the Lambertville Public Service Company, Flemington Light & Power Company and the Newton Gas & Electric Company. The New Jersey Power & Light Company plans to consolidate the three systems to be operated in conjunction with its present lines.

EAST ORANGE, N. J.—Bids will be received by the Board of Education, High School Building, Winans Street, until Aug. 22, for electrical work and the installation of heating and ventilating equipment, etc., in the addition now under construction at the Ashland School on Park Avenue. Frederick T. Dugan is secretary of the board.

HOBOKEN, N. J.—Plans have been completed by R. Neumann & Company, Willow Avenue, for the construction of a one-story power house [illegible] at their manufacturing plant.

MILFORD, N. J.—The Council is considering extensions to the street-lighting system. Plans provide for all-night service.

OXFORD, N. J.—The sawmill, including power plant, sawing machinery, engine, boilers, etc., at the plant of the Empire Steel & Iron Company was recently destroyed by fire. The mill, it is understood, will be rebuilt.

ALLENTOWN, PA.—Plans have been prepared by the Pennsylvania Power & Light Company for the construction of a large central machine shop and repair works at its electric generating plant at Hauto. The structure will be built by the Phoenix Construction Company, an affiliated organization.

ALTOONA, PA.—The Germania Brewery, 1808 Ninth Avenue, is having plans prepared for the construction of a two-story ice manufacturing plant, 80 ft. x 80 ft., to cost about $75,000 with machinery. Bids, it is understood, will be received by Miller & Rider, architects, 1510 Eighteenth Street.

HAZELTON, PA.—The New Boston Coal Company contemplates the installation of electrical equipment including motors, controlling devices, etc., at its local colliery. The Pennsyvania Power & Light Company will furnish electrical energy.

MEADVILLE, PA.—Bids will be received by R. X. Brown, secretary of the Meadville School Commission, until Aug. 22 for the installation of electrical equipment, ventilating and heating apparatus, etc., in the proposed high school to be built on Public Square. W. G. Eckles, New Castle, is architect.

NOTTINGHAM, PA.—The Oxford Electric Company, Oxford, operating in Chester County, has been granted permission by the Public Service Commission to acquire the properties of the East Nottingham Electric Company and the West Nottingham Electric Company. The new owner contemplates consolidation of the systems and improvements to same.

PHILADELPHIA, PA.—Plans have been filed by the Merz Worsted Company, Indiana Avenue and A Street, for extensions to its power house.

PHILADEPHIA, PA.—Plans have been filed by the American Motor Body Company for the construction of an addition to its power house on Glenwood Avenue.

CLIFTON FORGE, VA. — Notice has been filed by the Virginia-Western Power Company of an increase in its capital stock from $1,250,000 to $4,000,000.

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing the following: Until Aug. 26, Washington, Schedule 8620—miscellaneous quantity of magnet wire and cable; South Charleston, Schedule 8622—240 carbon electrodes and connecting pins. Until Sept. 2, Puget Sound, Schedule 8623—300 electric switches, etc.; Mare Island, Schedule 8621—miscellaneous quantity of magnet wire.

WASHINGTON, D. C.—Bids will be received at the office of the Chief of Engineers, U. S. Army, Washington, D. C., until Aug. 26, Advertisement 81, for furnishing two switchboard feeder panels and three watthour meters and assembled with three generator panels.

North Central States

MARLETTE, MICH.—At an election held recently the proposal to sell the municipal electric light and power plant to R. L. Blackmore of Saginaw was carried. Mr. Blackmore contemplates the establishment of a central power plant in Marlette for supplying electricity to villages and farms within a radius of 15 miles.

PORT HURON, MICH.—Steps have been taken by residents of Lapeer Avenue for the installation of an ornamental lighting system.

SPRINGPORT, MICH.—A special election will be called to submit to the voters the three following propositions on the lighting question: the erection of a transmission line from Albion to Springport; installation of new equipment in the old electric light plant providing for twenty-four-hour service; acceptance of the proposal from Riley Starks to purchase and operate the present plant.

BAY VILLAGE, OHIO.—The Northern Light & Power Company, care of I. H. Case, Eaglecliff, is having plans prepared for the construction of a one-story power plant, 40 ft. x 72 ft., in Bay Village, to cost about $75,000. A. W. Harris, Schofield Building, Cleveland, is architect.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, City Hall, Cleveland, Ohio, until Aug. 19 for furnishing paper-insulated, lead-covered cable. Specifications may be obtained upon application to Room 204, City Hall.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, Room 219, City Hall, Cleveland, Ohio, until Aug. 19 for furnishing and installing dimmer equipment, switchboards, stage-lighting equipment, reflectors for ceiling and cove lighting, lighting fixtures and clocks for public hall buildings, Lakeside Avenue and East Sixth Street. Drawings and specifications may be obtained at the office of the chief architect, 604 City Hall.

COLUMBUS, OHIO.—Plans are being prepared for the construction of a two-story addition, 100 ft. x 300 ft., to the power house at the Ohio State University, to cost about $300,000. J. N. Bradford, care of the board of directors of the university, is architect.

LEXINGTON, KY. — Plans are under consideration by the Lexington Utilities Company for an addition to its local power plant including installation of new equipment. The cost of the improvement is estimated at about $100,000. J. P. Pope is general manager.

LEXINGTON, KY.—The Commercial Coal Mining Company, recently organized, is contemplating the installation of mechanical and electrical equipment at its properties. J. H. Hall is interested in the company.

LIBERTY, IND. — The Liberty Light, Heat & Power Company has applied to the State Public Service Commission for permission to establish a connection between its transmission lines and the Dayton Electric Company at Westville, Ohio. The Liberty plant is served from the Richmond municipal plant.

CHICAGO, ILL.—A permit has been secured by the Illinois Steel Company for the construction of a three-story electric power station at its South Chicago works. The cost is estimated at about $250,000.

URBANA, ILL.—The installation of an ornamental lighting system in the northwestern part of Urbana, to cost about $52,032, has been ordered by the board of local improvements. The system will be of the same general type used in other parts of the city.

ADRIAN, MINN.—The municipal eletric light plant, waterworks and pumping station were recently damaged by fire. Thomas W. Newell is superintendent.

SLEEPY EYE, MINN.—Improvements to the municipal electric light and waterworks system to cost about $40,000 are under consideration.

URICH, MO.—Arrangements have been made by the City Council for a bond issue, the proceeds to be used for the installation of an electric light and power system in Urich.

FARGO, N. D.—Plans have been prepared by Robert T. Jacobson, city engineer, for the installation of a new ornamental lighting system on Broadway from Sixth Avenue to Twelfth Avenue, north, and on Third, Fourth and Fifth Streets, north. It is proposed to replace the five-lamp cluster now in use with single lamps.

WISNER, NEB.—The installation of a municipal electric power plant in Wisner is under consideration.

Southern States

MERIDIAN, MISS.—The Acme Building Company is considering the installation of power-plant machinery at its sash and door factory.

JUDSONIA, ARK.—The Arkansas Hydro-Electric Company has awarded contract for the construction of a hydro-electric plant on the Red River to J. Livingston, Grand Central Terminal, New York City. The project includes a gravity-type dam, 80 ft. high, with 450-ft. spillway and power house, to cost $1,460,000. The plans provide for an initial installation of 22,000 hp. Electricity generated at the plant will be transmitted to Little Rock, a distance of 55 miles. The company also contemplates the construction of two other dams to develop a total of 75,000 hp. J. E. Sirrine, Greenville, S. C., is consulting engineer. E. T. Stanfield, Boyle Building, Little Rock, Ark., is vice-president and general manager.

LITTLE ROCK, ARK. — The Arkansas Light & Power Company has filed notice of increase in capital stock from $4,750,000 to $5,750,000.

NEW BRAUNFELS, TEX.—The Planters & Merchants' Mill Company, Austin, is being organized with a capital of $1,000,000 for the purpose of establishing a cotton mill at New Braunfels. The company also proposes to build a hydro-electric power plant in connection with the operation of the mill. Lockwood, Green & Company, 101 Park Avenue, New York City, are architects and engineers. S. M. Ransopher director of industrial education, University of Texas, Austin, is interested in the company.

WHITNEY, TEX.—Arrangements are being made by the Council to issue $15,000 in bonds for the installation of a street-lighting system in Whitney.

Pacific and Mountain States

SEATTLE, WASH. — The City Council has passed an ordinance providing for an issue of $5,500,000 in additional bonds for further development of the Skagit River power project.

FRESNO, CAL.—The San Joaquin Light & Power Company has been granted permission by the State Water Commission to appropriate 550 sec.-ft. from the Kern River.

LA GRANDE, CAL.—The directors of the Plainsburg Irrigation District are considering the construction of an electric plant for furnishing power for pumping purposes. T. McSwain is president of the district.

LONG BEACH, CAL.—A movement has been started by the East Long Beach Improvement Association for the installation of an ornamental lighting system on a portion of East Anaheim Street in that district.

LOS ANGELES, CAL.—The installation of ornamental lamp standards on Lanewood Avenue between Orange Drive and La Brea is under consideration.

LOS ANGELES, CAL. — Petitions have been filed for the establishment of a number of high-way lighting districts to be known as the Annandale, Lankershim, Tujunga, Bell, West Adams, Verdygo and Forty-eighth Street Lighting Districts.

VENTURI, CAL.—A movement has been started for the installation of ornamental lamps on Main Street above Chestnut Street.

BLANCA, COL. — Arrangements have been made and preliminary work will be started soon, it is reported, on the development of a hydro-electric project on Ute Creek on the south slope of Mount Blanca. The plans provide for an electric railway to serve the eastern and southern sections of the San Luis Valley and the erection of electric transmission lines to furnish electricity for light and power in Blanca, Fort Garland, San Luis, San Acacio and other towns in the southeastern part of the valley. Water power rights have been filed by W. W. Snyder and Harry Martin of Blanca.

Canada

GLADSTONE, MAN. — The provincial government is contemplating the erection of a hydro-electric line to Gladstone this summer.

CHATHAM, ONT.—The Hydro-Electric Commission of Ontario is considering extensions to the rural service in Kent County. E. R. Mawler is district engineer for the commission.

HAMILTON, ONT.—Work will soon be started, it is reported, on the first rural Hydro line to be erected under the recent legislation. The line will probably be built in Saltfleet Township, near Hamilton.

RIDGETOWN, ONT.—The construction of an electric lighting and distribution system in Howard Township is under consideration. G. McDonald is clerk. A. Lawlor, 190 University Avenue, Toronto, is engineer.

TECUMSEH, ONT.—The Hydro-Electric Power Commission of Ontario is considering the erection of a transmission line to Tecumseh.

TORONTO, ONT.—The construction of a pumping station with equipment, in connection with harbor drainage work to cost about $691,000, is under consideration. T. L. Church is chairman of the Board of Control.

MONTREAL, QUE.—Bids will be received by the Administrative Commission, Montreal, until Aug. 20 for the construction of an electrically operated pumping station to cost about $250,000. A. E. Doucet is chairman.

MOOSE JAW, SASK.—Extensions to the municipal electric light and power plant to cost about $77,910 are under consideration

Electrical World

New York, Saturday, August 20, 1921

The Kind of Electrical World That You Need

WE ARE young in the world of electricity. The electrical industry is growing. Conditions are changing. Relations are altering. There is always a lot to learn.

We are edging into a commercial era —all of us—the scientist, the inventor, the engineer, the business man. True, dreams and discoveries—more and bigger ones—are needed as we grow. Inventions must be multiplied year after year. The engineer finds broader and more complex problems in his path and meets them with greater achievements. But it is to the man of finance and the man of business as well that the industry is looking today. For only by better organization, better management and better selling can we expect to expand the greater market and bring a more complete electric service into every home, office, store and factory.

Look back through the pages of the ELECTRICAL WORLD and you find the story of the evolution of the electrical industry. As the industry has slowly changed, so has the ELECTRICAL WORLD, because it reflects and interprets accurately and in detail the happenings, the thinking and the record of the electrical industry. First, the progress in science and invention was recorded. Then, engineering as it became the dominating force in that industry was the major theme. Now is the heyday of the business side. Consequently the needs and the tendencies in load building, merchandising of appliances, new financing problems and the building of better and better public relations, together with the development of adequate marketing and distribution of electrical apparatus and conveniences, are important considerations from the standpoint of needed revenue to do more and larger things and make electric service sufficient to existing requirements. In brief, the electrical man today must pay as much attention to the business opportunities for expansion of the electrical industry as to the engineering aspects. As the industry expands into the larger commercial era that awaits it, there is a real need for more facts, more inspiration and more leadership.

Some readers want the ELECTRICAL WORLD to be strictly "their kind" of paper—fashioned to the inclination of their own thinking. But they should ask themselves, "What is the world of electricity today?" As the industry forges on, the world of electricity further evolves. Just as each of us is broadening to the changing times, the ELECTRICAL WORLD strives to reflect them truly. There is a lot yet to learn.

Le Roy Clark

An engineer and wire manufacturer under whose leadership the insulated wire and cable industry made an enviable war record

WAR requirements brought confusion to many an industry because of the tremendous volume of orders that came from every direction. No industry, however, was confronted with a task in war production more difficult than the one which confronted manufacturers of insulated wire and cable. None the less, this industry accomplished its task with the minimum of confusion and the maximum of efficiency under the leadership of Le Roy Clark, president of the Safety Insulated Wire & Cable Company, who was chief of the wire and cable section of the finished products division of the War Industries Board.

Before the war England had been recognized as one of the world's most prominent wire-producing nations. By 1917, when the United States became a combatant nation, England had found it impossible to produce enough wire to supply the war demands of herself and her allies. Consequently, American wire manufacturers were called upon to help, and so successful and reliable were they that on Oct. 1, 1918, the Allied Council reached the decision that beginning March 1, 1919, it would be necessary for the United States to furnish all the twisted-pair insulated wire used by the Allies in the field. The estimated minimum requirements for this purpose were 100,000 miles a month. As an indication of the confidence placed in the American manufacturers it is only necessary to point out that the braiding capacity of the United [illegible]

The wire industry, however, was able to accomplish big things because it was organized and led by a wire man of recognized standing and the highest integrity. In Mr. Clark's hands was placed the disposal of the entire insulated-wire production of the country. All government and Allied orders cleared through him, and he was always able to tell the production situation at all mills and was thereby enabled so to route this essential business as to guarantee maximum production speed.

Mr. Clark [illegible] New York [illegible] Cable Company, which he joined [illegible] in perfecting paper-insulated wire.

[illegible] chairman of the Wire and Cable Section of the Associated Manufacturers of Electrical Supplies and was chairman of [illegible] same organization which made the concentric wiring investigation. He is president of the Electrical Manufac- [illegible]

Electrical World

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Shall the Electric Shop Render Service or Just Sell Electrical Merchandise?

EVERY now and then up comes the question, should the electric shop of the central-station company sell non-electrical merchandise? With it is coupled the suggestion that if this is done it calls attention to a serious weakness in electrical merchandise. But, after all, what difference does it make? The electric shop and electrical merchandise are young. The former is more limited in scope than it will be later on, for there is less variety in its electrical offerings than we shall see in years to come. Therefore, if the electric shop needs vital elements of "style" merchandise or low-priced goods to attract more customers of smaller means, why balk at it? The purpose of the shop is, first, to spread the electric service idea by increasing the use of electrical appliances and, second, to make money. Any proper merchandise that can be introduced harmoniously to promote these aims is therefore certainly justified. In times like these the sensible thing to do is to make the electric shop as successful and prosperous as possible. If mahogany table trays, tea sets, book rests and paper cutters provide a buying atmosphere and suggest the purchase of electrical appliances to the woman customer, or make her more satisfied with her electrical purchase, then by all means sell them to her.

Arbitrary Methods Shake Public Confidence

AS AN industry the electric light and power companies are gaining in public confidence. The good will of the public, however, is fickle to a large degree and may be lost quickly, particularly by companies which, thoughtlessly or otherwise, take unfair advantages. Recently two incidents occurred in a growing agricultural region that serve to illustrate what is meant. While the acts may not have been wholly wrong, they were decidedly unwise.

In one case a small utility went to the state public service commission for an informal discussion of an extension policy that obliged prospective customers to advance all money required to make extensions, no matter how small. A total expenditure of less than $40,000 was called for, a careful analysis of which revealed that less than $5,000 could be classified as representing extensions for which consumers could possibly be asked to advance the money, the remainder being for improvements not chargeable to individual consumers or groups of consumers. The other case involved the handling of money loaned by a small community to obtain electric service. The amount, though small, was sufficient to cause embarrassment to the small country banks if withdrawn too rapidly. In spite of an oral agreement to check out the money as needed over the construction period, it was withdrawn by one check a few days after the service contracts were signed, causing considerable embarrassment and a large amount of resentment.

Now, things like these simply shake public confidence, and when something really big and important comes up the public is afraid and distrustful.

Ford's Muscle Shoals Offer and Public Policy

MR. HENRY FORD'S offer for the government hydro-electric and nitrate plants at Muscle Shoals, Ala., is now receiving close scrutiny and analysis. Apparently the more the offer is studied the less attractive it becomes. It is of no concern to us, however, how much or how little Mr. Ford offers, bad as the showing is. It is enough to know that a private individual is seeking public property for private uses and individual gain. By and large, the water powers of the country belong to the public and should be developed for it either by the government itself or, preferably, by a governmentally controlled body like a public utility corporation. Then every cent expended and every cent earned come under the supervision of the state through its public service commission. Moreover, by this means the quality of the service and the rates to be charged therefor are also regulated. Thus control never passes from the public, which, while it gains through the initiative and enterprise of private capital expended for public use, merely pays in return a reasonable and publicly fixed rate on the money invested—no more.

On that account acceptance of any offer from Henry Ford is contrary to public policy so long as any public utility corporation or combination of utilities is willing to take over and operate the plants when they are completed by the government. Nor is Mr. Ford's offer in keeping with the spirit or letter of the federal water-power act of 1920. That measure provides for a fifty-year lease, whereas Mr. Ford seeks what is tantamount to a lease in perpetuity. If the government really wishes to dispose of its holdings at Muscle Shoals, we are confident it can quickly come to terms with public utility companies now in existence or hereafter to be formed. The value of the hydro-electric projects for public utility purposes can readily be fixed by competent engineers or, better still, by a public service commission which would use that valuation as a basis for service rates. Nothing could be simpler; nothing would more surely protect the investment of the War Department, and certainly nothing would commend itself more highly to the people of the Southern States, whose interest in the Tennessee River and the prosperity of the "old South" has lost none of its keenness. We have purposely refrained from referring to public utility companies because their interest is identical with the public interest, and, whether for weal or for woe, their fortunes are cast in the same die.

Where Reputation and Good Will Are Won or Lost

THE first step in building up good will toward the central-station company in any community should be the schooling of the employees truly to represent the company. This thought is brought out in the article by J. F. Owens in this issue in the relation of a bit of interesting experience. It is a point so self-evident that every manager might well be expected to keep it ever clear in mind but for the almost universal human failing that makes men overlook the simple, homely safeguard against hazards that in appearance are complex.

The public—meaning John and Mary and the rest of us—measure a business institution by a very fair and natural standard. They form their opinion of a utility corporation just as they form their opinion of a single person, by noticing the individual men and women who represent that company and by remembering what they say and what they do. If they see that the people in the company are courteous, just and efficient, they like the company; but if the employees are disobliging, selfish and negligent, they will not like that company, no matter how the printed advertising or the official spokesman may pour out the honeyed word.

The first duty of every utility executive therefore—the first duty not alone to the public but to the stockholders for whom he operates the company in trust—is to school his employees really to represent the spirit of the company. For it is the troubleman, the meter reader, the collector and the salesman that are being watched and remembered. It is they who build the reputation of the company and of the general manager as well, because the public rightly believes that these men mirror the attitude of the officials of the company.

Preventing Accidents from Oil Fires

HARNESSING the forces of nature for the use of man has gone on so rapidly that practices have sometimes been adopted in the absence of anything better which are unsatisfactory from the operating standpoint and often dangerous to life. The present use of oil as a cooling and insulating material in transformers and switches is a case in point. Oil is easily volatilized and when in that condition easily ignited. With the increase in the size of generating plants and with the resulting increased currents that must be handled it is being realized that something more than ordinary attention should be given switching and transformer equipment. When confronted with such a situation the first step the operating man will take will be to minimize the damage to surrounding equipment and the danger to human life by applying the best available methods for fire extinguishing.

The paper in this issue by C. T. Sinclair on "Combating Fires in Transformers and Oil Switches" is a good example of what a wise and able operator will do when facing the necessity of using operating equipment that he believes to be unsafe. However, further steps must be taken to meet the conditions of the future, the most important of these being the development of non-inflammable equipment for switching and transforming electrical energy. It must also be remembered that opening large currents means dissipating a very large amount of energy in a short interval of time. This alone may result in serious mechanical damage which in itself may be dangerous to life. Is not, therefore, the modern tendency, still opposed by many, of outdoor installation of transformers and switches the most constructive step toward improvement in operation? It certainly is the most efficient means of minimizing the danger to life and the possible damage to other equipment that we have so far developed. Beyond this, outdoor installations operate successfully against climatic disturbances and are nearly always justifiable from an economical viewpoint.

Keep Inductive Interference Out of Court

WHEN the inductive interference question came up for discussion by the sub-committee on public policy at the recent N. E. L. A. convention in Chicago there were some phases of the subject not completely covered in the interesting comments of R. H. Ballard and Bancroft Gherardi, and these phases need a little more attention before the program outlined can be successfully carried out. Unless cases now before courts or commissions can be settled without going to a formal decision, and unless litigation in other cases can be prevented, it is certain that these proceedings will, in some measure at least, embarrass the work of the joint committees, both state and national.

Such contests as that in the Homer case, recently decided in Illinois, can only produce sore feeling. An examination of the briefs in the case referred to reveals an attitude on the part of some of the attorneys that may be correct in an ordinary legal controversy but that will not lead to a state of feeling favorable to a real settlement of the matters at issue. It may be freely admitted that some of the men who took the stand did not possess an experience of years in the matters with which they were dealing. They were men who had won success in the fields in which they have worked—fields not totally unrelated to the matters at issue. In fact, the fundamentals with which they have had the greatest experience are the same as those underlying the problem of inductive interference. The attitude assumed by some of the attorneys in examining these witnesses may win a single battle, but it is the surest way to drive them and others concerned to a study that will give them an equal standing with any other men in dealing with this subject. The matters involved are not wrapt up in mysteries that research will not reveal. To make opponents the butt of arguments such as those set forth in detail in some of the Homer briefs is only begging the question and adding to its difficulties. Aspersions directed at men who have been successful in their work and bear national reputations are sure to provoke a bitter controversy that will end in a very unpleasant way.

Another inductive-interference case—this time in the East—has not reached the stage of publicity, but has already caused a feeling that the game is not being played entirely in accordance with the rules laid down in the Chicago discussion. This is apparently due to the presence of attorneys in the negotiations who cannot get away from the idea that the whole question is one of the legal rights of two contending parties and can be fought out in court with no regard for the public, since, in the attorneys' view, public rights are so little involved as to permit ignoring them. The utility business has suffered and is yet suffering from the prevalence of similar notions in the early days of its history. It would be the height of folly to let the present situation drift along until the public takes an arbitrary hand because it can no longer tolerate the bickerings of men who are too short-sighted to see anything but their so-called legal rights. After all, these rights are determined by the necessities of the public as a whole, for no individual seeking personal aggrandizement in opposition to the public good ever "gets away with it" for long.

Intensive Training in Public Relations

MORE than eighteen months ago a "courtesy and good will" campaign was begun by the Edison Electric Illuminating Company of Boston to attain better team play among its employees and a closer service friendship between those employees and the public. The methods of the campaign were described on page 1157 of our May 21 issue, and readers of that article could not help realizing how groundless and outworn attacks on such a company as a "soulless corporation" have become in the light of its achievements in the field of public relations. "Noblesse oblige" has a very real meaning to the Boston Edison man and woman. The proof? It has lately been our privilege to read nearly 150 short essays submitted in a prize contest for the best paper on some aspect of public utility relations within the company, and with scarcely an exception every contestant has clearly acquired a viewpoint of such sanity and comprehension as to what constitutes courteous, friendly and loyal service that President Edgar and his associates are to be congratulated. Nearly 450 subordinate employees out of a total enrollment of about 2,000 entered the competition, and from coalpasser to office worker it was evident that the "good-will and courtesy" idea had struck home. Though some of the essays could fairly be called homilies, they none the less expressed principles of conduct in mutual and public relations that might well be more widely practiced. Outside observation of the "approach" of employees and their attitude toward the public in multifarious contacts over the wire, in offices, by mail and among neighbors and strangers shows that as individuals these public utility men and women are striving to live up to the precepts of the campaign, and an extraordinary falling off in complaints received gives the final touch of success to an experiment of far more than local interest.

Simplification in a Converter Substation

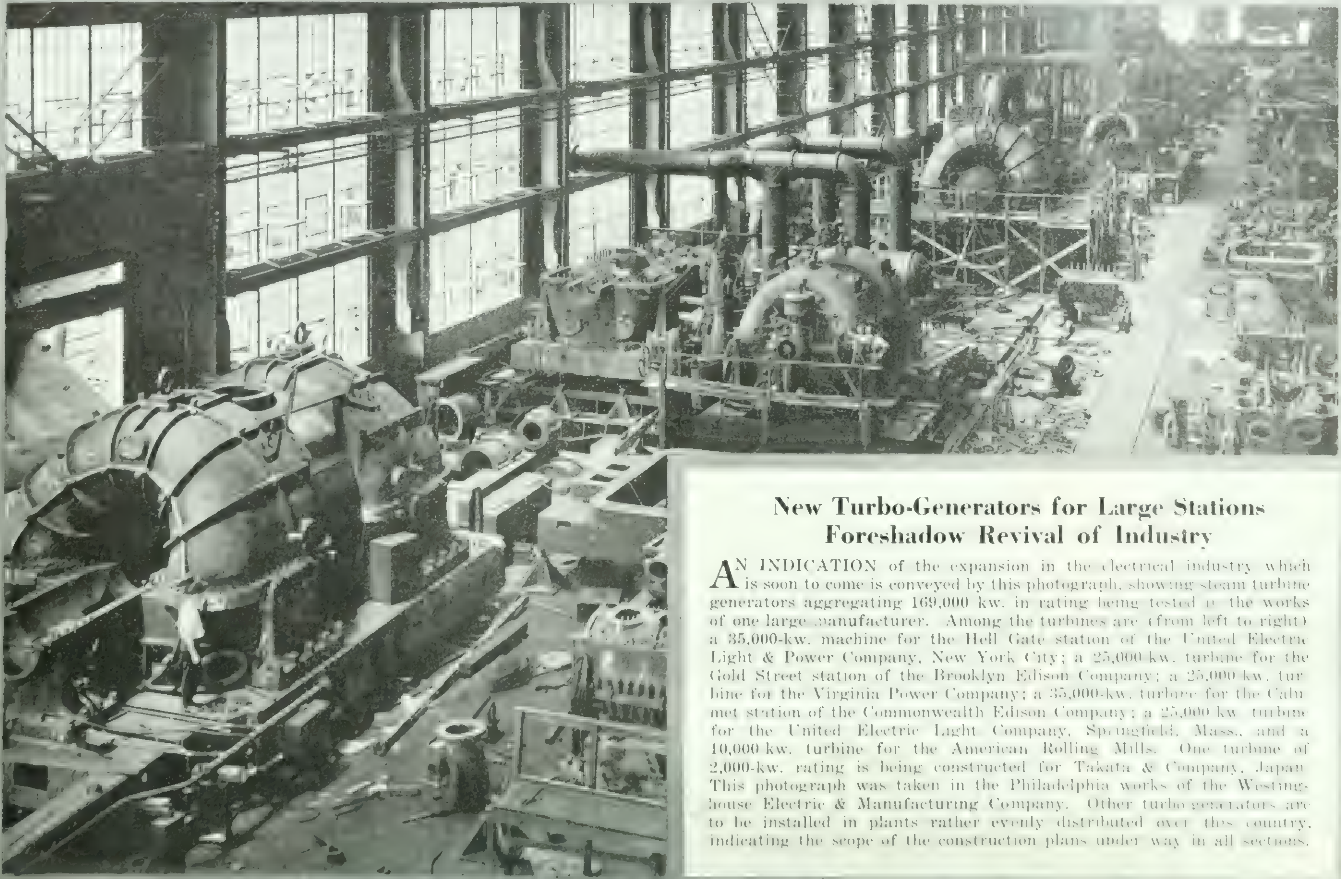
MODERN requirements have brought increasing use of converter substations in electric railway service, and incidentally enormous construction costs if conventional equipment is to be provided. For as time has gone on it has become customary to set one protective device to watch another, and a third to watch the pair, and an automatic contrivance to watch these, and remote-control oil switches to stand guard over the lot, and a special set of relays to protect the switches from "house-maid's knee," until the treasurer of the concern falls in a faint. There are signs, however, that more attention is now being directed toward such complications, with a decided drift toward simplification, or toward a perfectly definite automatic operation in which simplification of the things to be done is a necessary part. In the current issue J. E. Woodbridge gives a particularly instructive account of a new 4,000-kw. converting station in San Francisco in which simplicity and ease of operation have been the controlling features.

The losses in the railway system had risen to so formidable an amount that something had to be done, and the result was a compact and efficient converter station in the downtown district. Using converters so near to heavy load brings some risks from the absence of the damping effect of long feeders, but special precautions to guard machines and operators and a very slight use of resistors avoided the difficulty. One feature of the plant is the use of shunt-wound converters, which considerably diminished the danger from short circuits, reduced the heavy windings, eliminated equalizer connections and simplified operations generally. The slight additional drop in voltage has, in fact, proved somewhat advantageous practically.

A rather unusual feature of the installation is that the converters are on insulating bases, to lessen the blow from a flashover to frame or from windings to core. The main floor of the station also has an upper asphaltic layer that insures safety from high-tension contacts. The net result of the design adopted in this plant has been much simplification and highly efficient operation with but a single attendent per shift. Those who are contemplating the erection of converting substations will do well to give Mr. Woodbridge's article careful study.

Electric Service on the Western Ranch

WHILE the term ranch is still applied by the Western man to his rural homestead, the pursuits followed thereon frequently vary widely from the popular conception of bronco busting and cattle raising on a vast expanse of sagebrush. In the Pacific Coast and Northwest districts, where electric service lines and motor-driven pumps have created veritable gardens, an area of 40 acres is still rated as a ranch. In the San Joaquin Valley, for instance, where these small ranches abound, the public enjoys a real interpretation of electric service that would be a mighty asset to other sections as well. In that valley farmers or ranch owners are making advance applications for electric service connections and anxiously await station construction that will make these possible. Desert land now used for cattle raising and grain production at a value of $150 to $300 per acre will have a value of from $1,500 to $2,500 as soon as irrigation is made possible. Self-interest there is a powerful influence for electrial development, which is gaining the ear of the public service commissioner and the investor alike. But this same type of self-interest exists in other sections. The San Joaquin Light & Power Company has simply pointed the way to its application in the development of electric service elsewhere. Only fifteen years ago that company was a struggling concern with just enough generating capacity to take care of the limited needs of a few small communities and with a gross income of $125,000. Today it serves a great fertile valley and has a return of $4,500,000 annually, built largely upon the good will of the rural public it serves.



New Turbo-Generators for Large Stations Foreshadow Revival of Industry

AN INDICATION of the expansion in the electrical industry which is soon to come is conveyed by this photograph, showing steam turbine generators aggregating 169,000 kw. in rating being tested at the works of one large manufacturer. Among the turbines are (from left to right) a 35,000-kw. machine for the Hell Gate station of the United Electric Light & Power Company, New York City; a 25,000-kw. turbine for the Gold Street station of the Brooklyn Edison Company; a 25,000-kw. turbine for the Virginia Power Company; a 35,000-kw. turbine for the Calumet station of the Commonwealth Edison Company; a 25,000-kw. turbine for the United Electric Light Company, Springfield, Mass., and a 10,000-kw. turbine for the American Rolling Mills. One turbine of 2,000-kw. rating is being constructed for Takata & Company, Japan. This photograph was taken in the Philadelphia works of the Westinghouse Electric & Manufacturing Company. Other turbo-generators are to be installed in plants rather evenly distributed over this country, indicating the scope of the construction plans under way in all sections.

Combating Fires in Transformers and Oil Switches

Use of Carbon Tetrachloride, Bicarbonate of Soda and Sulphuric Acid, Foamite, Water, Sand and Wet Sawdust Studied with View Toward Determining Effectiveness and Protecting Personnel

By C. T. SINCLAIR
Assistant Testing Engineer Pennsylvania Water & Power Company

TRANSFORMER oils are required to perform the twofold function of insulating and cooling. To perform its function as an insulator properly it is necessary that the oil should have a high dielectric strength; to perform its function of cooling properly it should not be too viscous. However, oils of low viscosity have correspondingly low flash points, which means considerable fire risk. A heavier oil, with a correspondingly higher flash point, cannot readily be used owing to the fact that at lower temperatures it becomes extremely thick, in consequence of which its efficiency as a cooling medium is impaired.

On the other hand, in oil switches, oils of somewhat higher viscosity may be used, because here the property of cooling is relatively unimportant. However, selection of the oil is again limited by low temperature conditions, for it is obvious that an extremely viscous oil would be rather unsatisfactory for extinguishing the arc. The flash points of almost all of the transformer and oil-switch oils used are under 190 deg. Therefore there is considerable fire risk. Fortunately, transformer and oil-switch fires are comparatively rare, but in event of one starting they are difficult to extinguish by untrained men. A small amount of training of the operating personnel will render them fairly efficient in combating the majority of electric station fires. In consideration of these facts the Pennsylvania Water & Power Company made an investigation of the methods of extinguishing these fires, with the object of increasing the efficiency of operation and protecting its personnel and equipment.

Most Suitable Fire Extinguisher Depends on Conditions

The results of the investigation showed that for transformer fires the "soda" extinguisher is very satisfactory and no new equipment has to be purchased. It would only be necessary to run two short pipes to opposite ends of each transformer and in case of fire insert the nozzles of the extinguishers in the ends of the pipes. The transformer should be electrically dead before the soda is applied.

In the case of low-tension oil switches, if the fire is in the tops of the pots only, carbon tetrachloride may be used to extinguish it. If this fails it is necessary to render all parts of the switch electrically dead. Sand can be used successfully to extinguish any blaze in the bottom of the compartment, and then carbon tetrachloride will usually be effective in the tops of the pots. If this should be ineffective after considerable effort "soda" may be used, but this necessitates the "killing" of all apparatus within reach of the stream from the tank. The maximum length of the stream is about 30 ft.

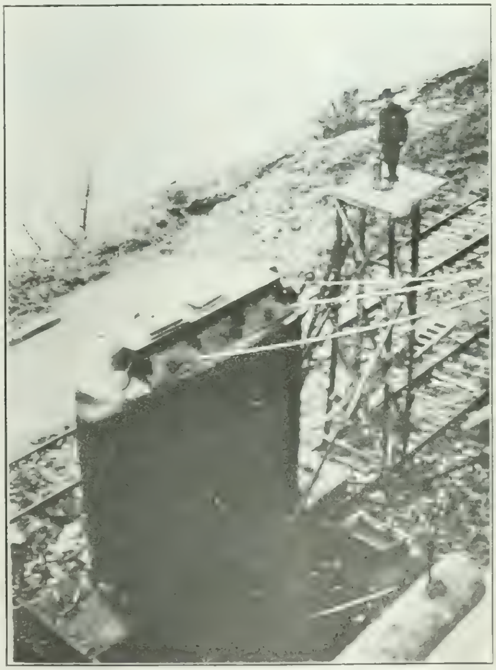


FIG. 1—TRANSFORMER WITH PIPE CONNECTIONS FOR INTRODUCING LIQUID EXTINGUISHERS AND ELEVATED PLATFORM FOR APPLYING EXTERNAL EXTINGUISHERS

In event of a high-tension oil-switch fire carbon tetrachloride should be used if possible. If this fails it will be necessary to use soda, killing as much apparatus as necessary to give the operator protection, which may mean as much as half of the station.

Personnel Must Be Warned of Hazards

It is very evident that in combating fires that occur in electric stations special training should be given to the operating force. In this company instructions similar to the suggestions mentioned are issued. Furthermore, members of the operating force are given the opportunity to witness demonstrations by experienced men in fighting fires and are required to extinguish fires themselves under supervision. The fact is impressed upon them that it is usually desirable to start at the base of an oil-switch fire and work upward. The equipment shown in Fig. 2 to 5 is used for this purpose.

The tests made recently of the rupturing capacity of various types of oil switches have shed some light on the fighting of oil-switch fires. It had formerly been assumed that a considerable portion of the oil was heated above the burning point at the time the switch opened owing to the arc, thus igniting the oil. The tests mentioned showed that this is not necessarily the case. The temperature rise of the oil in the pots may not be more than a few degrees Centigrade and still the oil may catch fire. When a switch opens under heavy load the arc produced vaporizes some of the oil and generates considerable pressure, which in turn forces some of the oil out through various openings in a spray. This "atomized" oil is ignited by the hot gases which pass out at the same time, causing in some cases long sheets of flame. Recent oil-switch designs are tending toward reducing this "atomizing" action by the use of baffling devices of one form or another, which permit the gas to escape, but not the oil.

FIGS. 2 AND 3—AN 11-KV. OIL SWITCH MOUNTED IN COMPARTMENT FOR TEST, SHOWING FIRE IN TOP OF POT AT LEFT AND VIOLENT EXTERNAL BLAZE ON RIGHT

Details of some of the tests made by the Pennsylvania Water & Power Company to determine the best methods of combating transformer and oil-switch fires follow:

Four Methods of Fighting Transformer Fires Studied

To facilitate conducting the transformer tests a shell, shown in Fig. 1, was prepared with a false bottom to reduce the quantity of oil required in the test. The oil was heated to the desired temperature by grid resistances. Four general methods were employed in extinguishing transformer fires, namely: (1) Carbon tetrachloride; (2) bicarbonate of soda and sulphuric acid (referred to as "soda")—a carbon dioxide and water extinguisher; (3) water; (4) Foamite, a form of carbon dioxide extinguisher.

In applying carbon tetrachloride it is necessary that a jet of the liquid impinge on a surface above the fire, in order that the liquid may be converted to a gaseous state, thus "blanketing" the fire and cutting off the supply of air. In order to obtain this condition a perforated pipe was run around the interior of the transformer just over the oil surface so that liquid admitted to the pipe would pass through the perforations and impinge on the opposite side of the interior of the transformer, thus forming a gaseous blanket over the oil surface. The oil was heated well above its burning point (varying from 160 deg. to 210 deg. C. on the various tests) and ignited, with one lid off to provide sufficient air for burning. The oil was permitted to burn for about five minutes, and carbon tetrachloride was admitted at a pressure of about 50 lb. per square inch. This extinguished the fire in ten seconds, using four gallons of the liquid. Considerable smoke and some increase in flame resulted from this application. This test was repeated several times, with similar results.

Soda was tried next. Two pipes were run from a somewhat elevated point to the opposite ends of the transformer, the ends of the pipes discharging directly onto the oil surface. The oil was ignited and permitted to burn as usual. Two standard "Underwriters" soda tanks (2½ gal.) were used, the nozzles being inserted in the ends of the two pipes leading to the transformer. After the fire had been burning for five minutes the tanks were inverted so that the carbon dioxide gas and water ran down the pipes into the transformer and extinguished the fire. Several tests showed that about eight seconds was required for the two tanks to extinguish the fire. If only one tank is used about twelve seconds is required. Only a slight increase in the volume of flame and smoke was noted when the soda was applied.

In applying water the perforated pipe used in the carbon tetrachloride tests was employed. Considerable flame, perhaps 20 ft. in length, was emitted with quantities of smoke and steam, and some oil was even thrown out of some of the openings. The fire was, however, extinguished.

Foamite, the trade name for a fire extinguisher somewhat similar in its action to the soda extinguisher, was next tried. The stream of this extinguisher was played directly on the burning oil surface. One tank extinguished the fire in fifteen to twenty seconds.

While the oil switches* used by the Pennsylvania Water & Power Company are very similar so far as their operating mechanism is concerned, their construction is so different that the same method of combating fires cannot always be used. To study what methods are best two compartments were constructed of sheet iron and pots mounted therein, the dimensions being the same as the dimensions of the 11-kv. and 70-kv. oil switch compartments (one phase only of each). Fig. 2 shows the 11-kv. compartment with the oil-switch pots in place, and Fig. 4 shows the 70-kv. compartment containing the pots. Electric heaters were used to raise the

FIGS. 4 AND 5—A 70-KV. OIL SWITCH IN TEST COMPARTMENT SHOWING FIRE IN TOP OF POT AT LEFT AND EXTERNAL FIRE ON RIGHT

oil in the pots (about 3½ gal. instead of the usual 2 gal.) to a fairly high temperature (about 300 deg. C.).

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*General Electric type HC rated at 11 kv. and 70 kv.

The low-tension switch was tested first. A quantity of wood was thrown in the bottom of the compartment, saturated with oil and ignited in order to render the condition more severe. A 2½-gal. tank of Foamite was used in extinguishing the fire. Similar fires were extinguished with tanks of "soda." Small fires localized in the tops of the pots were extinguished with carbon tetrachloride, which is entirely ineffective when applied to larger fires.

To test the efficacy of damp sawdust as a fire extinguisher a fire was built in and around the pots. Despite the violence of the fire produced (Fig. 3) it was successfully extinguished by the sawdust, thrown from a bucket. While this was being done a small quantity of the damp sawdust fell into the blazing pots. A miniature explosion took place, throwing blazing oil in all directions. This fire was extinguished by the application of more sawdust at the base of the switch and by the use of carbon tetrachloride to combat the small blaze in the pots. Sand may be substituted for sawdust, for it is equally effective.

Fires in the high-tension oil pots (Fig. 4) were extinguished with carbon tetrachloride, the temperature of the oil being 300 + deg. C. Next a small wood fire was built under the pots (Fig. 5) and permitted to burn for about five minutes, igniting the oil in the pots and making a violent fire. Application of Foamite extinguished the fire in about fifteen seconds. Two fires similar to this, but perhaps more violent, were built and successively extinguished by the use of "soda." Due to the design of this switch, which had an open base, sawdust and sand could not be used.

A number of open-wood fires were built and the different extinguishers tried on them. The Foamite and "soda" are both extremely effective on fires of this type, with a slight advantage in favor of the Foamite, as the thick foam generated adheres to the wood and prevents reignition.

PRECAUTIONS IN USING DIFFERENT EXTINGUISHERS

While it was known that both "soda" and Foamite fluids were conductors, tests were made to determine whether or not the jet issuing from the nozzle is a conductor. The tests were made with a megger and with voltages up to 80,000 volts. It was found that a "soda" jet was an insulator beyond about 44 in. from the nozzle, due to the drop form in the jet at this distance, but a few inches nearer it became a fairly good conductor on account of the solid stream of liquid near the extinguisher. Either liquid, if permitted to run over an insulator, will cause a flashover. Carbon tetrachloride is an excellent insulator.

Some precautions are necessary in applying these types of extinguishers to fires. In using "soda" or Foamite the apparatus should be electrically "dead," first, on account of the danger of a flashover, and, second, on account of the danger of the operator getting too near and permitting the jet to conduct the current to his body. In applying sand and damp sawdust the same rule applies; furthermore, great care should be taken that none of this sand or sawdust falls in the blazing oil pots, as the operator may be severely burned and the intensity of the fire increased.

It is particularly desired to call attention to the danger to life of employing the most widely used fire extinguisher—that embodying carbon tetrachloride—in small, poorly ventilated locations. After a number of deaths had occurred while using this extinguisher, the Bureau of Mines made an investigation and determined that under certain conditions the most deadly gases are generated often in toxic quantities, such as phosgene, chlorine, hydrogen chloride, carbon tetrachloride and chloroform (arranged here in order of their toxicity). It is not believed that the use of this liquid should be discontinued for electrical fires because it is often valuable in extinguishing small fires. However, it is believed that care should be taken in its use. It should not be used in a confined space unless an army gas mask or other suitable protection is used. The mere knowledge of the fact that dangerous gases result from its use renders it comparatively safe, as the operator will not remain in the presence of its fumes.

Electrification Program of Czechoslovakia

A Maximum Hydro-Electric Output of 355,500 Kw. in Bohemia, 200,000 Kw. in Slovakia and 59,000 Kw. in Moravia

BY PROF. FERNANDO PIETSCH

Professor of Electrical Engineering in Prague

TO THE best of the author's knowledge, this article is the first to give American readers a detailed account of the present and the planned developments of electric power supply in the new Czechoslovak republic.

As far as a geological survey could ascertain, the republic has within its boundaries total resources of anthracite, bituminous and lower-grade coal amounting to about 140,000,000,000 tons. According to official statistics for the year 1920, the coal production was: Anthracite (74,780 miners), 5,565,000 tons coal, 700,000 tons coke and 722,000 briquettes; bituminous (51,718 miners), 9,800,000 tons coal.

There were 272.76 working days in the year, or an average of 5.24 days per week. The average daily output per man and shift was 556 lb. anthracite and 1,355 lb. bituminous. The average yearly output per man was 148,800 lb. anthracite and 380,800 lb. bituminous. It is expected that this production will be increased considerably as soon as social conditions become more settled. From hydro-electric power plants the following energy is either already available or will soon be developed:

River	Method	Maximum Output, Kw.	Yearly Production Kw.-Hr.
In Bohemia:			
Elbe to Königratz	Dam	4,000	17,000,000
Elbe to Melnik	Canal	16,000	87,000,000
Elbe beyond Melnik	Canal	11,000	92,000,000
Tributaries to the Elbe	Dam	18,000	76,000,000
Moldau to Budweis	Canal	39,000	156,000,000
Moldau to Prague	Canal	87,000	450,000,000
Moldau to Melnik	Canal	12,500	106,000,000
Tributaries to the Moldau	Dam	168,000	674,000,000
Total		355,500	1,658,000,000
In Moravia:			
Total		59,000	178,000,000
In Slovakia:			
Total		200,000	

This gives a total of more than 500,000 kw. for the entire republic. Statistics of 1919 showed 390 power plants in the republic, of which there were six rated at more than 10,000 kw., three of from 5,000 kw. to 10,000 kw. and twenty-eight of from 1,000 kw. to 5,000 kw.

The largest of these plants is in Prague, the capital of the republic, with 22,300 kw. normal output. Virtually all of these plants operate on three-phase, 50-cycle current with transmission voltages of 3,000, 22,000 and 35,000. One system, operated by the Skoda works at the mouth of a mine, transmits power to Pilsen at 100,000 volts.

During the year in which the war began (1914) the Bohemian power plants sold a total of 160,000,000 kw.-hr. Before the war a number of power-plant associations were formed for the supply of certain rural areas. These existing companies, with several formed later, are now being used for the general electrification of the republic, and it is intended to combine them ultimately by one great merger. Six similar local enterprises are planned for Moravia.

In the meantime the new electrification law, which passed on July 22, 1919, provides for a general and systematic power supply of the entire republic. A first appropriation of 75,000,000 crowns has been made and will be used for the enlargement of hydro-electric plants and the assistance of such associations as will be a part of the new system. Financial participation of counties and joint-stock companies in this public service system has been limited to a maximum of 25 per cent. All plants which will participate in the general electrification plan have been classified as public utilities and will enjoy certain rights, as for example, the right of expropriation.

PLAN OF CONSULTING BOARD

Of great importance is the establishment of a consulting board for the entire system, consisting of representatives of industry, agriculture, science, labor and consumers of energy. All plans for new developments have to be presented to this board for approval. This board has established a number of standards for the systematic carrying out of the work, the most important of which are:

1. Steam power plants should be erected only on a large scale and, if possible, near mines, so as to obtain as high efficiency as possible.
2. Hydro-electric plants should be operated to maximum economy along the whole river and should be built with a view to co-operation with other nearby plants.
3. All transmission lines should be so built as to form a uniform network.
4. All energy generated should be three-phase at 50 cycles. Railway power stations and enterprises which can prove that such energy will not fill their requirements are excepted.
5. For the standard feeder voltage 22,000 volts has been decided upon, except for nearby power supply, for which the direct generator voltage is sufficient.
6. For the standard trunk-line voltage 100,000 volts has been chosen with the permission to use temporarily 50,000 volts.
7. The consumers' voltage should be 220-380 volts. For private enterprises 500 volts with grounded neutral is permissible. In direct-current distribution systems 440 volts with grounded neutral should be provided.
8. As standard generator voltage 6,000 volts has been established.

The goal of the whole program is to supply all needed electrical and mechanical energy from this systematized network, into which nine large steam power plants will feed. Besides these, all hydro-electric plants which operate by means of water storage are to be tied in and to cover all peak loads, in order to save coal. Assuming this hydro-electric energy to amount to 500,000 kw., a yearly saving of about 6,000,000 tons of coal will result. For all new steam-power plants gasification of the coal on a large scale is recommended, so as to obtain all the valuable by-products such as tar, ammonia, ammonium-sulphate, etc.

The cost of the new steam-power stations, the trunk lines and the feeder lines is estimated at about 1,500,000,000 crowns. These stations and the network should be completed in twenty years and the hydro-electric development in fifty years. The state will build all the water-power plants in co-operation with the county administrations. The steam plants should be erected by public utilities with state aid.

The use of electrical energy could be increased very materially by electrifying the principal railroads, but present conditions are not promising for this, and it is found far more profitable to sell the energy for industrial purposes. The railroad department is, however, investigating a main-road electrification within 50 km. of Prague which would relieve the present very congested conditions.

Baden Government Plans Extensive Hydro-Electric Development

THE German state of Baden has, according to a correspondent of the ELECTRICAL WORLD, just passed a law for the purpose of supplying electrical energy all over the country by means of a state-owned company. The nominal capital of this company is fixed at 30,000,000 marks, but it has in addition been authorized to raise a public load to the amount of 500,000,000 marks which will be fully guaranteed by the state. All electric plants owned and operated by the state, such as the important Murg power works, become the property of the new company. The existing power plants have not been nearly able to supply the increasing demand for energy. At the present time 500,000 tons of coal are required annually for the generation of power and light, corresponding to an output of 500,000,000 kw.-hr. This it is now proposed to produce by development of water power.

In the south of the country, on the line from Basle to the Lake of Constance, a number of hydro-electric power stations will be erected. One of the largest power plants will be constructed at Schwörstadt, on the German-Swiss frontier, and in this plant Switzerland will be interested financially as well as industrially, as the latter country will receive half the amount of energy produced by this station, namely, 189,000,000 kw.-hr. The total cost of this power station is estimated at 320,000,000 marks. In order to be able fully to utilize the Rhine power works, a great storage lake will be constructed in the southern part of the Black Forest with a capacity of 72,000,000 cu.m. Several subordinate companies, all controlled by the state, will be formed to carry out this part of the work. Similar steps have been taken for the electrification of the central and northern parts of Baden. The Murg power station is to have a large storage lake, to be created by means of a powerful dam across the surrounding valley, at a cost of 200,000,000 marks.

Simplified Layout of Rotary-Converter Substation

Shunt-Wound Machines Allow Operation of Feeders Only 250 Feet Long—Quick Resumption of Service After an Interruption—Direct-Current Starting Switches and Unnecessary Meters Omitted

By J. E. WOODBRIDGE
Resident Engineer Ford, Bacon & Davis, San Francisco, Cal.

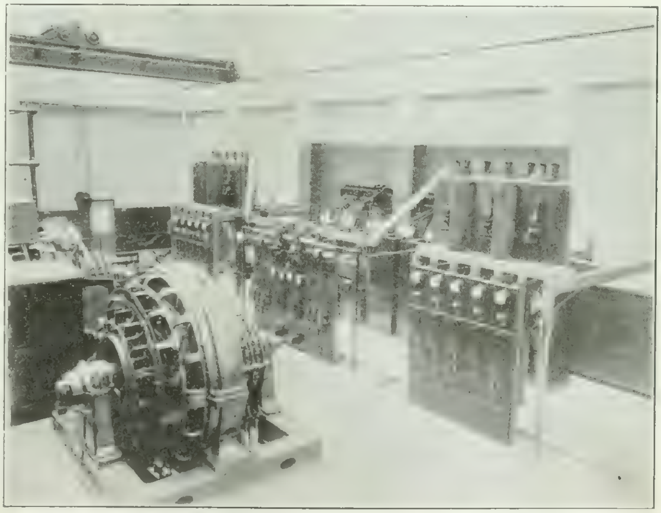
As IN most large cities, the substations and 600-volt feeder system of the United Railroads of San Francisco grew out of old steam plants poorly located for supplying the most congested portion of the load. As a result a large energy loss was present at times of heavy load in feeders and track circuits. It was to overcome this long-distance distribution and to take care of an increasing traffic that a 4,000-kw. rotary-converter station (ultimate rating 10,000 kw.) was designed and completed two months ago. Some special problems, such as very short feeder length, were solved in the design, which also includes novel and effective arrangements of machines, switches and circuits.

The downtown district of San Francisco, including the heavy traffic of four tracks on lower Market Street, was until recently supplied largely from the Bryant Street substation (originally a steam plant) situated about 20,000 ft. (6,000 m.) from the ferry. In spite of a large tonnage of feeders, the voltage drop during the peak hour from 5 p.m. to 6 p.m. would run as high as 250 volts, giving a loss of approximately 2,000 kw. wasted in heating overhead copper and track return. The United Railroads of San Francisco bought energy under a contract rate of $7.50 per 1,000 kw.-hr. at 11,000 volts, with a guaranteed load factor of 60 per cent. As this load factor is not reached, the basis of the contract becomes power and not energy, the price being approximately $40 per kilowatt of peak demand per annum.

As 2,000 kw. of loss amounts at this rate to $80,000 per annum, it is obviously worth while to give careful consideration to any means by which this loss can be materially reduced. Moreover, in spite of municipal competition, the traffic of the United Railroads of San Francisco (now the Market Street Railway Company) has been steadily growing, increasing the load on stations and feeders to the value reached during the Panama Pacific Exposition and requiring extensions to take care of future growth.

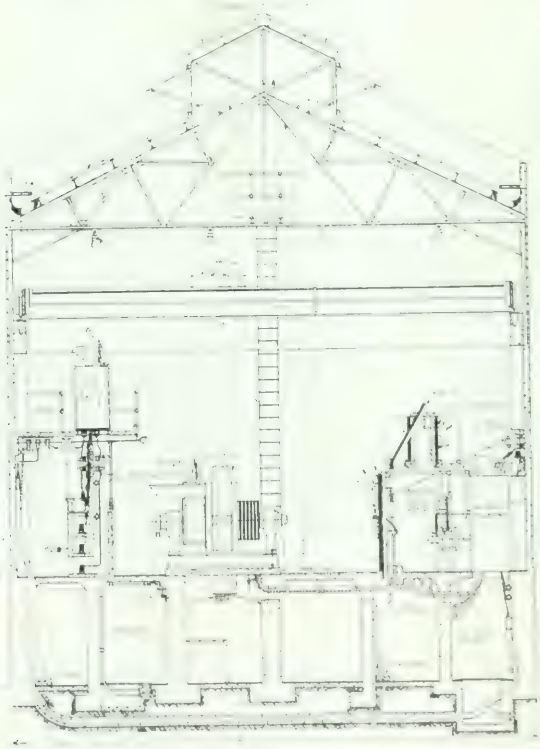
The writer estimated that the installation of a 4,000-kw. substation, suitably located in the downtown district, would reduce the feeder losses, and thereby the peak demand, by approximately 1,200 kw., besides releasing a large amount of copper. Such a substation has been built, and although it has been in full operation less than two months, which is not a sufficient period to give an accurate comparison of new with old system peak demands, there is every indication that the estimated saving will be exceeded.

On account of lower first cost and higher efficiency, converters were chosen for this service instead of motor-generator sets such as were used in the older stations. The use of converters so close to heavy traction loads involves several serious difficulties due to the absence of direct-current feeder resistance to reduce the rush of short-circuit current in case of a broken trolley, car-equipment failure or other fault from feeder network to ground. The old specification of no feeder taps nearer than 2,500 ft. to the station is not applicable where the heaviest load is 250 ft. away, and 2,500 ft. is about as far as the station feeds. The manufacturers' specification of sufficient feeder resistance to limit the short-circuit current of one feeder to three times full load of one machine is also not applicable where one feeder has a peak-hour average demand of 3,000 amp., which is approximately the rating of one converter. This would require a 30 per cent drop in this feeder or about a 500-kw. loss at $40 per kilowatt per



DISCONNECTING SWITCHES FOR OIL CIRCUIT BREAKERS ARE IN CONVENIENT REACH ON MAIN FLOORS annum. Precautions of various sorts, described further on, were taken to protect the machines, operators and circuit breakers, and the minimum resistance to any one point on the trolley network was made 0.025 ohm, which would obviously limit the current to 20,000 amp. at 500 volts. This resistance was obtained in most cases by bringing the feeders out from underground to overhead as near the substation as possible and running the rest of the distance in weatherproof cable at a higher current density than can be used underground without danger of burn-outs. Added resistance was necessary in only two feeders, involving a loss of approximately 10 kw. in each at the peak. One of these resistors is used as an electric furnace with air taken from the air-blast chamber to warm the office.

The converter fields are shunt-wound, this departure from standard railroad practice having been taken for several reasons, as follows: First, to ease the severity of short circuits; second, to reduce the number of heavy windings and large joints in the machines; third, to eliminate the equalizer busbar, switches and connections and to simplify operation; fourth, to improve the power factor on the assumption that the equipment will be loaded to its capacity on the basis of temperature rise, in which case improved power factor is a decided advantage. The commutating poles are of the high-reluctance design, their ampere-turns being greater than those of the armature.



CROSS-SECTION OF 4,000-KW. ROTARY-CONVERTER SUBSTATION EQUIPMENT IS ARRANGED FOR SAFETY AND FOR QUICK RESUMPTION OF OPERATION AFTER A "KNOCKOUT"

A somewhat unexpected advantage has resulted from the shunt characteristic. As the station output rises in the late afternoon from approximately 6,000 amp. to 9,000 amp., the voltage automatically falls off from 550 to 500. As the peak is occasioned by congestion of cars on the downtown streets, which of itself necessitates running slowly, the lower voltage undoubtedly results in less resistance loss in car equipments and in improved system economy. The voltage drop is, however, so much less than with the old long feeds that better schedules are maintained, and a car will probably be dropped from each of several routes without increase of headway.

The equipment is designed to make it possible to alter the voltage under load conditions without power-factor variation. This is accomplished by taps in the primary windings of the step-down transformers, these taps being brought out to step-by-step circuit-breaking contactors, manually operated, with auto-preventive reactors for maintaining the connections while stepping from tap to tap. The transformer ratio is changed 1.5 per cent per each of eight steps, giving a total ratio range of 12 per cent. The transformer primaries are star-connected, and the taps for this purpose are brought out at the neutral end of each primary, giving minimum voltage between the taps of the three phases and from contactors to ground. The transformers are of the air-blast type, and all taps for this purpose are brought out through the tops of the transformers to controllers installed immediately above them, giving a location in plain view and convenient of access for these devices "isolated by elevation." The transformers are installed behind the main switchboard, and the voltage control is actuated by means of mechanical shafting from hand cranks on the face of the board.

Voltage control was considered desirable in this case because of the convenience of such control in the motor-generator stations of the same system and the inconvenience of the fixed voltage of converters as ordinarily equipped. One of the chief advantages of voltage control is the ability it gives to transfer load to or from other stations at will on trackage fed from more than one station. While such advantages would not warrant the cost and added losses of induction regulators or booster converters, they are held to warrant the added cost of the step-by-step arrangement, which was $2,650 per machine, factory cost.

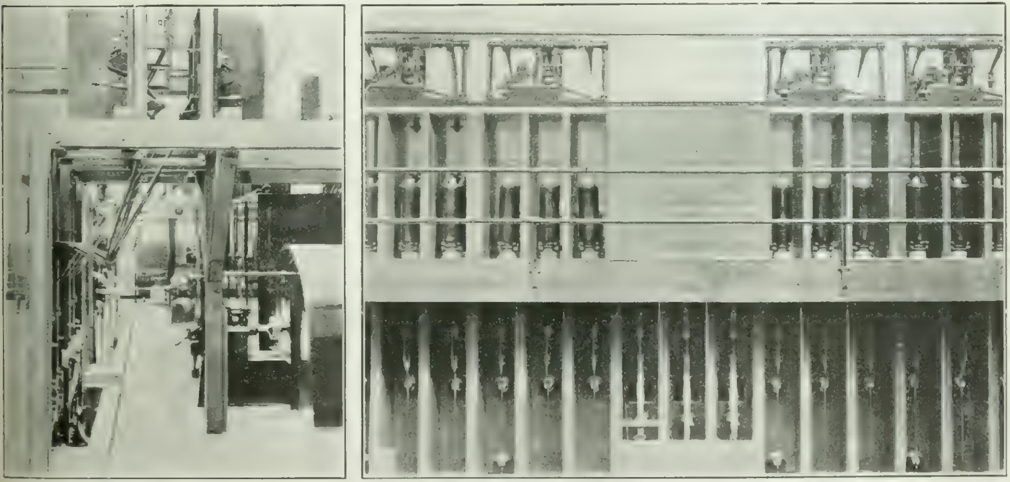
The location of the equipment in the substation differs somewhat from the usual design, which is intended to convey the power generally in one direction from incoming high-tension source to outgoing direct-current delivery. Such an arrangement involves considerable running around by the operator—from high-tension switch control to starting switch, to field switch, to direct-current panel, etc., which slows down restoration of power in emergencies. The substation here described is designed for operation by one man per shift. For this reason all operations are centralized so far as possible, and all control is collected in the immediate neighborhood of the telephone booth, which is treated as the operating center when operation must be made most expeditious, as in emergencies. All high-tension disconnecting switches between the busbars and the oil switches—commonly called "bus disconnects"—including the busbar sectionalizing switches, are placed within convenient reach from the main floor and in plain view from the operating position. No switches whatever are mounted on the machines. Negative switches are omitted as unnecessary and, the machines being shunt-wound, no equalizing switches are required. The field switches are placed with the alternating-current starting switches on the main switchboard. On account of the large number of cables to each starting switch (fifteen, each 2,000,000 circ.mils in size) it is, of course, advisable to have the starting switches between the transformers and the converters, which results in placing the transformers behind the board. Congestion on and around the main switchboard is avoided by careful lay-outs of cable runs and by the removal from the board of all devices, such as meters and relays, which do not require handling in emergencies.

The station is built for an ultimate capacity of four machines, of which two are now installed, the additional space being sufficient for two 3,000-kw. units, which would, if added, give a total capacity of 10,000 kw., sufficient for all probable downtown demand in San Francisco even with a subway under Market Street. In order to avoid an awkward location of the operating center with either the initial or the final equipment, the two machines first installed were erected in the middle of the station with room for another one at each end.

The converters face in a direction opposite to that found in the usual design of substations, the collector-ring end instead of the commutator end being toward the main working passageway and switchboard. This is done to avoid risk to the operator and nervousness on his part from the danger of flashing under emergency conditions, as when cutting in machines on feeders which may be short-circuited. The arrangement of the converters differs in another radical respect from the conventional. Resorting to a practice abandoned for many years, the bed plates are set on timbers and insulated from ground. This has been done to eliminate the short-circuiting effect of flashovers from positive brush rigging to pedestals or other portions of the frame and to cut out the severe burning that would otherwise occur in case of a breakdown from armature conductors to core. Each frame is grounded through an indicating lamp and suitable resistor to give notice in case of an insulation failure. Risk of shock to operators from live frames is eliminated by the use of an insulating floor as described later.

Unusually convenient access to the lower half of the brush rigging is obtained by mounting the negative busbar in another location, by the omission of all shunts and by keeping all cables out of the way. A removable bench is provided to give a safe, convenient working platform under the commutators. The negative busbar is so assembled that it can be increased in section or extended in length without slacking off its connections.

The site selected for the station has a frontage of 41 ft. by a depth of 80 ft. (12.5 x 24 m.) on a narrow back street immediately next to Market Street. This site was owned by the United Railroads of San Francisco, being the location of an old horse-car stable of the Sutter Street line previous to the San Francisco fire. The building is reinforced concrete with no structural steel below the roof trusses. The problem of adequate lighting, always difficult on a site surrounded by private properties on three sides with a narrow street on the fourth, has been solved by making the whole of the roof of glass. Corrugated, wired glass was used for this purpose, set on one-quarter pitch with 2-in. (5-cm.) slope lap, and it has proved eminently satisfactory in every respect. There is no leakage in downpours or driving storms, though some sheets have been cracked owing to being set on non-parallel purlins and overloaded by the weight of men working on them before the bad supporting conditions were noted. The roof does not sweat nor let in too much heat under San Francisco climatic conditions. Direct sunlight is so diffused that there is no objectionable glare, and the lighting on dark days is infinitely superior to that of any building with side windows or ordinary skylights.



MECHANISM CONNECTING OVERHEAD SWITCHES WITH BOARD

Ventilation is another feature requiring careful attention in a substation of this character, since the manufacturers refuse to design rotary converters with directed ventilation, thus leaving this as about the only class of electrical machinery to "stew in its own juice." The heated air is allowed to escape from this station through the sides of a monitor of the usual design, and cool air enters through louvers provided at both ends to admit air both above and below the main floor. This suffices for the two machines, but mechanically assisted draft will apparently be necessary for four.

The main floor is made large enough to admit a converter assembled, and the machines were shipped in that state. To avoid waste of space with hinged doors and the cost of jack-knife or roller doors, the main door is mounted on vertical slides and is arranged to be lifted by the crane. No door latch or lock is required. The air-blast pressure under the transformers is one ounce per square inch or about 150 lb. (10.5 kg. per sq.cm.) on the area of a door. A small air lock is provided with spring-hinged wickets in the inner and outer doors. The blower dampers are automatic.

The location of the telephone booth in the operating center between the two machines necessitated special soundproofing. The booth is of single-wall construction, lined with 1-in. (2.5 cm.) of hair felt with an inner lining of wall board. The inner windows are celluloid, the joint of the door is weather-stripped, the booth is mounted on rubber posts, and the floor is covered with a rubber mat. The result is almost absolute quiet.

The main floor is finished with 1 in. of Trinidad Lake asphalt mastic, which was preferred to concrete as being less slippery, less dusty and softer under foot. The writer has taken 11,000 volts from hands to ground standing on this floor without sensation except when taking hold and letting go of the circuit.

The high-tension bus structure with all barriers is concrete cast in one pouring. Its longitudinal wall runs up between the line and bus terminals of the motor-operated oil switches, thus keeping any fireworks on the line side from spreading to the bus side. The oil-switch cells have removable doors back and front to provide for easier maintenance and quick cleaning up after breaking heavy loads.

The outside disconnecting switches are double-throw with triple-pole, rod-operated short-circuiting and grounding switches that can be closed on the back throw only when the line is disconnected from the house. This does away with the need of the usual dangerous grounding wire.

All outgoing direct-current feeder panels and circuit-breaking equipment are mounted on timber framework of mill construction in place of the conventional grounded steel frames. This has been done to avoid the chance of short circuit from positive busbar or bare copper connections to the steel frame when working on live circuits. Since the feeders in a downtown district must always be energized and can never be shut down even during the midnight hours on account of "owl-car" service, this precaution is a decided safety-first advantage. On account of the severe circuit-breaker duty occasioned by low feeder resistance to the trolley network, the circuit breakers are not mounted as usual on the feeder panels, where they would be immediately above the head of the man operating them. They are installed in two rows above and behind the feeder switchboards, the double row allowing the breakers to be placed on 32-in. (76-cm.) centers with the panels on the usual 16-in. (40-cm.) centers. Transite barriers are mounted between the breakers, thus isolating each breaker in a cubical cell somewhat similar to the cells provided for high-tension oil switches but open at the top, front and bottom. In case repairs are required or burned-out breakers must be replaced, the operator can work in such a cell with its timber frame, slate and transite walls in comparative safety and is not endangered by accidental grounds or arcing from adjacent breakers.

In addition to the usual 600-volt main busbar, the feeder panels are equipped with what is termed a "hospital bus" supplied from the main busbar through a spare circuit breaker. Each feeder switch is double-throw so that any feeder can be connected via the hospital bar to the spare breaker. All feeders can be interconnected through the hospital bus at times of light loads when the station is shut down, thus allowing the main 600-volt busbar to be de-energized for work on it or on the circuit breakers. Each feeder is equipped with a pilot lamp and suitable resistance to indicate approximate voltage delivered via multiple connections from other stations. This detail was specified in place of the usual voltmeter plug because it was found that operators will not take the time to plug in a voltmeter on a cut-out feeder, but will cut in in a hurry to catch the cars before they slow down—a practice that sometimes has serious results.

In order to ring a gong when the breaker opens, each feeder breaker is equipped with an auxiliary switch serially connected to another auxiliary switch actuated by the corresponding feeder switch which stops the gong when the last-mentioned switch is opened. All switches and breakers have laminated studs.

The direct-current feeders are $\frac{5}{32}$-in. (4-mm.) paper-lead cables varying in size from one of 750,000 circ.mils to three cables per feeder each of 1,500,000 circ.mils. Total positive outgoing copper is 17,250,000 circ.mils, and negative current is returned by eight 2,000,000-circ.mil bare cables drawn into fiber ducts.

NO DIRECT-CURRENT STARTING SWITCHES

The line and converter switchboard has been simplified by the omission of several items often used but found unnecessary. No direct-current starting equipment has been provided, since with the variable-voltage alternating-current starting is always reliable. Instruments have been kept to a minimum. Each incoming line has pilot lamps and an ammeter only. Each converter has a reactive factor indicator on the low-tension side and a direct-current ammeter only. The main direct-current voltmeter has a suppressed zero to give an open scale. A 200-volt center-zero voltmeter is provided to show polarity and can be switched from either converter to positive busbar to serve as a paralleling voltmeter to avoid plugging a voltmeter from bus to machine and vice versa. Lamps are connected from the voltmeter bus to the battery to give a check test on polarity or to serve when the polarity indicator is out of commission.

All connections between transformers, converters and switchboards are made with 2,000,000-circ.mil cables, two per phase and four per direct-current terminal, making twenty such cables to each converter. The cable racks are hard wood held to steel straps by studs and malleable washers. The studs between phases of the alternating-current conductors are brass. All others, including those between cables of the same phase, are steel. All cable lugs were sweated on the ends of the cables, standing up in position.

Automatic protective features are as follows:

The machine circuit breakers are equipped with alternating-current low-voltage release attachments connected to centrifugal speed-limit switches and direct-current reverse-current relays. The alternating-current converter switches are equipped with inverse-time-limit overload and instantaneous low-voltage relays, the incoming lines with reverse-power relays. Plug switches are provided by means of which the winding of any relay may be energized from toy transformers with an overload current capable of adjustment, and in the case of the incoming lines with the proper phase and polarity. Thus the complete test of any relay may be made a routine operation.

The watt-hour meters are connected to triple-pole, double-throw switches for testing purposes which accomplish the following results. First, the current-transformer secondaries are cut off from the meters without opening the circuits of the current transformers but leaving the current coils of the watt-hour meters open. The potential coils of the two torque elements of the meter are connected in multiple and the current coils in series. As a result, either with the meter in service or out of service, the meter tester may from the front of the board make all necessary connections for the supply of and delivery from a phantom load, for testing each torque element of the meter and for making a check test on the two torque elements in series. The switch may then be sealed in the running position. An indicating lamp is connected across each potential coil of each meter to give notice of the blowing of any fuse, either primary or secondary.

ARTIFICIAL LIGHTING

Current for lighting the station is taken from the direct-current busbars as being the most continuously energized part of the network. At night the station is closed down and all the alternating-current equipment is disconnected for a general clean-up by the night shift. All direct-current lighting circuits consist of four 115-volt lamps in series, charging the control storage battery. No other charging equipment is required. A low-voltage release is so connected as to light automatically from the battery a sufficient number of lamps to illuminate the control center when direct current fails at night

The converters, transformers and direct-current switchboards are of Westinghouse manufacture. The high-tension switching equipment is General Electric.

The cost of the development, including transmission lines paid for by the power company, was approximately as follows:

Building	$51,000
Equipment, f.o.b. factory	76,000
Freight and installation	21,000
Conduits and manholes	[illegible]
Cables, positive, installed	[illegible]
Cables, negative, installed	[illegible]
Transmission lines	[illegible]
Engineering and overhead	10,000
Total	$336,000

The station was designed for the United Railroads of San Francisco by Ford, Bacon & Davis, consulting engineers, who also superintended the construction of the building and of the conduit system required therewith and the installation of all equipment, cables, etc.

Variation in Costs as Affecting Distribution Design

It Is Shown that Energy Lost in the Line Costs More than Energy Used—Effect of This on Design of Distribution Systems

By P. O. Reyneau* and H. P. Seelye**
Detroit Edison Company

The accurate determination of cost of construction and cost of energy as a basis for economical design were dealt with in the last installment of this series on "Economics of Electrical Distribution," printed in the Jan. 15 issue, page 146.

FURTHER VARIATIONS IN ENERGY COST

Up to this point only the average unit cost of the total energy delivered has been considered for any type of load and locality, without attempting to differentiate between costs for large loads and small loads of the same type, high power factors and low power factors, losses and used power, etc. There will now be indicated some of the possible variations in this cost, and methods of studying them will be suggested. It may be shown that all units of energy, even of the same class and locality, do not cost the same. For example, energy lost has a higher unit cost than energy used. Again, not only does the total kva. of any load increase as power factor decreases, but that increase costs more per unit than the average cost if a 100 per cent power factor were obtained. Further, under some conditions an increase in a load will cost more per unit than the former average.

The underlying theory involved may be readily seen if we consider the cost of lost or waste energy, for example. Most substations are regulated in some way, and if the energy losses between the substation and the customer could be reduced the current in the transmission cable to the substation would be also reduced. Since losses are proportional to the square of the current the cable losses eliminated by this reduction of the load on the cable would be proportional to the difference in the squares of the currents before and after reduction. Hence it will be seen that reduction in loss per unit reduction in load is greater than the average loss per unit of the total load after reduction. In other words, the loss in the cable due to the upper part of the load, which may be eliminated and hence may be considered waste, is greater per unit than the loss due to useful load. Since this energy must be supplied at the generating plant the energy generated will be more per unit for this waste energy than for the remainder of the load or useful load, and the cost will hence be more. This may be shown mathematically as follows:

Suppose a substation B is supplied through cables from a generating station A, and let

W = load in watts at B,
P = percentage of W lost beyond B, which may be considered waste power which might be conserved in some way,
p = $P/100$,
E = voltage at B,
R = resistance of cable.

For simplicity assume single-phase cables, unity power factor. Then

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*Distribution engineer. **Distribution department.

I^2R losses in AB due to total load $W = 2\left(\frac{W}{E}\right)^2 R$,

I^2R losses in AB due to power load only =

$$2\left(\frac{1-pW}{E}\right)^2 R.$$

I^2R losses in AB due to losses beyond B $(= pW)$ =

$$2\left(\frac{W}{E}\right)^2 R - \left(\frac{W}{E}\right)^2 R = \left(\frac{W}{E}\right)^2 R\,(2p - p^2).$$

or, expressed in percentage of total loss in AB,

$$= 100\,(2p - p^2) = 2P - (P^2/100) \text{ per cent.} \quad (1)$$

If the loss or waste power at B is a comparatively small percentage of W it will be seen that the losses in AB due to that waste are nearly twice that percentage of the total losses (10 per cent waste at B means that 19 per cent of losses in AB is due to that waste).

If Q = percentage of W lost between A and B,

$\frac{QW}{100}$ = total loss in cable,

$\frac{QW}{100}\left(2P - \frac{P^2}{100}\right)1/100$ = loss in cable due to waste beyond B. But waste beyond $B = PW/100$.

Hence the loss in the cable due to waste beyond B per unit waste

$$= \frac{\frac{QW}{100}\left(2P - \frac{P^2}{100}\right)1/100}{PW/100} = Q/100\left(2 - \frac{P}{100}\right), \quad (2)$$

since the average total loss in cable per unit total load at $B = Q/100$. If cost of energy per kw. at $A = C_e$, average cost at A of total energy at B =

$$\left(1 + \frac{Q}{100}\right)C_e, \quad (3)$$

and average cost at A of energy waste beyond B =

$$\left|1 + \frac{Q}{100}\left(2 - \frac{P}{100}\right)\right|C_e. \quad (4)$$

In other words, a loss of Q per cent in line AB increases the average cost of total energy delivered at B by Q per cent. But if P per cent of that total energy represents losses which may be assumed to be reducible or waste the average cost of such losses is increased by $Q\left(2 - \frac{P}{100}\right)$ per cent. The difference in average unit total cost and average unit waste cost is then

$$\frac{Q}{100}\left(1 - \frac{P}{100}\right)C_e,$$

or

$$\frac{\frac{Q}{100}\left(1 - \frac{P}{100}\right)100}{1 + Q/100} = \frac{Q\left(1 - \frac{P}{100}\right)}{1 + Q/100} \quad (5)$$

per cent of average cost at A of total amount of energy delivered at B.

For example, if 1,000 kw. be transmitted over a line for one hour with a loss of 6 per cent and if 10 per cent of that 1,000 represents reducible losses or energy wasted beyond the end of the line,

$$P = 10, \qquad Q = 6.$$

If energy at A cost 0.01 cent per kilowatt-hour the average cost per kilowatt-hour delivered at B, including losses in AB but not fixed charges on line $= (1 + 6/100)\ 0.01 = 0.0106$ cent per kilowatt-hour (from equation 3).

The average cost of energy waste beyond B is

$$\left|1 + \frac{6}{100}\left(2 - \frac{10}{100}\right)\right| 0.01 = 0.01114 \text{ (from equation 4)}.$$

The difference is 0.00054, which is 5.1 per cent of the average. The same percentage of increase would be obtained from equation 5.

$$\frac{6\left(1 - \frac{10}{100}\right)100}{100 + 6} = \frac{540}{106} = 5.1 \text{ per cent.}$$

It must be noted that the above deals with the average cost at A of energy delivered at B. In order to determine the average cost at B of energy delivered at B the charges on the line AB must be included. These should be practically proportional to W and hence would average the same per unit both for useful load and for losses.

The above merely establishes the fact of the increased cost of waste energy and must not be considered as indicative of the actual amount of that increase. In determining this a number of variable quantities must be considered.

1. The demand charge for waste energy at any point should be figured by the second method given under that heading, *i.e.*, making up the demand charge for any load of charges proportional to the amount of that load at the time of peak load on station, transmission cable, substation, etc. The reason for this is seen when it is considered that the demand cost on the station, for example, is considered proportional to the station peak. If that peak can be reduced by eliminating waste energy (without reducing the useful load) the demand cost will be likewise reduced in proportion. This line of argument does not apply to useful load, since for this the company is receiving a return. The actual demand cost should be distributed to such loads by the more equitable third method. In other words, a reduction of losses at off-peak time would not affect the actual demand cost of the station nor the distribution of that cost among the useful loads. A reduction of useful load at off-peak would reduce the revenue and hence increase the cost to other loads.

2. The example above uses the energy charge as a single total charge per kilowatt-hour and the loss at a definite percentage. Since the per cent loss varies as the load varies during the day the increase in cost will not depend on the per cent losses at maximum load. The variation in loss will affect both the demand charge and the kilowatt-hour charge, and each in different proportion.

3. If several loads of different sizes and characteristics are considered the problem is further complicated.

4. If lines are operated under the most economical load the losses may be considered as useful load rather than waste.

As has been stated before, the theory here explained can also be applied to determination of the additional cost of low power factor, of load increases (in some cases) and other similar problems. It would appear that each unit of energy comprising any load might be conceived as having a different cost. In dealing with increases in useful or salable load we have the further consideration of economical loading of lines, so that it would not be correct to say that an increase in load always costs more per unit than the average unit cost before the increase. In dealing with losses, however, a large percentage of loss may be assumed to cost more per unit than a small percentage. This idea of increased cost of losses and waste energy is an important one to bear in mind in all economical studies, since usually such a study is fundamentally the establishing of the most economical relation between cost of energy loss and other costs.

CONCLUSION

The above is intended to be rather a suggestion as to how the problem of cost of energy and energy losses may be studied than a complete solution or a recommended method to cover all cases. It may be easily seen that the study of energy cost might be carried to an almost infinite degree of refinement. Many economical studies are general for any part of a system and are intended to cover a period of time well into the future. For these cases a very detailed determination of energy cost would not seem necessary. If the more accurate costs are once determined, however, they can easily be averaged for a more general problem. Lack of time and of the necessary data will, in many cases, limit the study to more or less approximate results. It is hoped, however, that the methods and principles here explained will give a good idea of the nature of the problem. Detailed analyses of energy cost, when data are available will well repay the effort expended. Even a more approximate study with these theories in mind will indicate the relative costs of energy at various parts of the system of various types of loads and the relation between the cost of waste and useful energy.

Teaching the Employee to Be the Company

An Experience in Oklahoma Based on Importance of Educating Employees to Develop Responsibility and Self-Respect in Relations with Public

By J. F. OWENS
Vice-President and General Manager Oklahoma Gas & Electric Company

WE HEAR much these days about "public relations" and "good-will" activities. I believe that we cannot hear too much about these very important matters and a little repetition on these fundamental subjects will not hurt us. But I am convinced that in dealing with the broad phases of these two considerations we have extended our vision and our consequent analysis of particular requirements before we have thoroughly and completely examined and analyzed conditions near at hand. We have sought the answer to our peculiar problems largely through various methods calculated to educate the public and have perhaps paid too little attention to elements within our own organizations which seem to me to be vital to successful and friendly relationship between a utility company and its customers.

The good will, loyalty and intelligent co-operation of every member of a utility organization form the first requisite of public good will. We cannot hope for public co-operation without first making sure that our entire organization is willing and anxious to co-operate with the public. Nor can we effect harmonious conditions between our customers and our company unless we create within the public mind a cordial and friendly understanding of our peculiar problems. The whole matter cannot be worked out successfully through a one-sided arrangement. I believe, therefore, that first of all in dealing with this subject of public relations come "company organization" and "employee education."

It goes without saying that the ideal situation is one in which every employee, all the way down the line from superintendent to ditch digger, thoroughly understands the company's attitude toward customer and public and is earnestly striving loyally to co-operate in promoting friendly relations, as well as to render satisfactory service. This is the goal which I assume all of us are trying to reach.

No situation in any utility organization is of so little importance that it does not warrant the use of the greatest care in the selection of the man or woman who is to fill it. Particularly is this true of those positions where the nature of the work is such that the employee filling it is brought into contact with the public. Ambition is an essential qualification in any member of the organization. The man who has not a forward outlook will prove a drag on the company which employs him. It is not enough that a man be ambitious for himself. He must learn team work, and this means recognition of the fact that his best interests lie in the direction of loyal, intelligent co-operation with his fellows. I wish here to emphasize the word *intelligent*. Le me illustrate!

The company with which it is my privilege to be associated deals in both electricity and gas. Two years ago we were very short of gas. The producing company delivered to us only half enough to supply domestic needs on cold days. Frequently the electric meter setter or troubleman was asked, "What's the matter with the gas?" He did not know, and the inquirer immediately assumed that the company was trying to conceal something in connection with the gas situation.

We decided that it would be advantageous to start a rudimentary course of instruction on the "whys and wherefores" of the local and general gas situation. Department heads were requested to select three employees from each department who in the course of their work came in contact with the public frequently. Those selected were asked to meet for an hour twice each week. Classes were held from 11 to 12 in the morning, in company time. The gas situation as it changed and developed was discussed, and every member of the class was thoroughly informed on all of its phases. This beginning was followed by talks on other activities connected with our company by the men in our organization best fitted to handle each subject. Among the subjects discussed were gas and electric meters, engines and boilers, distribution systems, transformers and protective devices, transmission lines, the storeroom and the history of an order from the time it is made out in our offices to the completion of the work directed.

Another class of twenty succeeded the first, and now fifty-three members of our organization are taking a correspondence course with the understanding that upon its successful completion our company will refund one-half of the price of the cost. This is being done on the theory that the additional intelligent service rendered by those completing the course warrants the expenditure.

The first result of the preliminary school, if we may so call it, was that department heads, through co-operating with other department heads, were brought into close contact with one another's problems. Then the meter setter got a peep into the mysteries of the office and its method of operation and was allowed to see just how his failure to use care in making out his reports threw one of the cogs out of mesh and destroyed the efficiency of the entire machine. The contract clerk was conclusively shown in just what manner the incorrect address he wrote down on an order cost an extra trip, with consequent delay not only to one but to many waiting customers. All of these details were tied in with the paramount idea carried throughout the course —the idea of service.

The purpose of this recital of our company's activities is primarily to emphasize the importance of developing the good will, loyalty and intelligent co-operation of every member of a utility organization as a first requisite of public good will. Only when an employee has pride in the organization with which he is connected can he really give of himself fully and freely in its service. The development of this pride is a prerequisite to loyal service. There can be no set formula for its development. I have therefore avoided any seeming attempt to do so through laying out an organization chart.

Military men have long recognized the value of this pride in organization and have for ages used every resource to build up what they have termed "esprit de corps." The value of this intangible, difficult-to-obtain spirit of unity and organization pride has been conclusively demonstrated many, many times under the most trying and chaotic conditions on the field of battle. Its value to the individual and organization in stress of battle or routine of commercial activity is obvious.

Employees' organizations have helped where they are really employees' organizations. They serve as an outlet for the development and expression of the individual and the department as well as of the workers as a whole. Group insurance has been found a decided factor in creating a feeling of permanency on the part of the employee in his position. All of these factors are valuable and effective if they are introduced and carried forward in a manner that does not smack of paternalism. Any method used should aim to increase in the individual employee an ambition to go forward, and it should above all give the employee the greatest freedom in realizing his ambition.

The whole point I am trying to make is that the organization, be it large or small, is the first and most important element to consider in any attempt to bring about the proper attitude of the public toward a utility or, for that matter, toward any company. How many managers really know exactly what happens to a complaint when it is telephoned to the office? How many have really studied the nervous system of their organization to learn whether or not it is functioning properly and in a healthy manner? Our telephones and messenger systems are our organization's nerves. Does Mrs. Jones when she calls to say that she has misplaced her card and does not know the amount of her bill get the troubleman on the wire? Or does Mrs. Brown, who has discovered a gas leak at her meter, tell her story to the cashier before she learns that she should have been connected with the gas-trouble department? Is your switchboard operator a young and giddy person who spends most of her time snatching excerpts from current love stories or is she a woman of tact and judgment who knows just what telephone to ring when the irate customer is on the other end of the line?

If you have not made an honest, careful appraisal of your own organization, it would pay you to do so systematically, and it might pay you to begin with one of the most important individuals in the entire mechanism—the telephone operator. The contract and adjustment clerks, the cashiers, commercial men, the meter readers and meter setters, the troublemen—all are important links between the utility company and its customers. To the customers they *are* the company, for they are for the most part the only live, flesh-and-blood beings representing the company with whom the customer ever comes in contact.

The subject of "company organization" is one which does not lend itself to brief discussion. But it is also a subject concerning which a few general principles apply and cover the broad phases of its application. The method of satisfying these general requirements is largely a local one and must be dealt with on that basis.

I have unbounded faith in the sound sense and ultimate fairness of the American public. I am confident that the solution of our public relationship problems can be found in intelligent and persistent efforts to render courteous and friendly co-operation, as well as good service, from every department of our organizations, attended by a practical and broad-minded policy of education calculated to enlighten and inform the public concerning our business, its operation and its problems.

Wet Arc-Over at 485.000 Volts

(Photo Courtesy General Electric Company)

SOURCES of high potential varying from 300,000 volts to 750,000 volts have been available for general experimental and research work in several of the best equipped laboratories for some time back, but the fact that such voltages are now necessary for commercial tests is well illustrated in this photograph, which shows a transformer terminal bushing being subjected to arc-over voltage under rainfall conditions.

To cause the arc-over 485,000 volts was necessary. The test was purely a commercial one on bushings that have recently been shipped for use on a 220,000-volt transmission system.

Lower Labor Costs with Bigger Pay Envelopes

Outline of a Principle of Sharing Saving with Employees Which Is Getting Results in a Middle Western Public Utility Company

BY WILLIAM BAUM
Of William Baum & Company, Chicago

FIXED daily, weekly or monthly wage rates cannot and do not stimulate the workers to do their best. A scientific system of wage payment, however, based on metering of efforts, has in one of the Middle Western utility companies provided a strong incentive. This system allows an employee to earn a wage in excess of the ordinary compensation and thus benefits not only the worker but the corporation and the public as well.

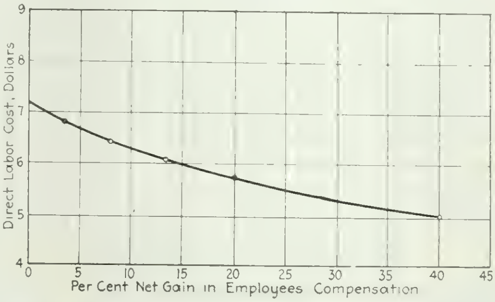
It is more and more being recognized by employers that the workers should in some way share in the profits resulting from their individual efforts. The gain-sharing system as proposed by F. A. Halsey in a paper before the American Society of Mechanical Engineers in 1891 (*Transactions*, Vol. XII) is particularly adaptable to public service companies and has been in operation with slight modifications in one of the large electric railway, power and light companies in the Middle West. The words "gain sharing" are used in preference to "profit sharing" as the workers receive a monthly premium for individual or group accomplishments rather than a share of the company's profits over which they have only indirect and partial control.

Under the principle of gain sharing the worker, or a group of workers, has allowed to him a definite and carefully determined standard time for performing a given operation, and if the work is done in less time—*i.e.*, at lower cost—a gain results, in which he shares with the company in a fixed proportion. For example, let the allowed or standard time for setting a 35-ft. (10.7-m.) wooden pole in dirt be twelve man-hours, a figure obtained by time study and fatigue allowance and checked with data obtained from past performances. If the pole gang performs the task in eight man-hours, a gain of four man-hours is accomplished, which under an existing agreement is shared with the company in equal parts. Thus, the net gain payable to the gang is two man-hours, or 25 per cent more than the compensation for the actual time of eight hours of work. This percentage is applied to the minimum or basic rate of each worker and constitutes his premium or bonus. In this particular operation gain sharing is based on group efforts. The same principle applies to individual gain sharing.

SOME UTILITY EMPLOYEES WHOSE SERVICES HAVE BEEN SUCCESSFULLY METERED

Department	Participants	Efforts	Basis of Gains	Standards
Power plants	Engineers Firemen Mechanics Oilers Cleaners Coal checkers Helpers	Group	Saving in fuel	B t u per switchboard kw.-hr.
Electrical distribution	Overhead	Group	Saving in labor	Man-hours
	Underground	Group		Man-hours
	Meter installers	Indiv.		Man hours
	Meter testers	Indiv.		Man-hours
	Troublemen	Indiv.		Man-hours
	Engineers	Group		Man-days
	Clerks	Group		Clerk-days
	Stores	Group		Man-hours
Way and structure	Construction	Group	Saving in labor	Man-hours
	Reconstruction	Group		Man-hours
Repair shops	Repairmen	Indiv.	Saving in labor	Man-hours
Accounting	Meter readers	Indiv.	Saving in labor	Man-days
	Credits and collections	Group		Clerk days
	Billing	Indiv.		Clerk-days
	Accts. receivable	Group		Clerk-days
	Railway receipts	Group		Clerk-days
	Bookkeeping	Group		Clerk-days

The application of the system to thousands of operations requires considerable engineering and clerical work, the expense of which may be met by deducting from the gross gain the cost for operating the system, usually about 20 per cent, and dividing the balance equally between the company and the employees. Deducting the cost of operating the system from the gross gain has been practiced for several years and is accepted by the employees in good faith. Gain sharing is also applied to reduce cost of materials, tools, expenses for injuries and damages, etc. Each department of a public service corporation presents new features, and no all-inclusive description of gain-sharing designs can be given. The co-operation of foremen and superintendents is desirable and is secured by allowing them to participate in the gains. In some plants demerits or special penalties for infraction of rules are also introduced.



LABOR COST OF SETTING A 35-FT. POLE WITH WAGES AT 60 CENTS AN HOUR UNDER GAIN-SHARING PRINCIPLE

The setting of correct standards presents the most difficult problem and one upon which the success of gain sharing depends. Proper allowances must be made for fatigue and delays. It is important that the computed time allowances be checked with a production study or with records of past performances. Standard time allowances must be made of sufficient magnitude to induce the best results. The writer's experience has shown that a premium of from 25 per cent to 50 per cent offers a sufficiently strong incentive to workers of public utility companies.

A partial outline intended to give a bird's-eye view of some of the more important departments to which gain sharing has been successfully applied is given in the table. Gain sharing is not limited in its application to operating and construction departments, but is also particularly fruitful in the case of clerks, bookkeepers, auditors and other office employees. Though it may appear at first that the metering of office work would offer too many obstacles, the application of gain-sharing plans to accounting departments has been particularly successful. In fact, in order to insure an all-around success and the enthusiastic co-operation of all employees, gain sharing should be applied to all departments.

The actual gains vary from month to month and in some cases are of considerable magnitude, as is shown by the following figures for a large Middle West company in one of the last months of 1919:

Department	Monthly Gains Paid to Employee
Accounting	$3,745 51
Electrical distribution	4,058 10
Purchasing	379 09
Rolling stock	10,123 46
Sales	2,416.78
Transportation	34,321.87

As the gains reflect the efficiency of a particular individual, group or department, the executives to whom the results of gain sharing are submitted monthly in graphical representation have a complete and ready check upon the work and the efforts exerted during the preceding month. If the curve showing the gains in percentage indicates a decreasing tendency, an investigation should be made for the purpose of determining the reason and the proper remedy. Employees showing a continuous rise in gains can be placed in the line of promotion.

Readers' Views and Comments

This is a readers' forum. Comments on questions before the electrical industry presenting economic, financial, engineering or commercial aspects and new or supplementary viewpoints on published articles are cordially invited

Export Possibilities for Electrical Products in Italy

To the Editors of the ELECTRICAL WORLD:

The Italian industries are suffering badly from German and Austrian competition. Italy produces no coal and no iron, and therefore the cost of manufacturing is much higher in that country than in Germany and Austria. Recently, when an order was placed for equipment for a hydro-electric power station, the German offers were 3,000,000 lire less than the Italian bids (9,622,000 lire against 12,600,000 lire). The German price included freight and duty. The prices for Italian-made electrical machines have risen considerably during the last few years. Thus, for instance, an electric motor of 50 hp. which before the war could be had at 1,350 lire (190 lire per 100 kg.) was sold at the rate of 5,650 lire (800 lire per 100 kg.) in 1919 and at 13,000 lire in 1920 (or 1,820 lire per 100 kg.).

In former years Switzerland exported considerable quantities of electrical machinery to Italy, but these exports have largely decreased as will be seen from the following table:

	1920 Twelve Months Francs	1921 First Quarter, Francs
Dynamos, electric motors	1 231,000	469,000
Electrical control instruments and apparatus	2,457 000	387,000
Other instruments and apparatus	820,000	117 000
Incandescent lamps	3,029,000	667,000

An especially large decrease took place in the Swiss exports of electrical control instruments and apparatus to Italy, as well as in the exports of incandescent lamps, of which 60 per cent went in 1920 to Italy. Out of a total exportation of 5,250,000 francs, lamps to the value of 3,000,000 were shipped to Italy. The electrification of the Italian railroads requires the importation of large quantities of electric products of nearly every description, above all of porcelain and glass insulators (for 12,000 volts to 80,000 volts) and steel pipes for poles. The Italian government recently objected to an increase of the customs tariff on those articles, and therefore, the market offers opportunities for the sale of such appliances, provided that the German competition can be beaten. HENRY L. GEISSEL.

Beaurivage, Thoune, Switzerland.

How X-Ray and Radio Service Problems Have Been Solved

To the Editors of the ELECTRICAL WORLD:

Inasmuch as the Duquesne Light Company has supplied electric service for X-ray and radio apparatus over a period of about six years, it is possible that readers of the ELECTRICAL WORLD will be interested in its experience along these lines.

Owing to the operating characteristics of X-ray apparatus, many cases of flickering lights occurred when we first served such apparatus. However, these disturbances have been eliminated by the installation of 2,200/110-volt transformers and services. Such an arrangement provides the X-ray operator with ideal service since he requires uniform voltage after he has set a machine to make an exposure. Since the X-ray machine is operated by professional men who derive a revenue from its use, they understand business problems, readily appreciate the necessity for special service and rarely hesitate to meet the central-station company half way. The result has been universal satisfaction relative to the operation of X-ray apparatus on the lines of our company.

The amateur wireless operator, however, has caused us considerable annoyance. The transmitting outfits have been the chief trouble makers. The following cases which I have selected from a hundred or more investigations will illustrate our difficulty and the remedy which we applied:

Several years ago a customer complained of flickering lights and electrical discharges similar to but not so severe as lightning. It was found that a wireless transmitting outfit was situated next door and that the flickering lights and discharges occurring on the switches and chandeliers were in synchronism with messages that were being transmitted. Grounding of the wireless outfit through various values and types of impedances in numerous ways was attempted, but no relief was obtained. A one-to-one transformer was also inserted in the wireless supply circuit without effect. Finally the wireless customer was disconnected from the 110/220-volt grounded-neutral distribution bank and served from a 1-kva., 2,200/110-volt transformer installed for his individual use. The disturbance ceased and was permanently eliminated.

In another case the wireless amateur had attached one end of his aërial to one of our poles which carried a three-wire 110/220-volt distribution circuit and four or five customers' services. The aërial crossed the services at various angles and not more than two feet distant from any of them. During rainy or damp nights, when the operator was transmitting, streams of fire could be seen between the aërial and our service lines directly beneath. The lights on these circuits flickered, the wall switches and chandeliers buzzed and emitted sparks, the telephone service was affected, and in one case the main house fuses were blown. The same disturbances occurred, but to a less degree, on dry nights and days. The aërial was removed to a safe distance, but the trouble was not completely eliminated until a separate 2,200/110-volt transformer was installed for serving the radio operator.

A more severe case of disturbance occurred quite recently. A wireless transmitting outfit broke down the insulation on the chandelier wiring in one room of the house next door. The ceiling canopy was melted and a hole 6 in. in diameter was burned in the ceiling. The main house fuses and tablet board were badly burned. The wireless customer compensated his neighbor for the damages, and we prevented repetition of the trouble by installing a 2,200/110-volt transformer to serve the wireless outfit.

Generally the amateur wireless sending outfit is found in the hands of a person operating it solely for pleasure, consequently he objects strenuously to any expenditure to obtain electric service. He does not even care to consider the viewpoint of the central-station company and does not understand why other persons should be annoyed by their light flickering and sparks flying around. He likes to see the sparks fly. He does not realize that for his own and the other persons' safety he requires a special service and that consequently he must bear the additional cost which is incidental to supplying that class of service.

From our experience, coupled with laboratory and field tests, we have developed our present policy relative to serving these two outfits. Briefly stated, it is as follows:

1. A separate 2,200/110-volt transformer and service is installed in all cases.

2. The wireless operator must keep his aërial 30 ft. from our lines.

3. Since the energy consumed is very low and the cost of connection and service, including the core loss of the specially installed transformer, is comparatively high, the customer must bear a share of this cost connection and then pay a monthly fixed service charge thereafter.

C. H. Mueller,
Superintendent of Electrical Testing Division.
Duquesne Light Company,
Pittsburgh, Pa.

Ebro Irrigation Power Company's Development

To the Editors of the Electrical World:

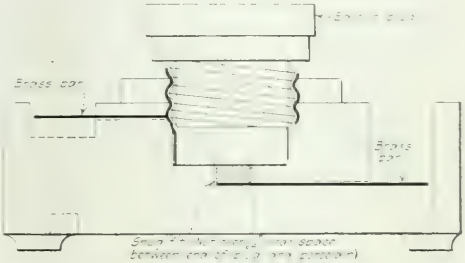
Please refer to the letter "Would Be World Record" on page 172 of the July 23 issue of the Electrical World. This communication is in part from a letter I sent you on June 7 which was not intended for publication. That part of the first paragraph which refers to P. L. Griffith is so erroneously stated as to require correction. In our letter of June 7 we stated: "A friend of our P. L. Griffith recently returned from Spain, and he, while there, was superintendent of electrical construction," etc. Mr. Griffith's friend, not Mr. Griffith himself, was superintendent of electrical construction. It was from this friend that we obtained the information given you.

M. W. Brower,
Statistical Department.
Electric Bond & Share Company,
New York City.

Proper Design of Cut-Outs and Fuses to Prevent Practice of Bridging

To the Editors of the Electrical World:

I have noted with interest the comments of your readers about bridged fuses. This is probably the most flagrant violation of safety requirements. In fact, nearly everybody except those who understand the serious nature of the practice is using coins and other foreign substances to replace blown fuses. The result is an increasing frequency of electrical fires caused in this way. Electrical inspectors find pennies in nearly every electrical installation, and even the housewife now keeps a handy penny near the cut-out so as to be sure of immediate service.



METHOD OF MAKING FUSE PLUG VIRTUALLY PROOF AGAINST TAMPERING BY AMATEUR ELECTRICIANS

A number of cities have enacted ordinances requiring sealed service fuse inclosed so as to insure that there will be at least one real fuse in the line at all times, but even these sealed cabinets are broken open and coins substituted. Perhaps a rigid enforcement of the electrical ordinances would tend to discourage this practice, but the difficulty lies in the prohibitive cost of a systematic reinspection of all electrical installations at frequent intervals; therefore most of the laws along this line are inactive and the violator is not brought to trial until after the damage has been done. Here, as elsewhere, an ounce of prevention is to be preferred to a pound of cure.

The only feasible way of handling this problem in a satisfactory manner is to design a cut-out and fuse that cannot be readily bridged. I doubt if there will ever be a cut-out designed that cannot be bridged by an expert, but it is a very simple matter to design a cut-out and fuse that would be very difficult for every householder to bridge and that could not be bridged by a coin.

I am inclosing a sketch of such a cut-out and plug designed by the writer. It will be noted that the only change is to make a depression in the porcelain receptacle and a corresponding raised terminal on the plug fuse. If a bayonet joint is substituted in place of the ordinary Edison screw shell, it would make the cut-out of even greater value, for the reason that the plug and cut-out threads would not meet unless the plug was firmly seated in the cut-out. It is difficult to get manufacturers to adopt new standards, but it is only a question of time when something must be done to eliminate the extra-hazardous features of the present design.

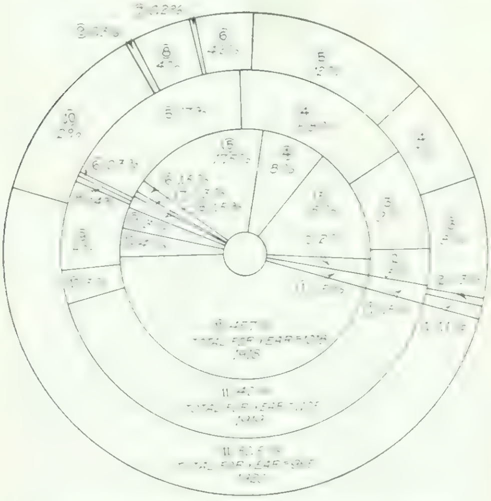
George Welman,
Chief Electrical Inspector.
Louisiana Fire Prevention Bureau,
New Orleans, La.

Station and Operating Practice

A Department Devoted to Problems of Installation,
Operation and Maintenance of Equipment for Economical Generation and
Distribution of Electrical Energy

Graphic Method of Analyzing Interruptions

FOR the purpose of analyzing the causes of trouble on the system of the Georgia Railway & Power Company a chart such as that shown in the accompanying illustration has been prepared. This chart gives the total number of interruptions for each of the last three years. Each ring representing one year is divided off into segments showing the percentage of interruptions due to various causes. The conclusions to be drawn from the circular chart are different for each kind of interruption. For instance, if it is desired to know whether or not the operators are becoming more careful than they were in the preceding year reference would be made to segment No. 1 on each of the circles. On this chart the interruptions of this class were 1½ per cent during the years 1918 and 1919 and for 1920 they are 1⅙ per cent, which is an indication that the operators are becoming more competent.



CAUSES OF INTERRUPTIONS FOR LAST THREE YEARS ARE PROPORTIONED ON THIS CHART

Numbers on chart refer to causes listed below.
1. Company's switching errors. 2. Overloads. 3. Clearance orders testing and switching. 4. Other connecting company's line trouble. 5. Failure company's apparatus. 6. Failure customer's apparatus. 7. Careless operation by customers. 8. Sleet and wind. 9. Unknown. 10. Miscellaneous. 11. Lightning.

It may be desired to find out how many breakdowns were due to failures of the company's apparatus during the year. This item is shown by segment No. 5. If this segment shows a larger percentage in one year than it did in the preceding year this indicates that a more thorough inspection system should be put into practice or it may indicate that the equipment is getting old and more easily subject to trouble, etc. If a comparison is made between the number of interruptions due to lightning, which is marked segment No. 11, with the amount of apparatus damaged during the year, this will form a basis for determining whether or not sufficient lightning protection is being installed on equipment.

An interesting item in the chart is the number of interruptions caused by other companies. These troubles of connected companies are reflected upon the system and cause interruptions on the branch circuits of the system. Out of the total interruptions for the year 1920 about 8 per cent were due to this one cause.

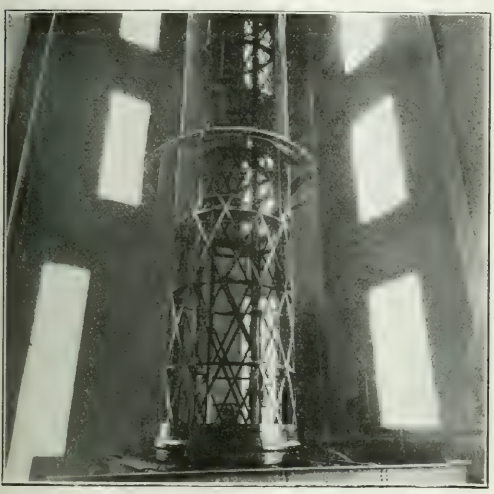
G. A. ILER,
Superintendent Operation, Tests and Repairs.
Georgia Railway & Power Company,
Atlanta, Ga.

Cylindrical Screen Takes Tons of Leaves from Condensing Water

ON ACCOUNT of the past success of a set of screens for condensing water in a station of the Louisville Gas & Electric Company a second set of screens was built recently. The object of the screens is to catch leaves and other trash. In flood time the highest amount of water which at present passes through the screens is 100,000 gal. per minute, or 60,000,000 gal. in a day of ten hours. The amount of trash will vary from a basketful when the river is clear to five or six carloads at times when a heavy storm has come upon the watershed, with the watershed covered with leaves. It is these peak loads that were formerly feared. A cartload of leaves, distributed flatwise, will stop up a very large area of screen. As soon as a screen is stopped it acts as a dam. The water piles up in front of it and goes down behind it, and in the case of a flat screen five or six minutes is frequently long enough for the differential pressure through the screen to become so great that it is impossible to raise the screen for cleaning without putting the machines non-condensing. If the station is loaded at the time, running non-condensing not only sacrifices economy but it takes off one-half the capacity and would amount to dropping a large portion of the load during the period that the screens cannot be cleaned.

To overcome these objections a triple set of cylindrical screens was built. These screens consist of three cylindrical screens one inside the other. They are about 63 ft. high and the outside screen is 16 ft. in diameter. Each cylinder is built of lattice work supporting No. 10 wire mesh with ½-in. openings. Any one cylinder may be raised independently of the other. The illustration shows the second screen during construction. It stands on a temporary platform which was removed as soon as the screen was finished. The pan which catches the water is shown under this platform. As soon as the screen was finished this platform was removed and the screen was lowered into a well previously prepared.

The water comes into the inside of the center screen and passes outward through all three screens, except during times when a screen is being cleaned, and then it passes through only two screens. The pressure of the water is equal in all directions, so that no matter how great the differential pressure may be, owing to the partial clogging of the screen, the screen can still be raised and cleaned. Cleaning is done by raising the screen and turning water into two pipes permanently erected so that they throw jets of water against the screen along its entire length. The jets of water strike the screen tangentially and cause it to rotate so that every part is cleaned.



CIRCULAR SCREEN WHICH FILTERS CARLOADS OF LEAVES OUT OF CONDENSING WATER

There is a wire basket running around the bottom of the screen which catches all the matter that falls off the screen while it is being hoisted. Otherwise this material would pass to the second screen and would eventually reach the condensers.

At periods when heavy rains have followed a leafy summer and a late fall all the leaves come down the river at once and these screens have caught literally carloads of them. None of them, however, reached the condensers, and the cleaning of the condensers once every three weeks has been found sufficient. This plan for screening water is covered by Patent No. 1,207,776.

DONALD MCDONALD,
General Manager.
Louisville Gas & Electric Company,
Louisville, Ky.

Arc Lamps Changed Over to Incandescent Type

TO REDUCE maintenance costs on its street-lighting system and to allow equipment to be used more efficiently, the Augusta-Aiken Railway & Electric Corporation is changing over from alternating-current inclosed series arcs to the compensator-type fixture with incandescent lamps.

This company has for years been operating some 300 series arcs on its 7.5-amp. series system, and in a great many cases it was necessary that series incandescent and series arcs be operated on the same circuit. It was decided some months ago to convert all arcs to compensator-type fixtures with auto-transformers rated at 7.5 amp. to 20 amp. and 600 cp. Reasons prompting this decision were five in number—lower maintenance, lower energy cost per unit, higher power factor, increased illumination and increased station capacity.

The installation of series incandescent lamps will have the effect of a 19 per cent increase in constant-current transformer capacity. At this time about 175 arc lamps have been replaced by compensator fixtures and the reduced load on station constant-current transformers is noticeable. It has been necessary to readjust the four circuits affected.

In addition to the increased capacity, the services of one man at an average saving of $120 per month are dispensed with. It is estimated that the cost of making the change will be approximately $11.50 per lamp.

COMPARISON OF SERIES ARC LAMPS WITH COMPENSATOR-TYPE INCANDESCENT LAMPS

	7.5-Amp. Arc	20-Amp Series Incandescent
Candlepower of unit 10 deg. below horizontal	325	1,280
Volt-amperes at station	819	434
Power factor....	0.65	0.80
Kw.-hr. per year of 4,000 hours	2,128	1,396

It so happens that the company had about fifteen old inclosed lamp casings on hand. The auto-transformer employed was easily adapted for use with these casings. This was done by merely removing the arc-lamp mechanism and substituting the auto-transformer and adjustable socket to receive the 600-cp., 20-amp. incandescent lamp.

At the present time no change is being made in the globe or in the lamp shade, but it is intended in the near future to replace the old outer globes with either the Holophane prismatic-band refractor or the Holophane prismatic-bowl refractor. M. H. HUMMEL,
Superintendent Electric Department.
Augusta-Aiken Railway & Electric Corporation,
Augusta, Ga.

Inconspicuous Service Entrance for a Fine Residence

AN EXAMPLE of how inconspicuous a service entrance to a fine country estate can be made is shown in the accompanying photograph. The secondary leads are brought to a pole behind a tree near the front gate of the estate. From the pole top they are carried down the pole in a conduit and then in conduit through the wall and underground to the mansion. Neither the pole nor the conduit and wires are conspicuous from the road outside. This entrance is on the system of the Edison Electric Illuminating Company at Milton, Mass.

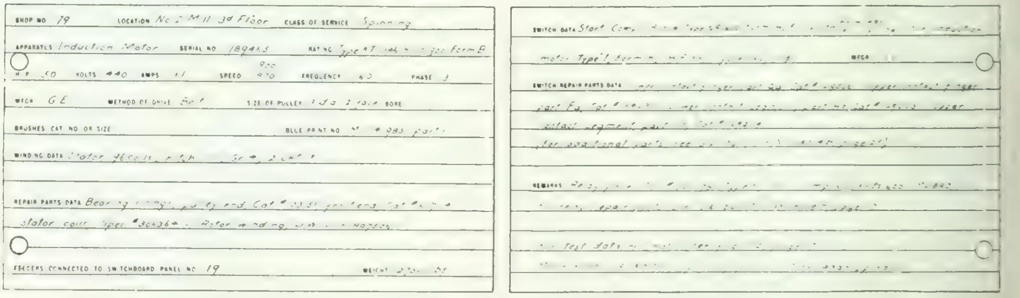
Industrial Applications

The Economical Utilization of Electrical Energy
in Mills and Factories, Together with Practical Details of Installation, Control,
Testing and Repair of Equipment Required

Records for Installed Industrial Equipment

IN INDUSTRIAL plants where a considerable amount of electrical equipment is installed the man who is responsible for its operation is at times called upon to give detailed data regarding certain pieces of equipment. With no record file, it becomes necessary for him to secure this information with considerable delay, and at times from apparatus that is in almost inaccessible places.

To meet such occasions the writer has devised a set of records of the equipment under his care. Herewith is reproduced a card which gives the shop number, location and class of service of an induction motor, together with the name-plate data, winding and repair parts data, its weight and the number of the switchboard panel to which the feeders are connected. Also the method of drive is recorded, including the size of the motor pulley. This might be carried a step further and the width, ply and length of the belt also be recorded. On the reverse side appear the switch data, together with the most important repair parts catalog numbers and letters. The number of the bulletin in which may be found the catalog numbers of additional repair parts which are less frequently used is also given as a means of saving time when it becomes necessary to look up these parts.



SHOP NO 19 LOCATION No 2 Mill 3d Floor CLASS OF SERVICE Spinning
APPARATUS Induction Motor SERIAL NO 189445 RATING Type AT [illegible] form B
H P 50 VOLTS 440 AMPS [illegible] SPEED 900 FREQUENCY 60 PHASE 3
MFGR GE METHOD OF DRIVE Belt SIZE OF PULLEY [illegible] BORE
BRUSHES CAT NO OR SIZE BLUE PRINT NO [illegible]
WINDING DATA Stator 96 coils [illegible]
REPAIR PARTS DATA Bearing [illegible] end Cat [illegible]
stator coils spec [illegible] Rotor winding [illegible]
FEEDERS CONNECTED TO SWITCHBOARD PANEL NO 19 WEIGHT [illegible]

SWITCH DATA Start Com[illegible]
motor Type [illegible] MFGR
SWITCH REPAIR PARTS DATA [illegible]
[illegible]
For additional parts see [illegible]
REMARKS [illegible]
[illegible] Test data [illegible]

THIS RECORD MAKES IT EASY TO CHOOSE SPARE PARTS FOR REPLACEMENTS

In this particular installation the motor is protected by means of an overload relay and the data for this, together with the number of the bulletins giving repair parts numbers and letters, have been recorded under the heading of "remarks." The winding data have been secured from the manufacturers of the various equipment and the information furnished by them, together with blueprints showing the coil connections, is kept in a file with repair parts bulletins, all of which are indexed for quick reference.

In gathering and compiling such information considerable care must be taken to avoid errors, as a record file full of errors is worse than none and will cause considerable delay and annoyance when ordering repair parts from such records.

LEROY A. FRANCIS,
Chief Electrician.
Utica Steam & Mohawk Valley Cotton Company,
Utica, N. Y.

Sixty-four Coils Reconnected from Series to Two-Parallel Star

CONNECTING sixty-four coils in a two-parallel star (three-phase) arrangement was necessary in a recent change of an induction motor from 440 to 220 volts. An odd arrangement of coils in groups was necessary to make this change. The motor was a 30-hp., 440-volt, 60-cycle, three-phase, eight-pole machine. As received the motor was connected series star with coils grouped as follows: 2-3-2, 3-2-3, 3-3-3, 2-3-2, 3-2-3, 3-3-3, 2-3-2, 3-(3—1)-3, there being one dead coil in the last group as indicated by (3—1 equals two coils). This made twenty-one coils per phase.

Now, to reconnect from 440 to 220 volts meant changing the connections to two-parallel star. As there were twenty-one coils per phase, there would be 21 ÷ 2 equals 10½, coils per parallel path. As one-half a coil is impossible, and ten coils in one leg and eleven in the other would not do, the only thing left would be to cut out three coils, one in each phase, or one coil out of every eighth pole-phase group containing three coils, or out of groups 8, 16 and 24. The resultant two-parallel grouping was as follows: 2-3-2, 3-2-3, 3-(2)-3, 2-3-2, 3-2-3, (2)-3-3, 2-3-2, 3-(2)-(2). In this notation the figures in parenthesis as (2) represent a group in which there is one dead coil. This makes four dead coils in the entire motor, which, however, was the best that could be done without rearranging the grouping, which meant removing all the stubs and jumpers, and losing the phase insulation in some places.

The motor was connected in two-parallel star and grouped as indicated and operated in a manner which proved satisfactory.

A. C. ROE.
Detroit, Mich.

Incorrectly Rated Pulleys Cause Machine to Be Driven Too Fast

TWO machines driven by motor through a line shaft were noticed recently to be running considerably faster than they should according to the rated speed of the motor and size of the pulleys. This was a shunt-wound, 230-volt motor rated at 1,150 r.p.m. The motor has a 4-in. pulley which is belted to a 24-in. pulley on the line shafting, and the 5-in. pulley on the line shafting is belted to a 13-in. pulley driving the machine. With the rated speed of the motor and this combination of pulleys, the machine should revolve at about 75 r.p.m. Upon investigation it was found that it revolved at about 88 r.p.m.

On checking the speed of the motor it was found to be 1,258 r.p.m., which was probably due to the motor running at a very light load and on a line having a potential of 242 volts. This, however, would not entirely account for the increased speed of the machine. Upon measuring the 4-in. pulley on the motor it was found to be 4⅛ in. in diameter, the 5-in. pulley on the line shafting was 5⅛ in. and the 13-in. pulley measured slightly under 13 in. All of these variations were sufficient to cause a change in the speed of from 75 r.p.m. to 87 r.p.m.

E. R. DEBMAN.

East Orange, N. J.

Voltage Readings on Large Battery Easily Taken by One Man

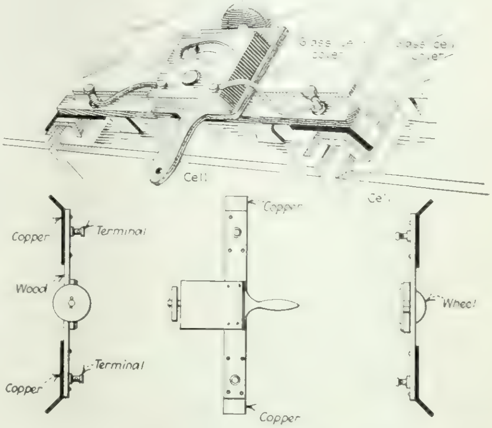
IN ORDER that voltage readings may be taken without trouble on the cells of a large stationary battery, a rolling holder with connecting contacts has been made by the writer. Taking voltage usually requires two men, one to carry the voltmeter and take the readings while the other marks them down. This device eliminates carrying the voltmeter on the arm and allows the man taking the readings to record them.

The meter rests upon a piece of ½-in. board sawed with a scroll saw in the shape of a paddle as shown in the drawing. The square part accommodates a voltmeter while on one edge a small spur is left to act as an axle for a wooden or hard-rubber wheel 4 in. in diameter. On the opposite edge to the axle a handle is formed. Handle, axle and meter platform are all one piece of wood. Small beading is tacked around the edge of the meter board to keep the meter from sliding off. To the bottom of this board is fastened a strip of wood, 1 in. x 2 in. in size, cut long enough to span the outside edge of the cell which has the largest spread.

Two pieces of copper or brass sheeting, 1 in. x 6 in., are mounted on each end of the stick so that about 2 in. projects beyond the ends. These pieces are fastened on by the studs of two binding posts which are mounted on the opposite side of the strip. These binding posts are mounted far enough from the end of the stick to insure that their studs on the opposite side will not come in contact with the lead-cell connectors. The ends of the metal strips are bent downward at an angle of about 45 deg.

In operation the meter is laid on the board and the leads are fastened to the binding posts. Before taking readings the plate-glass cell covers should be moved back from the edge of the cells to expose at least an inch of the connectors. The contacts are placed on the edge of the lead connectors, while the wheel bears on the center of the plate-glass cell cover. When it is desired to move the meter to the next cell the handle is lifted with one hand until the contact pieces are clear, and then it is rolled over the plate-glass cover to the next cell.

It is advisable to remove all rough spots from the lead connectors where contact is made as well as to brighten the brass contact surface. This little conveyor when not in use is hung in the battery room by means of a hole drilled in the handle.



METER SUPPORT CAN BE ROLLED OVER TOPS OF CELLS WITH EASE

Tuckahoe, N. Y.

JOHN E. MCCARTHY.

Selecting Varnish and Applying It to Motors and Coils

APPLICATION of varnish to armatures, armature coils and field coils is an art which depends on the preliminary treatment of the objects to be varnished, the proper selection of varnish and its proper application. As a guide in the selection of varnishes and their application the tables shown herewith will prove useful. Table II shows the varnishes most suitable for different classes of work. If the motor to be repaired is to operate under exceptional conditions, such as high temperature or dampness, Table III should be consulted to see what varnishes are suitable for these conditions. In Table I are found descriptions of the different types of varnish and instructions on how to apply them, time required for drying and the material used for thinning. Table II may specify several varnishes that can be used for a certain job, but reading the descriptions in Table I will usually allow a decision as to the best one.

In many shops too little attention is paid to preliminaries. It is well known that the cotton covering of wire, cotton tape and fibrous materials which go into the construction of coils readily absorb moisture, in many cases up to 10 per cent of their weight. This moisture must be driven out before the varnish is applied. This is done by subjecting coils to prebaking at a temperature above the boiling point of water for periods of one hour or longer, depending upon the size of coils and depth of windings. Prebaking is of value in other ways. The copper becomes uniformly heated,

TABLE I—CHARACTERISTICS OF VARNISHES USED IN MOTOR-REPAIR WORK

Kind of Varnish	How Applied	Baking Temperature Deg. C	Time to Dry or Bake	Thinner
1. Clear air drying varnish: A clear oil base varnish for all types of field and armature coils. It possesses high dielectric strength, is not affected by moisture and is proof against the action of lubricating oils. Intended particularly for use when it is not convenient to dry by artificial heat. Good for high-tension machines.	Dip or brush.		8 hours	Benzine
2. Black baking coil varnish: For all types of coils. It has high dielectric strength and is water repelling. It is particularly recommended for stationary motors and generators, where plastic properties are often necessary or desirable.	Dip or brush.	100	3-6 hours	Benzine
3. Black plastic baking varnish: Recommended for armature and field coils of direct-current motors which operate in damp surroundings. It is waterproof and oil-resisting and retains its plastic properties indefinitely.	Dip or brush	100	8 hours	Benzine
4. Clear baking coil varnish: A clear oil base varnish intended for the insulation of high-tension and low-tension coils where maximum elasticity is required. The insulation is high and uniform, and the varnish coating is moisture-resisting and impervious to lubricating oils.	Dip or brush	100 120	6-8 hours 4-6 hours	Benzine
5. Black elastic baking varnish: Made with China-wood oil and a black water-repellent gum base. Recommended for use on armature and field coils of all types of direct-current motors. On account of water-resisting properties, it is recommended for electric railway motors. It produces a strong, glossy black film impervious to lubricating oils.	Dip or brush	100	6-8 hours	Benzine
6. Clear heat melted varnish: A solventless, clear varnish which is liquefied by heat. Recommended for use on armature, field, lifting magnet, high-potential and other coils. It is very flexible, plastic and an excellent insulator. It has no injurious effect on either red or black-enameled wire. It is absolutely waterproof and fiber and paper may be moisture-proofed by treating in this liquid at 110 deg. C. and baking.	Dip or vacuum impregnation at 140 deg. C.	100	4 hours	None
7. Clear baking varnish: A light-colored, very flexible insulating varnish for use on coils where the maximum flexibility is desired. An excellent dielectric with a breakdown exceeding 1,250 volts per mil. Oilproof and waterproof. Recommended for high-tension work	Dip or brush.	100	4-6 hours	Benzine
8. Clear baking varnish: A light-brown flexible and adhesive insulating varnish suitable for form-wound coils, taped or untaped, braided or enameled. Very adhesive. Oilproof and waterproof. Recommended particularly for all one-coat work on armatures and fields.	Dip or brush.	100	6-8 hours	Benzine
9. Clear baking varnish: A golden-brown insulating varnish; produces an amber finish. It is very viscous and produces a smooth, hard, elastic and flexible film which is not easily abraded. It penetrates and fills the coils completely and dries internally. Recommended for all types of coils, armatures and stators. Form-wound coils treated with this varnish can be assembled after months of aging without damaging the insulating film. For apparatus subjected to wide ranges of temperature, severe vibration or operated in moist, oily or dusty places.	Dip or brush.	100 120	6 hours 3 hours	Benzine
10. Black waterproof compound: A solid compound for impregnating in vacuum, fields, small armatures, etc. It is recommended particularly for the electric railroad and tramway, motor-field coils and air-compressor coils. It liquefies readily within safe temperature limits. It has high insulating properties, is water repelling and possesses good heat-conducting properties. This last feature makes it particularly desirable for use in the impregnation of fields where there is abnormal temperature rise due to severe operating conditions.	Vacuum impregnating	Dipping point 100	Hardens on cooling	[illegible]
11. Black air drying coil varnish: A black insulating varnish composed of hydrocarbons recommended for the insulation of coils subjected to wide ranges in temperature and is particularly desirable for use on armature and field coils of all types of direct-current motors. The drying of this varnish is effected solely through the evaporation of its solvents. It has high insulating properties and is moisture-resisting and water-repellent.	Dip or brush.		2-4 hours	Benzine
12. Black finishing varnish: A black glossy finishing varnish for use as a last coat over armatures and field coils. It is water-repellent and a good insulator. This varnish is recommended for use in shops of manufacturers of dyanmos and motors, and particularly in the repair shops of electric railroads and tramways. It reinsulates and provides a waterproof covering, which will not become brittle nor scale off. Is acid-proof and alkali-proof.	Brush		30 min.	Benzine
13. Black alcohol base varnish: A black oilproof alcohol finishing varnish for dipping or painting armatures and fields to protect them from lubricating oils. Is absolutely oilproof and gives a bright, glossy finish, which will not fade. This is a quick, air-drying, alcohol-solvent varnish which combines elasticity with oilproof properties.	Brush, after removing oil with benzine rag		[illegible]	Denatured alcohol
14. Clear spirit varnish: A clear oilproof finishing varnish for armature and field coils. Dries with a hard, glossy finish, which is oilproof	Brush		30 min.	Denatured alcohol
15. Black coreplate varnish: This air-drying varnish is specially prepared for coating armature disks or laminations.	[illegible]		[illegible]	Benzine
16. Black frame paint: Pigment paint with [illegible]	Brush			

expanding the air in the coil, and the varnish, when applied quickly, penetrates to the inner layers of the winding. It has also been found that prebaking shortens the regular baking period. The latent heat of the coil tends to assist in the quick expulsion of solvent, and rapid and thorough oxidation of the varnish base.

Coils subjected to the preliminary treatment described are in a state to absorb quickly varnish to their full capacity. They should be taken from the oven and immediately submerged in the varnish. If the baking oven is heated by gas, the tank of varnish should be situated a suitable distance away so that all danger will be minimized. As the hot coils are submerged there will be a slight volatilization of the solvent. This solvent should be replaced when varnish is again used and proper dipping gravity checked by hydrometer.

The time of submergence depends upon the type and size of coil, the size of wire and the depth of winding. A few minutes usually is all that is required. A safe guide is the appearance of the varnish surface. As the varnish penetrates the winding, driving out the air, it causes bubbles to appear. When bubbles cease to come up it is safe to assume that the coil is well filled.

Coils are then taken from the varnish and hung up to drip. Usually fifteen minutes is sufficient and they should then be placed in the oven to bake. Field and magnet coils should be baked for one-half to one hour at a temperature not exceeding 71 deg. C. (160 deg. F.) after which the temperature is raised. The reason for this is that subjecting deep windings at once to the maximum baking temperature usually results in forming an oxidized film over the surface of the coil, which tends to seal in a portion of the solvent. This lengthens the drying time and in many cases proves injurious either through reducing the insulation or affecting the enamel (if wound with enamel wire), or both. The low temperature used for the prebaking period allows the solvent to escape quickly from the interior of the coil. It is not often necessary to subject armature coils to preliminary baking. The winding is usually shallow and the solvent is driven out at the high baking temperature before an oxidized coating is formed on the surface.

TABLE II—VARNISHES TO USE FOR DIFFERENT PURPOSES IN REPAIRING MOTORS

Part to Be Varnished	Varnish to Use (Numbers Refer to Table I)
Coils, form-wound	
Air-drying varnish	1, 11
Baking	2, 3, 4, 5, 7, 8, 9
Coils, field:	
Air-drying varnish	1, 11
Baking	2, 3, 5, 6
Impregnating in vacuum	10
Finishing	12, 13, 14
Armatures:	
Baking	5, 8, 9
Finishing	12, 13, 14
Stators	
Baking	5, 9
Laminations	15
Frame, inside	12
Frame, outside	16

TABLE III—VARNISHES TO USE ON MOTORS AND COILS WHICH OPERATE UNDER EXCEPTIONALLY BAD CONDITIONS

Special Qualities Desired	Varnish to Use (Numbers Refer to Table I)
[illegible]	9, 8, 5
[illegible]	2, [illegible], 11
[illegible]	3, [illegible], 12
[illegible]	[illegible], 14
[illegible] proof and oil-proof	12
[illegible]	10, [illegible]
[illegible] temperature range	11, 9
[illegible]	[illegible] 7

After the preliminary baking the temperature is raised to maximum and continued till the varnish is dried thoroughly. The baking time and temperature are governed by the type and viscosity of the varnish. Elastic or long-oil varnishes are not injured by high temperatures. In fact, a temperature of 115 deg. C. (240 deg. F.) gives best results. It is high enough to oxidize the varnish within the minimum time and not too high to injure the cotton, paper or fiber. Long-oil varnishes are now obtainable which will bake on armature coils in four to five hours. Not so long ago a varnish was not considered elastic if it required less than twelve hours to bake. This shortening of time without loss of elasticity has been brought about by the use of china-wood oil combinations and improved methods of manufacture.

Multiplicity of varnish coatings has solved many insulating problems, and the custom now followed is to give all coils at least two and up to twelve brushed or dipped coatings. In such cases the varnish is applied at reduced gravity by the addition of 20 per cent to 30 per cent of thinner—usually benzine. When one coat is applied varnish should be used at full body.

With small armatures wound with enameled wire and operating at high speed (4,000 r.p.m. to 12,000 r.p.m.) special attention must be observed in winding, balancing and applying and baking successive varnish coatings and in providing for the separation of conductors which do not run parallel.

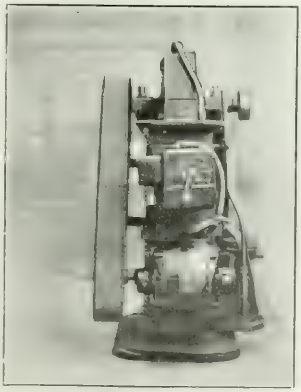
An approved specification for varnish coils is given in the following:

1. Preheat coils at 110 deg. C. (230 deg. F.).
2. Submerge in varnish at reduced consistency for five to ten minutes, or until bubbles cease to appear on surface.
3. Remove coils from varnish and hang up to drip for ten to fifteen minutes.
4. Place coils in oven. If armature coils, the maximum temperature may be applied at once. If deep windings, prebake at low temperature before applying the maximum.
5. Armature coils should be dipped twice and each coat thoroughly dried. The first coat is applied with leads down, the second coat with leads up. The second dipping with leads up insures the proper filling of the space at the joints where the lead leaves the coil, thus preventing the entrance of moisture at this weak point.

The value of this system of insulating coils is apparent. The coating is smooth and uniform, and by "breaking joints" a perfect high dielectric covering is insured.

JOHN C. DOLPH,
President.
John C. Dolph Company,
Newark, N. J.

Mounting a Motor Directly on a Grindstone Frame



FORMERLY DRIVEN BY OVERHEAD BELT

A METHOD of adapting individual drive to a grindstone formerly driven from a group shaft is shown in the accompanying photograph. The motor is bolted to straps attached to the pedestal near the floor level. The starting switch directly above the motor can be reached without stooping and a short run of flexible armored conductor makes connection between the switch and the motor. The metal belt guard at the left is strapped to the pedestal to prevent injury to the operator. This arrangement is economical of space and investment. Mounting the motor above the floor allows the floor to be cleaned and swept without inconvenience.

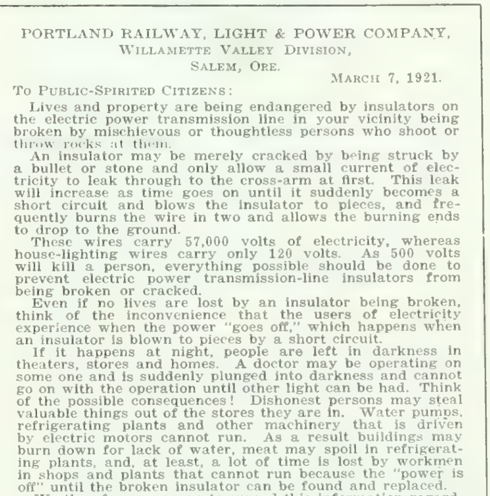
FIELD EDITOR ELECTRICAL WORLD.
Boston, Mass.

Central Station Service

A Department Devoted to Commercial Policy
and Management Topics, Including Methods of Increasing the Use
of Electric Light, Power and Heat

Malicious Breakage of Insulators Reduced by Educating Children

THE number of transmission-line insulators broken maliciously in the Willamette Valley division of the Portland (Ore.) Railway, Light & Power Company has been reduced almost to zero as a result of a campaign of education conducted among the school children of the territory. It was found that insulators were frequently broken by the children throwing stones or shooting at them and that even adults thoughtlessly did the same things without realizing the seriousness of their action. To correct this the local manager of the company, accompanied by the school superintendent, visited each of the schools and addressed the children upon the danger caused by broken insulators.



PORTLAND RAILWAY, LIGHT & POWER COMPANY,
WILLAMETTE VALLEY DIVISION,
SALEM, ORE.

MARCH 7, 1921.

TO PUBLIC-SPIRITED CITIZENS:

Lives and property are being endangered by insulators on the electric power transmission line in your vicinity being broken by mischievous or thoughtless persons who shoot or throw rocks at them.

An insulator may be merely cracked by being struck by a bullet or stone and only allow a small current of electricity to leak through to the cross-arm at first. This leak will increase as time goes on until it suddenly becomes a short circuit and blows the insulator to pieces, and frequently burns the wire in two and allows the burning ends to drop to the ground.

These wires carry 57,000 volts of electricity, whereas house-lighting wires carry only 120 volts. As 500 volts will kill a person, everything possible should be done to prevent electric power transmission-line insulators from being broken or cracked.

Even if no lives are lost by an insulator being broken, think of the inconvenience that the users of electricity experience when the power "goes off," which happens when an insulator is blown to pieces by a short circuit.

If it happens at night, people are left in darkness in theaters, stores and homes. A doctor may be operating on some one and is suddenly plunged into darkness and cannot go on with the operation until other light can be had. Think of the possible consequences! Dishonest persons may steal valuable things out of the stores they are in. Water pumps, refrigerating plants and other machinery that is driven by electric motors cannot run. As a result buildings may burn down for lack of water, meat may spoil in refrigerating plants, and, at least, a lot of time is lost by workmen in shops and plants that cannot run because the "power is off" until the broken insulator can be found and replaced.

We therefore urge you to spread this information regarding the result of cracked insulators as much as possible and do all in your power to prevent people from shooting or throwing stones at them.

If you cannot get some people to stop doing it, please give us their names and addresses and we will take the matter up with them ourselves and *compel* them to stop, if necessary.

You will also be of great service to the public if you will notify us at once by telephone of any "fireworks" on our line, which always indicates a short circuit. This will help us locate the trouble and get the repairs made as soon as possible.

We ask that you sign and return the attached slip so that we may know, as a matter of interest only, the extent to which this letter has been read and how much assistance we may expect from those to whom it has been sent. Yours truly,

PORTLAND RAILWAY, LIGHT & POWER COMPANY.
W. M. HAMILTON, *Division Manager.*
'Phones: Salem—55, 242. Silverton—Black 1121, Main 301.

Portland Railway, Light & Power Company,
Salem, Ore.

GENTLEMEN: I have read your letter of March 7, 1921, regarding broken insulators and will do what I can to prevent them from being broken in the future.

R. R. No. .... Box No.
Name
P. O. Address.

WIDE CIRCULATION OF THESE LETTERS REDUCED BREAKAGE OF INSULATORS TO MINIMUM

In addition each child received the letter reproduced here, which was to be taken home and read by the parents. The letters each carried a statement to be signed by the parent, detached and returned by the child to his teacher. These were later collected by the company. The teachers understood the value of the work and gave great assistance in getting the slips signed and returned. One point in getting the attention of the children was the exhibition of insulators which had been broken by stones, causing electrical failure.

W. M. HAMILTON.
Manager Willamette Division,
Portland Railway, Light & Power Company,
Salem, Ore.

Meeting the Public in the Commercial Office

AS A RESULT of the efforts to remove the prejudice against utility corporations from the minds of consumers there is evidence of greater progress than has been made at any time during the last two decades, John H. Ghegan of the Kings County Lighting Company asserted in a paper presented before the commercial section of the Empire State Gas and Electric Association. It is, he said, incumbent upon public utilities to take advantage of the popular trend of thought in order to remove to a large extent the well-established distrust, doubt and antagonism against corporations. Mr. Ghegan continued:

"When public service corporations are putting forth every effort to gain the good will of the public, educating them in public utility problems and endeavoring to interest them to the extent of investing their savings in stocks of these corporations, it is most importan that every consideration be given to the consumer wh finds his way to the company's office, no matter wha the purpose of his visit may be. He has called for specific purpose and is entitled to the courtesy and consideration that would be extended to him if he were t visit the establishment of any merchant. There h knows he would be welcome.

WHO SHOULD MEET THE CUSTOMER?

"The questions arise: Who shall meet the consumer Who shall represent the company? The impressio given by one who receives the visitor reflects the whol policy of the company in its relation to the community i serves. How necessary, then, that the first impressio be one that will convey evidence of good intentio good will and a desire to please—an impression that wi at once put the visitor at ease and one that will immediately establish the first step toward friendly relations.

"The spirit of complaint is contagious, and if the office arrangement is such that criticisms made by a consumer are overheard by others who at first had no idea of calling at the office of the utility to give expression to dissatisfaction, it invariably will be found that complaints will be registered by persons who entered the office with no idea whatever of making them. In our company an office has been set apart for the reception of the visitor who feels that he has a grievance against the company. A man whose experience and characteristics qualified him for the position was selected to take charge of this office and received the title of 'adjuster.'

PRIVATE OFFICE BEST FOR ADJUSTING COMPLAINTS

"The plan of bringing the caller into a private office, putting him at ease and honestly inquiring as to the cause of his visit had a very good effect. The customer who had called expecting curt attention and small consideration found to his surprise that he was not going to be treated in that manner and immediately became more reasonable and uttered his protest in a quiet, businesslike way. The matter could then be easily adjusted because the visitor had been brought to a receptive frame of mind, and when the case was settled he would leave well pleased with the interview and with an entirely different opinion of the company.

"In the matter of complaints about bills a system was devised whereby a complete record of a consumer's complaint is made from the time of its reception to its final disposition, giving all information gathered by the inspector, who on his visit to the consumer's premises carefully examined the entire installation, endeavoring in every way to leave the consumer satisfied before completing his inspection. This information is forwarded in a general report to the consumer, accompanied by a card showing him how to read the meter. This little card has done wonders in keeping down complaints, particularly where errors occurred in reading or where bills were for a longer period than the usual monthly term.

POOR SERVICE AND ACCOUNTING ERRORS MUST HAVE PERSONAL ATTENTION

"Other complaints of poor service and bookkeeping errors and the many other reasonable and unreasonable complaints received by the company are all handled by the adjuster's office, and in no case is the consumer allowed to feel that his complaint has not been carefully looked into. Whenever the case demands it proper adjustment is made promptly. Whenever it is found the fault lies with the company a letter of regret is immediately sent to the consumer. This personal contact with an employee who shows a desire to aid the consumer and who feels it his duty to place service above everything else is bound to create a good and lasting impression upon the visitor which in time will redound to the benefit of the company. The dissatisfied customer of today, properly handled, becomes the friend of tomorrow.

"The visit of a consumer to the company's office affords an excellent opportunity for the company to state its position directly to the user of its product. It is an opportunity to present its problems and to impress upon the mind of the caller the fact that the company realizes the full value of the public's good will and is at all times trying to gain this most valuable asset. The public is gradually becoming friendly to the public utility companies owing to the publicity given our problems, and to my mind one of the easiest and best ways of reaching the people is by inviting co-operation and by square dealing and courteous treatment restoring public confidence, and so gradually ridding the public mind of the antagonism which so long has been a barrier to progress.

"A capable man in the office can be a very important factor in establishing this result. It is absolutely necessary that the consumer should be met by one who is conversant with the affairs of the company, its policy, its problems and system, in order for him properly to enlighten the consumer and at the same time grasp the opportunity of educating him on those matters upon which he is not informed. To do this satisfactorily to all concerned requires more than the efforts of an office boy or a minor clerk. The adjuster himself must know his work; he must be a student of human nature; he must observe the golden rule, placing himself in the position of the complainant, and last but not least he must be endowed with an unlimited amount of patience."

Northwestern Electric Now Selling Preferred Stock Locally

THE Northwestern Electric Company, Portland, Ore., is beginning an active campaign in its territory to place $1,000,000 of 7 per cent cumulative first preferred stock. It is to be sold at 95, to yield approximately 7⅜ per cent. The original 6 per cent preferred stock, of which there is $1,870,300 outstanding, is convertible into this issue at the rate of one share of the original for nine-tenths of a share of first preferred. The proceeds are to be used for extensions and additions to take care of new business. Consideration is also being given to the construction of an 8,000-hp. hydro-electric station below the company's present station on the White Salmon River. This will be the first attempt of this company to place its securities directly and with its own consumers.

Central Maine Employees Sell Nearly 5,000 Shares of Preferred Stock

IN SEVEN contests for the sale of Central Maine Power Company preferred stock by employees, 4,967 shares were disposed of, according to an announcement in the *Exciter*, the company's official organ. Most of the work has been done within the past two years. The number of employees interested and the number of shares sold have increased rapidly with each advancing contest. In the first contest seventy-one employees participated and sold 277 shares, whereas in the seventh and latest competition 113 employees sold 1,103 shares. The largest single sale in any contest was 200 shares, and the prizes and commissions awarded in the last three contests reached a total of $6,253.25. In the last seven years more than $5,000,000 has been expended in new construction on the Central Maine system, and the number of customers served has been nearly doubled. The activity of employees has been most helpful in the development of the customer-ownership idea throughout the company's territory.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
of the World

Generators, Motors and Transformers

Diesel Engines for Generator Driving.—C. S. DARLING.—The points in the operation of the Diesel engine which should be watched carefully to prevent trouble are described in this paper. It states that the temperatures of inlet and outlet water from the cylinder jacket and the temperatures of exhausts should be always watched. The color of the exhaust flame and the presence of smoke should be noted. An analysis of the various troubles causing smoke shows that smoke of different colors is due to different defects. A table showing a typical test run of a 300-kw. engine is given. —*Beama* (British Electrical and Allied Manufacturers' Association), July, 1921.

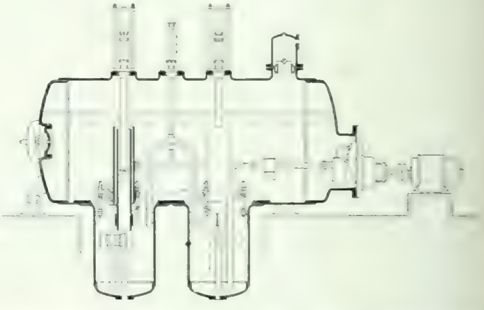
Generation, Transmission and Distribution

Surge Protection on Transmission Lines.—S. CUNHA and G. C. READ.—Discussion of problems with special reference to the method of surge protection used by the Montreal Light & Power Consolidated of Canada.—*Journal of Engineering Institute of Canada,* June, 1921.

Zillingsdorf Lignite Power Plant for the Supply of Vienna—II.—R. BERON.—The 38-km. transmission line consists of two 70,000-volt, three-phase lines of 50-sq.mm. copper strands supported on 20-m. steel towers, spaced 150 m. apart in the open and 60 m. near inhabited places. Four-disk and five-disk insulator chains are used. Above the power lines a galvanized 60-sq.mm. steel cable is fastened to the top of the poles to act as a lightning arrester. To avoid inductive disturbances the lines are transposed twelve times. The telephone wires are carried on separate poles, following a different route. During the year 1920 energy amounting to over 60,000,000 kw.-hr. was transmitted to Vienna, which helped very materially to overcome the coal shortage. The total equipment of the plant comprises at present a coal conveyor plant capable of handling 40 tons per hour, twelve boilers of 500-sq.mm. heating surface each, a set of twelve pressure and twelve suction fans for forced draft, a feed-water cleaning plant handling 20 cu.m. per hour, four turbo-generators of 8,000 hp. each, two turbo-generators of 12,000 hp. each, a 40-ton crane, two 8,500-kva. transformers rated at 5,000-35,000 70,000 volts, one 20,000-kva. transformer rated at 5,000-35,000 70,000 volts, one 3,000-kva. transformer rated at 16,000 volts.—*Elektrotechnik und Maschinenbau,* June 12, 1921.

Production of Power from Internal-Combustion Engines.—F. W. BURSTALL.—An economic comparison of gas engines and crude-oil engines, including capital costs, to be used as a basis for the selection of driving engines for electrical generation.—London *Electrician,* June 24, 1921.

The Electric Steam Boiler.—J. BUCHLI.—The electrically heated boiler can compete with a steam-heated boiler only if the electrically produced heat unit does not cost more than one has to pay for a heat unit derived directly from the usual solid or liquid fuels. This will permit in general the use of hydro-electric power only. Equipped with a steam accumulation chamber, for which any existing steam boiler may be used after some small changes, the electro-boiler is eminently suited to fill in the off-peak valleys of any generating station. This is of great importance for factories with their own hydro-electric plant. Another ideal use for the electro-boiler may be found on alternating-current railways in heating the train. Of three different types of boilers—the resistance, the arc and the induction type—only the first has found practical use. If the boiler is small and the feeding voltage below 1,000, resistance grids are placed within the boiler. For higher voltages, up to 20,000, the water itself represents the resistance between the steel wall of the boiler and one or more electrodes. Only alternating current can be used for the latter, to avoid the decomposition of the water into the highly explosive mixture of H_2 and O. Extensive tests made on large electro-boilers with alternating current of the lowest practically used frequency, *i.e.,* 16⅔ cycles, showed that there is no danger from any possible gas generation, and this possibility is, of course, still more remote with higher frequencies. The regulation of the current in relation to the steam demand may be effected either by controlling the depth of immersion of the electrodes in the water or by changing the position of an insulating cylinder placed coaxially with the electrode, and thereby increasing or decreasing the length of the path of the current through the water. The latter method has been highly developed by the Brown-Boveri company. For the automatic maintenance of a constant steam pressure the insulating cylinder may be connected to a float. The insulating cylinder may consist of earthenware for low voltage or of porcelain for high voltage. With large-output boilers only quartz will resist. To provide the necessary cooling of the



ELECTRICALLY HEATED STEAM BOILER USED IN HEATING CARS OF THE SWISS FEDERAL RAILWAYS electrodes in large-output boilers a water-circulating pump is provided. One of the great advantages of the electro-boiler, it is said, is that boiler scale does not form in it. The article contains many sectional drawings of electro-boilers, a photo of a 15,000-volt train-heating boiler and details of thirty-four existing plants up to 2,250 kw.—*Brown-Boveri Mitteilungen*, March-April, 1921.

Lamps and Lighting

Line Loss of Street-Lighting Circuits.—H. E. BUTLER. —An analysis of the losses in No. 6 and No. 8 wire and the per cent relation to lamp wattage, with a discussion of the factors that should be taken into consideration in deciding upon the proper size of conductors to be used.—*General Electric Review*, August, 1921.

Future Field of Illuminating Engineering.—J. H. ASDELL.—Lighting, according to this paper, can be considered perfect only (1) when obtained in a manner not injurious to the eye, (2) when the units harmonize with the surroundings and do their share in presenting the desired artistic or architectural effect, and (3) when mental appreciation is caused by the impression on the brain. Simultaneously the efficiency should be as high as possible consistently with these results both from the installation and the maintenance point of view. A discussion follows showing how these results can be obtained, and special explanation is given of the effect of various colors.—*Beama* (British Electrical and Allied Manufacturers' Association), July, 1921.

Traction

Battery Locomotives.—JAMES DALZIEL.—Gives operating characteristics for storage-battery shop locomotives.—London *Electric Vehicle*, July, 1921.

Results of Automatic Substation Operation on Chicago, North Shore & Milwaukee Railroad.—CHARLES H. JONES.—The service performed by the Chicago, North Shore & Milwaukee Railroad is of a heavy interurban character comparable to that given by many interurban steam lines. The demands on the substations are said to be exacting and the success of the six automatic substations is significant. Thoroughgoing methods for the inspection and maintenance of these substations are described. The system of inspection is outlined, and the paper also includes general statistics as to the amount of traffic and power consumption as well as data on the operation of the automatic equipments.—*General Electric Review*, July, 1921.

Electrification of the French Railways.—Various methods of heavy electrification are discussed to determine which is most satisfactory for France, with the conclusion that all three (three-phase, single-phase and direct-current) systems should be tried.—London *Electrician*, July 1, 1921.

Installations, Systems and Appliances

Accumulators or Secondary Batteries.—A history and a description of storage batteries of various types are given, including interesting details of manufacture.—*Beama* (British Electrical and Allied Manufacturers' Association), July, 1921.

Draft Tubes for Hydro-Electric Plants.—E. VOETSCH. —A discussion of various types of draft tubes and a comparison of their efficiencies.—*Power*, Aug. 2, 1921.

Electric Furnace Heat Treatment.—E. F. COLLINS.—Abstract of paper before the American Drop Forge Association which considers heat-treating furnaces under two heads: (1) When used with dies and metal-cutting tools, and (2) when used with drop forgings. The author shows that in a large furnace the cost per pound of heating steel is 0.199 cent for electricity, or if oil is used 0.317 cent for fuel.—*Iron Age*, Aug. 4, 1921.

Electrophysics and Magnetism

Arc Rupture of Liquid Dielectrics.—C. J. RODMAN.—Non-inflammable or semi-inflammable liquids of comparatively high dielectric strength and which may act as a medium of low viscosity were subjected to high-frequency arcing beneath the liquid surface. The liquid dielectrics are apparently broken down by a temperature pressure of very short duration, rather than by the sympathetic vibration and rearrangement of the compounds by high frequency alone.—*Journal Franklin Institute*, July, 1921.

Calculation of Direct-Current Electromagnets.—E. GABOR.—Electromagnets, especially those used in railway signal work, have to conform to a great number of most exacting requirements. They have to operate, for example, with a certain minimum amount of torque to actuate safely the particular device, regardless of considerably varying voltage. Methods and formulas for the design of magnets for such service with the least amount of copper and bulk are given in this interesting paper, dealing with the best shape of the coil, the torque, the location of the fulcrum of the armature for maximum torque, and the influence of the size and shape of the pole piece upon the magnetic pull.—*Bulletin de l'Association Suisse des Electriciens*, January, 1921.

Electrochemistry and Batteries

Thermal, Electrical and Magnetic Properties of Alloys.—ALPHEUS W. SMITH.—Results and generalization for numerous alloys grouped according to their solubility in each other.—*Journal Franklin Institute*, July, 1921.

Electric Reduction of Iron Ores.—H. A. DE FRIES.—A discussion of the comparative costs of the shaft type and pit type electric furnaces and of the adaptability of these furnaces to local conditions.—*Chemical and Metallurgical Engineering*, Aug. 3, 1921.

Precipitation of Suspended Particles in Gases.—A description of the use in a number of industrial plants of the Cottrell process for precipitation.—*Electrical Review*, July 30, 1921.

Telegraphy, Telephony and Signals

Oscillations in Three Coupled Electric Circuits.—L. C. JACKSON.—Development of mathematical theory of oscillations in three coupled electric circuits, in which the equation is obtained and then solved for certain special cases.—*Philosophical Magazine*, July, 1921.

A Survey of Radio Telephony.—R. L. SMITH-ROSE.—In this survey the high-frequency alternator, radio telephony for aircraft, the choke-coil method of valve modulation and duplex radio telephony are treated. A description of an ingenious arrangement devised by Alexanderson for effecting modulation for maintaining the load on the high-frequency alternator is discussed. Diagrams for valve connections are given.—*Beama* (British Electrical and Allied Manufacturers' Association), July, 1921.

Scientific and Industrial Research

(PRINTED IN THE THIRD ISSUE OF EACH MONTH)

A Department Devoted to Reports of Investigations Contemplated or Completed, Research Facilities Available, and Suggestions for Co-operative Work.

Conducted by **PROF. VLADIMIR KARAPETOFF**
Cornell University, Ithaca, N. Y.

Research in Progress and Completed

[When investigations which have been completed are, in the opinion of the editors, of wide enough interest to the field we serve, details thereof will be presented in other parts of this paper. Contemplated research or that which appears to have limited appeal will be only briefly reported in this section, but details may be had by communicating with the investigator or institution named in the report. Readers are referred to the department "Digest of Electrical Literature" for investigations reported in other journals. The news and engineering sections should also be followed for research reported before technical societies.]

HUMAN BODY, ELECTRICAL RESISTANCE OF.

Use was made of four connections to the body. Two of these constituted a pair of current terminals, and the other two a pair of potential terminals. In order to obviate disturbing effects at the electrodes, an alternating current and a detector which responded to alternating current only were used. Very little current was taken through the potential connections. Using the left hand and the left foot as current terminals and the right hand and right foot as potential terminals, the resistance of the trunk was found to be on the average about 26 ohms.—*Bureau of Standards, Washington, D. C.*

WELDING, ARC, EXPERIMENTAL STEEL BOX.

A box, 12 ft. x 10 ft. x 9 ft. (3.6 m. x 3 m. x 2.7 m.), was made of ½-in. (1.25-cm.) tank steel, using eleven different varieties of welds. The welding was done with 75-volt direct current. The principal objects to be ascertained in the construction of this box were: (1) Could a structure of this character be made close to drawing dimensions and without excessive distortions and warping of plates and parts? (2) Would the structure be strong and capable of withstanding severe shocks and distortions without serious ruptures? (3) What are the detail costs and time required to build such a structure? For a detailed account of tests on this box see *A. I. E. E. Proceedings*, April, 1919, page 608.—*R. E. Wagner, Pittsfield, Mass.*

BELT TESTING BY ELECTRICAL MEANS.

A series of tests on leather belting is being carried on, and it has been found that electrical machinery affords the most convenient and satisfactory apparatus for power transmission tests. The principal advantage is due to the saving obtained by absorbing the power transmitted and returning it to the driving motor. Two electric dynamometers are used, one driving the other through the test belt, with the losses supplied by a separate generator. Because of having two dynamometers, instead of a dynamometer and an ordinary motor, the belt can be run in either direction, with the tight side above or below.—*R. F. Jones, Cornell University, Ithaca, N. Y.*

[This is an extensive series of tests carried on under the auspices of the Leather Belting Exchange Corporation, an association of belting manufacturers.—EDITORS.]

ALLOYS, NICKEL-IRON, PHYSICAL PROPERTIES OF.

A graded series of alloys were studied with nickel content varying from 1 to 90 per cent. The specific heats were determined by a Joly calorimeter and the thermal conductivity by the Gray method. The thermoelectric powers relative to pure copper and the electrical resistance as a function of temperature were determined by use of a potentiometer. For a complete report and curves of the results see the *Physical Review*, Vol. 16 (1920), page 126.—*L. R. Ingersoll, University of Wisconsin, Madison.*

SPRINGS, SEASONAL BREAKAGE OF.

It is a very common belief among jewelers that after thunder showers they must be prepared to replace an unusual number of mainsprings. This they ascribe to the effect of electricity in lightning. A study of some records which jewelers keep of their repairs was made and a very pronounced effect was found. The seasonal breakage is not, however, due to electricity or magnetism, but to moisture which starts rust in minute spots, either on the surface of the spring or in minute cracks, causing the skin of the steel to be weakened and the springs to let go. Oil on the surface of the springs prevents breakage when the springs are placed in a moist atmosphere.—*S. R. Williams, Oberlin, Ohio.*

ALUMINUM SOLDERS, TESTS ON.

A series of tests has been made on aluminum solders. In spite of the claims made by those interested, no solder for aluminum has yet been found which will withstand the corrosion tests, although fused zinc-chloride solders withstand corrosion for the greatest length of time.—*Bureau of Standards, Washington, D. C.*

TUNGSTEN, SPECIFIC HEAT OF.

A. G. Worthing of Nela Park Research Laboratory and the writer have made a study of the specific heat of tungsten at incandescent temperatures to see whether the atomic heat approached the theoretical value predicted by several physicists. It has been felt that with some changes in the method more accurate data would be obtained. (See *Physical Review*, August and November, 1918.) The specific heat of a filament is obtained from measurements with a variable current, and different results have been obtained for increasing currents from those reached with decreasing currents. Further research is under way to find more refined methods of measurement.—*P. F. Gaehr, Wells College, Aurora, N. Y.*

[Two money grants have been given in aid of this study, one by the American Association for the Advancement of Science and the other by the American Academy of Science.—EDITORS.]

STEEL, CORRELATION OF MAGNETIC AND PHYSICAL PROPERTIES OF.

A study is being made of the possible relations between the physical and magnetic properties of various kinds of steel, including the possibility of detecting imperfection of structure. A precision permeameter is used in the measurements.—*W. B. Kouwenhoven, Johns Hopkins University, Baltimore, Md.*

TELEPHONE RECEIVERS, RADIO, HIGH-FREQUENCY, IMPEDANCE OF.

The input impedance of an electron-tube detector, and thus the intensity of signals received, depends among other things upon the radio-frequency impedance of the load in the plate circuit, an important part of which may be the telephone receiver used. Measurements have therefore been made of the impedance of various commercial types of radio head sets using resonance methods. These measurements were made at frequencies of from 3,000 to 600,000 cycles, which, with the ordinary low-frequency bridge measurements, give the impedance over the entire range of frequencies at which receivers are used.—*Radio Laboratory, Bureau of Standards, Washington, D. C.*

WATT-HOUR METERS, EFFECT OF NON-SYMMETRICAL CURRENT WAVE UPON.

Studies are being made to determine the effect of non-symmetrical alternating current upon the accuracy of induction watt-hour meters. A meter is carefully adjusted and calibrated at unity power factor, and its behavior studied with a symmetrical emf. wave and non-symmetrical current wave obtained with a tungar tube.—*W. F. Davidson, University of Michigan, Ann Arbor.*

[There are some industrial loads in which the alternating current is partly rectified or made unsymmetrical; for example all loads involving an electric arc. The question of the accuracy of induction-type meters on such loads has been asked more than once by operating companies.—EDITORS.]

Suggestions for Research

CHAINS, TRANSMISSION, STRESSES IN.

Silent chains, such as Morse, Reynolds, "Link-Belt," etc., are extensively used for high-speed electric drives. A theory is desired of the mechanical stresses in such chains, the curve form of the slack side, the pressures on the bearings, etc. The theory must particularly take into account the fact that the linear speed is high.—*Editorial Suggestion.*

FANS, ELECTRIC, RATING OF.

At the present time an electric fan is sold on the basis of the diameter of the blades, watts input into the motor, and, in the case of one or two makers, on the basis of the air delivery in cubic feet per minute. A universal standard is desired according to which fans of different makes and types could be directly compared with regard to their useful air supply. The latter must be defined not only in terms of cubic feet of air per minute in front of the fan, but also in terms of the average velocity and cross-section of the moving air at some agreed distance from the face of the fan. The latter data are desirable because a poor shape of the blades is conceivable with which large amounts of air might be "churned" in the vicinity of the fan, without throwing them forward. Air velocities may be measured (a) with a Pitot tube, (b) with a small disk [illegible] by a torsion spring at right angles to the blast, and (c) with an electric anemometer (see Research Section of April 19 and Dec. 20, 1919). A thorough investigation of the actual air currents will undoubtedly lead to further improvements in the shape of the blades and their best velocities. Fan designers might benefit from the recent vast experience of the builders of airplane propellers.—*Editorial Suggestion.*

WELDING, ELECTRIC, SPOT TYPE.

The present spot welders make one weld (or at most two) at a time. A natural development would be a multiple-spot welder which could make several welds simultaneously to save time. A still further, though more remote, improvement would be a continuous lap or seam welder which could make an uninterrupted weld between two plates. Such a weld would be of distinct advantage in shipbuilding and for high-pressure tanks.—*Editorial Suggestion.*

THERMOMETERS, RECORDING.

Temperature indicators of thermocouple and electric resistance type are usually dependable when well designed and carefully installed. Fairly inexpensive ones can be made, but they are not sufficiently dependable. There is a need for a reliable and inexpensive automatic temperature recorder for use in a great many industrial power plants and heat-treating processes —*N. E. L. A. Prime Movers Committee.*

VENTILATION OF GENERATORS, CLOSED AIR CIRCUIT.

A system of generator ventilation by which the air is passed through cooling coils supplied with water and is used over and over again has been tried out in England. The advantages claimed are clean generators and less ability to sustain combustion on the occurrence of internal fires. Investigation is desired upon the effectiveness and economy of such a system and on the design of the cooling coils.

TELEPHONY, HIGH-FREQUENCY, ON POWER LINES

Further investigation is desired on methods of "wired wireless" types of telephone communication over power lines. In a European installation with over 135 km. of power line an audion generator excites an aërial inductively coupled to the power line by suspension from the poles carrying it. Reception is effected either by an audion or by an ordinary crystal detector, the signals being of sufficient intensity to give a receiving intensity of 5 ohms (in parallel with a 1,000-ohm telephone), with 20 watts sending power. Both transmitting and receiving aërials are of the split-earth type, each being differently tuned. This kind of communication is being considered by some of the power companies in this country.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

Revised Revenue Bill Provides for Tax Reductions

AT A CAUCUS of Republican members of the House of Representatives Monday afternoon several vital hanges in the revenue bill were ordered. These were mbodied in a report submitted by the majority of the vays and means committee and call for a cut of almost alf a billion dollars in federal taxes. The salient eatures of the bill of interest to the electrical industry ollow: Repeal of excess profits tax, effective Jan. 1, 922; repeal of surtax rates in excess of 32 per cent, ffective Jan. 1, 1922; repeal of all taxes on freight, assengers, seats and berths; increase in income tax n corporations from 10 to 12½ per cent, effective Jan. , 1922; repeal of tax on electric fans; tax retained on elegraph, telephone and radio messages; permission to educt reserve for bad debts, and a tax of 25 per cent n addition to other corporation taxes aimed at corporations, however created or organized, which are ormed or availed of for the purpose of preventing the mposition of the surtax upon their stockholders or members through the medium of permitting their gains and rofits to accumulate instead of being divided or distributed. Provision is made for a 5 per cent tax on ortable light fixtures, including lamps of all kinds and amp shades if sold for more than $10.

President McClellan Announces Committee Appointments

AT THE first meeting of the board of directors of the American Institute of Electrical Engineers for he administrative year beginning Aug. 1, 1921, held n New York on Tuesday of this week, President McClellan announced the committee appointments. The ew chairmen will be:

Standing Committees.—Board of examiners, H. H. Norris, New York; code of principles of professional conduct, Comort A. Adams, Cambridge, Mass.; co-ordination of Institute ctivities, W. I. Slichter, New York; executive, William McClellan, Philadelphia; finance, L. F. Morehouse, New York; headquarters, W. A. Del Mar, Yonkers, N. Y.; law, H. Barnes, Jr., New York; meetings and papers, E. E. F. Creighton, Schenectady, N. Y.; membership, E. H. Martinale, Cleveland; publication, A. S. McAllister, New York; ublic policy, H. W. Buck, New York; research, F. B. Jewtt, New York; safety codes, H. B. Gear, Chicago; sections, ohn B. Fisken, Spokane; student branches, C. F. Harding, Lafayette, Ind.

Technical Committees.—Educational, C. E. Magnusson, Seattle; electrical machinery, B. A. Behrend, Boston; electrochemistry and electrometallurgy, Carl Hering, Philadelphia; electrophysics, F. W. Peek, Jr., Pittsfield, Mass.; ndustrial and domestic power, W. C. Yates, Schenectady, N. Y.; instruments and measurements, F. V. Magalhaes, New York; iron and steel industry, E. S. Jeffries, Hamilton, Ont.; lighting and illumination, C. E. Clewell, Philadelphia; narine, Arthur Parker, Camden, N. J.; mines, Graham Bright, Pittsburgh; power stations, H. P. Liversidge, Philadelphia; protective devices, H. R. Woodrow, New York; telegraphy and telephony, Donald McNicol, Roselle Park, N. J.; transmission and distribution, Edward B. Meyer, Newark, N. J.

In accordance with the by-laws of the Edison medal committee, the board of directors confirmed the appointment by President McClellan of new members of the Edison medal committee as follows: B. A. Behrend, Boston; John H. Finney, Washington, and C. S. Ruffner, Amsterdam, N. Y.—for terms of five years each. The board also elected three of its membership as members of the Edison medal committee for terms of two years each, namely, A. W. Berresford, Milwaukee; L. F. Morehouse, New York, and R. B. Williamson, Milwaukee.

Shutdown of Springfield (Ill.) Utility Service Averted

TOTAL shutdown of the light and power service at Springfield, Ill., was threatened this week at the expiration of the franchise of the Springfield Gas & Electric Company. The franchise expired on Aug. 15, and as the result of failure of the city to provide the necessary funds to carry out the arrangements made last spring for taking over the properties it seemed that the company would carry out its expressed intention of abandoning its light and power service. On Friday of last week, however, an ordinance extending the franchises of the company for twenty years was introduced and the City Council officially declared its intention of not interfering with the operations of the utility until final action on the franchise extension could be taken. The ordinance must lie over for a week before the Council can act on it and then cannot be submitted to the voters for twenty days. In the meantime the company is operating without franchise. Final action cannot be taken until some time in September, and then only if the Council acts promptly on the measure now before it.

Bonding of Electrical Contractors Is Required by Topeka Ordinance

AN ELECTRICAL ordinance passed by the city fathers of Topeka, Kan., on Aug. 9, requires a five-thousand-dollar bond for all electrical contractors and dealers in electrical supplies. It eliminates the license fee of $100 heretofore paid by such dealers and gives the city electrical inspector power to condemn electrical supplies and electric wiring that does not conform to the national electrical code. Mistakes and defects in wiring are penalized by shutting off the supply of electricity. A board of managers in electrical matters is provided in the ordinance, to include one journeyman electrician, one master electrician and the city electrical inspector. Violation of any provisions of the ordinance means a fine of from $5 to $50.

Hydro Radial Scheme Gets Severe Jolt

AN ADVERSE report on the project for constructing and operating a number of electric railways by the Hydro-Electric Power Commission of Ontario through an issue of bonds guaranteed by the provincial government has been made by the commission appointed by that government to investigate the matter—the commission condemning the scheme as "unwise and economically unsound." The estimates upon which the Beck project was based are found to have been prepared by inexperienced men, this applying both to construction costs and traffic expectations. The people of Ontario are reminded that their debt is mounting and are advised to wait for results from the elaborate system of highways before assuming further heavy obligations.

The reasons cited are as follows:

> The financial condition of the electric railways in Ontario and in the United States has been precarious and unsatisfactory and the outlook discouraging. The evidence submitted indicates that the proposed electric railways would not be self-supporting. Their construction, paralleling and competing with the Canadian National Railways system, would be economically unsound and a serious blow to the success of government ownership. Until the Chippawa power scheme, estimated to cost $60,000,000 or upward, is completed and shown to be self-supporting, the government would not be justified in indorsing the construction of an electric railway system at an initial estimated cost of $45,000,000. The indorsement of bonds by the province for systems of electric railways at the instance of the municipalities concerned is held highly dangerous and likely to lead the province into great financial difficulties, as it would give rise to demands for like accommodation from other localities which it would be hard to refuse. The expenditure of $25,000,000 on public highways in the province having been begun, it would be unwise to commence the construction of electric railways until the effect of highway improvement has been ascertained and the use of them by motor cars and trucks made clearly apparent. The rapidly increasing debts and financial commitments of the Dominion, province and municipalities have aroused well-founded apprehension and are a cogent reason against the embarkation in the construction of the contemplated electric railways.

The report is signed by four of five members of the commission—Judge Sutherland, the chairman; General C. H. Mitchell, W. A. Amos and A. F. Macallum, C. E. The minority report, by Frederick Bancroft, labor representative, controverts most of the conclusions arrived at in the majority report, recommending that the government should adopt the principle of publicly owned and operated electric railways. He states that employment conditions should be taken seriously into account and that the hydro-radial development would bring considerable relief.

City of Boston Sues Edison Company on Account of Coal Clause

SUIT has been filed against the Edison Electric Illuminating Company of Boston by Corporation Counsel Hill of that city to recover $90,000 collected by the company in connection with the supply of energy to the municipality. The city contends that the coal clause and 10 per cent additional charge in effect at various times since September, 1917, are illegal. Corporation Counsel Hill asserts that the Massachusetts Department of Public Utilities, which is investigating the company's rates in a pending case brought by the city, can determine the future of the rates objected to, but that the courts must settle the disposition of moneys collected hitherto.

Preparations to Promote Electrical Export Trade

PLANS for the new commodity division of the Bureau of Foreign and Domestic Commerce dealing with export problems in electrical goods of all kinds are being worked out. The announcement of the appointment of R. A. Lundquist, an electrical engineer of Minneapolis, as chief of the division has been made. Mr. Lundquist has been investigating foreign markets for electrical goods for the bureau during the past five years.

The electrical division is one of the commodity divisions authorized recently by Congress at the personal request of Secretary of Commerce Hoover. Congress appropriated $250,000 for that purpose. It is expected that twelve or more divisions will be formed in an effort to assist the leading export industries to extend their foreign trade. The details of the organization of the individual divisions have not yet been worked out.

Important Merger of Utilities in Indiana

PROPOSED consolidation of seven Indiana electric light and power companies into the Indiana Electric Corporation, for which authority is asked in a petition filed with the Indiana Public Service Commission, will be thoroughly investigated by the commission at a public hearing, according to Chairman John W. McCardle. Articles of incorporation with a nominal capital of $10,000 have been filed in the office of the Secretary of State. It is understood that the corporation intends to conduct its affairs under this capitalization pending action of the Public Service Commission on its petition to complete the merger plan.

The companies concerned operate in a score of counties and have total property holdings valued at $18,250,000. They are the Merchants' Heat & Light Company of Indianapolis, the Indiana Railways & Light Company of Kokomo, the Elkhart Gas & Fuel Company, the Valparaiso Lighting Company, the Wabash Valley Electric Company of Clinton, the Putnam Electric Company of Greencastle and the Cayuga Electric Company.

It is the ultimate intention of the men backing the enterprise to build a great power house on the Wabash River in Vigo County, probably north of Terre Haute at an expenditure of several millions of dollars, and to connect it with a system of transmission wires which will deliver electrical energy from the Indiana coal fields to many parts of the state. A triangular transmission line 300 miles long would distribute the energy, one line extending from the central plant to Kokomo, another to Indianapolis and the third from Kokomo to Indianapolis. The theory back of the plan is that of generating electricity in the heart of the coal fields and transmitting it by wire to remote sections of the state. Arguments in favor of such a system are that the small community would have the advantages of electric service from a superpower station manufacturing its energy with coal purchased without high freight rates. It is contended that the transmission of energy by wire is much cheaper than hauling coal across the state to rural communities.

The incorporators of the Indiana Electric Corporation are Joseph H. Brewer of Grand Rapids, Mich. president of the Merchants' Heat & Light Company Charles O'Brien Murphy, vice-president and genera manager of the same company; Paul D. Birdsall, its secretary; Lex J. Kirkpatrick of Kokomo, vice-president of the Indiana Railways & Light Company, and Marshall V. Robb of Clinton, secretary of the Wabash Valley Electric Company. Mr. Brewer is president of the board of directors. Mr. Murphy is vice-president and treasurer, Mr. Kirkpatrick is a vice-president, and Mr. Birdsall is secretary. The plan of financing embraces the acquisition of the various properties by issuing $4,000,000 in common stock and $1,850,000 in 8 per cent preferred stock, $3,250,000 in 7.5 per cent fifteen-year first and refunding bonds, $2,250,000 in 7.5 per cent serial bonds maturing within fifteen years and $750,000 in one-year 8 per cent notes.

Analysis of Henry Ford's Muscle Shoals Offer

SINCE the publication of Henry Ford's offer for the government hydro-electric, steam and nitrate plants at Muscle Shoals, Ala., contained in his letter of July 8 to General Lansing H. Beach, chief of engineers, U. S. A., there has been a widespread and growing interest in the matter. Letters continue to pour into Washington to senators and representatives insisting that the government complete the project. Others are equally insistent that a policy of retrenchment and economy shall prevail. Senator Underwood, in whose state the projects are located, maintains that the operation of the Muscle Shoals plants by the government is the only way in which the public will receive the maximum benefit from this natural resource. Meanwhile, the War Department continues to ponder over Mr. Ford's offer and several others submitted to it in response to the request of the chief of engineers, with no indication of when a decision will be reached.

An engineer familiar with the power situation in the South and thoroughly conversant with all the government work at Muscle Shoals, Ala., when asked for an opinion of the Ford offer by the ELECTRICAL WORLD, said: "Mr. Ford proposes that Dam No. 2 (the Wilson Dam) shall be completed with an installation of 600,000 hp. at the expense of the government and turned over to him as soon as the initial 100,000 hp. is installed under a hundred-year lease agreement, renewable in perpetuity. The estimated cost to complete this work, as shown by official estimates, is $33,000,000, in addition to the $17,000,000 already spent, or a total of $50,000,000. For the use of this property Mr. Ford proposes to pay 6 per cent on $20,000,000 or $33 per horsepower installed—less than half the total cost—leaving the taxpayers to pay the interest on the remainder. Mr. Ford's proposed interest payment amounts to $2 per horsepower of installed capacity per year.

"Mr. Ford also proposes that the United States build Dam No. 3 with an installed capacity of 250,000 hp. and turn it over to him upon completion, under a hundred-year lease agreement renewable in perpetuity. This project is an entirely new one situated 17 miles above Dam No. 2, around which most of the discussion has centered. According to the government reports, this new dam would be about 6,300 ft. long (nearly one and a quarter miles long and 1,500 ft. longer than dam No. 2) and 50 ft. high, making available an effective head of 40 ft. on the turbines. No work has been done on the project and no property rights have been acquired by the government.

"The foundations of this dam have been questioned by expert geologists who passed favorably on the foundations of Dam No. 2. Approximately 30,000 acres of the finest bottom land in the Tennessee Valley in northern Alabama would be flooded out or damaged by this development. The cost of this dam and power plant, completed, as required by the Ford proposal, has been variously estimated under present-day costs at from $25,000,000 to $35,000,000, and for the use of this property Mr. Ford proposes to pay the government 6 per cent on $8,000,000—one-third to one-fourth of the total cost, and equivalent to $32 per horsepower of installed capacity and $1.92 per horsepower-year.

"Since both power plants will belong to the United States, Mr. Ford taking a lease on them, he would never have to pay any taxes or licenses of any character—a manifest injustice to and discrimination against other companies engaged in selling power to the public which have to pay state, county and city taxes and licenses.

"To those who must finance projects costing $200 and more per installed horsepower with existing interest rates averaging around 12 per cent or $24 per horsepower-year these figures will be amazing, and to the independent manufacturer who is endeavoring to meet competition without government assistance such figures are appalling. If the government enters into this arrangement, it will amount to a subsidy to Mr. Ford and his industries amounting to millions of dollars annually.

"Even the above interest charges do not apply during the early years of operation, for Mr. Ford will be virtually exempt from interest charges for the first five years of operation of Dam No. 2, paying only $200,000 per year and $160,000 per year for the first three years of operation of Dam No. 3, and in addition would pay absolutely no interest during the four-year construction period preceding the beginning of the lease. This exemption would be equivalent to another subsidy, as the rule of business is that interest on money shall begin with the day on which investment is made.

"Mr. Ford agrees to pay to the United States $55,000 annually for the repairs, maintenance and operation of the dams and the locks and gates of both dams. All repairs, maintenance and operation of same are left under the direction, care and responsibility of the United States. The amount allowed to the government for this purpose is grossly inadequate, and a large amount of government money will have to be provided annually for this purpose. The maintenance of about $3,000,000 worth of metal work in crest gates, lock gates, etc., would cost alone over $150,000 per year, or approximately three times as much as the entire allowance under this proposal for all repairs and maintenance.

"Mr. Ford's proposal is based upon two leases of 100 years duration, one for each of the two government dams. Each lease is to be automatically renewed at the end of its period. No provision is included for regulation of the selling price of products of the Ford company, and no license fees are to be paid. It in no sense conforms to the federal water-power act, which has many provisions to safeguard the public and requires all licenses on navigable streams to run for periods of not over fifty years."

OTHER PROPERTY ACQUIRED

In addition to the acquisition of the water-power plants on the terms given, Mr. Ford in his offer of July 8 proposes to acquire for the sum of $5,000,000 various nitrate plants, steam plants, transmission lines, substations, quarries and patents which have cost the government to date $87,346,897. On investigation the ELECTRICAL WORLD finds these to be as follows:

Nitrate Plants.—Nitrate Plant No. 1 embraces about seventy acres of land just outside the town of Sheffield and on the lines of both the Louisville & Nashville and the Southern Railroad as well as the local street railway. In addition to the power plant and process buildings, it comprises about twenty-five houses for general administrative purposes, employees' homes, etc., several miles of railroad siding and streets and recreation grounds. Its calculated capacity was 60,000 pounds of ammonia per day or 10,000 tons annually.

Nitrate Plant No. 2 is located on a bluff on the south bank of the Tennessee River and three miles east of Sheffield. The reservation is rectangular in shape with a river frontage of 10,900 ft. and a north and south depth of 9,200 ft., and it covers 2,200 acres. As at present completed, it constitutes the foundation of a splendid industrial plant capable with a few modifications of turning out other products and commodities than fertilizer.

The plant comprises more than seventy-five process buildings and a total of 2,400 structures including employees' quarters and houses. The reservation includes housing for a permanent town of 12,000 people with a filtration plant capable of serving 20,000 persons, a 65,000,000-gal. storage reservoir and settling tank, a sewage system, 19 miles of permanent roadway, 4 miles of trolley line and many miles of railroad siding.

The lime-burning plant includes several kilns, each capable of handling 200 tons of raw stone per day and producing 100 tons of burned lime. Used as a cement plant for which all necessary auxiliaries are available, the plant could produce 4,000 barrels of Portland cement per day, and, furthermore, with the raw materials and power at hand, this is an admirable location for such an industry.

The carbide department is complete in all details and can produce a daily output of 500 tons.

STEAM PLANTS, TRANSMISSION LINES, SUBSTATIONS, ETC.

Steam Plants.—(a) The steam plant at Nitrate Plant No. 1, which is up to date, has an installed generating capacity of 5,000 kw. and is equipped with all modern equipment such as underfeed mechanical stokers, condensers, cooling ponds, etc.

(b) The steam plant at Nitrate Plant No. 2, with a capacity of 60,000 kw. in one high-efficiency unit, is, on account of its size, even more completely equipped than the No. 1 plant. The manufacturers have estimated that this plant may be operated with a lower coal consumption than any other plant in the world.

(c) The extension of the Warrior Reserve steam plant at Gorgas, with an installed capacity of one 30,000-kw. steam-turbine generating unit and twelve 1,200-hp. boilers, with all auxiliaries, is located in the heart of the Black Warrior coal fields, on the banks of the Warrior River, with ample condensing water and coal-handling facilities.

This last-named plant and that at Nitrate Plant No. 2 are the largest and most complete steam plants in the South, and all three plants are of permanent character, designed and built for many years' service, and are in distinct contrast with the temporary types of construction as employed in cantonments and other war buildings.

Transmission Lines.—The 110,000-volt, 30,000-kw. transmission line, 90 miles in length, connects the steam plant at Gorgas with Nitrate Plant No. 2. This line is fitted with the latest type of insulation and is paralleled by a private telephone line. Patrolmen's houses are located at several points along the line.

Substations.—The substations are at each end of the Gorgas-Nitrate Plant No. 2 transmission line. In them are installed two banks of three 6,666-kva., 110,000-volt to 13,200-volt water-cooled transformers together with high-tension oil switches, lightning arresters and control apparatus. Each substation has a rated capacity of 40,000 kva.

Waco Quarry.—This quarry is near Russellville on a branch of the Southern Railway and is served by the Gorgas-Nitrate Plant No. 2 transmission line. An ample supply of limestone may be secured from this quarry, and the government has already expended several hundred thousand dollars in the development to provide sidings, quarry tracks, quarrying and pumping machinery, etc.

Patents, Processes, Methods and Designs.—In connection with the two nitrate plants the government acquired as licensee the right to use various patents, rights and privileges in manufacturing nitrates for war purposes. An exact tabulation of these rights and their value is from their very nature difficult, but their value i estimated in millions.

RESULT TO TAXPAYERS

Thus it would appear that Mr. Ford, by paying to the government $5,000,000 for property which cost the government more than $87,000,000 and annual interes and sinking fund payments eventually equivalent to $2 per horsepower of installed capacity, proposes to acquire perpetual control of all the natural resources at Muscle Shoals, plus the property placed there by the government, at a total cost to the government, with the new money the offer calls for, of $162,346,897. In addition Mr. Ford would receive perpetual exemption from stat and federal taxes and license fees on the water-powe properties which all other developers of hydro-electri power must pay. Far from relieving the government o financial burdens, it is claimed, the plan would plunge i into new expenditures of many millions of dollars. I holds out a specious promise of cheap fertilizer which examination proves to be no promise at all, and it offer the government little or nothing though exacting much

Formally presented at the outset by skillfully worde statements and headlines in the newspapers, and supported by a campaign of propaganda for which, it i claimed, funds have been openly solicited and collecte in the South, Mr. Ford's offer has undoubtedly receiv favorable public attention, unjustified by the fact Fortunately the War Department officials charged wit responsibility in the matter are not affected by suc propaganda and are analyzing the proposal in detai They will no doubt not enter on any program until th final cost can be reasonably ascertained.

Executive Committee of Southwestern N. E. L. A. Holds Meeting

A MEETING of the executive committee of th Southwestern Geographic Division, N. E. L. A., wa called at New Orleans for Aug. 19 and 20 to outline th work of the division for the coming year. The divisi embraces the states of Arkansas, Louisiana, Mississipp

Oklahoma and Texas. The movement to hold sectional atherings of the division periodically, where subjects f special interest to those engaged in the industry can be discussed and an interchange of views on financial, dvertising and other matters may take place, is said to be gaining support in this territory. W. E. Clements f the New Orleans Railway & Light Company had harge of the arrangements for the executive committee meeting this week.

Great Lakes Division, N. E. L. A., Changes Date of Convention

THE date for the annual convention of the Great Lakes Division of the National Electric Light Association at French Lick Springs, Ind., has been hanged from Sept. 14, 15 and 16 to Sept. 21, 22 and 23. The meeting will be held in conjunction with that of he Indiana Electric Light Association. The program has been only partly arranged and tentatively includes an address by Milan R. Bump, president National Electric Light Association; a paper on "Contract Routine" by R. T. Duncan, Detroit Edison Company; an address on "The Analysis of Kilowatts Sold for Residence Use" by George Neal, a report on "Electric Vehicle Progress" by L. T. Carpenter, Commonwealth Edison Company, and a talk on "The Illinois Committee on Public Utility Information and Its Future Plans" by B. J. Mullaney. It is probable also that Martin J. Insull, past-president of the National Electric Light Association, and John F. Gilchrist, vice-president Commonwealth Edison Company, will address the meeting on subjects not yet announced.

President Bump Completes N. E. L. A. Committee Appointments

IN ADDITION to appointments of committee chairmen already announced, President Milan R. Bump of the National Electric Light Association has made the following appointments of chairmen of special national committees: National counselor to the United States Chamber of Commerce and national representative upon the National Industrial Conference Board, John W. Lieb, New York Edison Company; finance committee, Joseph B. McCall, Philadelphia Electric Company; water-power development, Franklin T. Griffith, Portland (Ore.) Railway, Light & Power Company, electrical resources of the nation, M. S. Sloan, Brooklyn (N. Y.) Edison Company; lamps, Frank W. Smith, United Electric Light & Power Company, New York; wiring, R. S. Hale, Edison Electric Illuminating Company of Boston; insurance, S. E. Wolff, Hodenpyl, Hardy & Company, New York; constitution and bylaws, W. C. L. Eglin, Philadelphia Electric Company; Doherty and Billings prizes, A. S. Loizeaux, Consolidated Gas, Electric Light & Power Company, Baltimore.

The following have been appointed by President Bump as chairmen of general national committees: Accident prevention, Charles B. Scott, Bureau of Safety, Chicago; company employees' organizations, R. B. Grove, United Electric Light & Power Company, New York; membership, Walter Neumuller, New York Edison Company.

The second meeting of the national executive committee, including the chairmen of committees named above, will be held at national headquarters Thursday, Sept. 1, to consider the N. E. L. A. program for the year and to take up important matters including the approval of budgets for divisional, sectional, committee and headquarters' activities.

Women to Participate in Public Relations Section Work

A FEATURE of the work of the Public Relations Section of the N. E. L. A. during the coming year will be the educational work to be carried on with the assistance of the women of the industry and other women, as shown by the appointment of a woman's committee on public information, which has just been announced by Chairman Martin J. Insull of that section. This committee will be headed by Miss S. M. Sheridan, Detroit Edison Company, the other members being Miss B. H. Lowerie, H. L. Doherty & Company, New York City; Miss O. A. Bursiel, Boston; Miss C. H. Zillerson, Philadelphia Electric Company, and Miss R. E. McKee, Middle West Utilities Company, Chicago.

Two other new committees are included in the organization of the Public Relations National Section. These are a committee on employee relations with the public and a committee on public speaking. Their chairmen will be H. C. Blackwell, Kansas City (Mo.) Power & Light Company, and H. C. Couch, Pine Bluff (Ark.) Company.

Howard T. Sands of Charles H. Tenney & Company, Boston, has been appointed chairman of the committee on state organization of public utility information; W. W. Freeman, Union Gas & Electric Company, Cincinnati, of the committee on uniformity of state regulatory laws; M. S. Sloan, Brooklyn (N. Y.) Edison Company, of the committee on relations with bankers; F. R. Coates, Toledo Railways & Light Company, of the committee on upholding the industry, and P. L. Thomson, Western Electric Company, of the manufacturers' advertising committee.

Michigan Electric Light Association Arranges Program

THE tentative program arranged for the annual convention of the Michigan Electric Light Association, to be held at the Hotel Ottawa, Ottawa Beach, Mich., on Tuesday, Wednesday and Thursday of next week, Aug. 23 to Aug. 25, includes an exhibition on the opening day of a publicity motion picture prepared by the National Electric Light Association. On Wednesday there will be addresses by George E. Lewis, president of the association; Milan R. Bump, president of the N. E. L. A.; M. H. Aylesworth, executive manager of the N. E. L. A., and W. L. Goodwin, representing the Society for Electrical Development. At the banquet in the evening Alex Dow, president Detroit Edison Company, will speak.

On Thursday there will be reports from the committee on public information, of which H. H. Tinkham is director; the committee on overhead lines, E. Holcomb chairman, and the committee on safe wiring, J. C. Langdell chairman. James V. Oxtoby of the Detroit bar and W. W. Potter, chairman of the Michigan Public Utilities Commission, will speak. Entertainment features of the convention include dancing and tournaments at golf and cards.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Municipal Light Plant Makes Good Showing.—The city of Tacoma's municipal lighting plant made a net profit of $342,979 for the first half of 1921, according to an official report published recently. For the three years 1918 to 1921 inclusive the annual net profits have averaged over $450,000.

Spectacular Lighting Effects for Electrical Show.—New York City, according to the *Edison Monthly*, will be treated to something new in spectacular lighting effects when its electrical show opens in the Seventy-first Regiment Armory on Sept. 28. Illuminating engineers are working on plans to flood the tall tower of the armory with light. The scheme will, it is said, probably combine features of outline illumination and floodlighting with the jewel effects which were developed for the Panama-Pacific Exposition. A battery of searchlamps which will send rays to all parts of the city will top the display.

The Cobbler's Child at Last Gets Shod.—Although only a few miles from Niagara Falls, the village of Queenston, Ontario, was not served with electric power until this summer, when a new "Hydro" distributing line was placed in operation. Sixty villagers, says the *Canadian Engineer*, have now at last put away their oil lamps and purchased tungsten bulbs. Power lines have radiated in many directions from the Falls for many years, carrying power to communities hundreds of miles away, but it happens that Queenston is not in the direct path of any of these lines, and it was not until last winter that the village authorities issued debentures to pay the cost of building a transmission line from Niagara.

Chicago Utility Development Portrayed in Booklet.—A graphic portrayal of the development of public utilities in Chicago since 1849 is given in a booklet just published for the Chicago Publicity Club by the Illinois Committee on Public Utility Information. The publication is designed for distribution to all Chicago users of public utilities, which includes virtually the entire population of the city, and plans are under way to make the distribution even wider. The pamphlet gives historical and other data on the electric light and power companies of Chicago, the elevated railroads, the surface lines, the telephone and the gas industry. It draws a sharp contrast between present conditions and those when local utilities were small or did not exist at all. The publication is in line with other activities of the committee.

Byllesby Sales of Stock to Customers Increase.—Despite prevailing financial and industrial conditions, says the *Byllesby Monthly News*, the Byllesby utility companies, pioneers in the customer-ownership movement, have had no difficulty beating the preferred-stock sales record of the first half of last year. Gross sales reported for the first six months of 1921 aggregated $3,877,000 par value, distributed in 7,220 separate transactions. This is an increase of 20 per cent in the volume of securities sold. In June there was the usual seasonal decline in sales, but at the same time upward of $500,000 of preferred stock was placed with the customers of the companies.

Driverless Automobile Controlled by Radio.—Hundreds of people hurrying to work in Dayton, Ohio, one morning recently stopped in amazement as they saw an oddly shaped driverless car about 8 ft. long wend its way through the business section. What they saw, reports a New York *Times* correspondent, was the first radio-controlled car. In the experiment, conducted by Captain R. E. Vaughn of McCook Field, the car was guided through the traffic by a radio apparatus, attached to an automobile, following 50 ft. behind it and operated by Vaughn. As the car approached street intersections traffic signals were observed, and the horn was blown if some pedestrian or other obstacle got in the way.

Detroit May Procure Power from Ontario Hydro System.—Mayor Cousins of Detroit is quoted in the daily press as asserting that, following a conference with Sir Adam Beck, chairman of the Ontario Hydro-Electric Power Commission, a draft contract between the city of Detroit and the commission for the supply of hydro-electric power from Niagara would be drawn up for submission to the Detroit City Council. The initial supply, the report says, will be about 60,000 hp. Eventually a new transmission line will have to be constructed. Mayor Cousins is said to expect that the city will not only be able to operate new municipally owned street railway lines with this power but to light its streets as well.

Utah Case to Go to Supreme Court.—An appeal to the United States Supreme Court has been taken by some of the customers involved in the "special contract" case, wherein the Public Utilities Commission of Utah decided some time ago that a number of the special contracts of large power customers of the Utah Power & Light Company were discriminatory and ordered them placed on standard schedules. The appeal is taken to obtain final decision as to the right of the Public Utilities Commission of Utah, under the law of Utah and the federal constitution, to change the rates fixed in the contracts, the contention of the appellants being that the contracts were signed before the utilities act of the state went into effect and that the commission had no power to alter them. The commission assumed the power to change the rates as the result of a long hearing, and its decision was sustained by the Supreme Court of Utah.

Power Surcharge Rate Investigation.—The Board of Public Utility Commissioners of New Jersey has inaugurated a series of hearings to investigate the 25 per cent power surcharge of the Public Service Electric Company. The inquiry has a unique feature in that it will include only 240 customers of the company, or the wholesale power users on the system. In 1919 about 80 per cent of these users urged the commission to continue the surcharge.

Associations and Societies

Northwest Association Chairmen.—At a meeting of the executive committee of the Northwest Electric Light & Power Association held in Portland, Ore., chairmen of the four association sections were chosen as follows: Accounting Section, J. S. Simpson, Spokane; Commercial Section, A. C. McMicken, Portland; Public Relations Section, W. H. McGrath, Seattle; Technical Section, Markham Cheever, Salt Lake City. Boise, Idaho, was selected for the convention of June, 1922.

N. E. L. A., Iowa Section.—This section has elected the following officers for 1921-22: President, S. C. Dows, Iowa Railway & Light Company, Cedar Rapids; vice-presidents, C. N. Chubb, People's Light Company, Davenport, and C. A. Sears, Mississippi River Power Company, Keokuk; secretary-treasurer, M. G. Linn, Des Moines Electric Company. F. J. Hanlon, O. H. Simonds, F. H. Brooks, C. S. Macy, A. W. Jones, H. Bellamy, E. F. Bulmahn, W. J. Bertke, Don Sterns, Chris Miller and John A. Reed from the executive committee.

Coming Meetings of Electrical and Other Technical Societies

Michigan Electric Light Association—Ottawa Beach, Mich., Aug. [illegible] (For program see "News of the Industry".)

N. E. L. A., New England Division—New London, Conn., Sept. 6-9.

International Association of Municipal Electricians—Colorado Springs, Col., Sept. [illegible]

Pennsylvania Electric Association—Bedford Springs, Pa., Sept. 7-10.

N. E. L. A., Nebraska Section—Omaha Sept. 14 and 15.

N. E. L. A., Great Lakes Division, and Indiana Electric Light Association—French Lick Springs, Sept. [illegible] (For program see "News of the Industry.")

Association of Iron and Steel Electrical Engineers—Chicago, Sept. [illegible]

N. E. L. A. Rocky Mountain Division, and Colorado Electric Light, Power and Railway Association—Glenwood Springs, Sept. 19-21.

West Virginia-Kentucky Association of Mine, Mechanical and Electrical Engineers—Huntington, W. Va., Sept. [illegible]

Illuminating Engineering Society—Rochester, N. Y., Sept. 26-29. (For program see issue of Aug. [illegible], page [illegible].)

American Electrochemical Society—Lake Placid Club, N. Y., Sept. 29-Oct. 1.

American Electric Railway Association—Atlantic City, N. J., Oct. 3-7.

Empire State Gas and Electric Association—Lake Placid, N. Y., Oct. 6 and 7.

N. E. L. A., Southeastern Section—Chattanooga, Tenn., Oct. 18-20.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities

Examination of Utility's Books.—The cities of Elkhart, Ligonier, Mishawaka and South Bend and large power users established therein having applied to the Indiana Public Service Commission for an order granting authority to examine the books and property of the Indiana & Michigan Electric Company, the commission denied the application, asserting that it had no jurisdiction to make such an order, except in the case of an agent on its own staff.

Reproduction Cost During 1919-1921 Not Reasonable Rate Base.—"The commission does not hesitate to state," declared the California Railroad Commission recently in its Southern California Edison rate hearings, "that reproduction cost new, or reproduction cost depreciated, based upon price conditions existing during 1919, 1920 and 1921 is not a reasonable basis for rate-fixing purposes, except in so far as it applies to those portions of the properties that were of necessity constructed during the period of high prices."

Inductive Interference.—In handing down its decision in what is known as the Homer inductive interference case (see ELECTRICAL WORLD, July 9, page 84), the Illinois Public Utilities Commission made this succinct statement of the legal issue involved: "The law is clear that public utility companies exercising similar franchises, such as companies operating transmission, telephone and telegraph lines, have equal rights in the highways, and that priority of occupancy by one company does not give to that company the right to exclude other such companies from occupying the highway. Prior occupancy may perhaps give the prior occupant a right superior in some respects to that of a later comer. This superior right, however, is limited to protection from interference substantial in character."

What Is a Just Mean Between Two-Year and Ten-Year Averages in Fixing Value?—In placing a valuation of $585,835 on the electric property and $469,252 on the gas property of the Superior Water, Light & Power Company, which the city of Superior is acquiring in condemnation proceedings, the Wisconsin Railroad Commission thus explained how it arrived at these figures, which are nearly 40 per cent under those of the company's engineers: "The company relies upon the two-year average figures and upon the unit costs of 1920. These are so far out of line with unit prices which formerly prevailed and so far removed from actual investment costs that, in our opinion, they should not be given the controlling influence which the company seeks for them. They may, perhaps, be wholly out of line with prevailing prices in the not far distant future. They represent a temporary and sporadic condition. They would place the purchasers of this property under such heavy burden of investment as to be wholly unreasonable. They represent a figure which, in our opinion, could not be secured from a willing purchaser capable of negotiating with the company were the company seeking a fair purchase price for its property. The reproduction cost estimate on the ten-year average basis ended April 1, 1919, of the commission engineers represents, on the whole, some inclination to the pre-war level and includes some low-level years. We believe, therefore, that a level of unit prices somewhat higher than shown by this ten-year average is justified. The city has furnished us no estimates of reproduction cost, the company only with the reproduction estimates already referred to. There is no five-year average in evidence. A five-year average ending with the year 1919 would contain four years which clearly represented the war-inflated values and only one year, namely, 1915, approaching a pre-war level. We think this would represent a somewhat higher level than should be accepted. We have made sufficient investigation of the unit costs through our staff to arrive at the conclusion that such five-year average would not be far from a reproduction cost new of $1,398,000 and a reproduction cost, less depreciation, of about $1,060,000, omitting materials and supplies. But for the reasons already expressed, and taking all things into consideration, we are inclined to consider these figures as somewhat high as final basis for fixing the valuation when the investment and other elements are also taken into account."

Legality of "Period of Repose."—An important decision made by the New York Public Service Commission, Second District, before its supersession this year, hinged on the power of the commission to change the rates of a petitioning company for a second time within the period—in the case at issue twelve months—set in the order last issued. By a vote of three to two, the commission held that the statutes in fixing a "period of repose" had made a new revision within that period impossible, and one was therefore denied to the Lockwood Light, Heat & Power Company, even though the chairman of the commission expressed the opinion that evidence presented showed the company to deserve higher rates. The dissenting members held that the law should not be construed to prohibit a rate change when unexpected conditions had made the rate either unreasonable and extortionate to customers, or so low as to threaten the ability of the corporation to continue its service. The petition, these commissioners held, should be treated as an application for a rehearing.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies

Power of Reviewing Commission Decisions in Illinois.—The Public Utilities Commission of Illinois is given no arbitrary powers by the statute creating it, the Supreme Court of that state has declared (ex rel. Illinois Central Railroad Company vs. Smith), and its orders and decisions must be reasonable and lawful. Reviewing courts will examine the facts on which the commission's order is based, and if there is substantial evidence to sustain it, the order will be sustained. (131 N. E. 371.)*

Municipally Owned Public Utilities Do Not Need Certificate of Convenience and Necessity.—The Los Angeles Gas & Electric Corporation brought an action to enjoin the Department of Public Service of the city of Los Angeles and the Board of Public Service Commissioners of that city from erecting and operating an electrical plant until the California Railroad Commission should issue a certificate of public convenience and necessity therefor. The District Court of Appeal affirmed the judgment of the court of first instance for the defendant on the ground that, the Railroad Commission having no authority to regulate municipally owned utilities, no such certificate was necessary, and the Supreme Court denied a further hearing. (197 Pac. 962.)

What Are "Just and Reasonable" Rates?—"To make an order requiring a public utility to set apart yearly a depreciation fund of a fixed amount and to prevent a compliance by refusing the income necessary for that purpose is not the fixing of a just and reasonable rate," the New Jersey Supreme Court asserted, in Public Service Railway Company vs. Board of Public Utility Commissioners, in the course of a decision upsetting the commission's findings upon the company's application for a 10-cent fare and remanding the case to the commission with instructions to fix a rate which would be just and reasonable. "The question is not a novel one, for in many municipalities in other states the rate has been fixed at 10 cents, sometimes with a qualification that tickets of a given quantity shall be sold at a less rate, but all having a tendency to approximate that rate, but in this proceeding the board did nothing along that line; it merely refused to do anything to advance the present rate, which the evidence shows is not just and reasonable in view of existing conditions."

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*The left-hand numbers refer to the volume and the right hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel—Responsibilities and Association Appointments of Men Engaged in Professional, Executive, Operating and Commercial Branches of the Industry

Edwin Gruhl, who was elected a vice-president of the North American Company about a year ago, has recently been appointed general manager working with the new president, Frank L. Dame. Mr. Gruhl has been closely associated with the executive matters of the company since November, 1912, when he was made assistant to the president. He was graduated from the University of Wisconsin in 1908 but delayed his course one year to engage in valuation work with the engineering staff of the Wisconsin Railroad Commission. Later he served as the statistician of that commission until his connection with the North American Company. Mr. Gruhl is also vice-president of the Wisconsin Edison Company, Inc., and president of the Wells Power Company, a subsidiary of the former.

EDWIN GRUHL

B. M. Larsen has been elected a fellow in the University of Washington for electrometallurgical work in the Bureau of Mines station at Seattle.

Roy E. Chatfield has left educational pursuits in California to accept the post of executive secretary for the British Columbia Electrical Development Association, with headquarters at Vancouver.

L. G. Van Ness, formerly vice-president of the Memphis (Tenn.) Gas & Electric Company, and well known in the Middle West as an electrical engineer, has been appointed general manager for the receivers of the Cincinnati, Lawrenceburg & Aurora Electric Street Railroad. For the last three years Mr. Van Ness has had an office in Cincinnati as a consulting engineer.

G. F. Klein has been appointed assistant chief engineer of the Union Electric Light & Power Company, St. Louis.

William M. Eader, Frederick, Md., has been appointed engineer in charge of the municipal electric light plant and system.

B. T. Ergenbright, who has been manager for the Southern Sierras Power Company at Victorville, Cal., has resigned to become manager of the Bear Valley Utilities Company.

Peter Cooper Hewitt underwent an operation in Paris on Tuesday, Aug. 16, for abdominal trouble. A dispatch to the daily press says that the surgeons expressed entire confidence in his rapid recovery.

Dr. Irving Langmuir, assistant director of the research laboratory of the General Electric Company, sailed for Europe Aug. 13 to attend the annual meeting of the British Association for the Advancement of Science, to be held in Edinburgh, Scotland, Sept. 7 to 14. He will also attend a meeting of the Faraday Society in London on Sept. 28, and will be awarded the honorary degree of doctor of laws by the University of Edinburgh on Sept. 13. Dr. Langmuir will open the discussion on molecular structure at the British Association meeting. He will also read a paper before the Faraday Society on chemical reactions on surfaces and open discussion on that subject. During his stay abroad he will make a business trip to a number of European countries. He is expected to be absent from the United States between two and three months.

IRVING LANGMUIR

Emmet N. Britton, formerly managing editor of the *Journal of Electricity and Western Industry*, has resigned to become assistant to the general manager of the San Joaquin Light & Power Corporation, with headquarters in Fresno, Cal. Mr. Britton will devote his attention particularly to public relations and the extension of the public policy of the San Joaquin Light & Power Corporation, which has been found of such great value in the recent rapid expansion of the company. Mr. Britton is a native Californian. He was born in 1892, was graduated from the University of California in electrical engineering in 1914, and subsequently was in the employ of the Pacific Gas & Electric Company as superintendent of the Drum district and of the gas works in Sacramento. He served in the war as first lieutenant in charge of communication for the 363d infantry. Mr. Britton was first connected with the San Francisco office of the McGraw-Hill Company in the spring of 1920. He is a son of John A. Britton, vice-president and general manager of the Pacific Gas & Electric Company, who is widely recognized as the dean of the electrical industry on the Pacific Coast because of his broad vision and the influence he has wielded in electrical development in that section during the past forty-seven years. The younger Britton possesses many of the characteristics of his father, and has already won distinction from his studies and interpretations of the influence of electric service in the development of Western industries.

E. N. BRITTON

J. B. Wheeler has been appointed assistant chief engineer of power plants in charge of the Ashley Street station of the Union Electric Light & Power Company, St. Louis.

Dr. Albert A. Michelson of Chicago, winner of the Nobel prize for physics in 1907, has gone to Pasadena, Cal., to resume the experiments in measurement of light that he carries on annually in association with the Mount Wilson Solar Observatory and the California Institute of Technology.

R. A. Lundquist, electrical engineer, Minneapolis, has been appointed by Secretary of Commerce Hoover to take immediate charge of the new commodity division which will deal with export problems in electrical goods of all kinds. Mr. Lundquist was born in Red Wing, Minn., and received his primary education there. His higher education was obtained at the University of Minnesota, from which he was graduated with the degree of electrical engineer in 1905. His first engineering position was with the Missouri River Car Company. He was stationed at Helena, Mont., as assistant to the company's electrical engineer there. He spent the summer of 1907 at the Westinghouse plant in order to acquire manufacturing experience. Later in that year he became connected with the La Crosse (Wis.) Water Power Company as an electrical engineer. He retained that position until 1911, when he opened an office in Minneapolis to do general consulting work. He continued in that field of activity until 1916, when he undertook an investigation of the foreign electrical field for the Bureau of Foreign and Domestic Commerce. On his first trip abroad he investigated the markets for electrical goods in Australia, New Zealand, China, Japan, Korea and eastern Siberia. On a second trip for the Department of Commerce Mr. Lundquist visited British South Africa, Portuguese East Africa, British East Africa and India.

R. A. LUNDQUIST

Commander C. S. McDowell, U. S. N., former vice-president of the A. I. E. E. received the honorary degree of doctor of science from the University of Wisconsin.

Brig.-Gen. George H. Harries, vice-president of H. M. Byllesby & Company, who acted as chief of the allied commission in charge of prisoners of war in Germany after the armistice, has been decorated with the Order of Leopold by the Belgian Ambassador, in recognition of his services in behalf of the Belgian prisoners. The ceremony took place recently at the Belgian Embassy in Washington in the presence of officers of the Belgian and American armies.

M. P. H. Smith has been appointed manager of the power division of the Atlanta office of the Westinghouse Electric & Manufacturing Company.

H. H. Bradley of the International General Electric Company has left the Schenectady office of the company to become its special representative in San Juan, Porto Rico.

John J. Swan has become associated with the Engineering Business Exchange, New York. Mr. Swan was formerly connected with the Prest-o-Lite Company, Indianapolis.

John D. Nicklis has been appointed manager of supplies and purchases of Manning, Maxwell & Moore, Inc., and affiliated companies, with headquarters at 119 West Fortieth Street, New York.

J. D. Sparks has been appointed representative in Utah, Idaho and Montana of Landers, Frary & Clark, New Britain, Conn. Mr. Sparks was formerly employed in the sales department of the Western Electric Company, Salt Lake City.

Everett Morss, president, Simplex Wire & Cable Company, Boston, has been elected president of the Boston Chamber of Commerce. Mr. Morss is chairman of the executive committee and a member of the corporation of the Massachusetts Institute of Technology.

D. W. Niven, for twenty-one years connected with the General Electric Company and since 1910 with its marine department, has been appointed manager of that department. He entered the employ of the company as a test man in the switchboard drafting department, later becoming connected with the power and mining engineering department.

Joseph D. R. Freed, who during the war was radio engineer at the radio test shop in the Washington (D. C.) Navy Yard and subsequently for over two years designing engineer and then assistant chief engineer of the Wireless Improvement Company, has organized the Radio Manufacturing Company, 156 Fifth Avenue, New York, to manufacture radio apparatus of all kinds. Mr. Freed will also act in the capacity of consulting radio engineer and is prepared to undertake radio engineering commissions.

D. E. Hayner, formerly with the Harry M. Hope Engineering Company, Boston, is now connected with the Interborough Rapid Transit Company, New York City, in the capacity of assistant engineer in the economic division. Mr. Hayner's experience has been largely in the electrical design of stations and industrial plants. He was engaged in this line while with the Harry M. Hope company. Previously he had been with the General Electric Company as designer, including some time spent on the design of the control boards of the Panama Canal locks. Among other connections he has held positions with the Electric Bond & Share Company, New York City; Stone & Webster, Boston; Monks & Johnson, Boston, and the New York Municipal Railway Corporation.

Hoyt Catlin has been made advertising manager of the Bryant Electric Company, Bridgeport, Conn. He was formerly with Landers, Frary & Clark, New Britain, Conn., and has been identified with the electrical industry for many years.

Obituary

George W. Thomas, president R. Thomas & Sons Company, manufacturer of electrical porcelain, East Liverpool, Ohio, died at his home in that city on Aug. 7, following a long illness. Mr. Thomas was born in East Liverpool in 1852, and in 1869 became associated with his father in the manufacture of doorknobs first at Beaver Falls, Pa., and afterward at East Liverpool and Lisbon, Ohio. In 1896 the Lisbon plant was devoted exclusively to the manufacture of electrical porcelain, a line of business in which the firm was a pioneer. It is said to have been the first to make porcelain for use on high-voltage transmission lines. Mr. Thomas was also identified with silica-producing firms in East Liverpool and in Oregon, Ill.

G. W. THOMAS

George D. Munsing, for several years manager of the Consumers' Electric & Street Railway Company of Tampa, Fla. (now the Tampa Electric Company), died recently at Red Bank, N. J.

Charles O. Bond, manager of the physical laboratory of the United Gas Improvement Company of Philadelphia, died on Aug. 2. He was the first past-president of the Illuminating Engineering Society to die since the society was founded in 1906. Mr. Bond was elected president of the society in 1913 and had previously been a vice-president. Throughout the life of the society he had been prominent in committee work, and he had served for a number of years on the committees on lighting legislation, nomenclature and standards, and reciprocal relations. He was also a member of the society's war service committee.

Trade and Market Conditions

Business Reviews, Together with Market Letters from Important Trade Centers, on the Supply, Demand and Prevailing Prices of Electrical Apparatus and Supplies

Some Further Price Reductions on Power Apparatus

SINCE the announcement of price reductions of 10 per cent on integral motors, control and starting equipment, effective about July 9 to July 12, some further reductions have been announced at various dates since then and on several kinds of electrical equipment. Oxide-film lightning arresters show an average lower list price of about 8 per cent, effective Aug. 8. Certain makes of distribution transformers in sizes up to 500 kva. were lowered about 10 per cent around July 21 and 22. At least one make of station relay on Aug. 12 was reduced 10 per cent. Some fractional-horsepower motors were marked off 10 per cent the last week in July, while others in the single-phase type only did not come down till Aug. 3.

Inquiries are apparently increasing in number for motors, and here and there the orders are coming in in slightly greater volume, but still each order is rather small in value. Figuring of inquiries and proposition work are keeping motor salesmen busy.

Seven Millions to Be Spent for Telephones

THE National Administration of Posts and Telegraphs of Uruguay, according to reports from Montevideo, has signed provisionally a contract with an American banking syndicate headed by the Equitable Trust Company of New York for a loan of $9,000,000. The money is to be used for the construction of an underground telephone system. It will be issued, it is said, at 91 and bear interest at 8 per cent. The understanding is that the money will remain in the United States for the purchase of material. Conditional on the successful negotiation of the loan, the contract has been placed with the Western Electric Company for the entire telephone plant, both inside and outside, to the extent of about $7,000,000

Cases of Motor-Driven Devices to Be More Fully Marked

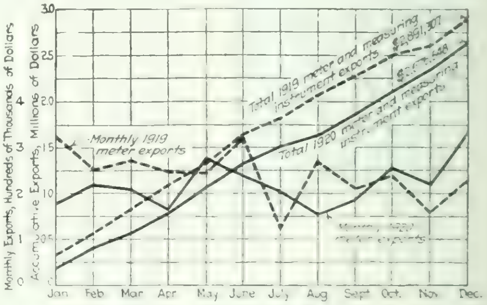
ONE of the recommendations which were unanimously adopted by the members of the Electrical Supply Jobbers' Association at their last general meeting, held in May, was "that manufacturers of motor-driven devices be requested and urged to mark plainly cases in such a way that information concerning voltage, frequency and the serial number of the motor can be readily ascertained, as well as other important details with reference to the appliance, without in any case making it necessary to open the box or crate to learn the details concerning the appliance packed therein."

The recommendation was drawn up by the committee on motor-driven devices after a careful study of the situation, as a means of overcoming some of the difficulties encountered by jobbers, distributers and dealers in warehousing and selling these devices. On July 15 the national representative of the association sent copies of this recommendation to all manufacturers of motor-driven devices asking their co-operation, and to date he has received sufficient answers to satisfy himself that the jobbers are being supported in their request. Many answers state that the marking is now being placed on the cases and others that it will be done. The secretary of the American Washing Machine Manufacturers' Association, for instance, has taken the matter up with all members of that association and is waiting for the replies.

British Possessions Import Meters Heavily in 1920

FOR the year 1920 exports of meters and measuring instruments from the United States amounted to a value of $2,676,548. This figure is 8 per cent less than the exports for the previous year, which amounted to $2,891,307. Canada took the greatest amount, with $488,568, while Japan was a close second and England a poor third. Cuba, fourth, took a large amount for that island, but it was only one-third that of Canada.

In considering these exports from a national standpoint, England and her possessions—Canada, Australia, New Zealand and British South Africa—took meters and measuring instruments in value of $922,177, 34 per cent of the total exports.



METER EXPORTS IN 1920 BELOW THOSE OF 1919

From a geographical standpoint, the greatest value went to North America, including Cuba, which absorbed $747,740, or 28 per cent of the total exports. Asia took the next greatest amount, with $589,220, or 22 per cent, closely followed by Europe, with $568,323, or 21 per cent. The islands southeast of Asia took 9 per cent, and the South American countries imported only 8 per cent.

METER EXPORTS FOR YEAR 1920

Canada	$488,568
Japan	441,871
England	237,632
Cuba	163,687
China	148,145
Brazil	131,621
Australia	113,438
Italy	101,554
Mexico	95,515
Spain	66,199
Argentina	65,828
Philippine Islands	59,515
France	56,675
New Zealand	48,242
Netherlands	42,271
British South Africa	36,337
Belgium	34,751
Dutch East Indies	29,749
Denmark	29,345
Peru	27,668
Sixty other countries importing meters and measuring instruments	250,877
Total	$2,676,548

The accompanying list of countries shows only those which took in $25,000 and more of meters and measuring instruments, and the sixty other countries which imported American meters took a total of $260,877. These figures were compiled by the ELECTRICAL WORLD from data obtained from the Bureau of Foreign and Domestic Commerce, Washington, D. C.

Virtual Tariff Bill Passes British House of Commons

WHAT purports to be a tariff measure without being called such is the bill providing for the safeguarding of British industries which was passed by the House of Commons on Aug. 12. The bill was certified by the Speaker, since the House of Lords is powerless to amend it because of its being a money bill.

One of its clauses, it is said, provides for the levying of a customs duty of 33⅓ per cent ad valorem on importations entering the United Kingdom of optical glass, optical instruments, scientific glassware, porcelain instruments, magnetos, tungsten and its products, synthetic and organic chemicals, except dyestuffs; colors, coloring matters and fine chemicals.

Another clause provides for duties on any articles not mentioned which the Board of Trade under the act will have the power to specify on the ground that the said articles are being sold or offered in the United Kingdom at prices below their production, or, owing to exchange depreciation, at prices below what they can profitably be produced for in Great Britain.

Better Tone in Switch and Socket Market

MANUFACTURERS of wiring devices interviewed last week by a representative of the ELECTRICAL WORLD uniformly agreed that the low point in the trade depression has now passed and that a gradual improvement in market conditions may be expected to continue during the coming months. Not only are inquiries increasing considerably in volume but also actual orders are showing a tendency to increase. One of the leading Connecticut producers of wiring devices said that the jobbers in his section of the country are now ordering from thirty to sixty days' supplies in switch and socket products, which is a very favorable indication of improving conditions. This plant has gone upon a schedule of five days per week within a few days past and expects to dispose of its higher-priced raw material through production within the next three or four months. Another manufacturer has adopted a four-day week after a rather protracted run at three days. The annual fortnightly vacation shutdown is in process at another large establishment, and another producer is awaiting expansion in the building field before pushing his output to higher levels; but by and large the volume of domestic trade is clearly improving.

Manufacturers who briefly commented on the recent price movements in this field pointed out that a fairly stabilized condition has now been reached. Opinions differ as to the effect of these late downward movements on orders. None held that the reductions established caused any boom in sales, but several agreed that jobbers are disposed to order more freely now that prices are easier. The opinion was vigorously affirmed that prices are sufficiently stable now to warrant reasonable buying for expected needs of the next few months. It has been pointed out that the cost of wiring devices is a very small percentage of the total expense of building, and it is widely believed that, electrically speaking, it is time to go ahead on necessary construction without waiting for further price changes which would make but little difference in the ultimate cost of jobs. One manufacturer pointed out that his prices are now on the level of Jan. 1, 1916, and while foreign business is greatly hampered by the exchange and credit situation, the domestic output is expected to show a further decided gain next month.

Stocks are sufficient to make deliveries very easy on almost all standard lines. One factory reports filling seventy-six out of eighty items on a recent order from stock. Another has probably $400,000 in finished product ready for shipment on demand. Even those factories which do not make a practice of carrying large stocks are in a position to respond at once to increased demand through the utilization of the extra facilities put in during the war. The schedule-material maker is in a strong position to meet the requirements of a boom in building should one develop. Labor is more efficient, sales organizations are on their toes for business, jobbers are buying more consistently, raw material has been pretty well reduced in volume, and prices are lower than for some time. Improved banking conditions are telling of better credits, and there is ground for real optimism in viewing the future of this branch of the electrical industry.

Lower Prices Recorded on Cast Iron Conduit Bodies

NEW discount schedules of from 5 per cent to 13 per cent additional discounts on cast iron conduit bodies such as condulets, v.v. fittings, taplets, unilets, etc., were announced this week. The value of the order and its quantity as relates to standard package units are considered in the new prices.

Formerly orders in less than one-fifth standard package lots were sold at list prices; on one-fifth standard package lots 5 per cent was allowed, and on standard packages and over the discount was 15 per cent. The new schedule provides that on orders for quantities totaling less than $15 list price a discount of 5 per cent will be allowed on less than standard-package lots and 15 per cent on standard packages. Orders totaling $15 but less than $100 list price are discounted 10 per cent for less than standard package and 20 per cent for standard packages. Orders amounting to $100 and over receive a discount of 20 per cent for less than standard packages and 28 per cent for standard packages.

Metal Market Situation

THE copper market presents a stronger tone, particularly as producers are quite unwilling to sell any large amounts at the prevailing price of 12 cents for spot and August, delivered. This is said to be below production cost in most cases, but producers feel that this level will not hold much longer. There is especially little desire to sell to traders at this figure to hold for a better market. Inquiries are being received from consumers in much larger numbers than heretofore, showing a feeling out of the market to care for returning business. For September 12.25 cents a pound is the producers' quotation, although 12.12½ will be taken.

The Copper Export Association on Aug. 15 is reported to have paid off its Series A notes, due Feb., 1922, in an amount of $1,000,000. It is said the funds for the transaction came from sales of copper abroad.

Lead price is holding officially at 4.40 cents, but the outside market is 4.45 cents for prompt. Buying is fairly active. Slightly higher figures are being quoted in the scrap copper and brass market, but not because of any heavier buying.

NEW YORK METAL MARKET PRICES

	Aug. 9, 1921	Aug. 16, 1921
Copper	£ s d	£ s d
London, standard spot	70 0 0	69 17 6
	Cents per Pound	Cents per Pound
Prime Lake	12 00	12 25
Electrolytic	12 00	12 00
Casting	11 37	11 50
Wire base	13 50 14 00	13 50 14 00
Lead, trust price	4 40	4 40
Antimony	4 60	4 55
Nickel ingot	41 00	41 00
Sheet zinc, f. o. b. smelter	10 00	10 00
Zinc, spot	4 75	4 70
Tin	27 75	26 12
Aluminum 98 to 99 per cent	24 50	24 50

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	9 50— 9 75	9 50—10 00
Brass, heavy	4 25— 4 50	4 50— 4 75
Brass, light	3 50— 3 75	3 75 - 4 00
Lead, heavy	3 25 3 37½	3 25 - 3 37½
Zinc, old scrap	2 00 2 25	2 00 - 2.25

THE WEEK
IN TRADE

Prices When Quoted Are Those Prevailing at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

WHILE virtually every district reports a spotty condition of the electrical jobbing industry, the New York territory reports a noticeable improvement in orders and Portland and Spokane also show some improvement. In New York the buying seems to be less spasmodic and on a better weekly level. Inquiries are on the mend in general and are making much work for motor sales departments. There is better activity in short line extensions of utilities in the Middle West and in the South.

Conditions are improving fundamentally. In the South residence building is keeping up a good movement of construction materials; agricultural communities are in better condition in St. Louis districts; the live-stock situation in the Intermountain region is improving and money is slightly easier; textile, rubber and shoe industries in New England are working well. Building in New England is holding up well but has not come to the electrical stage. Strikes in the building fields in San Francisco are upsetting, but still some building is going on. Range and water-heater sales are good there. In the Northwest lumber and coal are moving quite well and the wheat harvest is satisfactory. Collections are holding their own throughout the country.

Secretary of Labor Davis estimates 5,735,000 unemployed at this time in the United States.

NEW YORK

Without doubt there is a noticeable improvement in the general condition of the electrical trade in this territory. Business, which three weeks ago flared up for one or two days a week and then flattened down to almost nothing, has steadied to a more continuous flow of small to moderate-size orders. Jobbers who were very skeptical about the possible return of activity prior to the fall report that their sales are showing increases from week to week.

The demand for materials for residential wiring continues and is being augmented by additional requirements for new business buildings and a certain amount of industrial work. A number of new buildings are coming into the electrical stage and other construction work is now under way and will be ready for the wiremen during the fall. Further inquiries for material for new construction work continue to come in, and the sale of small motors of from 5-hp. to 20-hp. shows signs of renewed activity.

Collections cannot be termed "good," but few of the electrical credit men report excessively long collections. These conditions in the electrical trade seem to be much better than in some other trades and industries which virtually have been at a standstill for the last six months. Furthermore, a good many of the accounts which are difficult to collect were contracted by industries whose plants have shut down during the period of depression.

Conduit.—Prices remain virtually unchanged since last week. In 2,500-ft. lots ½-in. black is quoted at $55 to $58; ¾-in., $74 to $77; 1-in., $105 to $106.76. Galvanized pipe in the same sizes is as follows: $62.75, $81.50 and $116.96. Stocks are fair and well distributed and immediate shipments can be made. Demand continues to be steady, although sales are mostly in small quantities.

Flexible Armored Conductor.—Demand continues to be fairly active in small quantities and stocks are good. The price for No. 14, two-wire, single strip remains at $48 per 1,000 ft.

Rubber-Covered Wire.—Stocks are good and the demand for rubber-covered is steady. Sales are usually in small lots covering immediate requirements. No. 14 rubber-covered was quoted this week at $6.50 to $6.77 per 1,000 ft. There does not seem to be much inclination to cut prices on this material, and an advance in price is looked for in some quarters.

Non-Metallic Flexible Conduit.—Demand is small in this territory, and stocks are only sufficient to meet occasional orders. In 1,000-ft. lots prices quoted this week are for 7/32-in. size, $21 to $22; ¼-in., $23 to $24, and ⅜-in., $36.

Outlet Boxes.—Stocks are good, while demand is light and erratic. Price cutting on this material, which was in evidence a few weeks ago, is not so keen and discounts are holding at 50 per cent on black boxes and 45 per cent on galvanized.

Heating Appliances.—There have been no changes in the market conditions or prices of heating devices during the past week. Dealers are not inclined to place orders for their fall requirements until later, although at this time there does not seem to be any likelihood of another drop in prices.

CHICAGO

There has been little perceptible change during the past week, unless a comparative absence of price decreases may be considered something new. There still exists a vague feeling of optimism, but very few continue to predict much of a resumption of business this fall, as was the general expectation in the spring.

Jobbers report that practically every line is moving slowly. In the appliance line this merely reflects the comparative dearth of retail buying. Fortunately there has been a flurry of inquiries for transmission-line supplies and equipment, and jobbers are depending on orders of this sort to bring their sales volume up to a satisfactory total. Sales for July barely held their own with those of June, according to several large distributers, and are below those for last year, though fan orders were extremely heavy.

Flexible Armored Conductor.—Small orders were received by jobbers in unaccustomed volume for several days after the announcement of a price cut of about 10 per cent. The activity was not sustained, however, and sales have again dropped to a minimum set by immediate requirements. Jobbers are still well stocked and are placing only meager orders with manufacturers. No. 14, two-wire, single-strip is quoted at $48 per 1,000 ft. in 5,000-ft. lots.

Lamps.—Sales have begun to pick up and dealers and distributers who have had large stocks for some time are more hopeful. The demand should increase steadily from now on, however. The movement of the large sizes of gas-filled lamps is showing the growing tendency to substitute them for the arc lamps even in smaller cities.

Wire.—Prices have not changed during the past week, but show indications of stiffening, which may be ascribed to better inquiries rather than to better orders. Contractors' housewiring needs are easily supplied, and while central-station purchasing agents seem to be doing considerable shopping around, they are not placing many orders yet. No. 8 bare is quoted at 15 cents per lb. in 1,000-lb. lots.

Poles.—Jobbers have comfortably large stocks and there seems to be little opportunity of moving them this fall. Transmission-line requirements have come into the market more in the last month than in June, but the demand still falls considerably short of the supply. Judging from the size of the average individual order, the maintenance and short extension work going on is about normal with most central-station companies in the Middle West, but this class of work takes only a small proportion of the supply. A representative price is $13.90 for the Western cedar 35-ft. pole, 8-in. top.

Insulators.—Both glass and porcelain insulators are in fairly good demand, and jobbers are usually able to take care of orders out of stock. Prices remain steady.

Cross-Arms.—There has been a brisker market during the past two weeks, unaccompanied by price changes. Railroad buying has been more noticeable while central-station business is holding up well. Inquiries are improving.

BOSTON

Jobbers report uneven trade from day to day, with increased inquiries and general agreement that improved business is close at hand. Prices held firm last week in most lines. Buying from manufacturers is dull, local stocks meeting present needs in the main. Collections are little changed compared with last week. July trade was better than June's in several distributers' establishments. Building and engineering contracts in New England for the week ended Aug. 9 totaled $4,993,900 against $4,617,000 for the corresponding week last year. This total has been exceeded in but three years since 1900. Wiring-device factories in Connecticut have in some cases lengthened their weekly hours of production by 25 per cent in response to somewhat better buying by distributers in various parts of the country. Textile, rubber and shoe manufacturers report better business.

Motors.—Inquiries are more active among local distributers. Stocks are ample with occasional exceptions and prices are firm.

Industrial Electric Trucks.—Inquiries are more active than formerly, and while sales are dull the resumption of manufacturing operations or a larger scale renders the market more hopeful.

Rigid Conduit.—Pipe is moving in moderate quantities. Representative prices Monday were as follows: Galvanized, ½-in., $63 per 1,000 ft.; black, $57.90; galvanized, 1-in., $117.55 per 1,000 ft., black, $107.35, all in 2,500-lb. lots.

Lamps.—A vigorous trade in 21-cp. gas-filled automobile headlight lamps continued last week to meet the new regulations.

Porcelain.—Moderate sales are reported, with easy prices. Three-inch tubes sold Monday at $5.50 per 1,000 in barrel lots, two-wire and three-wire unglazed cleats at $12.50 per 1,000 in barrel lots, and "Nail-it" knobs at $17.50 per 1,000 in barrel lots.

Washers and Cleaners.—Better business than in early summer is reported and, while nothing like a rush is on, a good fall trade is anticipated. In this field very energetic sales efforts are reaping their due reward.

Flexible Armored Conductor.—Wiring jobs are absorbing this material in fair lots, considering the building trade's slow advance toward normal. No. 14 double-strip sold at Boston the first of the week at $50 to $52 in 2,500-ft. lots.

Wire.—Despite some tardiness in the construction field which holds back the movement of wiring materials, a better feeling is apparent in the wire market. No. 14 rubber-covered wire sells around $6.50 per 1,000 ft. in 5,000-ft. lots. A slight tendency toward stiffening prices is evident in copper circles.

Fans.—Cooler weather has slowed down fan sales sharply, following very satisfactory movement. Stocks are not exhausted, but are much lower than a few weeks ago.

ATLANTA

Jobbers are finding business rather spotty, one week showing a healthy activity followed by a week of stagnation; but, taking the situation as a whole, conditions are undoubtedly considerably improved over those of the past few months and little pessimism regarding the future is to be found. Business is of a more healthy tone; that is to say, the orders being received are for the more standard lines that the jobbers have in stock, whereas a few months ago a large number of the orders received called for shipments from factory. This state of affairs is enabling jobbers to reduce their stocks of standard material. The heavy building boom that is evidencing itself in all of the large cities is serving materially to reduce non-employment and is stimulating the lumber, wholesale hardware and electrical jobbing business, although as yet no general activity in heavy industrial construction is in evidence. The industrials have not in a large way entered the active market, though inquiries are on the increase, most of the purchases at the present time being made by the smaller contractors, central stations and municipal plants. Collections have again become very unsatisfactory owing to the inability of the rural merchants to make collections from their retail trade.

Lamps.—The dullness in industrial lines is reflected in the lamp market, sales being 16 per cent below those of last year, but the revival for fall demand is evidencing itself in the increased sales of incandescent lamps.

Service Boxes.—A reduction of 15 to 20 per cent has been reported in the price of black and galvanized service boxes. The demand for these has held up very well throughout the depression. Jobbers' stocks are well filled and factories are giving prompt deliveries.

Portable Lighting Fixtures.—Price reductions are noted in a number of different types by manufacturers of commercial lighting fixtures and portable types, but the demand is somewhat stagnant. Dealers' and jobbers' stocks are in fairly good shape.

Safety Switches.—The demand continues active and one manufacturer has reduced his price this week approximately 8 per cent. Prompt deliveries are being made from jobbers' stocks and all sizes are shipped promptly from factory.

Wire and Cable.—One manufacturer has reduced his base on weatherproof ½ cent this week, but at the present time the demand is very sluggish. Rubber-covered is comparatively active, however, and the market price is a little unstable. Several good orders were placed this week for bare stranded wire at price slightly below the market. All orders for heavy cable and bare wire are snapped up at low prices with very prompt delivery promised.

Poles and Pole-Line Hardware.—There is some activity in pole-line hardware and insulators for short extensions, and it is anticipated that good business will be transacted this fall if the many inquiries now out materialize in actual construction. There has been no reduction in the price of poles or pole-line hardware for the past three weeks. Prompt deliveries can be had on this class of material. Glass and porcelain insulators are being sold at prices slightly shading the market.

Portable Drills.—Manufacturers' agents and jobbers report awakened interest, particularly within the past six weeks, the stagnation prior to the month of July having given away to considerable activity in this line. Most inquiries are coming from the smaller industrial plants with a moderate volume of inquiries from more active automobile lines. Stocks are on hand in reasonable quantities in popular sizes.

ST. LOUIS

Very little change could be noticed in the business situation here last week. Jobbers report that it is spasmodic, brisk days alternating with dull ones, and that the sum total is about the same as a month or two ago. One jobber, however, reports a slight decline in billings. Manufacturers, with the exception of the shoe industry, are operating, if at all, on a materially reduced basis. The shoe factories are operating at about full force. Some gray-iron foundries are on a basis of from 25 to 50 per cent of normal. Malleable and steel foundries are exceptionally quiet.

Some large power-plant apparatus is being sold to the municipalities. The sale of a large turbo-generator outfit to a Missouri city was reported last week, as was also a good sized sale of boilers to an educational institution in Kansas. Immediate construction work, both residential and industrial, shows a tendency to decrease, but it is noticed that the industrials are increasingly formulating plans for enlargements or for new plants. Sales of appliances are falling off except where stimulated by special campaigns or by substantial price reductions.

Recent reports from the state board of agriculture indicate that the amount of grain raised this year will be slightly less than that of last year. Nevertheless, the condition of the agricultural communities is reported to be improving, and it is felt that credit conditions will be better this fall. Collections by the jobbers remain on an average basis of sixty days.

Porcelain.—Ten per cent lower prices have obtained since Aug. 2. "Nail-it" knobs, in barrel lots, now sell at $17 to

$18.50 per 1,000, two-wire cleats at $15 per 1,000, and 5/16-in. x 2½-in. tubes at $5.90 per 1,000. Only a moderate demand is found and stocks as a rule are in line.

Flashlamps.—Normal sales are reported and stocks are inclined to be low. A representative quotation on a three-cell nickel lamp is $1.15 and on a two-cell lamp it is $1. Batteries are finding a fast movement and low stocks prevail.

Lamp Cord.—Slow movement is still experienced. No. 18 cotton-covered remains at $13 per 1,000 ft. in 5,000-ft. lots, and silk-covered varies from $23 to $26 per 1,000 ft.

Magnet Wire.—A slight reduction is announced, the new prices being founded on a base of 16 cents per pound. There is no movement worthy of mention and stocks are abnormally heavy in most instances.

Dry Cells.—A steady demand, approximately normal, is reported by all jobbers. The regular cell is quoted at 31 cents by a representative jobber and the igniter at 32 cents.

Tape.—The demand for both friction and rubber tape is reported to be fairly good and low stocks are found in a number of instances. In 100-lb. lots the friction is selling at 38 cents per pound and the rubber at 36 cents.

Conduit.—Slow movement continues, though there was slight improvement immediately following the termination of the electrician's strike in St. Louis. Stocks are reported in good shape. The ½-in. black is quoted at $5.85 per 100 ft. and ½-in. galvanized at $6.37 per 100 ft., both in carload lots.

Conduit Elbows and Couplings.—A reduction of nine points in the discounts is just reported. Stocks are slightly heavy and the demand is quite dull.

Wire.—Owing to conservative buying, stocks of many jobbers in No. 14 rubber-covered are quite low, and in fact that of one large jobber is entirely exhausted this week. Sales continue in about the same volume as has prevailed for the past two or three months. No. 14 rubber-covered is quoted at $6.40 per 1,000 ft. in 10,000-ft. lots. Some variation from this price can be found, depending upon the desire of the individual jobber to move stocks. Weatherproof is being quoted on a 14½-cent base and bare copper wire at a base of 14 cents.

SAN FRANCISCO

The builders' strike has reached a new stage because virtually all the unions involved have elected representatives who have repudiated the former union officials and have counseled a general strike. Employers report that more and more men are working, although building is still but a small fraction of normal. Some local freight rates have been reduced because of auto truck competition. Collections are slightly better than they were last month, but a big factor in the present electrical financial situation is the big stocks which have accumulated with the dealers.

Schedule Material.—An intensive drive is being made on fuses, for which contracts are being taken on refilled types. Rather good sales are reported especially to dealers who specialize in regular customers. Prices are low, but as still lower prices seem to be expected orders are in the smallest quantities possible to earn fair discounts.

Ranges.—The Great Western Power Company is staging a considerable campaign on the larger energy-consuming devices such as electric ranges, large radiators and water heaters. The rate is very good. There is a flat water-heating rate which averages about $3.50 per family per month. About 100 ranges have been marketed in the last two months, but with increased crews and more distributing centers better business is expected. The devices are sold at actual cost and easy terms of payments are granted on request.

Household Devices.—During the past week business on sewing machines and vacuum cleaners has noticeably increased. Although washers are still moving slowly, very few sales campaigns are being waged, and it is felt that a few permanent employees steadily pushing household appliances are far better for the dealer in the end than the clean-up type of sales crew. Such crews have really giver the business in this section a black eye.

SEATTLE—SPOKANE—PORTLAND

Although Seattle jobbers report no noticeable improvement in the electrical business over last week, nevertheless in other quarters some increased activity is noticed, indicating a slight upward trend. Some movement in lumber is again being felt, largely as a result of Japanese demand. The total volume of new business, however, is relatively small, and the orders booked are on an unprofitable basis. Yet the mills are operating at 71 per cent of normal in order to keep them going and supply their men with work. Coal operators in western Washington, whose properties have been tied up since March 15, have again commenced operation, this time on an open-shop basis. Collections are still on a forty-five-day to fifty-day basis. Buying is largely from hand to mouth and seems to be governed by immediate necessity only. Lamp-cord stocks are ample and demand is very moderate. Schedule materials have suffered no price change. In the past two weeks, with the exception of shade holders, which are down 15 per cent, demand is moderate and stocks are all in good shape.

More inquiries for quotations and increased sales have given Spokane jobbers much satisfaction and caused a brighter outlook during the last week and continued improvement is looked for during the fall months. Prices are weak, with slight drops reported on wire and conduit and a 50 per cent cut in porcelain. Collections are still slow and are not expected to improve materially until the harvest is further along and wheat money begins to circulate. Stocks are in good shape and deliveries prompt. Altogether, dealers are feeling better than in a long time. Wheat, in those districts where the harvest is under way, is averaging well and sustaining the estimates made, which will give a bumper yield. This makes for a much better feeling, though the actual results are not yet in evidence.

Portland jobbers report an appreciable increase in business during the past week, principally from the country districts. Considerable activity has been shown in the sale of ranges, washing machines and mangles. Another slight decline has been noted in the price of appliances. Collections and credits remain unchanged. Contractors for large wiring work report prospects to be improved, and there is more optimism felt than for some time. There will undoubtedly be a decrease in wages Sept. 1. Dealers report the volume of business to be the same or possibly a little slower. There is much keener activity in residence wiring than formerly and the number of permits being issued is somewhat decreased. The number of electric wiring permits issued for the month of July was 1,007, with a valuation of $123,436.

SALT LAKE CITY—DENVER

The employment situation has shown marked improvement in the past few weeks, seasonable occupations having done much to relieve the widespread condition of enforced idleness. The home-building boom that has been more or less successfully launched in the larger cities of the Intermountain West has given work to thousands of artisans, and electrical contractor dealers are also beneficially affected. Much interest centers in the question of rates affecting the shipping of live stock and farm produce grown in the mountain region. Nothing at present could be a greater boon than a material lowering of the freight schedule. Pending the adjustment, however, farmers are showing a tendency toward immediate marketing of their grain.

A slight easing of the money market is the first and most salutary result. The live stock situation is much improved as a result of available loans through the operation of the Stockgrowers' Finance Corporation. Lambs are moving to market at a lively rate and bringing usually a satisfactory price. This will help the sheepmen through their worst straits. There is little change in the credit situation and collections continue slow.

Wire.—Insulated wire has recently taken a 5 per cent advance in price. The increase is due to the fact that many jobbers have used up their stocks purchased in job lots and are now buying on the market again. Bare wire is still in small demand and the price remains down.

Conduit.—Stocks are heavy and demand is light. The ½-in. galvanized is now selling at $8.35 per 100 ft.

Manufacturers' Activities

Devoted to the Business Side of Manufacturing, Distribution and Sales, News from Jobbers and Foreign Fields and a Record of New Devices and Trade Literature

September Meetings of Supply Jobbers' Association

Announcement has been made of the late summer meetings of the Electrical Supply Jobbers' Association. On Sept. 19 the committee on committees will meet in Buffalo, and on Sept. 20 and 21 the executive committee will meet in the same city. Sept. 22 has been scheduled for the Atlantic Division meeting at the Bellevue-Stratford in Philadelphia, while the Central Division will take the two days of Sept. 22 and 23 for its conference in Chicago.

Copper and Brass Companies Join to Stimulate Sales of These Products

About thirty copper, brass and copper-alloy interests on Aug. 9 formed the Copper and Brass Research Association, an unincorporated, voluntary organization.

The purpose of the organization is to stimulate by co-operative effort the use of copper, brass and copper-alloy products. Membership is open to producers of copper sold here or selling agents of copper in the United States; to fabricators of copper, brass and copper products generally in the United States and in Canada, and to others directly engaged in or connected with the copper and brass industries. R. L. Agassiz, president of the Calumet & Hecla Mining Company, is president; Fred S. Chase, Chase Rolling Mills Company; C. F. Kelley, Anaconda Copper Mining Company, are vice-presidents; W. S. Eckert is secretary, and William A. Willis is manager of the association. Membership of the copper wire and electrical equipment manufacturers are, for the most part, conspicuous by their absence.

Dealers Use Maker's Showroom for Prospective Customers

The Beardslee Chandelier Manufacturing Company, as a means of working with dealers, is urging them to make use of its showrooms at 216-220 South Jefferson Street, Chicago, for prospective customers seeking lighting fixtures. Realizing that the average dealer cannot carry a large stock of fixtures, the company has issued two cards for the use of dealers. It is figured that a large customer within 250 miles of Chicago will probably have need to go to that city occasionally, and one of these cards is made out by the dealer as a card of introduction to the company, so that the customer may have access to the thirty-five thousand-dollar stock of fixtures carried in the Chicago showrooms. The reverse of the card shows the store in relation to hotels, depots, etc.

The other card is to enable the dealer to notify the Beardslee company that he has given one of the introductory cards to one of his customers. The system is working well.

R. A. Lundquist to Head Electric Machinery Division

Announcement has been made by the Department of Commerce of the appointment of R. A. Lundquist of Minneapolis to take charge of the newly created electrical machinery division in the Bureau of Foreign and Domestic Commerce, made possible by Congress through the export industries act. It is planned to obtain the services of other engineers to assist Mr. Lundquist, who himself is an electrical engineer of wide experience and a graduate of the University of Minnesota.

Second Quarter Sales Report of Allis-Chalmers

For the second quarter of the present year sales billed by the Allis-Chalmers Manufacturing Company, Milwaukee, amounted to $7,014,373, which is less than 10 per cent smaller than sales billed over the first quarter. Net profit after provision for federal taxes in the second quarter came to $635,880, while for the first quarter it was $774,189. Unfilled orders on hand as of June 30, 1921, aggregated $9,472,772, as against $12,943,633 on March 31.

Pacific States Electric Is Coast Hotpoint Distributer

The Pacific States Electric Company, has been appointed Pacific Coast distributer for Hotpoint electric appliances and Hotpoint-Hughes electric ranges. Complete stocks of these appliances and ranges will be carried at the company's warehouses in Los Angeles, San Francisco, Oakland, Portland and Seattle, and at these points sales service also will be maintained.

Thoner & Martens Issue First Catalog

Thoner & Martens, 468 Commercial Street, Boston, manufacturers of disconnecting switches, heavy-duty switches, etc., recently issued their first catalog. This publication contains twenty-four pages, covering the different types of disconnecting switches, heavy switches, and T. & M. switch locks manufactured by the company. The firm also specializes in power-station apparatus and installation.

Westinghouse Lamp to Issue Series of Practical Lighting Bulletins

Arrangements have been made by the Westinghouse Lamp Company, 165 Broadway, New York City, to compile and issue a series of semi-technical bulletins on the subject of illumination and the proper uses of artificial light. These booklets will deal with important features of illumination, such as lighting intensities, the illumination of retail stores, cleaning and maintenance, paints and painting for light, residence lighting, illumination calculations and the lighting of various industries. They will treat of only the practical usage of light, based upon the accumulation of facts by well-known authorities and supplemented by large amounts of original research data not heretofore published. The first of the series, bulletin E-100, entitled "The Foot-Candle Meter," has been issued and gives instructions for measurements of illumination. A cabinet or container will be issued with one of the later bulletins in which the complete set may be kept.

Western Union Issues $15,000,000 Fifteen-Year Gold Bonds

The Western Union Telegraph Company has issued and sold $15,000,000 in fifteen-year 6½ per cent gold bonds, due Aug. 1, 1936, in denominations of $1,000 and $500. The purpose of the issue, according to a statement from President Carlton, is to reimburse the treasury of the company for expenditures made on account of extensions, additions and improvements to its plant and equipment (outside of the State of New York) and to provide funds for further extensions, additions and improvements (outside of that state). The issue was sold directly the books were opened.

Cushman Electric Company in New Hands

A newly organized company, consisting of Garrett M. Ross, president; A. L. Cushman, vice-president, and Alexander P. Achimore, manager, has recently purchased the machinery, tools and fixtures of the Cushman Electric Company, Concord, N. H., and is operating the plant. The old company name remains, and under that name Mr. Ross is in charge of the New York City office at 255 Greenwich Street. The special products of the company are motors for typesetting machinery and motor-generator sets for telegraph use. Mr. Cushman will continue in the design of the motors. Mr. Achimore was formerly a power engineer with the Western Union Telegraph Company.

Japan Orders Two Locomotives from Westinghouse

Official announcement has been made by the Westinghouse Electric International Company that an order has been received from the imperial government of Japan for two 62-ton freight electric locomotives, these locomotives to operate around Tokyo. They are the standard box type, 42-in. gage, and are to operate on 1,200 to 1,500 volts direct current, with overhead-line equipment, multiple-unit control, containing four motors of 250 hp. each.

These locomotives will be built at the East Pittsburg works by the Westinghouse Electric & Manufacturing Company, the work to begin at once and to be completed in one year.

Largest 60-Cycle Waterwheel Units Now Under Construction

In considering the largest 60-cycle waterwheel units ever built, which the Allis-Chalmers Manufacturing Company is constructing for the Mount Shasta development of the Pacific Gas & Electric Company, the weights of steel, iron and copper may be interesting. The rating of each generator is 35,000 kva., 11,000 volts, 60 cycles, three-phase, 257 r.p.m. Net weight of each generator with its exciter is estimated by the manufacturing company at 549,000 lb., while the raw materials used in each generator consist mainly of cast iron, 151,700 lb.; cast steel, 189,300 lb.; forged steel, 24,600 lb.; punchings, 148,000 lb.; copper, 46,000 lb., and miscellaneous, 10,700 lb.

Westinghouse Company Installing Interworks Radio System

The Westinghouse Electric & Manufacturing Company is arranging to demonstrate on a large scale one of the important commercial uses of radio apparatus by installing an interworks system of wireless telegraphy and telephony. Factories at East Pittsburgh, Pa., Newark, N. J., Bloomfield, N. J., Springfield, Mass., South Philadelphia, Pa., Cleveland, Ohio, and elsewhere have been, or will be, equipped with high-powered transmitting and receiving sets, and it is expected that much of the pressing correspondence between these factories will be conducted by means of this system in the near future.

Several of the stations, notably those at East Pittsburgh, Cleveland, Springfield and Newark, are already in operation. The East Pittsburgh station (KDKA) has become well-known to all wireless operators (professional and amateur) because of its nightly broadcasting of concerts, addresses, church services, government agricultural reports and other interesting radio-phone messages.

The company's offices adjacent to these stations may in time be linked into this system, and it is possible that in the not very distant future all of the offices may be communicating with those within operating range by means of wireless telephony.

The American Wiremold Company has established a sales office at 71 West Twenty-third Street, New York City, under the direction of C. W. Abbott, vice-president and general sales manager. The headquarters of the company will continue to be maintained at its factory in Hartford, Conn.

The M. H. Detrick Company, 155 East Superior Street, Chicago, manufacturer of the Detrick arches and the Detrick-Hagan steam-jet ash conveyors, announces the appointment of H. W. Thompson, 503 Mining Exchange Building, Denver, as its sales representative in that territory.

The Triangle Conduit Company, Inc., 50 Columbia Heights, Brooklyn, N. Y., announces that Thomas H. Bibber has been appointed general manager of the company's Western business. In addition to his new duties Mr. Bibber will continue to handle the production and sale of "Tri Cord."

The Multi Electrical Manufacturing Company, 703 Fulton Street, Chicago, announces that A. C. Walton is now located at 500 Fifth Avenue, New York City, where a complete line of "Multi" porcelain cartridge fuse cut-outs is displayed.

The Cutler-Hammer Manufacturing Company, Milwaukee, announces that its Cincinnati office has been removed from the Dwywne Building to the Dixie Terminal Building. A. R. Maujer, formerly of the sales-engineering force of the Pittsburgh office, is now in charge of the Cincinnati office.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

A mercantile company in India (No. 35,286) desires to secure the representation of manufacturers for the sale of electrical goods, railway supplies, etc.

A commercial agency in England (No. 35,308) desires to secure the representation of firms for the sale of wire ropes, cables, electrical fittings, machine tools, etc.

An agency is desired by a commercial traveler in Canada (No. 35,339) for the sale of tools for machinists, electricians, etc.

TENDERS FOR ELECTRIC EQUIPMENT FOR DURBAN, SOUTH AFRICA.—Tenders will be received at the office of the town clerk, Durban, South Africa, until Sept. 28, for furnishing two 500-kw. rotary converters, switchgear and automatic controlling devices and a small quantity of high-tension supply feeders. Specifications are on file at Room 49, Department of Overseas Trade, 35 Old Queen Street, London, S.W.1, England.

EQUIPMENT FOR ELECTRIC PLANT FOR COVENTRY, ENGLAND.—Tenders are invited by the chairman of the electricity committee, Council House, Coventry, England, until Sept. 1, for furnishing and installing at the proposed new generating station, Longford, near Coventry, the following machinery: Two 10,000-kw., three-phase turbo-alternators complete with condensing plant; four water-tube boilers, complete with chimneys, superheaters, mechanical stokers, economizers and all accessories. George E. Tough is engineer and manager.

INTERNATIONAL FAIR TO BE HELD IN PRAGUE, CZECHOSLOVAKIA.—Official announcement is made of the Third International Fair to be held in Prague, Czechoslovakia, from Sept. 1 to Sept. 8. The products to be shown will be classed in eighteen groups, including building and metal trades, electrical and mechanical goods, etc.

NEW ELECTRIC POWER PROJECTS IN JAPAN.—[illegible] according to *Electrical [illegible]*, [illegible] the Abukuma-gawa Hydro-Electric Company and the Tokyo Electric Transmission Company. The former will have a capital stock of 10,000,000 yen and it proposes to build a hydro-electric plant on the Abukuma River, Fukushima-ken, to develop [illegible] kw., while the latter will be capitalized at [illegible] yen and will supply its power to Tokyo.

New Apparatus and Publications

ELEVATOR MOTORS.—The Ideal Electric & Manufacturing Company, Mansfield, Ohio, has issued a [illegible] on its elevator motors.

INSTRUMENT SWITCHES.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has recently placed on the market its type RS instrument switches.

INDOOR CURRENT TRANSFORMERS.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has recently brought out an indoor current transformer known as type K, which is listed for ammeter, wattmeter and watt-hour-meter use.

METERS.—The Sangamo Electric Company, Springfield, Ill., is distributing a six-page leaflet covering its various models of meters.

PULVERIZED COAL.—"Catechism of Pulverized Coal as Applied to Boilers" is the title of an article published in the July, 1921, issue of *Fuller News*, published by the Fuller Engineering Company, Allentown, Pa. Company, Chicago, have issued catalog and

CONDUIT FITTINGS.—S. R. Fralick & illustrated price list No. 21, listing conduit fittings and wiring devices.

INSULATING MATERIAL.—The Diamond State Fibre Company, Bridgeport, Pa., is distributing a four-page leaflet describing its "Condensite Celoron" insulation for gears and radio equipment.

ELECTRIC OVENS.—The Despatch Manufacturing Company, Minneapolis, Minn., is distributing a revised price list applying to catlog 3 of its electric ovens, which went into effect Aug. 10, 1921, and supersedes all previous lists.

AUTOMOBILE CUT-OUT RELAY.—A new cut-out relay has just been added by the Westinghouse Electric & Manufacturing Company to its line of automotive products.

LABORATORY RHEOSTATS.—Beck Brothers, 3640 North Second Street, Philadelphia, are distributing catalog C-10, covering their "Becbro" laboratory rheostats.

DIRECTORY AND BUYERS' GUIDE.—The *Engineer* Directory and Buyers' Guide" (No. 21) has been issued by the *Engineer*, Ltd., 33 Norfolk Street, London, W.C. 2, England.

ELECTRICAL SUPPLIES.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., is distributing its catalog of electrical supplies for 1921 and 1922. The book is cloth-bound, contains [illegible] pages and is thumb-indexed. A general outline of the company's industrial motors and controllers, railway equipments and power and marine [illegible] is also included. This catalog replaces all catalogs issued heretofore on detail supplies.

New Incorporations

M. J. GRUEBEL & COMPANY, 243 Palisade Avenue, West Hoboken, N. J., has been organized to manufacture and deal in electrical appliances. Michael J. Gruebe is head of the company.

THE WOODBRIDGE (N. J.) CONSTRUCTION COMPANY has been incorporated with a capital of $[illegible] to install electric light, heat and power plants. The incorporators are Norman and Clarence Headland, 118 Barron Avenue.

THE NEW JERSEY STORAGE BATTERY MANUFACTURING COMPANY, Jersey City, N. J., has been incorporated by Daniel E. [illegible] and Andrew Weger, 26 Tyson Place. The company proposes to manufacture storage batteries and other electrical equipment.

WALSH & MEAD, INC., New York, N. Y., has been incorporated with a capital of $10,000 to manufacture electric motors and parts. The incorporators are W. R. Walsh, R. Mead and W. Smith. Wechsler & Kohn, 128 William Street, represent the company.

THE SOLAR ELECTRIC LAMP COMPANY, Danvers, Mass., has been incorporated with a capital of $50,000 to manufacture electric lamps, etc. The directors are Oscar R. Bodwell and Peter N. Wettlaufer, Danvers, treasurer.

THE KEMPTON ELECTRIC COMPANY, Topton, Pa., has been incorporated with a capital of $5,000 to operate a light and power system in Topton. D. S. Martin, Reading, is treasurer of the company.

THE A. L. NICHOLS MANUFACTURING CORPORATION, Poughkeepsie, N. Y., has been incorporated with a capital of $50,000 to manufacture electrical products. The incorporators are J. W. Allgaze and C. F. Malcolm, Poughkeepsie. F. E. Hamilton, 61 Broadway, New York City, is interested in the company.

THE GENERAL GAS & ELECTRIC COMPANY, Hanover, Pa., has been incorporated with a capital of $5,500 to operate an electric light and power system in Hanover. W. F. Kintzing is treasurer.

THE COALDALE POWER COMPANY, Riddlesburg, Pa., has been chartered with a capital of $5,000 to operate an electric light and power plant and system in Riddlesburg. John M. McIntyre is treasurer.

THE BLOOMFIELD STORAGE BATTERY COMPANY, Montclair, N. J., has been organized by William H. Cleland, 37 Cloverhill Place, and others to manufacture batteries and equipment.

THE BEAR CREEK (WIS) ELECTRIC LIGHT CMPANY has been organized to operate an electric light system in the village of Bear Creek.

Record of Electrical Patents

Notes on United States Patents

(Issued Aug. 2, 1921)

1,385,979. ELECTRICAL MEASURING INSTRUMENT; Chester T. Allcutt, Wilkinsburg, Pa. App. filed March 2, 1917. Symmetrical rotating electrostatic fields.

1,385,980. CIRCUIT-INTERRUPTING DEVICE; Chester T. Allcut Wilkinsburg, Pa. App. filed Sept. 1, 1917. For automatically interrupting circuits under predetermined conditions.

1,385,981. SWITCH; James M. Brown, Pittsburgh, Pa. App. filed Oct. 8, 1917. To indicate selectively voltage of, or a ground on, any phase of polyphase circuit.

1,385,989. TERMINAL STRUCTURE FOR ELECTRIC RANGES; Frank F. Forshee, Flint, Mich. App. filed March 1, 1920. Busbar structure to which conductors may be connected.

1,385,995. VENTILATING APPARATUS; Rudolf E. Hellmund, Swissvale, Pa. App. filed Aug. 7, 1917. Prevents snow or ice from entering machine casing.

1,385,996. REGENERATIVE CONTROL SYSTEM; Rudolf E. Hellmund, Swissvale, Pa. App. filed Feb. 3, 1916. Control for dynamo-electric machines of commutator type.

1,385,997. SYSTEM OF CONTROL OF SINGLE-PHASE COMMUTATOR-GENERATORS; Rudolf E. Hellmund, Swissvale, Pa. App. filed Dec. 8, 1917. For governing motors of single-phase commutator type under regenerative conditions.

1,386,016. SYSTEM OF CONTROL; Hurd T. Morris, Wilkinsburg, Pa. App. filed June 4, 1915. For alternating-current motors of commutator type.

1,386,017. ELECTRODE-MOUNTING MECHANISM; William L. Morris, Chicago, Ill. App. filed April 19, 1920. Electrode holders for electric furnaces.

386,0[illegible]. ELECTRICAL MEASURING INSTRUMENT; Harold B. Taylor, Wilkinsburg, Pa. App. filed Feb. 4, 1918. Direct-current wattmeters used in connection with shunt.

1,386,045. ELECTRICAL REGULATORS; Walter R. Woodward, Wilkinsburg, Pa. App. filed Aug. 10, 1916. Vibrating-contact type employed for adjusting field excitation of dynamo-electrical machines.

1,386,076. OXIDATION AND COLORATION OF FERROUS SURFACES; Tito Rondelli, Turin, and Quirino Sestini, Bergamo, Italy. App. filed Aug. 24, 1920. Surface to be bronzed is electrolytically coated with iron.

1,386,094. ELECTROLYTIC APPARATUS; Herbert H. Dow, Midland, Mich. App. filed Sept. 3, 1918. For electrically treating natural brine.

1,386,095. ELECTRODE ELEMENT FOR GALVANIC BATTERIES AND METHOD OF PRODUCING SAME; Thomas A. Edison, Llewellyn Park, West Orange, N. J. App. filed Nov. 6, 1919. Improved negative electrode element for primary batteries.

1,386,150. RHEOSTAT; Derek S. Breitenbach, Washington, D. C. App. filed Jan. 21, 1920. Variable type has maximum ventilation.

1,386,155. ELECTRIC FURNACE; Walter S. Burch and William A. Schell, Rochester, N. Y. App. filed July 31, 1919. Manufacture of calcium carbide.

1,386,159. CONTROLLING SYSTEM FOR FEED MOTORS; G. Harry Case, Philadelphia, Pa. App. filed Oct. 7, 1914. For automatically controlling feed mechanism.

1,386,215. ELECTRIC WELDING SYSTEM; David H. Wilson, Paterson, N. J. App. filed Nov. 24, 1913. Automatic regulation of current.

1,386,231. ELECTRICAL IGNITION APPARATUS FOR INTERNAL-COMBUSTION ENGINES; Frederic Billon, Solothurn, Switzerland. App. filed Feb. 13, 1918. Rotor balanced statically, dynamically and magnetically.

1,386,234. CONTROL MECHANISM FOR FLUID AND ELECTRIC COUPLINGS; Thomas R. Brown, Sparkill, N. Y. App. filed May 22, 1914. For controlling train-line circuits.

1,386,244. METHOD OF TREATING BRINE; Herbert H. Dow, Midland, Mich. App. filed Sept. 26, 1918. To prepare brine for electrolysis.

1,386,287. APPARATUS FOR SEPARATING SUBSTANCES OF DIFFERENT DIELECTRIC CAPACITIES; Henry M. Sutton, Walter L. Steele and Edwin G. Steele, Dallas, Tex. App. filed Sept. 24, 1904. Producing dielectric hysteretic impedance in the material

1,386,300. ELECTRIC HEATER; Charles A. Xardell, Utica, N. Y. App. filed Oct. 12, 1920. Self-regulating.

1,386,303. HEAT-CONDUCTING DEVICE; Percy A. E. Armstrong, Loudonville, N. Y. App. filed March 2, 1920. Hot-plate type.

1,386,321. TELEPHONE REPEATER EQUIPMENT; Charles S. Demarest, Brooklyn, N. Y. App. filed May 9, 1919. Means for testing repeaters.

1,386,326. TROLLEY-WIRE SPLICE; James J. Fisher, Junior, West Va. App. filed March 9, 1921. Particularly adapted for use in mines.

1,386,356. ELECTRIC HEATER; William E. Pasik, De Kalb, Ill. App. filed Jan. 19, 1920. Maximum amount of heat-radiating surface.

1,386,387. TYPEWRITING MACHINE; John Waldheim, Elizabeth, N. J. App. filed Sept. 22, 1919. Return of carriage and line-spacing by power-actuated means.

1,386,421. SWITCH OR RECEPTACLE BOX; William J. Newton, Lynbrook, N. Y. App. filed March 9, 1916. Means for securing box in position.

1,386,464. CIRCUIT-CONTROLLING TELEPHONE-RECEIVER SUPPORT; James B. Furber, Rahway, N. J. App. filed Nov. 1, 1919. Hook lever controlled by receiver.

1,386,474. FLASHLIGHT; Joseph Vince, Brooklyn, N. Y. App. filed June 26, 1920. Conductor removable with battery.

1,386,484. DISTILLING APPARATUS; Charles G. Adsit, Atlanta, Ga. App. filed Sept. 14, 1920. For cracking and distilling crude petroleum.

1,386,487. ELECTRICAL STEAM AND HOT-WATER BOILER; Nils R. Forssblad, Vasteras, Sweden. App. filed June 10, 1920. Steam produced by current passing between electrodes submerged.

1,386,535. ELECTRIC IRON; Jose A. [illegible] and Godfrey Alfred De Lange, New York, N. Y. App. filed Aug. 6, 1920. Means for permanently cutting off current when certain temperature has been reached.

1,386,566. GRAVITY TROLLEY RUDDER; Fred Graf, Lankershim, Cal. App. filed Dec. 30, 1918. Wheel automatically aligned with pole when out of contact with wire.

1,386,569. INCUBATOR AND BROODER; Oscar W. Herd, Tulare, Cal. App. filed May 27, 1920. Electric heating means.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

LEWISTON, ME.—Plans have been completed for placing wires of the Androscoggin Electric Company underground from the North Bridge to Hospital Square. O. D. Mudgett is superintendent of the company

SKOWHEGAN, ME. — Bids will be received until Aug. 23 for the installation of an electric lighting system on the grounds of the State Reformatory for Women at Skowhegan. Plans and specifications can be seen at the office of the superintendent, Skowhegan.

NEW IPSWICH, MASS.—An appropriation of $20,000 has been authorized for the installation of a municipal electric light system in New Ipswich. Walter S. Thayer is a member of the electric light committee.

HARTFORD, CONN. — The Plimpton Manufacturing Company is considering extensions and improvements to its power house.

NEW HAVEN, CONN. — The United Illuminating Company has awarded contract for the construction of a two-story addition, 60 ft. x 65 ft., to its electric power plant on Grand Avenue, to the Standard Construction Company, 153 Court Street.

NEW HAVEN, CONN.—The installation of an ornamental lighting system on State Street between Chapel and Water Streets is under consideration.

Middle Atlantic States

BEACON, N. Y.—Application has been made by the Southern Dutchess Gas & Electric Company to the Public Service Commission for permission to erect an addition to its electric power plant near East Fishkill.

BROOKLYN, N. Y. — Plans have been completed by the Artistic Dyeing Company, 100 Jewel Street, for the construction of a two-story power house, 52 ft. x 68 ft., at Moultrie and Meserole Avenues.

CANANDAIGUA, N. Y.—Plans are under way by the Rochester Gas & Electric Corporation for the erection of a new transmission line to Canandaigua, a distance of 28 miles, to cost more than $200,000. Steel lattice-work poles will be used and as an additional support to the line fifty strain towers will be utilized. The plans also include the construction of a substation at Canandaigua and rebuilding the Canandaigua-Littleville transmission line to provide for an increase from 6,600 volts to 11,000 volts.

FILLMORE, N. Y.—Plans are under way by the Fillmore Electric Company, Inc., for the erection of a new transmission line from Belvidere to Friendship, with distribution system at the latter town for light and power service. The company has applied to the Public Service Commission for authority to operate.

GASPORT, N. Y.—The power house of the Wickwire Limestone Company was destroyed by fire recently, causing a loss of about $30,000.

GOUVERNEUR, N. Y.—The purchase of the Duzee water power site for development of electricity for light and power purposes is under consideration by the Village Board.

LAWRENCE, N. Y.—The Milling & Lighting Company, Brasher Falls, has applied to the Public Service Commission for permission to build an addition to its local plant. A franchise for the work has been granted by the Common Council of Lawrence.

NEW YORK, N. Y.—The P. Lorillard Company, 119 West Fortieth Street, manufacturer of tobacco, plans immediate construction of a [illegible]-story plant at Avenue A and Seventy-first Street, to cost, with equipment, about $500,000. Special machinery, transmission equipment, motors and other electrical machinery will be required

NEW YORK, N. Y.—Bids recently received by the Delaware, Lackawanna & Western Railroad Company, 90 West Street, for electrical equipment for the operation of a section of its line in the anthracite district of Pennsylvania have been rejected. New bids, it is understood, will be advertised at an early date. Gibbs & Hill, Pennsylvania Terminal, are consulting engineers.

PATERSON, N. J.—Bids will be received by the Board of Education, Room 24, City Hall, Paterson, N. J., until Aug. 26 for furnishing material and completing work required for the installation of a system of electric lighting and bells in School No. 14. Lee & Hewitt, 152 Market Street, are engineers.

TRENTON, N. J. — The installation of street lamps on South Montgomery Street with underground conduit system is contemplated by the City Commissioners. The Public Service Electric Company serves the city.

TRENTON, N. J.—The installation of an electric lighting system consisting of about 1,000 lamps is under consideration by the Woodlawn Park Association in connection with amusement devices to be erected at Woodlawn Park.

ALLENTOWN, PA.—Plans has been approved by the City Council for extensions to the street-lighting system on Hamilton Street from Penn to Second Streets, and on South Eleventh Street from Hamilton to Walnut Streets.

HARRISBURG, PA.—The City Council is considering the construction of an addition to the municipal filtration plant at Island Park, to cost about $800,000. Considerable electrical and mechanical equipment will be required.

PHILADELPHIA, PA.—The Transportation Committee of the City Council has approved ordinances providing for the condemnation of land at Arrott Street and Letterly Street, where two power houses will be built by the city for the operation of the Frankford Elevated Railway. The additional power plants will cost about $900,000. Work is now under way at Fairmount Avenue on a power house also be used in connection with the railway.

PITTSBURGH, PA. — Preparations are being made by the North Pole Ice Company, Carson Street, for the construction of a one-story ice-manufacturing plant, 60 ft. x 100 ft., to cost about $50,000.

SCRANTON, PA.—The Delaware, Lackawana & Western Railroad Company, coal-mining department, Scranton, has awarded contract for the construction of a one-story machine and forge shop, 50 ft. x 200 ft., at its Storrs Colliery, to cost about $60,000, to the Industrial Construction Company, 514 Union National Bank Building. The company also plans to build a one-story addition to its coal-washing plant at this point to cost about $35,000, and an electric power station and engine hoisting house at the Bellevue Colliery.

SHENANDOAH, PA. — Extensions are under consideration by the Philadelphia & Reading Coal & Iron Company, Reading, to its high-tension electric transmission system in the vicinity of Shenandoah.

ANNAPOLIS, MD.—Bids will be received by the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Aug. 31, Specification 4487, for construction of a coal bunker extension to power house at Annapolis, Md. Address chief of bureau.

GLEN WHITE, W. VA.—Plans are under consideration by the E. E. White Coal Company for the construction of a tipple at its properties. The company also contemplates the erection of a one-story power house with boilers equipped with automatic stokers.

WILLIAMSON, W. VA.—A company is being organized by Mark H. Russell and M. T. Perseger, with a capital of $1,000,000, to construct and operate a cold storage and ice-manufacturing plant in Williamson, for which plans are under way. Considerable electrical equipment will be required.

ALEXANDRIA, VA. — Plans have been prepared for the Bureau of Yards and Docks, Navy Department, Washington, D. C., for the construction of a power house at Alexandria, Va.

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing the following: Until Aug. 30, Norfolk, Schedule 8631 — 320 knife switches; Hampton Roads—4,000 link fuses and miscellaneous fuse elements. Until Sept. 6, Schedule 8637—miscellaneous quantity of electric cable and thirteen terminals; Schedule [illegible]—miscellaneous quantity of electric [illegible].

North Central States

DOYLESTOWN, OHIO.—The Doylestown Electric Light & Power Company, recently organized, has been granted a franchise to install a distributing system in Doylestown. Contract for the construction work has been awarded to the Collier Construction Company, 570 East 101st Street, Cleveland. H. C. Petit is president. Herbert C. Tinker, 771 Chalker Street, Akron, is engineer.

RANDOLPH, OHIO. — The Randolph, Suffield & St. Joseph Electric Light & Power Company, recently organized, is planning to furnish electricity in the villages of Randolph, Suffield and St. Joseph and surrounding territory. Contract for the erection of a transmission line has been awarded to the Collier Construction Company, 570 East 101st Street, Cleveland. J. C. Rogers is president. Herbert C. Tinker, 771 Chalker Street, Akron, is engineer.

LOUISVILLE, KY.—The Kentucky Utilities Company, it is reported, has secured a franchise to erect an electric transmission line to the Federal Sanatorium, now under construction at Dawson Springs. The franchise also permits the company to operate elsewhere in the same territory.

NOBLESVILLE, IND.—The N. O. Nelson Manufacturing Company, 928 Chestnut Street, St. Louis, Mo., is planning the erection of a power house at its local works in connection with the extensions to the enameling furnace and other parts of the plant. L. D. Lownin is president.

MATTOON, ILL.—The proposal to issue bonds for the establishment of a municipal lighting plant in connection with the water system is under consideration. C. I. Jarnes is superintendent of the waterworks.

NEW BOSTON, ILL.—The Illinois Northern Utilities Company is considering the erection of a high-tension transmission line through New Boston, and also about 3 miles of rural line.

OSHKOSH, WIS.—The installation of an ornamental lighting system in Oshkosh is under consideration. For further information address F. A. Fuller, board of directors.

MINNEAPOLIS, MINN.—The City Council has ordered investigation of the feasibility of utilizing power to be developed at the government high dam in connection with a municipal electric plant. The survey will include data as to the amount of power available at the high dam, cost of installing turbines, cost of an auxiliary steam plant, and in what manner the power could be utilized for municipal purposes. F. W. Cappelen is city engineer.

CHILLICOTHE, MO. — The installation of additional street lamps in Chillicothe is under consideration by the Council.

LANAGAN, MO.—The erection of a transmission line from the municipal power plant to Anderson is under consideration by the City Council.

ST. LOUIS, MO.—Plans are to be carried out next year for resuming work of placing overhead wires underground in the residence district of the city at the rate of 4 miles a year.

REDFIELD, S. D. — The Spink Power Company is contemplating the erection of a transmission line from a generating plant at Aberdeen to connect with the lines of the company in Mellette. Proposal to issue bonds for construction of the line will be submitted to the voters in towns along the route. The cost of the entire project is estimated at $150,000.

BEATRICE, NEB. — Petition has been filed requesting the City Commissioners to call a special election to submit to the voters a proposal to issue $150,000 in bonds for an addition to the municipal electric lighting plant.

MADISON, NEB.—The construction of a new municipal electric light plant to cost about $70,000 is under consideration, estimates for which have been prepared by the Henninson Engineering Company, Omaha.

Southern States

LEXINGTON, N. C.—Extensions to the municipal electric light and water systems are contemplated, to cost about $50,000. Paul R. Raper is clerk.

WILMINGTON, N. C.—The Wilmington Cooperage Company, it is understood, is considering plans for rebuilding a portion of its power house recently destroyed by fire.

WILLISTON, S. C.—The Williston Ice Company is considering rebuilding its ice-manufacturing and refrigerating plant recently destroyed by fire.

ATLANTA, GA.—The substation of the Georgia Railway & Power Company at 145 Edgewood Avenue was recently destroyed by fire, causing a loss of about $10,000.

BIRMINGHAM, ALA.—The construction of a new plant, 140 ft. x 150 ft., to cost about $150,000, at the Birmingham Flour Mills is under consideration. Electric equipment, [illegible] and [illegible] machinery and other mechanical apparatus will be purchased.

HARTSELLS, ALA.—[illegible] Lynn of Hartsells contemplates the construction of a dam on Big Four Ranch in Morgan County to cost about $100,000.

JACKSON, MISS.—The construction of an ice-manufacturing and cold-storage plant to cost about $150,000 is under consideration by P. P. Vail and associates of Jackson.

MOUNTAIN HOME, ARK.—An organization is being formed by Dillen Underhill and associates for the purpose of operating an electric light and power plant in Mountain Home. The new company also proposes to erect an ice-manufacturing plant to be operated in connection with the power plant.

CORPUS CHRISTI, TEX.—The Corpus Christi Light & Power Company is considering extensions and improvements to its electric light and power plant including the installation of a new generating unit, to cost about $200,000.

SAN ANTONIO, TEX. — The sum of $100,000 has been appropriated for the construction of a power plant at the Southwest Texas Insane Asylum. J. G. Springer is suprintendent.

Pacific and Mountain States

CHEHALIS, WASH.—Preparations have been made by the North Coast Power Company for improvements to its power plant on Coal Creek in Chehalis, to cost about $17,500. The company plans to change its fuel feed system and install conveyors and equipment to burn "hog" fuel.

HOQUIAM, WASH. — Steps have been taken by the Commercial Club to secure a new street-lighting system in Hoquiam.

BLYTHE, CAL.—Plans are under way for rebuilding the local power house of the Southern Sierras Power Company recently destroyed by fire. The new building will be [illegible] ft. x [illegible] ft. L. V. Wise is local superintendent.

LOS ANGELES, CAL. — The Southern California Edison Company has had plans prepared for the construction of a [illegible]-story power house, 43 ft. x 55 ft., at [illegible] Southwestern Avenue.

LOS ANGELES, CAL.—Plans are under consideration for the installation of electric lamps on Western Avenue and on Windsor Boulevard.

SAN FRANCISCO, CAL.—The Great Western Power Company has been authorized by the Railroad Commission to sell $1,000,000 in bonds, the proceeds to be used for completion of the Caribou plant on the Feather River and for the construction of a high-tension transmission line from the plant to Valona.

ELKHORN, MONT. — Permission has been granted to the Boston-Montana Milling & Power Company, a subsidiary of the Boston-Montana Corporation, by the Federal Power Commission to erect a high-tension transmission line to furnish electricity for the [illegible] and [illegible] works of the company and to towns along the route of the [illegible] Railway. The line will extend from the power plant of the Montana Power Company [illegible] Big Hole River to the [illegible] properties of the Boston-Montana Corporation. It is expected to have the line completed by Sept. 15.

FARMINGHAM, N. M.—The local electric light plant, flour mill and ice plant, it is reported, were recently destroyed by fire.

Canada

WINNIPEG, MAN.—The Winnipeg Electric Railway Company has awarded general contract for the construction of a power plant at Point Du Bois, to the Northern Construction Company, Union Bank Building, Winnipeg. The cost of the plant is estimated at about $5,500,000.

Electrical World

New York, Saturday, August 27, 1921

Electric Service—An Inspiring Message From the Pacific Coast

AN INDUSTRIAL conference was held not long ago at Del Monte, Cal. Men representing every branch of the civic, commercial, industrial and financial life of the West were there. They were talking about Electric Service, and Wigginton E. Creed, president of the Pacific Gas & Electric Company, gave them a message from the electrical men of the Coast that should be passed along until it echoes around the world.

The electrical industry, Mr. Creed told them, has been working a revolution in California that eventually will bring to every land a sweeping advance in both social and economic life. For California has been demonstrating for all men to see that power for production can be created and applied on a scale so great that it staggers the imagination.

In California last year, he said, the electrical energy generated totaled over 3,500,000,000 kw.-hr. This was the equivalent of the labor of ten million men, created out of the rushing waters of the mountains, to aid those who work in California to produce more wealth and serve more greatly. To do this cost less than half of 1 per cent of a three-dollar wage. And the program of hydro-electric development now under way in the states west of the Rockies contemplates the harnessing of a further 2,500,000 hp. within the next ten years, at an investment of more than a billion dollars. The cities of the East proclaim their industry by smoking stacks. The Coast is writing industry across its skyline with tall steel towers and great transmission lines.

The world needs power—more power and more. For power is the cheapest tool. Power takes the place of men. Power makes it possible for one man to do the work of ten. Electrical energy in the United States last year saved 25,000,000 tons of coal. Merely to mine this coal would have absorbed the labor of 70,000 men thus released for other use. And the electrical industry has reduced the average cost of electrical energy itself by 50 per cent in the last eighteen years. So is the work of man increased to serve his growing needs and meet his greater opportunities.

The United States uses more power than any other nation—Great Britain included. We generate today four times as much electrical energy per single employee as in 1902. The great plans for our nation-wide water-power development and superpower distribution promise new power beyond conception. And here great inspiration comes from the marvelous achievements of the electrical men of the Far West. The ELECTRICAL WORLD believes their message should be carried to every corner of the nation.

Loyall Allen Osborne

An executive-engineer whose original and constructive work in electrical manufacturing and sales organization and whose leadership in rushing war production of munitions and effective service on the National War Labor Board have gained wide recognition.

DURING the past thirty years L. A. Osborne has been a potent influence in the affairs of the Westinghouse Electric & Manufacturing Company. The plan of its production organization at East Pittsburgh is largely his; the sales organization has also been of his making, and today he is in charge of the company's general commercial and foreign policy. Whenever problems have required original and constructive thinking his leadership has been outstanding, and its influence has extended into the broad field of industry.

It was Mr. Osborne, for example, who was elected by the Westinghouse company to execute the order for [illegible] Russian rifles which he secured from the British government in [illegible] [illegible] problems of intensive production ever placed before an American manufacturing concern. So well was this work planned and executed by the New England Westinghouse Company, an organization created by Mr. Osborne, that when the United States entered the war in 1917 it was possible to turn out 60,000 Browning heavy machine guns with the [illegible] perts held had never been equaled.

In 1917, when the necessity for uninterrupted production of war essentials was manifest and the strained relations between employers and employees were jeopardizing the successful prosecution of the war on the part of the United States, it was Mr. Osborne whom the National Industrial Conference Board chose as its spokesman in presenting to the government a remedial plan. That plan resulted in a Presidential call for a conference between employers and employees and the creation of the National War Labor Board, of which Mr. Osborne was made one of the members by the President.

Mr. Osborne was born in Newark, [illegible] Cornell University in 1891. He began his business career with the Westinghouse Electric & Manufacturing Company on Aug. 1, 1891. After about one year spent in erecting that company's machinery he was placed in charge of the engineering and designing work in its Newark plant. In 1894 he resigned to engage in private enterprise. One year later, when the company established its main works at East Pittsburgh, Pa., Mr. Osborne was asked to assist in organizing the production department, and soon thereafter was appointed assist- [illegible] 1900 manager of works, and in 1902 fourth vice-president in charge of manu[illegible] His work soon involved activities outside of the duties laid down for his office, and in [illegible] charge of the sales organization as well as engineering activities.

In 1917 Mr. Osborne's headquarters [illegible] the Westinghouse Electric International Company when that company was or- [illegible] while on a visit to Japan, Mr Osborne was decorated by the Emperor with the [illegible] in recognition of the part he had personally played in developing the electrical industry of that nation. Mr. Osborne is a fellow of the A. I. E. E., a member of the other leading national engineering societies, vice-chairman of the National [illegible]

Electrical World

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Illuminating Engineers to Remain in Engineering Societies Building

LAST spring, when it seemed probable that the Illuminating Engineering Society would have to leave the Engineering Societies Building, because of lack of space, the ELECTRICAL WORLD protested against the contemplated change, insisting that the building was erected for just such engineering bodies and that there was yet room in it for the illuminating engineers. This led to numerous conferences, and after a thorough canvass of the situation very desirable quarters were offered to the illuminating engineers and accepted by them. Thus the matter has been amicably settled with credit to every one concerned. Both the Engineering Foundation and the Illuminating Engineering Society are to be congratulated on the outcome, and particular thanks are due the American Society of Civil Engineers for its generosity in giving up part of its quarters to the illuminating engineers. Co-operation of this sort is highly commendable.

The Untoward Effects of a Spirit of Economy

JUST now there is a wave of economy sweeping through the land. Depression in business and loss of employment have been widespread so that readjustments and retrenchments have become in many instances absolutely necessary. Congress has caught the fever and the edict has gone forth that governmental expenditures must be cut. But are we not borrowing trouble in dealing with matters of an economic character in a crude and hysterical way, rather than in a businesslike and fundamentally sound manner? And can we afford as a people to jeopardize progress and deal unfairly with those who have in a spirit of faith and loyalty contributed greatly to the nation's upbuilding?

Our navy is admittedly the best equipped in the world, and the electrical industry has played no small part in making it so. It has specialized in electric propulsion and built expert organizations and huge plants to handle this branch of naval work, firm in the conviction that the work would be appreciated, commitments adhered to and the industry sustained. Now the whole structure is threatened and progress retarded through lack of appropriations. Huge plants specially built for naval work will have to shut down and the trained organizations built up at much pains and expense to disband if the plan now contemplated is carried out. This, to put it mildly, is a great injustice to those electrical manufacturing companies and to their employees who have co-operated with and favored the government to the exclusion of more profitable and abundant commercial business. The Navy Department itself does not wish to cancel, but rather to postpone, the contracts; however, the commitments are so large and the monetary value of the work so great that no company can carry without great hardship the financial burden that deferred returns would cause. Moreover, it is rather poor policy for the government to add to the ranks of the unemployed at a time like this. We cannot beget optimism by practicing pessimism, but when it comes to matters of national defense the government apparently has learned nothing from the late war. Otherwise the mistake of discouraging developments in armament that carry with them vast commercial possibilities would be obvious to it.

Utility Securities Receiving Much Favorable Publicity

IN THOSE metropolitan newspapers that carry a column devoted to investment suggestions the securities of public utilities are receiving an amount of favorable publicity that could not be secured by the utilities themselves in any form of paid advertising. When requests are made for safe and reasonable investments the bonds and notes of well-known companies are frequently mentioned in the same class as Liberty bonds and the obligations of the foremost railroads that are recognized investments for savings banks.

This is valuable publicity for two reasons—first, it sets the man in the street thinking about the safety of public utility securities, and second, the recommendation frequently brings home to him an understanding that the reason for this safety is regulation by public service commissions and the growing tendency to allow the electric light and telephone companies to earn a better return on their investment through higher rates for the services they render. Appreciation of the need for adequate rates of return brought about in this way should help to overcome the grumbling often heard in the past when increases for light, power and telephone services are put into effect; and as the army of small investors in these securities grows this tendency will be a real factor in promoting so-called public good will toward the utilities.

What Happens When the Power Goes Off

AMERICAN manufacturers have a traditional failing which has undoubtedly been a serious obstacle to the development of American foreign trade in many quarters of the world. They have unwittingly taken the attitude that when the goods are unloaded at the freight depot from which they are to be shipped the responsibility of the manufacturer ends. As a matter of fact it cannot end until the distant customer receives his purchase in good order; for, so far as practical results are concerned, there is no virtue in making the goods right unless they are packed right and shipped right so that they will be right when they arrive.

There is a partial parallel in the manufacture and sale of electrical energy since it is not enough that the customer be connected and served if the service is interrupted at times and injury is thereby caused. What the purchaser expects is continuous service, and in many cases such service is absolutely vital. To insure unbroken continuity therefore becomes the very essence of the responsibility of every employee. In this issue R. H. Tillman presents this thought with a definite statement as to just what does happen to different classes of customers when the power goes off. He stresses an aspect of central-station service that may profitably be impressed on the minds of the entire organization.

Benefit-Sharing System for Utility Employees

TO APPLY the general principle of a bonus or premium for efficient work to miscellaneous employees of a public utility company is a somewhat difficult task, but one of our big Middle Western utilities has been attempting it with very satisfactory results. The particular scheme used is the fixing of a standard fair time for a worker or gang of workers performing a definite task. If that time is bettered, there is a proportionate saving to the company, and this gain, figured at the usual rate, is divided "fifty-fifty" between the gang and the company after a percentage sufficient to cover the clerical cost of operating the plan has been subtracted. In our last issue Mr. Baum gave an outline of the extent to which this principle has been carried and the various tasks to which it has been successfully applied. It will be seen that the premiums won are big enough to matter, and that varieties of work are covered which at first thought seem hardly within the scope of such an arrangement.

The gain-sharing scheme in more or less modified forms has been tried many times in manufacturing establishments, and generally with excellent results, but this is the first instance which has been brought to our attention where a utility has carried it out through a force of employees ranging all the way from engineers and firemen to meter readers and bill clerks with consistent fairness and success.

Automatic Substation Practice

A CHANGE from so-called standard practices is justified whenever it leads to future progress, even though it does not save a cent at the immediate moment of its installation. The great and costly blunders in electrical distribution have been in sticking to old-fashioned methods when they were clearly passing into obsolescence, saving perhaps a few temporary dollars to perpetuate conditions of inefficiency. From our viewpoint the automatic substation is fully justified and is likely to play a very important part in future electrical development, as is also the automatic hydro-electric generating station. The automatic substation on widespread alternating-current distributing networks has been thoroughly tried out and has proved so successful that in the majority of cases there is little occasion for using anything else. The elimination of substation labor as well as substation buildings of any elaborate kind is a very important measure of economy.

The larger central-station companies are in a rather bad situation, looking at the distribution as a whole. Starting as direct-current stations pure and simple, with a feeling that alternating current was a device invented, if not patented, by his satanic majesty, they stood committed by formidable investments to a direct-current policy which had long been outworn. Their voltage of distribution is absurdly low from the standpoint of modern practice. They are perpetuating things that belong to the century past and not to the century present, but they are doing it for the most part under the compulsion of investments which cannot be thrown away and under circumstances where it is at least temporarily desirable to make the best of a bad matter. By means of the automatic substation it becomes possible to serve a direct-current network which is a model of inefficient distribution on account of its low voltage. It has to be fed, if any sort of economy is to be realized, at a considerable number of points, and if labor as well as space has to be wasted at each one of these points, the situation is a sorry one indeed. It is possible, however, by methods which have now been thoroughly worked out, to feed in from synchronous converters, motor-generators and the like at a large number of points without a demand for great space and with the possibility of eliminating all labor except that of inspection. The synchronous converter has been rather the favorite instrument of conversion, although we are half inclined to think that the motor-generator, or perhaps better yet the cascade converter, is likely to find application as simpler on the whole to manage automatically than the ordinary rotary.

Will Illinois Make Rural Utilities Successful?

THE possibility of building up rural utilities is seen in the rural service rules which have been adopted by the Public Utilities Commission of Illinois. The result of the application of these rules, which are printed in part in this issue, will be watched with intense interest, particularly as most public utility men who must face this problem are beginning to feel that such utilities are not likely to prove any greater success from an operating standpoint than have the rural telephone utilities. It is significant that in the rules governing classes I and II, under which the rural utility and purely mutual companies will be formed, the company that is called upon to furnish energy to the rural utilities must assume the responsibility of determining whether the overhead construction conforms with the commission's requirements. It would seem that this is a confession of weakness. Legally such companies as those just alluded to are competent to carry out the duties of a utility corporation, but the commission has apparently been compelled to recognize that from a practical standpoint there is difficulty in enforcing the legal obligation. The rules as written will probably insure the use of proper construction to begin with, though at the cost of some worry to the utility that must refuse connection to improperly constructed lines. The real test will come a few years hence when the effect of routine maintenance work begins to be felt. Those lines to individual consumers maintained by the utility under class III will constitute only a utility problem as the rules provide for ownership and maintenance by the central-station company. Whether the rural utilities and mutual companies will be able to see the wisdom of proper maintenance is a moot question that time only will answer. The rural telephone utilities have not been able to realize the necessity of proper maintenance or even construction.

A Real Help in Routine Work

THE development of a simple formula by which rough transmission or distribution-line calculations can be made without the aid of charts or other reference data is a need that all electrical engineers have felt. Such a formula is required chiefly when the engineer is in the field away from his handbooks and reference data. Elsewhere in this issue Austin Burt presents a "rough-and-ready rule" the basis of which is two key numbers and a simple formula. With this formula and a slide rule or pencil and paper, or the usual field equivalent in the shape of a board, the principal checks can be worked out. The formula may not satisfy the stickler for mathematical exactness, but Mr. Burt does not claim more than approximate results. He is, however, adding to the field equipment of the engineer a formula that will enable him to discover errors in the average run of line design and know whether he must resort to further investigations. It will also enable him to answer readily the numerous questions that arise in the field as to what size of conductor is needed under certain assumed conditions. In such calculations the use of refined formulas is generally a waste of time, since the working out of exact data on which to base estimates will make no material change in the estimated cost of lines. This, after all, is the test as to whether methods used in estimating are justified. Such contributions as Mr. Burt's are a real help in the routine work of the transmission and distribution engineer.

Some Difficulties in Parallel Operation

IN THIS issue D. D. Higgins of the Commonwealth Edison Company describes some experiments made to analyze certain surging effects between two stations of that company. The phenomenon examined was a surge following an attempt to transfer a load from one station to the other and varying from a slight disturbance of voltage of no great importance to one that threw the circuit breakers on the tie line. An investigation disclosed that the trouble was chargeable to lack of reactance in the line coupled with lack of flexibility in the regulation. The receiving machines, being held up to voltage, had to drop back in phase, and since the sending station could not furnish current output against the tie-line resistance extra load came on the receiving end. Down came the instantaneous speed, a cross-current began to demagnetize the receiving machines and the mischief was on. The effect of the surging was aggravated by the high inertia of the fast-running turbines and became cumulative.

This situation is one quite typical of the troubles which follow the inflexibility in the dynamical sense that results from closely regulated prime movers and lack of the electromagnetic buffer provided by liberal reactance. Similar troubles have occurred in other stations and under quite different conditions. They have been commonest in steam-driven stations of large capacity and rather rare on hydro-electric systems with long lines to soften the shocks. It is most important to run down the exact details of the difficulty, as was done here, for interchange of energy on a big scale is one of the necessary features of modern distribution systems. The broad moral would seem to be that the several participating stations should not be tied in too rigidly, but should work, at least during periods of rapidly changing load,, through enough reactance to ease up the working conditions. It was found out in the early days of power transmission that there was such a thing as excessive inherent regulation, and the same principle applies with even greater force to the bigger units and vaster stores of energy in the superpower plant of the future. We do not apprehend much trouble on the long trunk lines. It is far likelier to occur, as in Chicago, where big stations work together in an area of immense output.

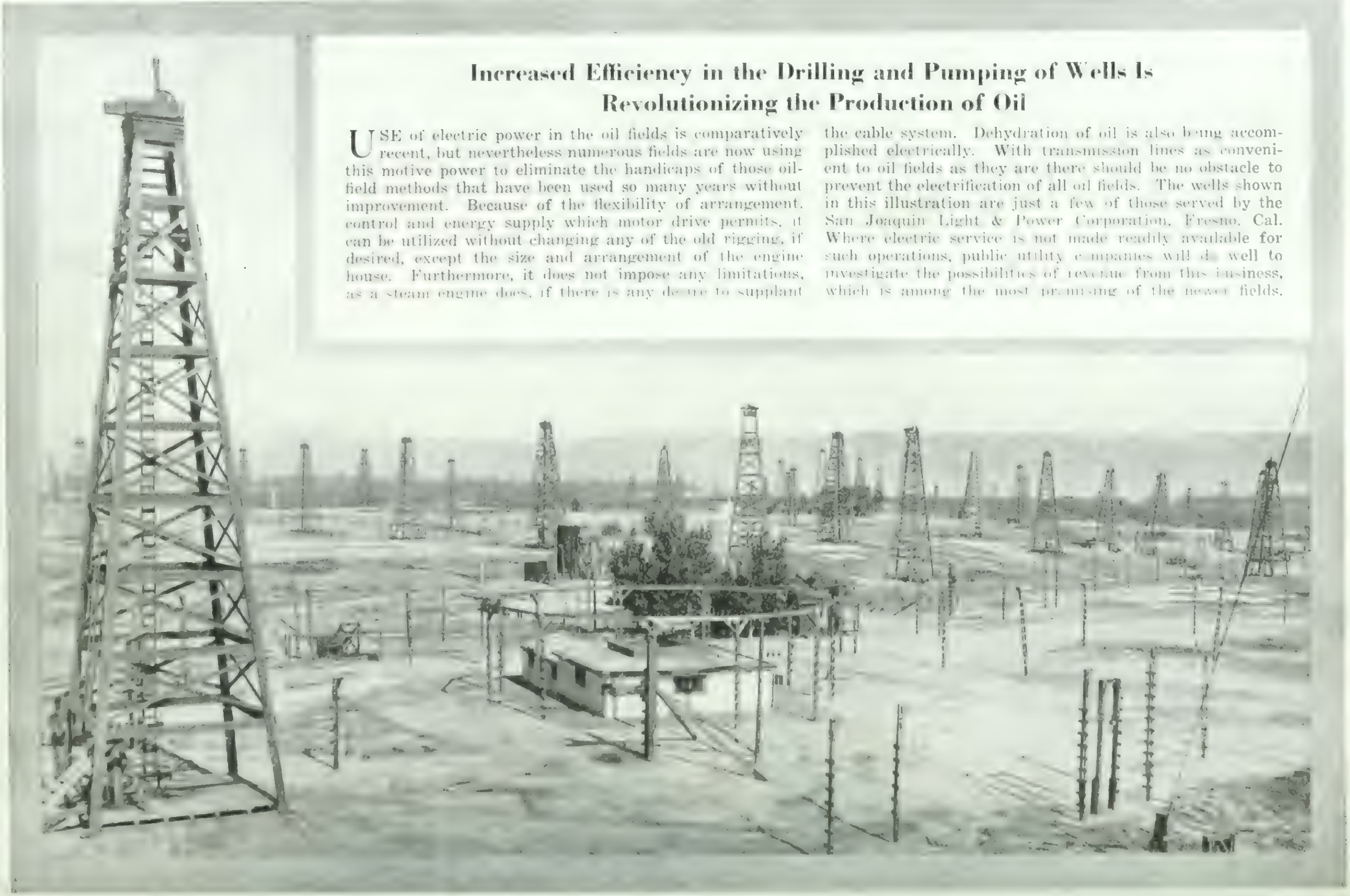
Advances Probable in High-Frequency Field

RECENTLY perfected methods of multiplexing in telephony by the use of carrier currents of different frequencies, and experiments in wired radio or guided wave transmission, are of interest not only because of the improvements they offer over existing methods, but also because a relatively unknown field of electrical phenomena is involved and new methods of exploration made available. Multiplexing is of value chiefly on long toll lines between important centers, and the application of the new methods to this class of service constitutes an important advance in telephony. However, while the equipment needed is relatively simple as compared with other methods which have been proposed, the questions of complication and cost of operation are still serious, and in congested short-range districts operation is still more economical by increasing the number of connecting lines and the use of present standard methods. The chief advantages claimed for wired radio or guided wave transmission, in addition to the multiplexing feature, are increased efficiency, greater purity or quality, greater secrecy and the possibility of using power lines for signaling purposes also, by superposition of the high-frequency carrier current. The last of these appears to have promise of most importance, but the developments in this direction are as yet too meager to indicate certain value.

Great importance attaches to these developments, however, in that through them the whole field of frequency value is laid open. For years after the first introduction of low-frequency alternating currents imagination reached into the vast stretch of unknown frequencies, in speculation as to the possible treasures to be found there, but with no means of exploration available. The oscillating circuits of spark telegraphy, the Poulsen arc and the high-frequency alternator have made their well-known advances; but it remained for the hot cathode tube, with its flexibility as generator, amplifier, rectifier and detector and its simplicity in control, not only to render multiplexing by resonant methods possible but to throw open the whole field of frequency for study and use. The developments already reported indicate that extensive study and investigation will be necessary. Inductance, capacity and resistance as we know them all require modification, and the relations between radiated and transmitted energy are still obscure. However, with so powerful and flexible an instrument as the thermionic tube and the experimental technique already developing, it is certain that rapid progress will be made in uncovering the laws controlling this new field and in showing their possibilities. Multiplexing and guided wave transmission are the first but probably not the last products of the use of high frequency over wires.

Increased Efficiency in the Drilling and Pumping of Wells Is Revolutionizing the Production of Oil

USE of electric power in the oil fields is comparatively recent, but nevertheless numerous fields are now using this motive power to eliminate the handicaps of those oil-field methods that have been used so many years without improvement. Because of the flexibility of arrangement, control and energy supply which motor drive permits, it can be utilized without changing any of the old rigging, if desired, except the size and arrangement of the engine house. Furthermore, it does not impose any limitations, as a steam engine does, if there is any desire to supplant the cable system. Dehydration of oil is also being accomplished electrically. With transmission lines as convenient to oil fields as they are there should be no obstacle to prevent the electrification of all oil fields. The wells shown in this illustration are just a few of those served by the San Joaquin Light & Power Corporation, Fresno, Cal. Where electric service is not made readily available for such operations, public utility companies will do well to investigate the possibilities of revenue from this business, which is among the most promising of the newer fields.



What Happens to the Customer When the Power Goes Off

A Review of Definite Conditions Caused by Service Interruptions in a Number of Typical Industries—Evidence of the Importance of Continuous Service—Customers Are Rational Beings Much Like Other Men

By R. H. TILLMAN
Manager New-Business Department, Consolidated Gas Electric Light & Power Company, Baltimore, and Chairman Commercial Section, N. E. L. A.

EVERY day that passes finds it necessary for us to try to convince some one of our customers or prospective customers that we furnish the most nearly continuous and perfect power supply that can be had from any reasonable or equitable source. As a subject it is one vitally interesting both to our company and to our customers. Although the word "service" has been worn threadbare, it still stands for the fundamental idea of the utilities business and represents one, if not the most important, aspect of our business today. Why is it so necessary to give uninterrupted or good and continuous service? The majority of the American people are much more interested in service than in cost. The general public recognizes that poor service is dear at any price and is willing to pay for the best, so unless real service is given rate adjustments are impossible and new business, which is necessary for the continuous growth of our industry, cannot be obtained.

This article was written by Mr. Tillman as a paper to be presented before the engineering and operating departments of the Consolidated Gas, Electric Light & Power Company of Baltimore. Mr. Tillman writes:

"On first thought this might seem too severe a criticism of modern electric power service, but outages do occur and it is well to know what they mean to the good friend on the other end of the line. We hear so much these days about good service records and the large investments that are made in generating stations and substations to minimize the possibility of interruptions of the electrical supply. We hear so little of what really happens when service is discontinued without notice to the user.

"Many operating men think of little beyond the switch and meter boards of the stations in which they are working, yet they are responsible for keeping the service on the lines and they should fully understand the kind of disasters that are caused when they are not on the job. No man can do his best work when he does not appreciate why it is being done and what happens when it is not done."

The Baltimore utilities have had this paper placed in the hands of every employee in their organization whose duty it is to see that uninterrupted service is maintained or that if trouble does occur it shall be remedied as speedily as possible.

The importance of the subject, therefore, must be plain to every clear-thinking electric light and power company employee. Interruptions to any part of the system mean inadequate service, and such interruptions cannot be corrected without, first, knowing the causes and, second, finding the means for their prevention.

It must be remembered that the utility business should be considered as a whole and that what occurs in one city has its effect throughout the industry. In fact, our first information as to serious interruptions of service in other cities often comes to us through customers and prospective customers. Although purely local concerns and industries know and appreciate the service given by a local utility, the prospective power customer who has had poor power survice from a public utility in some other part of the country is certainly from Missouri when we attempt to convince him of the excellence of our local service. We therefore need good friends at court—satisfied customers—to give evidence to such prospective customers that the utility representative can do what he promises.

Of course, it is difficult to get a customer to put in writing the fact that he has received good service, even though he knows that his electric supply has been unquestionably satisfactory. The explanation is that the average customer will remember one minute's interruption longer than the other 525,599 minutes of good service in the year. In fact, he has a natural tendency to forget all but the one minute's trouble. If you try to tell him that he should shut down a steam pump and operate by electric motors, he will tell you in strong language the destruction wrought by that one minute's outage.

In many industries customers can prove their statements to the effect that interruptions of electric supply cause considerable destruction and loss. Let us see what happens in some of these typical businesses with which we are familiar when an interruption to our service occurs.

The Fertilizer Industry.—Continuous supply is important in this industry and is important to our company. We have in Baltimore seven plants that manufacture their own acid, and in these plants an interruption causes the greatest loss possible in the fertilizer industry. These seven plants have a connected load of 14,600 hp. As is well known, the present method of producing sulphuric acid is the burning of pyrites or sulphur to form sulphur dioxide and the combining of this with oxygen and water by means of gas circulated in chambers and towers. If the power supply is even momentarily interrupted the fans circulating the products of combustion through the towers stop, and the fumes leak back out of the regular channels and are injurious to the workers or to any one coming in contact with the fumes. In addition to this actual danger to life, there is also a great loss of acid production and permanent injuries to the lead chambers.

A fifteen-minute interruption will cause a greatly reduced production for at least three days. If the interruption lasts for thirty minutes to two hours, depending upon the acid and water-storage capacity at the top of the towers, the plant will have to be entirely shut down, all acid withdrawn, the furnaces rebuilt and the plants started up in the same manner as a new plant. This will take at least one week to ten days. Moreover, the plant will have to be operated long enough to eliminate all of the impurities from the chambers before pure sulphuric acid can be manufactured. Of course, all of this is in addition to labor loss in all of the departments of the plant.

Most Chemical Processes Must Be Continuous

Other chemical industries exist in most of which the same troubles are experienced when an interruption occurs. We have one plant in which two serious difficulties arise whenever there is any stoppage in the process of manufacture. First, arsenic acid is made from nitric acid, and it is necessary to have air at all times to keep the acid in circulation in order to absorb the very deadly gas which is generated. This air is obtained from an electrically driven air compressor and pulsometer. When electric drive stops no air can be obtained and the deadly arsenic gas is set loose through the air, which results not only in a great loss in gas but also in serious inconvenience and danger to those working around the plant. If the interruption be of long duration, all the atmosphere around the plant becomes brown from the escaping fumes. Second, in this plant, which also manufactures insecticides, mixers are driven by electric motors. When any interruption occurs the lime or calcium in the solution falls to the bottom. It is then very difficult to start mixing again, often requiring from two hours to two days to get the mixers going properly, and in some cases the gears are stripped by these mixers in starting.

The Bottle Industry.—We have in Baltimore four glass works, all on our lines and all producing machine-made bottles. Although one of these companies still retains its steam-driven air compressors and other steam-driven equipment, with this exception they are entirely dependent on us for service. This necessitates the continuous operation of a boiler plant, as the customer puts it, "entirely for protection against a cut-off of power."

In the glass-bottle manufacturing process the glass-melting furnaces and the bottle-making machine cover the main and important work. These two processes require approximately 40 lb. air pressure (2.80 kg. per sq.cm.). Some of this air is reduced by reduction valves to 15 lb. (1.05 kg.) for the oil burners on the furnace and some for variable pressures used on the machines for bottle blowing. Some air also is used for the automatic operation of part of the mechanical features of the bottle machines. Electric motive power is required for the main drive on the machine, and it is necessary that this combination function simultaneously. Any interruption to either the air or the electric current causes the machine to stop, with disastrous results, in that the molten glass immediately changes its state and the machine must be cleared before any further glass can be taken from the furnace. Besides, if there is any interruption in the air pressure which operates the oil fires in the furnaces, it permits the oil to lodge in the molten glass and burns and causes bubbles in the glass and ruins the output of the furnace for a period of one or two hours after such an interruption. In fact, in this class of industry the claim is made that an outage of five seconds or less is as serious as if it had been of minutes' duration instead of seconds'. Therefore any disturbance on our system which would cause either the no-voltage or the overload release to operate on the air-compressor motor of a glass machine would cause serious trouble.

We have always experienced difficulties in satisfying this class of industry that electric service is reliable and satisfactory for its particular work. At the present time one of the glass companies is seriously considering installing an isolated plant, regardless of the cost of operation, since it feels that it can by this means provide itself with a continuous electric power and air supply, just as it did before it discontinued the use of its own plant. It is unreasonable to require our customers to make large investments in their own plants solely to safeguard their apparatus and processes from interruptions of our service.

The Foundries.—It has been an arduous task to convince our customers who have cupolas that we supply sufficiently reliable service. As is well known, if the cupola is in operation with molten metal and an interruption occurs for any great length of time, the complete melt will freeze, and this necessitates digging out the entire run. One of our large customers has threatened several times to discontinue our service as a result of short interruptions and has rendered us bills because we have caused serious losses both in its furnaces and its cupolas.

The Railroads.—Among the statements made by the representatives of railroads as to the importance and seriousness of interruptions of our service, we find that the interruption of our Monument Street 25-cycle feeders to the Mount Royal station of the Baltimore & Ohio Railroad means the tying up of the main line of the trunk railroad. The Belt Line is the neck of the bottle of traffic at this point, and with electric locomotives out of service freight trains are held up, with delay to passenger schedules.

Interruption of the 60-cycle service at Mount Royal means a complete tie-up of all traffic from Mount Royal to the Camden station in both directions through the Howard Street tunnel, because automatic signals which are operated from our 60-cycle distribution system have been installed recently between the Mount Royal and Camden stations. An interruption of 60-cycle service to the Mount Royal and Camden passenger stations from our Sharp Street substation is also very serious, as it means the absolute confusion of the public in trying to get to and from the trains at night.

Outage of our Pennsylvania Street 25-cycle feeder to the Mount Clare shops and Camden station means that 2,500 men are idle, the hydraulic freight and passenger elevators are tied up, the public suffers inconvenience and so on. A stoppage of the 25-cycle service to Curtis Bay means an interruption in the operation of the coal pier as well as the tying up of boats scheduled to sail, thereby incurring heavy demurrage charges.

Interruptions to service to the Pennsylvania Railroad grain elevator and coal pier and signal system cause complaints similar to those just cited for the Baltimore

& Ohio. One statement from the Pennsylvania Railroad regarding the ventilation of the tunnel and the service to Union Station and the signal system implies that a tie-up in its signal system would be a great deal more serious even than the one on the Baltimore & Ohio. Traffic, both passenger and freight, comes through Union Station, and there are a great many more trains per day.

Ice Manufacture.—All electrically driven ice plants in Baltimore are of the raw-water type, which means that a continuous agitation of the water in the cans must be maintained to produce clear, crystal-like ice. There are two methods used in the electrically driven plants, in one of which the agitation is by compressed air from a tube inserted in the center of the can of water and in the other from a tube forming part of the can itself. If the service is interrupted, the water backs up in the tube, and when the tube is next to the brine it will freeze immediately. No further air can be sent to the bottom of the can for agitation, and therefore the ice freezes white. It has been ascertained that the loss due to outages which caused the production of white instead of clear ice is $400 per interruption.

About half of our large ice-making customers have the low-pressure system and can stand an outage of ten to fifteen minutes without freezing the air-supply tube. Another makes ice by the plate system and is affected in the same manner.

Other Classes of Customers.—We have had serious complaints from large coffee-roasting companies where approximately 6,000 lb. (2,700 kg.) of coffee was ruined owing to a short outage of electric service. Even greater losses can occur in some of our larger coffee-roasting concerns by less than a minute's discontinuance of the energy supply.

In hospitals the paramount issue is of dependability of service, since the loss which an interruption in service may cause cannot be measured in dollars and cents, but may perhaps result in loss of life, if it occurs during an operation. This is undoubtedly the only reason we have not gained one of our large prospective hospital customers. The management claims that during the history of the institution it has not sustained a single interruption of the service given by its own electric plant.

There have been losses sustained by bakeries, enameling companies, theaters and hotels for which recompense has usually been claimed with insistence. We are fortunate that the newspaper and printing establishments in Baltimore are in our direct-current district, because of the safeguard thus afforded them by the storage battery.

The seriousness of an outage in the retail stores, particularly during the busy hours, is obvious and requires no elaboration. The municipal buildings, street lamps and city water supply are also entirely dependent on our service, and it is therefore extremely important that there shall be no interruption in furnishing it.

The selling and disposing of electrical energy governs all the functions of our business, for if the energy cannot be sold at reasonable rates, it cannot be produced, transmitted and delivered. Therefore any cause that limits its usefulness or makes it less salable is a detriment to the proper growth of our business. We must remember that continuity of service is vital, and where there is not continuity our customers inevitably suffer loss of efficiency, loss of time, loss in production, and therefore loss of confidence.

Fire Chiefs' Reports Show Few Electrical Fires

Early in 1921, when widespread publicity was given to the fire-loss statistics compiled by the National Board of Fire Underwriters, the Society for Electrical Development compiled figures showing that the report of the Underwriters was unjust and misleading. The action was taken within a few hours of the publication of the damaging reports and was made possible by reason of the society's having for several years collected fire-loss data from the fire chiefs of the country. While the Underwriters' statement gave electricity as the chief single cause of fires, the figures compiled by the society from reports received from 345 cities showed, as printed in the Electrical World for Jan. 29, page 277, that in these cities 138,553 fires occurred in 1919, of which those of apparently electrical origin numbered only 3,568, establishing a ratio for electrical fires of 2.57 per cent.

This year questionnaires sent to the fire departments in all cities of 5,000 population or more are bringing unusually complete and satisfactory reports, indicating that while electricity is rapidly replacing all other sources of illumination, the number of fires due to electrical causes has not increased in the same proportion. Furthermore, there are many notable examples of relatively small fire losses chargeable to electricity. In Cambridge, Mass., in 1920 there were 780 alarms, with a total fire loss of $431,905. Only one fire in a building was of electrical origin, and the loss was only $259. This electrical fire represents one-fourth of 1 per cent of the total number of fires, and the loss was one-fifth of 1 per cent of the total loss. In Springfield, Mass., with a population of 129,000 and 1,002 fires, with a total loss of $360,115, there were only three fires of electrical origin, and the loss was only $36.61. In Carthage, Mo., there were sixty-four fires. One was caused by defective wiring and was responsible for a loss of $155. The total loss from all fires was $34,587. Thus far fifty-six cities and towns have reported no fires of electrical origin during 1920. These places have a total population of 818,000, and the total fire loss was more than $1,600,000.

Educating the Fire Department Officials

In compiling the fire-loss statistics the society's object is not merely to obtain the fire departments' figures but to educate the fire department officials so that they will recognize what should and what should not be classified as an electrical fire. In the past a large number of the fire officials have classified as electrical many fires of so-called mysterious origin simply because the buildings were supplied with electric service and no other cause of fire could be ascertained.

There are, moreover, numerous fires which are confined to street cars, automobiles, poles, transformers, generators and motors. These fires in no way affect property of private ownership and hence should be segregated from those fires which cause losses in residences and commercial buildings. Efforts are also being made to classify all electrical fires according to their origin so that it may be possible to take steps to correct the faults and thus reduce the number of such fires to a minimum.

Thirty Million Japanese Enjoy Electric Service

More than Half the People of the Island Empire Live in Electrically Lighted Houses—Number and Size of Lamps per Dwelling Very Low

THE growth of the electric light and power industry in Japan in the past fifteen years resembles very closely the great strides which have been made by this industry in the United States during a similar period. As shown in Fig. 1, the number of electric power companies in Japan has increased from 500 in 1903 to 3,400 in 1918, and during the same period the installed rating of the central generating plants of these companies increased from about 90,000 kw. to about 1,820,000 kw. Based on past growth, it is estimated that the installed generator rating at the present time is about 2,100,000 kw., or about equal to the combined rating of the central generating stations of the states of Pennsylvania and Ohio.

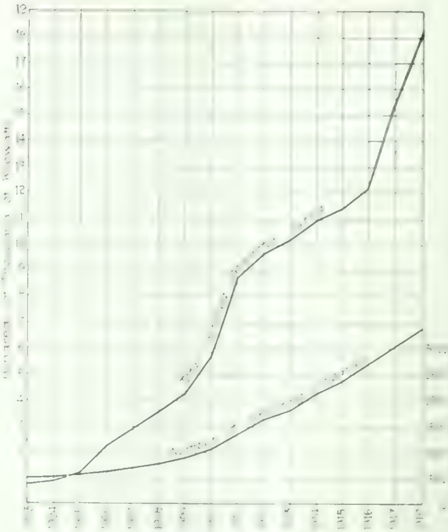


FIG. 1—NUMBER OF ELECTRIC LIGHT AND POWER COMPANIES AND TOTAL INSTALLED GENERATOR RATING

As indicated in a survey of domestic electric service among the people of foreign countries, the results of which were published in the ELECTRICAL WORLD for Feb. 28, 1920, Japan appears to lead all foreign countries in the percentage of inhabitants living in electrically lighted dwellings. Fig. 2 shows the growth in the number of houses in Japan lighted by electricity. In 1918 there were about 5,000,000 electrically wired houses in Japan, and it is estimated that this figure has been increased to about 6,000,000 at the present time. Assuming an average of five persons to the dwelling, which is believed to be conservative, it is estimated that there are about 30,000,000 Japanese now enjoying the luxuries of electricity in their homes, or more than half of the population of the country. No other nation can show such a large proportion of its population living in electrically lighted homes.

The table shows the situation in the principal cities and gives an interesting view of the extent to which the development of service has progressed. The high percentage of houses lighted is also interesting. As indicated in this table, the number and size of the lamps per dwelling is, however, pitiably small. Taking the nation as a whole, Fig. 2 shows that the average installation consists of between two and three lamps. Even in the most up-to-date Japanese city, Tokyo, the average number of lamps per house is only four. Fig. 3, showing the average candlepower per electric lamp from 1907 to 1918, gives an interesting illustration of the effect of the change from carbon to tungsten-filament lamps and the time taken to educate consumers to the use of the more efficient units. This is more clearly shown in Fig. 4, where the demand per house as well as the number of lamps per house is shown for the same period. The drop in number of lamps per house has been due to the increase in efficiency and also to the displacement of carbon-filament lamps by tungsten lamps. The reduction in demand per house has undoubtedly been due to the same reason.

Owing to the high ratio between lighting bills and other living costs, the flat rate has been largely used. In 1918 it was estimated that about 16.8 per cent of the lighting was on the demand or meter basis.

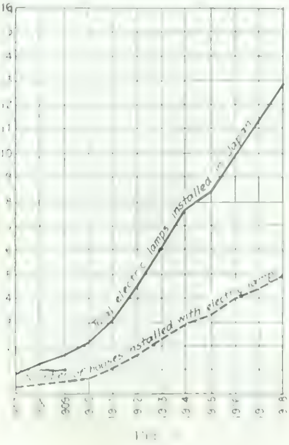


Fig. 2

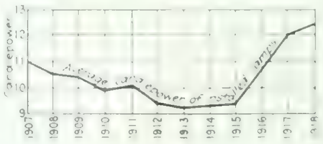


Fig. 3

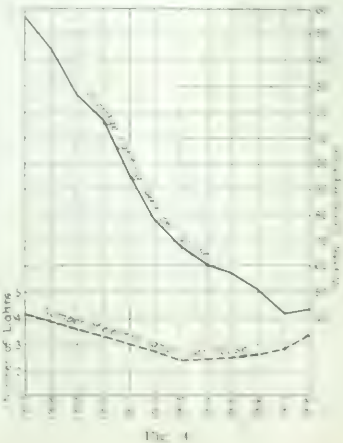


Fig. 4

FIG. 2—NUMBER OF ELECTRICALLY WIRED HOUSES AND TOTAL ELECTRIC LAMPS INSTALLED IN JAPAN

FIG. 3—AVERAGE CANDLEPOWER PER ELECTRIC LAMP

FIG. 4—AVERAGE ELECTRICAL ENERGY DEMAND PER WIRED HOUSE AND NUMBER OF ELECTRIC LAMPS PER HOUSE

ELECTRIC SERVICE IN PRINCIPAL CITIES OF JAPAN

	No. of Lamps Used per 100 Persons	No. of Lamps Under Demand Rate Basis, per Cent	Average No. of Lamps per House	Average Candle-power per Lamp	Houses Lighted, per Cent	No. of Lamps per Square Mile	No. of Houses Lighted per Square Mile
Tokyo	71.7	30	4	12.5	68	57,103	14,081
Osaka	51.2	16	1.8	21.2	68	38,295	9,928
Kyoto	59.7	39.7	3.4	12.8	76	29,442	8,624
Yokohama	57.1	25.1	3.6	14.9	92	20,080	6,563
Nagoya	46.3	12.1	2.4	16.0	85	13,763	5,762
Kobe	51.6	18.6	1.2	14.7	80	22,576	7,462

Efforts are being made with a great deal of success looking toward better illumination. Under the old condition of few and small lamps, installation and maintenance costs have been high and lighting efficiency has been poor. Extreme simplicity marks residential lighting, although the store-window illumination and floodlighting seem to parallel American practice.

Two stumbling blocks are encountered in developing sign lighting. The first is the limited height of buildings. Most of these are but two stories. Those of three stories are few, and buildings of seven or eight stories are very rare even in the larger cities. The second is that Japanese characters, unless they are very large, are none too legible in signs. The difficulty is further increased by government limitations upon the size of bases for sign lamps. These make the smallest diameter of a sign lamp about 1 in. Transparencies and painted signs are used, but are spoiled in effectiveness by the dust and the heavy rains of Japan.

The curves and other data used were furnished by Y. Ishikawa, illuminating engineer of the Tokyo Electric Company, Ltd., of Kawasaki, Japan.

Illinois Provides for Rural Utilities

Consumers Classified Into Rural Utilities, Mutual Companies and Individual Consumers—Lines to Individual Consumers Must Be Operated and Maintained by Company Furnishing Service—Rates to Individual Consumers Built on Service Plus Energy Charge

RULES covering the construction, ownership and maintenance of electric distribution circuits in rural districts and establishing the basis of rates for such service have been issued by the Public Utilities Commission of Illinois under the designation of General Order No. 59. Unlike the similar set of rules in Wisconsin, the Illinois rules apply to the whole state and differ from the so-called Wisconsin rules* in a number of particulars, the most radical being in the classification of consumers into groups that are given a treatment suitable for the conditions of each specific group. The general form of rate applied to the individual consumers follows the same principles as those in the Wisconsin rules, though the detail of method of calculation is not specified. It is believed that the Illinois rules are the most comprehensive that have as yet been placed in force to cover an entire state. The following analysis of the rules should be helpful to those who are trying to establish service practices for rural service.

CLASSIFICATION OF CONSUMERS

Three classes of rural consumers are provided for the individuals entitled to such classification, being defined as "any consumer, except industrial light and power consumers, located outside the corporate limits of an incorporated municipality." The first class covers those organized into a rural utility to serve all applicants along the proposed lines and are treated essentially as any other light and power utility. All requirements as to overhead construction made by the commission must be complied with and the rates to the rural utility's customers must be filed with the commission. No service can be given by the central station wholesaling the energy until the rural utility has complied with all commission requirements.

The second class consists of those consumers formed into a mutual company. Such a company must meet the construction requirements of the commission but is not required to file the rates to its own consumers, as the company is operating for mutual benefit only and not for profit. These mutual organizations may make construction maintenance and operating agreements with the company supplying the energy. These agreements must be filed with the commission by the utility furnishing the service. To both of these classes the regular rates for energy on file with the commission shall apply.

The third class consists of the consumers receiving service as individuals and the rules covering this class are parallel in many ways with those in Wisconsin. Following is a brief analysis of these rules.

CONSTRUCTION OF LINES TO INDIVIDUAL CONSUMERS

These lines may or may not be financed by the consumer, but the arrangements must be such that the utility furnishing service will be responsible for maintenance, operation and replacement. Additional consumers on the route of any line must be taken on under arrangements that are non-discriminatory. If constructed by the utility furnishing service a certificate of necessity and convenience must be secured, while the lines constructed by the consumers must be covered by a similar certificate authorizing the utility to take over and operate the lines. In either case the rules governing overhead construction must apply.

RATES FOR INDIVIDUAL SERVICE

The rates consist of (a) a service charge, representing the excess cost of service to the rural consumers over the cost of similar service to urban and city consumers, and (b) the regular rate, including demand charges, if any, applied to the consumers of the same class in the municipality from which the service is furnished. No method of calculating the service charge is specified as is done in the Wisconsin rules. Service charges to the consumers requiring the same service capacity on any given line shall be uniform, though on different lines the charge will vary in accordance with the cost of service on the individual line. The rate form as regards the service charge is much less specific than the Wisconsin rule in that each utility will use its own method of arriving at the excess cost.

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*See ELECTRICAL WORLD, Dec. 18, 1920, p. 1205

Meter readings at not less than three-month intervals are recommended, though provision must be made for billing the service charge in monthly installments. Readings may be at less intervals than three months if so desired.

The policy of permitting the formation of rural utilities, while not new, is rather against the feeling of a large part of the utility men who have faced the problem of rural service. This is especially true if the West, where irrigation pumping in the rural districts has been well developed, is considered. It seems probable that the lack of a uniform method of calculating the rural service charge may lead to considerable lack of uniformity in the rates in various sections of the state. It may also lead to considerable resort to the commission for decision as to what items may be properly included in the calculation of excess cost of service. While past experience with rural telephone utilities has not been particularly encouraging, the development in Illinois under these rules will be watched with a great deal of interest. The rules in full for Classes I and II are as follows:

CLASSIFICATION OF RURAL CONSUMERS

Rural Consumer Defined. For the purposes of this order, a rural consumer is defined as any consumer, except industrial light and power consumers, located outside the corporate limits of an incorporated municipality.

Rural Consumers Classified. For the purposes of this order, rural consumers are divided into three classes:

Class I—Those prospective rural consumers who shall organize a corporation for the purpose of constructing the lines necessary to furnish the service and who propose to render such service to all applicants along the routes of the said lines.

Class II—Those prospective rural consumers who have formed a corporation, organization or association of a strictly mutual character for the purpose of operating without profit for the securing of electric service to stockholders alone.

Class III—Those rural consumers who contemplate receiving electric service as individuals, *i.e.*, those consumers who expect the electric utility furnishing the service to furnish a meter for each consumer and to read these meters and collect each consumer's bill separately.

CLASS I.—THOSE CONSUMERS WHO HAVE FORMED A CORPORATION FOR RENDERING SERVICE

1. *Certificate of Convenience and Necessity.*—Those consumers who have formed a corporation as given under Class I and who expect to render service to all applicants along the routes of the lines built by them are public utilities and as such shall secure from the commission, in the manner provided by law, a certificate of convenience and necessity authorizing the construction and operation of the necessary lines before any of the said construction work is undertaken. All construction work undertaken by corporations organized under this rule shall be done entirely in compliance with the commission's General Order No. 30, establishing standards of overhead electrical construction. Any electric public utility which shall be requested to furnish wholesale electric service for such a corporation shall refuse to connect its circuits with the circuits of such corporation until these requirements of the rules have been complied with.

2. *Rates to Other Utilities.*—Electric public utility companies which shall furnish service to such rural corporations shall sell energy to them only at rates filed with and authorized by the commission for the type of service to be rendered, provided that all terms and conditions precedent to the securing of such rates have been fulfilled by the rural corporation.

3. *Rates to Be Filed.*—Such a corporation shall file with the commission, in compliance with the law, a complete schedule of its rates and charges covering all classes of service to be rendered by it.

CLASS II.—THOSE CONSUMERS WHO HAVE FORMED A MUTUAL ORGANIZATION

1. *Standard Construction Required.*—If the prospective rural consumers have formed a corporation, organization or association of a mutual character, for the purpose of operating without profit as set forth under Class II above, any electric public utility which may agree to furnish service at wholesale to such mutual organization shall, before connecting its circuits with the circuits of such mutual organization, make certain that the character of the construction installed by such mutual organization will meet all requirements of the commission's General Order No. 30, establishing standards for overhead electrical construction.

2. *Rates to Mutual Organizations.*—The rates at which such mutual organization shall purchase energy must be only such duly authorized rates as the electric utility furnishing the service may have on file with the commission for the class of service to be rendered.

3. *Agreements for Construction and Operation of Property.*—The construction, maintenance and operation of the property of a mutual organization may be made the subject of an agreement between the electric utility company and the organization, which agreement shall be filed with the commission by the utility furnishing the service in its regular rate file.

Rules governing the supply of electrical energy to those consumers receiving service as individuals (Class III) will be given in a later issue.

Unit Expenses of Boston Company

Coal Consumption Reduced to 1.435 Lb. per Kilowatt-Hour Produced Notwithstanding Decreased Station Output—Analysis Based on Exhibit to Commission

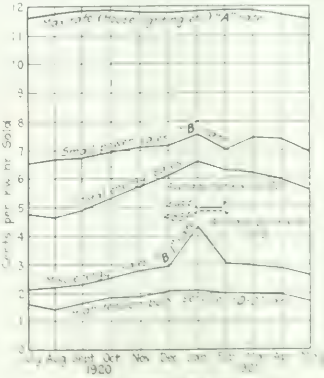


FIG. 1—RATES FOR SEVERAL CLASSES OF SERVICE

A MARKED improvement in plant efficiency on the system of the Edison Electric Illuminating Company of Boston, Mass., has been secured during the past few months according to data filed by the company with the Massachusetts Department of Public Utilities. The coal consumption per kilowatt-hour manufactured, Fig. 2, fell from 1.83 lb. in September, 1920, to 1.435 lb. in April, 1921, and this notwithstanding a later increased and then a decreased station output. The use of turbo-generators of about 30,000-kw. rating at the company's principal tidewater station at L Street, South Boston, combined with highly efficient boiler plant practice, is yielding excellent results. The interchange of energy with the New England Power Company over the 66,000-volt tie line between West

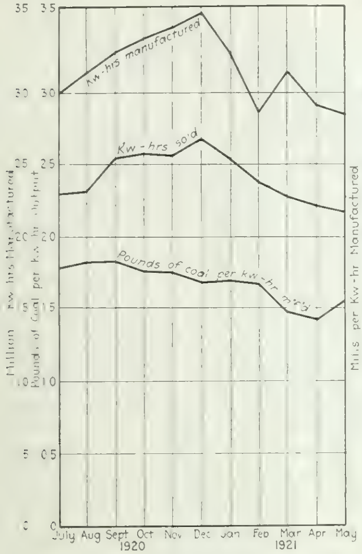


FIG. 2—STATION OUTPUT AND COAL PER KILOWATT-HOUR

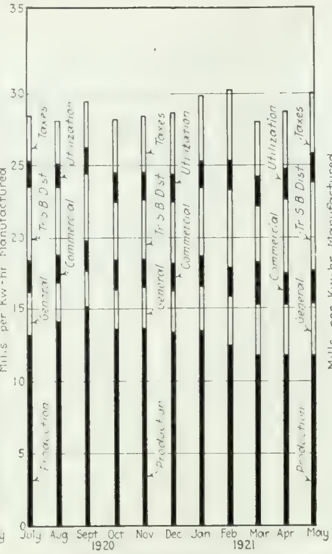


FIG. 3—ITEMIZED EXPENSES PER KILOWATT-HOUR SOLD

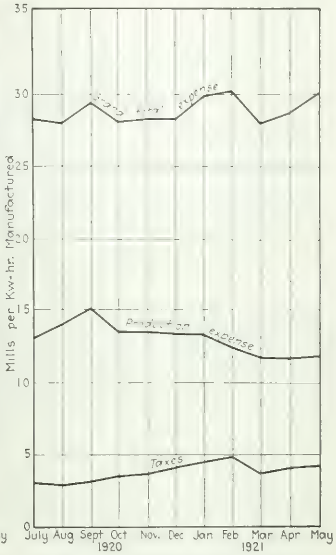


FIG. 4—TOTAL EXPENSES, PRODUCTION AND TAXES PER KILOWATT-HOUR

Roxbury and Clinton is also working out well, and while the capacity of the transformers for this line represents but 10 to 15 per cent of the normal rated generating capacity of the system, the utilization of hydro-electric energy at Boston for street lighting or other service has at times been very convenient. The New England company, on its part, has also found this interconnection advantageous under various conditions of load and water supply.

This gain in plant efficiency has been a factor in holding total expenses, including taxes, to a maximum of slightly over 3 cents per kilowatt-hour manufactured during the period from July, 1920, to May, 1921, inclusive. Fig. 3 is a plot of the expenses of the company by months. It shows clearly the importance of production expenses in total operations and the extent to which taxes have encroached upon the expense account of the company. The relative importance of these items is indicated in Fig. 4, the upward trend in taxes being significant.

The company's revenue is derived from eleven classes of service, four of which are shown in Fig. 4. Those plotted are the "A" or non-contract rate, applying to about 90 per cent of the customers; the "B" rate, applying to small power users in the main; the "B-1," or miscellaneous energy rate, covering secondary service for large business, battery charging, cooking, direct heating, refrigeration by compression, water supply and irrigation, and the "D-2," high-tension bulk service, embracing energy sold in bulk in the alternating-current districts. In general, there has been a gradual decrease in revenue per kilowatt-hour sold since the maximum attained last winter, and it is a fair inference that this gain to the public would not have been achieved had not the most vigorous efforts been made by the company to operate efficiently. The cost of coal per long ton burned in July, 1920, was $12.70 and in May, 1921, it was practically the same. The cost of living for this, the largest of New England central stations, had evidently not begun to decline with any marked rapidity up to June 1, notwithstanding a standard of plant operation which reflects highly creditable service.

Data filed with the board show that there was a decrease of 8.42 per cent in the total kilowatt-hours sold during May, 1921, compared with the previous year, while the income increased 0.92 per cent, the income per kilowatt-hour increasing 10.10 per cent.

Queenston Plant Nearing Completion

AS WILL BE SEEN from this photograph, taken July 20, the Queenston-Chippawa plant of the Hydro-Electric Power Commission of Ontario is fast nearing completion. The first two units, which are now being installed, are expected to be in service this autumn. Three more units will be installed in about six months. The plant is designed for nine units with a generator rating of 50,000 hp. each.

Unstable Operation of Generating Stations in Parallel

Results of Tests to Discover Causes of Momentary Surges When Interchanging Energy Between Large Stations—A Forerunner of What May Be Expected in Superpower Systems—Proper Relation of Resistance to Reactance Is Important

By D. D. HIGGINS
Assistant Chief Engineer Northwest Station, Commonwealth Edison Company

LOOKING ahead as far as possible is of more than ordinary importance at the present time because of the economic pressure which is causing the consolidation of existing generating systems of all sizes, the exploitation of water-power sites and the erection of huge power stations at coal mines. The metropolitan transmission problems of today are the forerunners of the future problem of supplying an entire state or a number of states from a single generating system consisting of a number of huge stations and several stations of lesser capacity, all operating in parallel.

Of the major operating problems of the future, voltage regulation and interchange of power between stations will be of prime importance. Obviously, on constant potential systems the interchange of any considerable amount of energy between the stations, and with the probability of the necessity for reversal of the direction of flow of energy in the tie lines, it becomes apparent that some means must be resorted to which will obviate the necessity of altering the voltage of the generating stations. Undoubtedly this will be done by phase control of the lines; that is, by the insertion of reactance in all the connecting tie lines, either in reactors or high-reactance transformers.

To illustrate the importance of proper voltage regulation on an interconnected system the stability of operation at the time of an interchange of energy between Fisk Street and Northwest Stations of the Commonwealth Edison Company, Chicago, is cited. Cases of instability have resulted in opening the connecting tie lines between these two stations. The first case occurred in September of 1912, shortly after Northwest Station was put into service; other cases have occurred since then, the last being on Oct. 26, 1920.

A recent experiment was made, with the object of bringing about the instability gradually when observers were present and prepared to note the sequence of the effects produced. It has been generally conceded for several years that this instability is due to some sort of voltage disturbance, such as improper excitation of the two stations. To the writer's knowledge, this particular problem of transmission has not been encountered elsewhere, or at least has not been recognized, and there is no information as to just what actually happens that gives rise to the instability; that is, the so-called surging, which causes the lines to open automatically. In these cases of momentary unstable operation the system as a whole is not seriously affected, no synchronous apparatus is thrown off, and there is but a momentary dip of 10 to 15 per cent in the voltage, and it is for this reason that the solution of the problem has been neglected so long.

The conditions simply stated were as follows: The two generating stations were operating in parallel, each carrying its own load, and there was no particular interchange of power over the tie lines. One station attempted to transfer a portion of its load to the other station by reducing the steam supply to its turbines. The voltage of the system dropped off 2 per cent gradually and over a period of ten minutes. Suddenly there was a surging between the stations and the connecting tie lines opened automatically. The following observations were made:

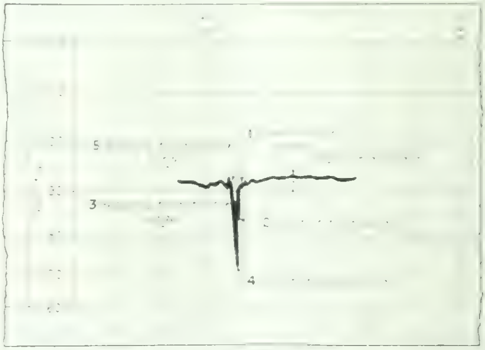


FIG. 1—SURGES IN TIE LINE BETWEEN NORTHWEST AND FISK STREET STATIONS

All such disturbances have occurred at the time when power was being delivered over the tie lines.

They have occurred when the amount of power was being varied.

Some of the disturbances have occurred when Northwest Station was feeding Fisk Street Station; others have occurred when Fisk was feeding Northwest.

Trouble occurs when the available generator capacity is being limited by governor control in the receiving station to something less than the load on that station.

It is the practice to try to maintain a given standard voltage at each station continuously, not, however, the same in each station at the same time.

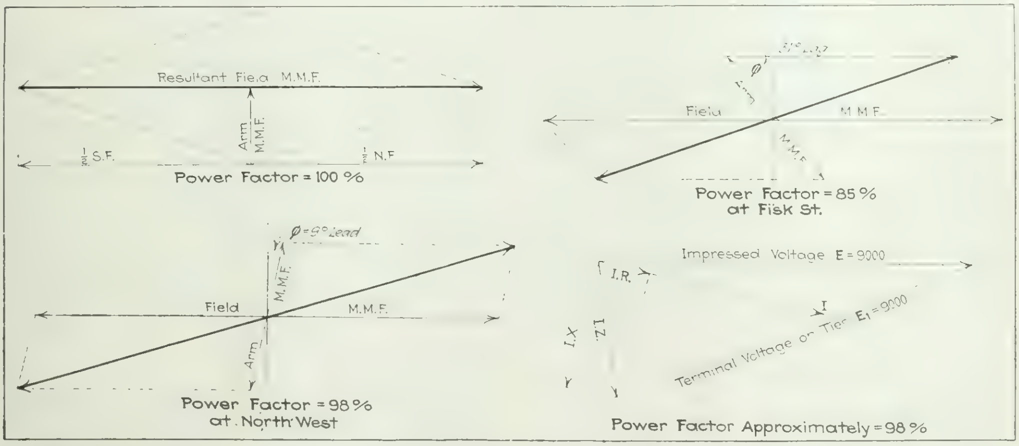
The actual disturbance has occurred suddenly; that is, has started with a violent surge.

The tie lines have very little reactance and the resistance, while low, is actually several times greater than the reactance.

From an analysis of the observations it appears that the trouble has been caused in the past by the attempt to transfer an increasing amount of energy from one constant potential system to another over a tie line which had a high resistance relative to its reactance. The recent test, while no different from the other disturbances, will be used for the purpose of illustration because it is fresh in the minds of the observers.

Northwest Station operated in parallel with Fisk Street so long as the load at Fisk did not much exceed the generator capacity (limited by governor control); that is, so long as the tie load was within a certain limit. Then, as the generator capacity was further limited at Fisk Street and the tie lines began to feed more into that station, the voltage drop in the ties due to the resistance began to increase.

At Fisk Street the bus voltage was not regulated; that is, the excitation was not reduced in proportion to the reduction of load on the generators. As a result it was forced to drop back in phase relation to Northwest. The additional current required at Fisk Street could not come from Northwest, because the voltage at Fisk was being maintained and also because the additional resistance drop in the ties would cause their terminal voltage to drop below that of the Fisk Street bus.



FIGS. 2 AND 3—EFFECTS ON AN ALTERNATOR'S FIELD MAGNETOMOTIVE FORCE OF IN-PHASE LAGGING AND LEADING LOADS, EFFECT OF REACTANCE BEING 2.5 TIMES THE RESISTANCE

The load had to be taken by the Fisk Street generators, and as the turbines were limited in output, the units supplied the power momentarily by slowing down; that is, supplied the power from their mechanical momentum, as was indicated by the first surge, which was followed by a few seconds of stability. During this process Fisk Street stepped back in phase still further compared with Northwest, and due to this phase displacement a cross current (leading in the ties at Northwest but lagging with reference to Fisk) partly and coincidentally demagnetized the Fisk Street generators. This required about one second, which compares fairly well with the time in which a short circuit can demagnetize the fields. The fields gradually weakened until the voltage at Fisk Street had dropped sufficiently to allow the additional load current in the tie lines.

Because of the changed conditions, Northwest Station picked up the load and Fisk Street, being relieved, began to accelerate and come back into phase with Northwest. As a result the phase displacement with its consequent cross current and the demagnetizing effect of the cross current all disappeared. The fields of the Fisk Street generators then gradually built up again to their original strength, and as the voltage at Fisk Street Station returned to normal, it picked up its load again, the power transfer into Fisk Street was again limited and the surge occurred the second time. The surging was aggravated by the inertia of the large turbines and was therefore cumulative. This caused phase displacements, with consequent cross currents much greater than required for the load readjustments, and resulted in the ties opening.

When Fisk was feeding Northwest the disturbances which occurred were explainable in a similar way, the only difference being that the relations of the stations referred to in the foregoing were just reversed.

SIGNIFICANCE OF INSTABILITY

Transmission of large amounts of energy between huge interconnected power stations is an economical way of operating. That this is true will be seen when it is understood that, on account of the power stations being separated by some zoning system or geographic division, a diversity in the time of the individual station's maximum loads occurs.

This condition is found in large cities, where the transmission systems which span a portion of the country are within two time standards, such as Eastern and Central time.

In the large cities those power houses located in the outlying districts do not carry their maximum loads until possibly a half hour or more after the centrally located stations have carried theirs. This is due to the fact that it takes time for the loaded street cars to travel from the downtown districts out into the residential districts.

By taking advantage of this diversity in time of maximum load it is possible to avoid considerable investment in plant capacity. This, however, means that the stations will have to help each other out at the time of the two peak periods, and so introduces this problem of stability and proper voltage regulation.

The large power systems of today are essentially constant potential systems, and when any considerable voltage change occurs it mitigates against good service, so that the transmission of large amounts of energy, which necessitates frequent changes in the standard station voltage, is a condition that will have to be overcome.

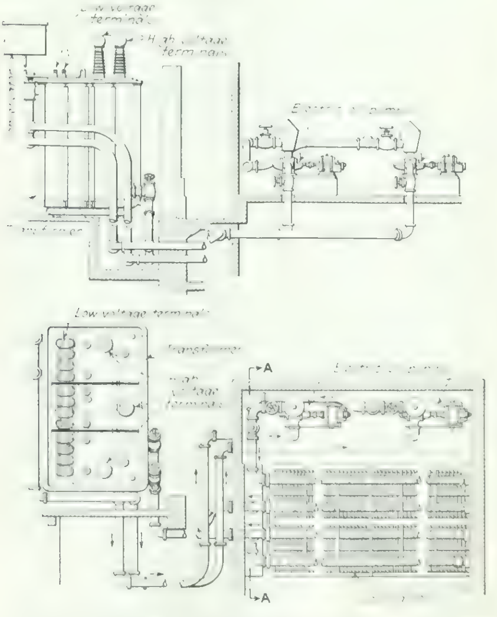
At the generating station end of all feeders the installation of reactors for the protection of the station equipment and to hold the station voltage at times of cable short circuits will overcome troubles of the nature described, for the following reasons:

When load is to be delivered to one station from another, the generators in the receiving station will drop back in phase and cross currents will consequently flow between the stations. These cross currents will be leading in the tie line and will therefore raise the terminal voltage, due to the reactive drop becoming partly additive to the impressed voltage at the sending end of the lines.

With proper value of reactance with reference to the resistance, the reactive drop will more than overcome the resistance drop in the tie line and therefore will maintain approximately constant voltage at the receiving end, independent of the load transferred. This will allow the receiving station to hold up to its own voltage schedule better, regardless of the amount of energy being received from the other station. (See Fig. 3.) Thus it may be seen that by the introduction of reactors part of the present-day problems are solved. However, the solution by such methods is likely to introduce new problems that will have to be solved in turn.

Assume a case wherein reactors have been installed on a long feeder and the feeder short circuits close to the station. As the impedance of the short circuit, reactor, cable and generator winding is mostly made up of reactance, the power factor of the short-circuit load will be low and hence will not impose a severe shock on the system, nor will the voltage be affected seriously, providing the reactor has sufficient reactance. Such short circuits have in the past been dreaded because of the effect on the voltage.

Now assume the short circuit occurs at such a distance from the station that the resistance of the circuit is equal to the reactance. In this case the power factor of the short circuit will be high, and therefore the short-circuit load will amount to tens of thousands of kilowatts. This will cause the station affected to drop behind others operating in parallel with it temporarily, and again the question of system stability appears. Thus it is seen that the solution of one problem introduces another.



60,000-KVA., THREE-PHASE, 50-CYCLE, 110-KV. TRANSFORMER OF GERMAN DESIGN

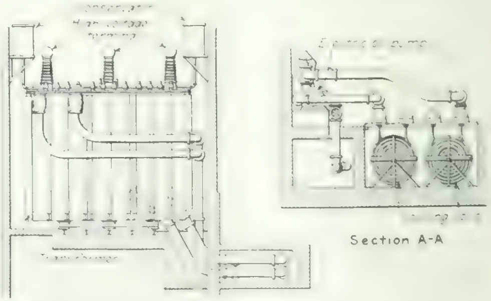
The section at right shows some details of the forced oil cooling system required.

Germans Build 60,000-Kva. Transformers

Engineer Says 75,000-Kva. Transformers and 10,000-Kva. Converters Are Feasible—60,000-Kva. Transformers Already in Service

An INCREASE in size of three-phase transformers to 75,000 kva. is easily possible in Germany, according to W. Reichel, writing in a recent number of the *Zeitschrift des Vereines Deutscher Ingenieure*. Several 60,000-kva. units are said to be in operation.

The accompanying illustrations are reproduced to show general plans for a 60,000-kva., three-phase, 50-cycle, 110-kv. transformer, together with a general arrangement of the huge cooling outfit for this transformer. The complete weight is 150 tons, or 2.5 kg. (5.5 lb.) per kva. The unit weight per kva. does not decrease appreciably for larger capacities. The cooling problem also is difficult, but the author says that it can be safely handled. For this purpose forced oil circulation maintained by electrically driven pumps and external cooling is used for these large units. The use of an oil conservator, which excludes air from contact with the hot oil, is strongly advocated. The weight of a 75,000-kva. unit would probably be about 184 tons or 2.45 kg. (5.4 lb.) per kva. It is said that 30,000-kva., three-phase transformers have been built in Germany many times for 110,000-volts, high tension. The weight of the 30,000-kva. unit is 80 tons including oil, or about 2.67 kg. (5.88 lb.) per kva.



Regarding the present limit of conversion machines, the author says that there is no demand for very large sizes of any kind of converters as only part of the generated energy will be transformed to direct current. A size of 10,000 kva., although not reached as yet, seems to be the ultimate limit. As a typical example of the use of large motor-generator sets details of an installation of several three-machine units (one motor and two direct-current dynamos) are given. The synchronous three-phase motor is rated at 4,000 kva., 5,200 volts, 500 r.p.m. (50 cycles), delivering 3,800 kw. (270-volt and 14,000-amp.) from two direct-current generators with two commutators each. The unit weight amounts to 29 kg. (64 lb.) per kilowatt. With higher direct-current voltage the output could easily be increased to 6,000 kw. at the same speed, or to 10,000 kw. with increased speed. At 500 r.p.m. a direct-current output of 3,000 kw. per generator seems to be the possible limit. Cascade converters have been built up to 4,000 kw. (250 r.p.m., 510-volt, direct-current.) An increase to 6,000 kw. may be regarded as the limit.

As to the maximum output of rotaries, this is said to be largely limited by the direct-current side. A direct-current voltage of 250 is about the lowest possible on account of insurmountable difficulties with the commutator and the collector rings. Several machines of 3,500 kw. (250-volt and 14,000-amp., are in operation for chemical purposes. An upper limit of 5,000 kw., 520 volts, 214 r.p.m., has been reached successfully. A schematic design is given for a converter of 10,000 kw. (500-volt, 20,000-amp., 94-r.p.m.) with a probable unit weight of 13.5 kg. (29.8 lb.) per kilowatt in the original. This is said to represent the limit which can probably be attained.

Quick Line Calculation Without Charts or Tables

Rough-and-Ready Rule that Can Be Applied from Factors Easily Carried in Mind—Rule Applied to Common Problems—Rule Is Approximate, but Accurate Enough for Every-Day Use

By AUSTIN BURT

Manager Citizens Gas & Electric Company, Waterloo, Iowa

Calculation of transmission and distribution lines is often a problem because the necessity for it arises when tables and charts are not available. A quick estimate or a check of certain results may be desired when one is in the field and reference works are a long distance away. To meet this need a "rough-and-ready" rule has been developed. The basis of the rule is two simple key numbers, one (96) for 60-cycle and the other (130) for 25-cycle, three-phase lines. These numbers can be carried in the memory.

It is not claimed that the results obtained are absolutely accurate, but they are close enough for all practical purposes. For important work final results should always be attained by using the more rigorous methods.

At 80 per cent power factor and 10 per cent voltage drop any given line will have a fairly definite line constant, *W*, which will remain unchanged for virtually any delivered voltage and load as long as the wire size is not changed. The rule is based on these assumed conditions.

METHOD OF OBTAINING LINE CONSTANT *W*

W = Key number minus ten times wire size where key = 96 for 60 cycles and *W* = Key number fifteen times wire size where key = 130 for 25 cycles

B. & S. Gage	60-Cycle Three-Phase	*W*	B. & S. Gage	25-Cycle Three-Phase	*W*
No. 6	96 — (10 × 6) =	36	No. 6	130 — (15 × 6) =	40
5	96 — (10 × 5) =	46	5	130 — (15 × 5) =	55
4	96 — (10 × 4) =	56	4	130 — (15 × 4) =	70
3	96 — (10 × 3) =	66	3	130 — (15 × 3) =	85
2	96 — (10 × 2) =	76	2	130 — (15 × 2) =	100
1	96 — (10 × 1) =	86	1	130 — (15 × 1) =	115
0	96 — (10 × 0) =	96	0	130 — (15 × 0) =	130

To obtain the line constant *W*, represent any wire gage size by *N*. *W* will be the key number minus ten times *N* for 60-cycle, three-phase, and minus fifteen times *N* for 25-cycle, three-phase. To illustrate: The accompanying table gives *W* for copper-wire sizes in ordinary use from No. 1/0 to No. 6. The method of calculating *W* for wire sizes from No. 2/0 to No. 4/0 and for No. 7 and No. 8 on both 60-cycle and 25-cycle lines varies as given under F. at the close of this article. The most commonly used wire sizes are given in the accompanying table.

The other factor in the rule is the delivered kilovolts; or

$$\text{Kv.} = \text{delivered volts} \div 1{,}000.$$

From these factors the rough-and-ready rule may be stated as:

$$W \times \text{kv.}^2 = \text{line kw.-miles}; \qquad (1)$$

or, to state the formula completely for 60-cycle or 25-cycle lines:

For 60-cycle, two-phase or three-phase,

$$(96 - 10 \times N)\ \text{kv.}^2 = \text{line kw.-miles}. \qquad (2)$$

For 25-cycle, two-phase or three-phase,

$$(130 - 15 \times N)\text{kv.}^2 = \text{line kw.-miles}. \qquad (3)$$

The following points should be noted in the use of the rule:

A. The line kw.-miles are the same for two-phase as for three-phase lines.

B. For single-phase lines take half the line kw.-miles for three-phase; thus

$$(W \times \text{kv.}^2)\tfrac{1}{2} = \text{line kw.-miles}. \qquad (4)$$

C. Up to 95 per cent power factor the line kw.-miles are almost directly proportional to the load power factor; thus, for 75 per cent power factor,

$$(W \times \text{kv.}^2) \times 75/80 = \text{line kw.-miles}. \qquad (5)$$

D. The line kw.-miles are directly proportional to the drop. Thus, for a 6 per cent drop,

$$(W \times \text{kv.}^2) \times 6/10 = \text{line kw.-miles}. \qquad (6)$$

E. In applying the "rule" care should be used not to exceed the safe carrying capacity of the wire.

Herewith are given various examples of the method of applying the "rough-and-ready" rule to various forms of problems that arise in practice. Where voltage-drop calculations are carried out the drop calculated by the accurate and longer method is given for comparative purposes.

Rough-and-Ready Rule Applied to Electric Line Calculations

Example 1.—To obtain kilowatt-miles.

A 60-cycle, three-phase line, No. 2 wire, delivers energy at 6,200 volts, 80 per cent power factor and 10 per cent drop. What will be its line kw.-miles?

$$W = 96 - (2 \times 10) = 76.$$

From rule (formula 1):

$$76 \times (6.2)^2 = 2{,}920 \text{ kw.-miles.}$$

Example 2.—Kilowatt load for given length of line.

If the line (Example 1) is 16 miles long, what kw.-load can be delivered?

$$\text{Kw.} = \text{kw.-miles} \div \text{kw.} \qquad (7)$$

From Example 1:

$$\text{Kw.-miles} = 2{,}920,$$
$$\text{Kw.} = 2{,}920 \div 16 = 183.$$

Example 3.—Calculation of line drop (three-phase).

Deliver 1,500-kw. at 85 per cent power factor and 31,000 volts, over a 60-cycle, three-phase No. 4 line, 24 miles long. What will be the voltage drop?

$$W = 96 - (4 \times 10) = 56.$$

From Note C:

$$\text{Line kw.-miles} = 56 \times 31^2 \times 85/80 = 57{,}100 \text{ kw.-miles.}$$
$$\text{Actual kw.-miles} = 1{,}500 \times 24 = 36{,}000.$$

From Note D:

$$\text{Drop} = (36{,}000 \div 57{,}100) \times 10 \text{ per cent}$$
$$= 6.3 \text{ per cent.}$$

(Drop by accurate method = 6.7 per cent.)

Example 4.—Calculation of voltage drop (single-phase).

At 25 cycles, single-phase, deliver 600 kw. at 72 per cent power factor and 12,700 volts over a No. 1/0 wire line 25 miles long. Find the voltage drop.

$$W = 130 (0 \times 15) = 130.$$

From Notes B and C:

$$\text{Line kw.-miles} = 130 \times (12.7)^2 \times \tfrac{1}{2} \times 72/80$$
$$= 9{,}430 \text{ kw.-miles.}$$
$$\text{Actual kw.-miles} = 600 \times 25 = 15{,}000.$$
$$\text{Drop} = (15{,}000 \div 9{,}430) \times 10 \text{ per cent}$$
$$= 15.9 \text{ per cent.}$$

(Accurate drop = 15.2 per cent.)

Example 5.—Calculation of line drop for three-phase line instead of single-phase in Example 4.

If the above line were three-phase instead of single-phase, find the drop.

From Note B:

$$\text{Line kw.-miles} = 9{,}430 \times 2 = 18{,}860.$$
$$\text{Actual kw.-miles} = 15{,}000.$$
$$\text{Drop} = (15{,}000 \div 18{,}860) \times 10 = 7.9 \text{ per cent.}$$

(Accurate drop = 7.6 per cent.)

Example 6.—Size of wire needed to limit voltage drop.

A problem that arises frequently, especially in farm-line work, is to find the size of wire to use for a given drop and load. This "rough-and-ready" rule affords quite an easy solution of the problem.

A load of 80 kw. at 90 per cent power factor must be delivered 12 miles over a single-phase line, with 6,600 volts, 60 cycles, at the main substation and with a voltage drop at the load not over 6½ per cent of the delivered voltage. What size wire is needed?

$$W = \text{unknown quantity.}$$
$$\text{Delivered volts} = (6{,}600 \times 100) \div (100 + 6.5)$$
$$= 6{,}200 \text{ volts.}$$

From Notes B, C and D:

$$(96 - 10 \times N) \times 6.2^2 \times \tfrac{1}{2} \times 90/80 \times 6/10$$
$$= \text{actual kw.-miles.}$$
$$= 80 \text{ kw.} \times 12 \text{ miles.}$$
$$= 960 \text{ kw.-miles.}$$
$$96 - 10\,N = (960 \div 6.2^2) \times 2 \times 80/90 \times 10/6 = 74.$$
$$96 - 74 = 10\,N = 22.$$
$$N = 22/10 = 2.2.$$
$$\text{Wire size} = \text{No. } 2.$$

Taking No. 2 wire and checking back, one gets:

$$W = 96 - (10 \times 2) = 76.$$
$$\text{Line kw.-miles} = 76 \times (6.2)^2 \times \tfrac{1}{2} \times 90/80$$
$$= 1{,}642 \text{ kw.-miles.}$$
$$\text{Actual kw.-miles} = 960.$$
$$\text{Drop} = (960 \div 1{,}642) \times 10 \text{ per cent} = 5.9 \text{ per cent.}$$

(Accurate drop = 5.94 per cent.)

Example 7.—Calculation of wire size for single-phase line—predetermined drop with distributed load.

A more common variation of Example 6 is to find the correct size of wire for several different loads distributed at various distances from the station or main substation. The "rough-and-ready" rule will give an easy solution of this problem.

The following loads are located at the given distances from the main substation: 75 kw., 3 miles; 50 kw., 8 miles; 100 kw., 12 miles, and 25 kw., 18 miles, and 12,500 volts at 60 cycles is to be delivered at the last load with an average power factor of 85 per cent. If the line is single-phase, what size of wire must be used for a drop of 5 per cent?

Find the total actual kilowatt-miles by adding the separate kilowatt-miles.

	Kw.-Miles
75 × 3 =	225
50 × 8 =	400
100 × 12 =	1,200
25 × 18 =	450
Total....	2,275

$$W = \text{unknown quantity.}$$

From Notes B, C, and D:

$$(96 - 10\,N) \times 12.5^2 \times \tfrac{1}{2} \times 85/80 \times 5/10$$
$$= 2{,}275 \text{ kw.-miles.}$$
$$96 - 10\,N = (2{,}275/12.5^2) \times 2 \times 80/85 \times 10/5 = 55.$$
$$96 - 55 = 10\,N = 41.$$
$$N = 41 \div 10 = 4.1.$$

Required wire = No. 4.

Example 8.—Substitution of three-phase for single-phase line in Example 7.

If a three-phase line were used in Example 7, what size wire would be required?

From Note B, the single-phase factor, ½, is omitted from the kw.-miles formula, and one has from Example 7:

$$(96 - 10\,N \times 12.5^2) \times 85/80 \times 5/10 = 2{,}275.$$
$$96 - 10\,N = (2{,}275/12.5^2) \times 80/85 \times 10/5 = 27.$$
$$96 - 27 = 10\,N = 59.$$
$$N = 5.9.$$

Required wire = No. 6.

Example 9.—Application to long lines.

Although this "rough-and-ready" rule as given applies only to lines up to 50 or 60 miles in length, it may be used to advantage for longer lines by applying a correction factor (F) to the rule formula (1).

Thus:

$$\text{Line kw.-miles} = W \times \text{kv.}^2 \times F.$$

For 60 cycles:

$$F = (850 + 3 \times \text{miles}) \div 1{,}000.$$

For 25 cycles:

$$F = (950 - 180) \div 1{,}000 = 1.13.$$

Deliver 8,000 kw. at 84 per cent power factor, 88,000 volts, 25 cycles, over a three-phase line 180 miles long. No. 1/0 wire. What will be the approximate drop?

$$W = 130.$$
$$F = (950 - 180) \div 1{,}000 = 1.13.$$
$$\text{Line kw.-miles} = 130 \times 88^2 \times 84/80 \times 1.13$$
$$= 1{,}190{,}000 \text{ kw.-miles.}$$
$$\text{Actual kw.-miles} = 8{,}000 \times 180 = 1{,}440{,}000.$$
$$\text{Drop} = (1{,}440{,}000 \div 1{,}190{,}000) \times 10 \text{ per cent}$$
$$= 12.1 \text{ per cent.}$$

(Accurate drop = 12.6 per cent.)

It will be noted that all of the calculations are readily made on the slide rule.

Final Note F.—The values of W for No. 8 and No. 7 and for No. 2/0 to No. 4/0 have been omitted as there is a slight variation in the method of determining them. This variation is not difficult to memorize, however, and is as follows:

For 60 cycles:

No. 8. $W = 96 - (9 \times 8) = 24$.
No. 7. $W = 96 - (9\frac{1}{2} \times 7) = 29.5$.
No. 6. $W = 96 - (10 \times 6) = 36$.
No. 0. $W = 96 - (10 \times 0) = 96$.
No. 00. $W = 96 + (10 \times 1) = 106$.
No. 000. $W = 96 + (10 \times 2) = 116$.
No. 0000. $W = 96 + (10 \times 3) = 126$.

It will be noted that for No. 8 and No. 7 the factor $(10 \times N)$ is changed to $(9 \times N)$ and $(9\frac{1}{2} \times N)$ respectively. For No. 2/0 to No. 4/0 N is negative and therefore is added instead of subtracted, and also it is the sequence number of the wire; that is, for No. 2/0, $N = -1$, etc.

For 25 cycles:

No. 0000. $= 130 + (30 \times 8) = 26$.
No. 000. $= 130 + (30 \times 7) = 32$.
No. 00. $= 130 + (30 \times 6) = 40$.
No. 0. $= 130 - (15 \times 0) = 130$.
No. 6. $W = 130 - (15 \times 1) = 160$.
No. 7. $W = 130 - (14 \times 2) = 190$.
No. 8. $W = 130 - (13 \times 3) = 220$.

For No. 8 and No. 7 the factor $(15 \times N)$ is changed to $(13 \times N)$ and $(14 \times N)$ respectively.

For No. 2/0 to No. 4/0 the factor $(15 \times N)$ is changed to $(30 \times N)$. N is negative and therefore added instead of subtracted, and it is the sequence number of the wire as above.

For aluminum lines use the equivalent copper size and the rule will give reasonably close results. With these modifications there will be no other changes in the use of the "rough-and-ready" rule.

The percentage of power loss may be found, approximately, from the percentage of voltage drop if under 15 per cent by means of a simple formula, thus:

$$\text{Per cent power loss} = \frac{13 + N}{20} \times \frac{\text{Per cent drop}}{\text{P. F.}}. \qquad (8)$$

For wire sizes No. 2/0 to No. 4/0, N will be negative and equal to the sequence number of the wire, thus, for No. 3/0,

$$N = -2,$$

and therefore:

$$\text{Per cent power loss} = \frac{13 - 2}{20} \times \frac{\text{Per cent drop}}{\text{P. F.}}. \qquad (9)$$

Kansas Industrial Court Declares Mining Methods Wasteful

METHODS of mining bituminous coal now followed in Kansas are severely condemned by the Industrial Court of that state, which has been conducting an investigation into the mining industry there. The court finds that thousands of the men working in the mines are not skilled miners but ordinary laborers drawing miners' pay. "For many years," the court says, "it was the custom for the miners to undercut a section of the face of the coal vein. The present method is to do little or no undercutting of the coal. The miner simply drills a hole into the face of the coal vein, puts a stick of dynamite into it and blows out several tons of coal. All he has to do then is to take a shovel and throw it into the cars."

Under this uneconomical practice, the court continues, the percentage of slack or steam coal has virtually doubled, and as it cannot be stored successfully, when it begins to accumulate the mines shut down until it is cleaned up. It is also asserted that the heating power of the coal is injured by the use of dynamite.

Readers' Views and Comments

This is a readers' forum. Comments on questions before the electrical industry presenting economic, financial, engineering or commercial aspects and new or supplementary viewpoints on published articles are cordially invited

A Small Electric Fireless Cooker

To the Editors of the ELECTRICAL WORLD:

My attention has been called to the editorial in the ELECTRICAL WORLD for July 30, page 203, entitled "A Few Missing Electric Cooking Utensils." Item No. 4 on page 204, column 1, referring to a fireless cooker, is of particular interest to our company, because we make a device of this kind that is giving satisfaction in every way and is guaranteed to perform any cooking operation that any other electric stove or range will do, with the exception of broiling a steak or boiling water. This cooker connects to an ordinary lighting circuit and therefore meets the requirements which you point out.

Sterolectric Company, J. H. REICHART.
Muncie, Ind.

Definitions of Power Factor

To the Editors of the ELECTRICAL WORLD:

There are certain things contained in the two definitions of "kilowatt-ampere" in balanced and unbalanced, three-phase circuits, as proposed at the thirty-sixth annual convention of the American Institute of Electrical Engineers at White Sulphur Springs, W. Va., that are of vital interest to those engaged in the purchase and sale of power. The two definitions were formulated as follows:

Definition No. 1.—Power factor in a polyphase circuit is the ratio of the total watts to the arithmetical sum of the volt-amperes in the several phases, each measured to a non-inductive neutral point.

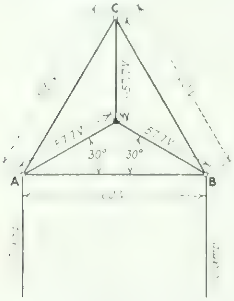
Definition No. 2.—Power factor in a polyphase circuit is the ratio of the total watts to the vector sum of the volt-amperes in the several phases.

Since the power factor of a customer's load affects largely the capacity of the electrical portion of the system, which represents from 70 to 85 per cent of the investment, it is generally conceded that the kilovolt-ampere is a more equitable unit to be used in charging for demand than the kilowatt.

Under the first definition of power factor, "kilovolt-ampere" is defined as the arithmetical sum of the volt-amperes in the several phases, each measured to a non-inductive neutral point, and under the second definition it is defined as the vector sum of the volt-amperes in the several phases. If the load on the system is balanced, the demand in kilovolt-ameperes metered in accordance with either definition will be the same, the values differing, however, when the load on the three-phase system becomes unbalanced.

Referring to the accompanying sketch, a 10-amp., single-phase load is shown connected across phase *A-B* of a 100-volt, three-phase system. Since the first definition defines "kilovolt-ampere" as the arithmetical sum of the volt-amperes in the several phases measured to a non-inductive neutral point, the kilovolt-ampere load on the three-phase system in this case would be volts to neutral times amperes in phase *A* plus volts to neutral times amperes in phase *B*, or 57.7 × 10 × 2, or 1,154 volt-amperes.

The second definition defines "kilovolt-ampere" as the vector sum of the volt-amperes in the several phases. Referring to the diagram, it will be noted that the single-phase load current leads the voltage by 30 deg. in one phase and lags behind the voltage 30 deg. in the other phase. Therefore, in accordance with the second definition, the kilovolt-amperes metered will be the volts to neutral times the amperes in phase *A* times the cosine of 30 deg. plus the volts to neutral times the current in phase *B* times the cosine of 30 deg., or 57.7 × 10 × 0.866 × 2, or 1,000 volt-amperes, which corresponds to the single-phase load of 10 amp. at 100 volts. Therefore, a single-phase load of 1,000 volt-amperes on a three-phase system metered in accordance with the first definition will be recorded as 1,154 volt-amperes, and when metered in accordance with the second definition will be recorded as 1,000-volt-amperes. The difference is a factor of 1,000 ÷ 1,154 = 0.866, or the cosine of 30 deg.



VECTOR RELATIONS FOR A 10-AMP. SINGLE-PHASE LOAD CONNECTED TO A 100-VOLT, THREE-PHASE SYSTEM

It is apparent that on balanced loads the demand metered in accordance with either definition will be the same, but on a mixed single-phase and three-phase load the first definition will increase the metered kilovolt-amperes by an amount approximately equal to the single-phase component of the load divided by the cosine of 30 deg., or 0.866. A single-phase load across one phase of a three-phase system or the single-phase component of a combined single-phase and three-phase load is, so far as the investment in electrical apparatus is concerned, virtually equivalent to a three-phase load at 0.866 power factor, since the single-phase load is 30 deg. out of phase with the voltage to neutral.

Since an unbalanced load tends to lower the capacity of a three-phase system, a power consumer having an unbalanced load should be called upon to carry a greater investment and higher demand charge than a customer having the same load unbalanced. Metering the demand in accordance with the first definition automatically compensates the supplier for the added investment necessary owing to unbalanced load conditions on the customer's premises, whereas the second does not discriminate between a balanced and an unbalanced load.

So far as defining power factor is concerned, no doubt the second definition is preferable, since unbalance does not affect the values arrived at. So far as the demand item in power bills is concerned, the first definition seems to be preferable, since the values secured are more nearly proportional to the investment required to serve a customer, regardless of whether his load is balanced or unbalanced. The effect of unbalance is automatically taken care of without the necessity of special metering equipment and special clauses in the power contract.

It seems that the second definition has been tentatively adopted by the American Institute of Electrical Engineers, and that the consensus of opinion is that, while definition No. 2 is technically to be preferred, definition No. 1 has its value as a unit for the measurement of demand for the reasons that have been outlined above. D. J. Angus.

Esterline Company,
Indianapolis, Ind.

Unreliable Grounding Clamps

To the Editors of the Electrical World:

In preparing some installation rules requiring the grounding of single-phase neutrals, in addition to the main grounds installed by the power companies, I have been struck with the inadequate type of ground clamps now on the market. In fact, we have found it impossible to obtain what I consider is a sufficiently good clamp for the purpose and have been driven to the necessity of making arrangements with a local manufacturer to make clamps according to our own specifications.

To show that our complaint as to the type of clamps is also agitating other inspection interests, I should like to quote the following opinions of recognized authorities on this subject.

At the convention of the National Association of Electrical Inspectors in Philadelphia in October, 1920, W. J. Canada, director of the engineering department of the N. E. L. A., made the following statement: "One of the worst obstacles to thoroughly reliable grounding of circuits has been the frailty of the various ground clamp devices marketed for connecting the sturdy ground wire with the even more sturdy water pipe."

In commenting on Mr. Canada's remarks Washington Devereux, president of the National Association of Electrical Inspectors, said: "One of the greatest troubles seems to have been a first-class, A1, reliable and dependable ground clamp."

It is also apparent that the same question is agitating the electrical fraternity in Great Britain, for at a meeting of the National Association of Supervising Electricians in London, on June 15 last, Allan Kirk is quoted in the *Electrical Times* as saying, "The writer has not yet seen what he considers a sound bonding clamp on the market."

In the recent issue of Handbook No. 4 of the Bureau of Standards, containing a discussion of the National Electrical Safety Code, I find the following statement on page 26, under the head of Ground Clamps: "There is a great need for stronger ground clamps than have been in general use. Many ground clamps are of rather flimsy construction, which makes their usefulness uncertain."

I am sending the above remarks on to you, trusting they may be the means of awakening a little interest on the part of manufacturers of these devices, believing that if this demand were catered to the manufacturers would find a ready market. It should be remembered that a clamp that may be suitable for one purpose may not be suitable for another. When we have to deal with the grounding of the neutrals of secondaries the whole grounding installation should be of the most thorough and effective nature. The efficacy of the grounding should not depend on improperly designed appliances of the character criticised. F. A. Cambridge,
City Electrician.

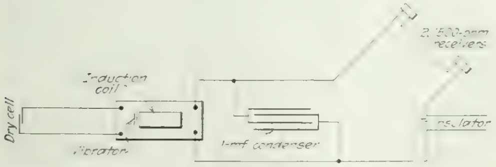
Winnipeg, Canada.

Station and Operating Practice

A Department Devoted to Problems of Installation,
Operation and Maintenance of Equipment for Economical Generation and
Distribution of Electrical Energy

Easily Made Detector for Locating Faulty Insulators

FOR weeding out faulty high-tension insulators from the line, a "resonator" has been developed by the Narragansett Electric Lighting Company, Providence, R. I. The resonator, as shown in the accompanying drawing, is an induction coil with a vibrator, a 1-microfarad condenser, one dry cell, and a pair of 1,500-ohm receivers. The condenser is connected across the secondary terminals of the coil and the receiver is in series with the insulator to be tested. The connection is made to the insulator with Okonite duplex lamp cable, which need not be specially insulated from the ground or floor. When listening to a good insulator the sound is low and of fairly high frequency. However, if the insulator is cracked or porous, a louder noise is heard which has not as smooth a sound as the noise from the good insulator.



RESONATOR FOR DETECTING CRACKS AND POROSITY IN HIGH-TENSION INSULATORS

The outfit was made from old material at a cost of about $17. It has proved very satisfactory and entirely safe. On a badly defective insulator the current is so slight that it cannot be felt except by taste. The resonator has been used chiefly on 22,000-volt to 66,000-volt insulators. E. F. LATIMER.

Narragansett Electric Lighting Company,
Providence, R. I.

Testing for and Preventing Migration of Gas in Duct Lines

AMONG the several devices used to detect the presence of dangerous gas mixtures in underground ducts, the Davy safety lantern, a gas indicator made by Short & Macon, Ltd., London, and the Burrell indicator have been reported satisfactory by companies using them. Various methods are used for clearing duct lines and manholes of gas. In some cases a small hand-operated blower may be used successfully, but in bad cases a power-operated blower must be employed. Ventilation of a manhole is frequently obtained by the use of a canvas curtain suspended over the manhole so that the wind will blow into it.

Companies disagree as to the advisability of plugging ducts in main runs, but it is the common practice to plug ducts leading into stations and buildings.

The presence of gas is much more common in duct lines which parallel high-pressure gas mains. Troubles have been experienced from sewer gas entering manholes through sewer connections; also from gasoline draining into duct lines through manhole covers and from gasoline tanks buried in close proximity to duct lines.

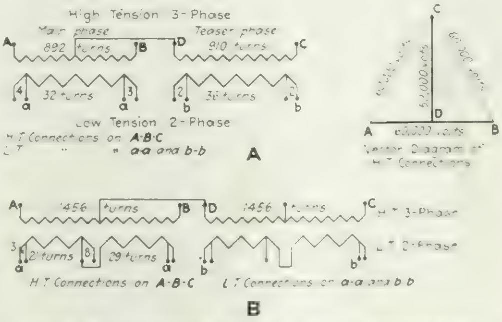
This information was presented at a meeting of the Northwest Electric Power and Light Association.

FIELD EDITOR ELECTRICAL WORLD.

San Francisco, Cal.

Reconnecting Transformer for a Higher Voltage

OWING to increased load on certain 30-cycle, three-phase transmission lines it was desired to raise the voltage from 50 kv. to 60 kv. since this would increase the carrying capacity of the lines about 44 per cent. This involved an interesting job of changing the transformers to operate at the higher voltage. The lines are supplied from two power houses. In No. 1 plant the transformation is 2,200 volts, two-phase, to 50,000 volts, three-phase. There are twelve shell-type transformers in this station, two of 1,100-kva. rating each, and ten of 2,200-kva. each. Five of the 2,200-kva. transformers are of one make and five of another. Core loss and magnetizing current tests were made on a number of the transformers and it was ascertained that the five 2,200-kva. transformers of one manufacture would operate satisfactorily with 60,000 volts on their high-tension windings. The core loss and magnetizing current of the other five were so high at 60,000 volts that it was not practical to operate them at that voltage.



TAPS ON LOW-TENSION WINDING AFFORDED DESIRED RATIO

It was decided to make use of the latter transformers for teasers, using their full high-tension winding. This winding has 910 turns, and the complete low-tension winding forty turns. Two-turn taps were available on the low-tension winding, which gave a ratio of 910: 38 = 52,600: 2,200 or 52,600 volts on the teaser winding. This is equivalent to $\frac{52,600}{0.866} = 60,900$ volts on the three-phase connections.

The five transformers to be used on the main phase have 892 turns in the high-tension winding, and thirty-nine in the low. A four-turn tap was available in the low-tension winding, but it was necessary to unstack the transformers in order to take out an additional three-turn tap, making seven turns in all. The ratio then was 892: 32 = 61,300: 2,200, thus giving 61,300 volts on the high-tension side. When these transformers were reassembled means were found to add about 2 in. of iron to the core of each to assist in taking care of the increased magnetic flux.

It will be noted that the theoretical voltage is slightly higher in the case of the main transformers, but as their reactance is also higher, it was apparent the voltage unbalance would be slight. A connection diagram for these banks and a vector diagram of voltages is shown at *A* in the drawing.

The two 1,100-kva. transformers were found to be satisfactory for operation on 60,000 volts. Arrangements were made to operate them in Scott connection on either phase. These transformers have 1,456 turns in the high-tension winding and sixty-four turns in the low. By means of a three-turn tap which was available on the low-tension side the ratio was changed to 1,456: 61 = 52,500: 2,200 or 52,500 volts on the teaser phase. This corresponds to $\frac{52,500}{0.866}$ 60,700 volts on the three-phase leads. To adapt the 1,100-kva. transformers for use on the main phase an eight-turn tap was brought out. This was readily done, without unstacking the transformer, by tapping onto the connector between coils. By making use of the three-turn tap already provided, a total of eleven turns were cut out on the low-tension side. The ratio was then 1,456: 53 = 60,500: 2,200. It would have been possible to connect both transformers of this bank alike on the low-tension side and to use 87 per cent of the high-tension winding on the teaser phase. However, it was considered more advisable to make use of the extra turns in order to keep the core loss down. A connection diagram for this bank is shown at *B*.

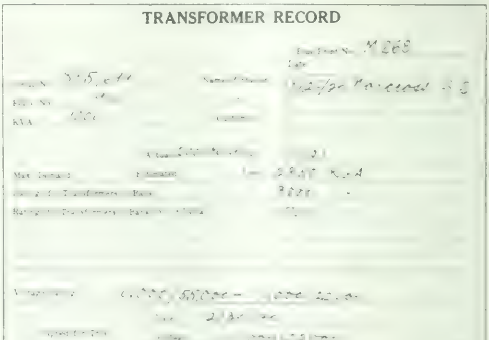
In No. 2 power house there is a bank of three shell-type, 5,000-kva. delta-delta-connected transformers. Tests on these transformers showed that at 60,000 volts the magnetizing current and core loss became excessive. It was therefore decided to remove one coil from a low-tension group and add one coil to a high-tension group in each transformer. The high-tension winding was made up of sixteen coils, four of thirty-three turns each and twelve of forty-two each, or a total of 636 turns. The low-tension winding consisted of twelve coils of seven turns each. The ratio then, after adding a forty-two-turn coil to the high-tension side and taking a coil away from the low-tension side, was 678: 77 = 58,100: 6,600 = 60,000: 6,810. This ratio requires 6,810 volts on the low-tension bus, which is permissible. Under these conditions the magnetizing current and core loss are not excessive. It was necessary, of course, to unstack the transformers to make this alteration. One transformer was taken out of service at a time and the two remaining transformers operated on open delta. Approximately one week was required for making the alteration on each transformer and another week for drying it out and putting it back into service.

In all the alterations the turns were cut out in such a manner as to leave the active winding as symmetrical as possible. Extra taps were brought up to the terminal boards so arranged that the change over from 50 to 60 kv. could be quickly made.

C. R. Reid,
Power House Superintendent.
Shawinigan Water & Power Company,
Shawinigan Falls, Quebec.

Sheet Holds Complete Record of Power Transformer

For keeping a complete record on power transformers the sheet shown in the accompanying cut is in use by the Georgia Railway & Power Company. This gives the rating, number of the transformer and the place where it is installed together with the date. It also gives information on actual and estimated load. The full nameplate data of the transformer are given, together with its weight, the amount of oil required, the date of purchase, cooling system, information on the bushings, etc. On the back of the sheet are recorded the oil tests before filtering and the filtering test and date. An attempt is made to sample oil in each transformer once every month, and this report has places for a year's records. If any repairs are made to the transformer, the details are noted on the card together with the cause of the damage.



TRANSFORMER RECORD

KVA

REMARKS

ALL PERTINENT INFORMATION ON TRANSFORMER RECORDED ON THIS SHEET

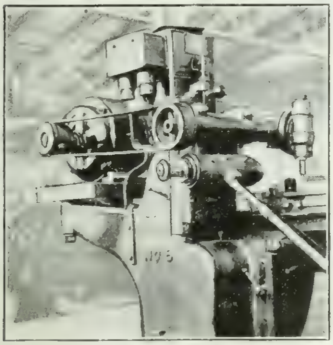
G. A. Iler,
Superintendent Operation, Tests and Repairs.
Georgia Railway & Power Company,
Atlanta, Ga.

Industrial Applications

The Economical Utilization of Electrical Energy
in Mills and Factories, Together with Practical Details of Installation, Control,
Testing and Repair of Equipment Required

Adapted Motor Drive Provides Convenient Service for Miller

IN A MASSACHUSETTS industrial plant where many machine tools formerly driven in groups have been equipped with individual motors the convenience with which such tools have been adapted to the new drives is striking. This is illustrated by the No. 6 Whitney miller run by a 1-hp. Westinghouse motor turning 1,140 r.p.m. shown in the accompanying photograph. The motor is mounted on a 2-in. wooden platform attached to the frame of the machine at a height of about 5 ft. above the floor, enabling a short belt drive from motor pulley to the main shaft to be utilized. The starting switch, mounted on 1-in. x $\frac{3}{8}$-in. iron straps, is carried at the top of the machine behind the main shaft on the motor side and still most convenient for the operator. In this case the bracketed machine frame supports the motor without requiring the bracing structures sometimes necessary, considerably reducing the cost of adaptation.



MOTOR AND SWITCH ON MILLING MACHINE ARE OUT OF WAY OF PASSERSBY

FIELD EDITOR ELECTRICAL WORLD.
Boston, Mass.

Some Pointers to Follow When Rewinding Armatures

TO INSURE the best life from an armature extreme care should be used to see that every point that might cause failure is guarded against while the armature is being wound. First of all, any sharp corners and any roughness in the slots that might damage the coils should be filed down and all chips and filings removed before applying the insulating material to the core. In applying the insulating material on the coil supports the material should be evenly placed and no thin spots allowed. The coils should fit tightly in the slot and be wound so as to bring their tops $\frac{1}{32}$ in. above the band grooves. Fillers should be used between the coils if necessary to meet these conditions. This will permit the bands to pull the coils down tightly and at the same time finally rest on the iron, which allows the minimum movement of the coils in the slots. If the coils are wound too high the bands will not rest on the iron and, when the insulation dries out in service, loose bands will result.

The coils should not be twisted, bent or abused any more than is absolutely necessary to get them in place. Care should be taken not to get the wires or leads crossed in such a manner that when pressure is applied in banding short circuits will occur. The coils on the end windings should be down, so as to make a solid foundation for the bands, but pounding should not be carried to the extent that the coils or leads are damaged. Insulating protecting pieces should be placed at all points where the coils cross and where there is danger of short circuits occurring. It is good practice to weave braid between the leads directly back of the commutator, both on the top and bottom layers.

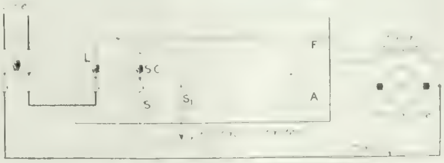
The leads should be tinned back to such a distance that there is no untinned copper in the commutator neck. The cotton sleeving on the leads should not be allowed to get into the commutator slot, as it may hinder soldering to such an extent that a poor connection will result. The tool used in driving the leads into place should be free from sharp corners that might nick the leads, as a nicked wire may result in a broken lead.

JOHN S. DEAN,
Motor Engineering Department.
Westinghouse Electric & Manufacturing Company,
East Pittsburgh, Pa.

Simple Starting Board for Direct-Current Motors

WHERE a number of various sizes of direct-current motors have to be run frequently as in repair shops, etc., a starting board such as shown in the accompanying diagram will be found very useful.

The motor or any number of motors in parallel are connected up as shown. The switch *L* closes the field circuit. A portable starter is connected across *S* and S_1 and the starting resistance is then gradually cut out, after which the short-circuiting switch *SC* is closed. The starter can then be removed and used elsewhere. This arrangement is useful and economical where a number of motors have to be frequently given a test run.



PORTABLE STARTER CAN BE USED FOR SEVERAL MOTORS IF THEY HAVE BOARDS LIKE ONE SHOWN IN THE DRAWING

EUSTACE C. SOARES,
Electrical Engineer.
Ophuls, Hill & McCreery,
New York.

Battery on Trolley-Type Locomotive Speeds Tunneling

BY MOUNTING a battery on a trolley-type electric locomotive the work of driving an 18-ft. x 18-ft. tunnel for the Kerckhoff power plant was considerably speeded up. This was a 17,000-ft. tunnel being cut by the "bench and heading" method. The speed of driving the tunnel through granite is principally dependent upon the time required to remove the muck. For this purpose 6-yd. dump cars (which were rebuilt in order to lower the box for loading with steam shovel and increase their capacity) were hauled by 6-ton electric locomotives on a 3-ft.-gage track. Two 50-kw., 250-volt generators, direct-connected to induction motors, were set up outside the tunnel portal, and No. 0 trolley wire was strung from the roof of the tunnel or supported by brackets from the side.

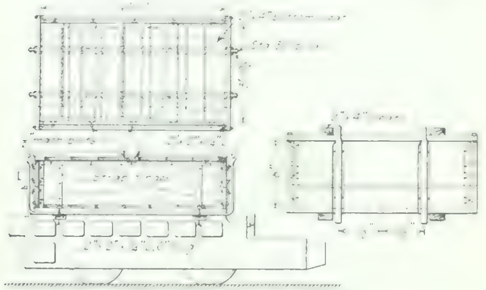


FIG. 1—BOX FOR MOUNTING STORAGE BATTERY ON TROLLEY-TYPE MINE LOCOMOTIVE

Box to be made of good, clear material. Joints painted with asphaltum paint as assembled. Skids to be made from standard 30-lb. rails. Top to be made in two sections and cleated on the outside. Top to be hinged in center on top and covered with one piece of heavy canvas and painted to waterproof. Inside of box to be painted with hot asphaltum paint and lined with two thicknesses of tar paper cemented together with asphaltum and finished with good coat of asphaltum paint. Will accommodate 110 cells of Exide MV-11 "Hi-cap" batteries.

The usual schedule was as follows: Drilling was completed and the shot was put off about midnight. After the gas had cleared sufficiently the workmen entered the tunnel and cleaned up the track preparatory to moving the steam shovel up for mucking. When the steam shovel was working on the muck pile, drillers were at work drilling the heading for the next shot. After the shovel had cleaned up the muck, then the bench was drilled. This schedule worked out so that a shot was usually made at midnight each day.

It was necessary for the electricians to take down about 300 ft. or 400 ft. of trolley wire and lighting circuits prior to firing the shot and replace them after shooting was completed. This work, together with the maintenance of circuits, rail bonds and shotting lines, required the services of three station operators for the motor-generator sets, and three wiremen, including one who acted as foreman. In many instances the electricians would hesitate for a considerable time before entering the tunnel after the shot, owing to the inconvenience of working amid gases with limited light from an acetylene torch.

It was desired to eliminate, if possible, the need for so large a force of electricians and consequent delays in getting mucking crews to work. The use of storage batteries on the locomotives was at first considered expensive, but further investigation was made to obtain exact requirements, and a curve-drawing ammeter was connected in the circuit in order to determine the volt-amperes and maximum demand of current for hauling out the muck for one complete shot with a total haul of 3,000 ft.

It was noted that the locomotives were taking current from the line for very limited periods, and that the ampere-hour demand was much smaller than would naturally be expected. In making a test of the locomotives it was found that a load of 10 tons required 51 hp. in starting and 33 hp. running. The speed of the train is 3.87 miles per hour, with a pressure of 250 volts on the trolley. This would give a current demand of approximately 152 amp. for starting and 93½ amp. for running. With this information it was determined that a 110-cell Exide MV-11 battery would be sufficient for hauling out all the muck for one complete round. The normal discharge rate of this battery is 27½ amp. on four-and-a-half hour rating.

A section of trolley was left in so that when the locomotive was not in use it would normally be left connected to the trolley and thus take on current.

The locomotives on which these batteries were used were General Electric Company type LS-2C5 and Westinghouse Baldwin mine-type locomotives, each having a 6-ft. wheel base and 3-ft. gage. As the trolley stem was mounted in the center, it was moved and mounted on the side of the car before the battery was installed. A strong box, for containing the battery arranged so that it could be lifted by derrick, was constructed and lined inside with tar paper and pitch (see Fig. 1). Fig. 2 shows a photograph of the locomotive, complete with battery, at the portal of the 8,400-ft. section of the tunnel.

After this equipment was put into service, it was possible for one electrician to take care of the batteries and do the work which had previously been done by six men. The generating equipment required was reduced from two 50-kw. machines to one 37½-kw. machine.

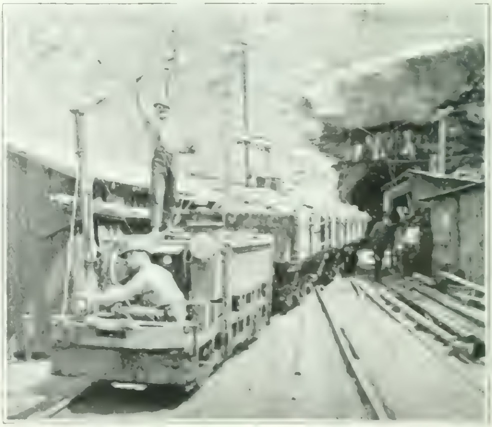


FIG. 2—BATTERY INSTALLED ON TROLLEY LOCOMOTIVE SPEEDED JOB OF MUCKING OUT TUNNEL

The delays in getting into the tunnel after a shot were considerably reduced by the fact that it was possible for the electrician to come into the tunnel on the battery locomotive as far as the track was clear, and the headlights on the front provided ample illumination for putting up the circuits in the heading and thus furnishing light for the pipe filters to get the air lines up in the heading for the drillers. The necessity of taking down 300 ft. or 400 ft. of trolley wire was obviated, as no trolley was carried within 700 ft. of the heading, and bonding rails for this distance was also avoided. The extension of the trolley and bonding rails could be done at opportune times, without in any way delaying the driving of the tunnel. The necessity of maintaining a trolley on the dump track was also done away with.

It is believed that this system had considerable to do with the speed which was made in driving the south end of this long section, where there was not a single round lost from the time when the battery locomotives were put into service to the time when the tunnel was holed through.

R. C. STARR,
Construction Engineer.
San Joaquin Light & Power Corporation,
Fresno, Cal.

Some Advantages Claimed for Copper-Alloy Steel

SINCE there are many services in which a metal is needed for electrical structures and apparatus that is particularly immune to corrosion from weather, fumes and other causes, readers of the ELECTRICAL WORLD may be interested in the following information on copper-alloy steel from R. V. Bingay, president of the Pittsburgh Transformer Company.

Test pieces of copper-alloy steel and plain steel were exposed simultaneously to the Pittsburgh atmosphere for periods of one to six months. In all cases the corrosion loss was less for copper-alloy steel, being from one-half to one-fifth that for plain steel, depending on the length of exposure. The corrosion of the copper-alloy steel virtually stopped after the fourth month of exposure, evidently owing to the protective coating formed by rusting. With plain steel, however, the rusting progressed at a rapid rate, as shown by the accompanying table, which indicates corrosion losses for the samples in ounces per square foot of sample exposed. The sample of plain steel, which was exposed six months, rusted from a weight of 18.3 grams to 0.9 grams and was wholly disintegrated.

Mr. Bingay claims other advantages for copper-alloy steel. For instance, he contends that paint coatings adhere better thereto than with plain steel. Besides, the alloy welds better both with electric arc and acetylene flame. The weld is softer and more homogeneous, the metal flow better, and the resultant weld is stronger than ordinary steel. Still another advantage claimed is that the alloy is more easily fabricated, being softer and more ductile.

CORROSION LOSSES IN OUNCES PER SQUARE FOOT OF COPPER-ALLOY STEEL AND PLAIN STEEL EXPOSED

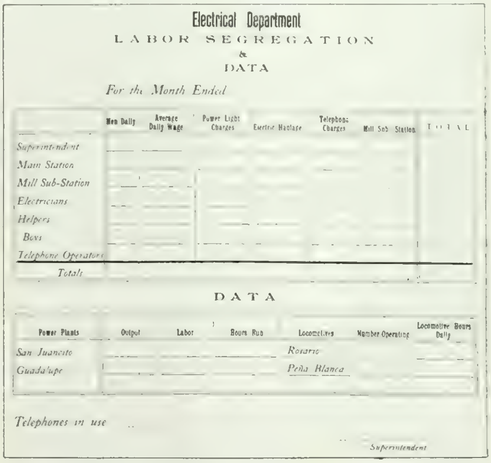
Period of Exposure (Months)	Copper Alloy Steel, Ounces per Sq Ft	Plain Steel Ounces per Sq Ft.
One	0.52	0.90
Two	0.64	1.82
Three	0.95	3.00
Four	1.13	3.64
Five	1.13	4.41
Six	1.17	5.53

As a result of these experiments and data submitted before various national engineering associations and in technical journals, Mr. Bingay concludes that the life of unprotected copper-alloy steel is 300 to 500 per cent greater than that of plain steel and that the metal is particularly adapted for use as transformer tanks or other cases and structures for electrical apparatus that must be exposed to the weather.

New York City. FIELD EDITOR ELECTRICAL WORLD.

Power-Cost Distribution in Mill with 1,800 Hp. in Motors

FOR purposes of comparison, and as a permanent record of the electrical power cost per ton of the various stages in the mining and milling of 400 tons of ore per day, the electrical department of a large silver producer makes use of a monthly cost sheet in which the energy costs for the various processes are carefully distributed. For this purpose, two report forms are prepared monthly by the electrical department, which, together with data from the other departments, furnish the information for the preparation of the cost sheet by the accounting department. This company generates its own power in two 700-kva. hydro-electric plants and the cost includes both operation and maintenance. The organization is divided into three main departments, mine, mill and administration, and four auxiliary departments, electrical, mechanical, surface and laboratory. All costs must eventually be segregated to the main production departments, the mine and mill, and to administration or overhead expense. The electrical charges against the mechanical department, for example, are segregated by that department and charged out according to the work done for the main departments.



Electrical Department
LABOR SEGREGATION
&
DATA

For the Month Ended

	Men Daily	Average Daily Wage	Power Light Charges	Electric Haulage	Telephone Charges	Mill Sub Station	TOTAL
Superintendent							
Main Station							
Mill Sub-Station							
Electricians							
Helpers							
Boys							
Telephone Operators							
Totals							

DATA

Power Plants	Output	Labor	Hours Run	Locomotives	Number Operating	Locomotive Hours Daily
San Juancito				*Rosario*		
Guadalupe				*Peña Blanca*		

Telephones in use

Superintendent

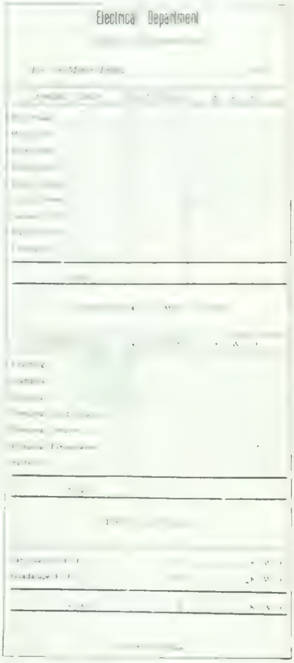
FORM 1—ELECTRICAL LABOR COSTS DISTRIBUTED ACCORDING TO DEPARTMENTS

The integrating kilowatt-hour meters at the two power plants are used to determine the total power consumption, the line and transformer losses being neglected. The kilowatt-hours and the per cent of the total used by each department are then entered in the first table of Form 2.

These percentages are obtained from the reports of the two substations and are based on the average of hourly ammeter readings and data secured from tests of motor loads and the time of shutdowns. The percentages for the distribution of the mill power are obtained in a similar manner. As the bulk of the electric power for the mine is utilized at the compressor plant, the mine department further segregates this item according to the work done with the compressed air underground. Material drawn from the storeroom is charged directly to the department for which it is used and so appears on the cost sheet, except that used in the power rial drawn from the a power charge. The labor segregation is made on Form 1. It will be seen that these labor charges are either directly against the other departments for maintenance or against power and light. From the total power and light charges, which include operation and maintenance of the power plants and transmission lines, the cost per kilowatt-hour is then calculated and charged against the various departments, according to the segregation in Form 2. Another form consists of a weekly report of power houses and substations for the attention of the manager of the property.

FREDERICK KRUG.

New York & Honduras Rosario Mining Company,
San Juancito, Honduras, C. A.



Electrical Department

FORM 2—ENERGY USED BY EACH DEPARTMENT ITEMIZED IN THIS RECORD

Four-Inch Conduit Bent in Place

RECENTLY in running some 4-in. conduit in an industrial plant it was found that an undesirable sharp bend could be avoided if a slight bend could be put in the section already laid. As the section was made up and tightly joined, some time would have been required to uncouple the one length in which the bend was desired. Consequently it was decided to try to bend the conduit without removing it from the ground. To accomplish this the earth was shoveled away from the conduit and the trench widened for about 15 ft. Then a large kerosene blue-flame torch was applied to the conduits. In five minutes one was heated red hot and was easily bent about 15 deg. with a crow-bar, after which another was bent likewise. After cooling, all couplings were thickly painted with asphaltum and the earth was replaced. The total time of heating, bending and painting was not over forty-five minutes.

East Berlin, Conn. H. S. RICH.

Unusual Frequency Obtained for Driving Foreign Machines

A NEW ENGLAND factory imported fourteen precision grinding machines from Switzerland, each equipped with two ½-hp. motors and a $\frac{1}{16}$-hp. motor. The two larger motors were wound for 110 volts, three-phase, 50 cycles, and the smaller for 110 volts, single-phase, 50 cycles. The two available services at the factory, however, were 220 volts, two-phase, 60 cycles, and 220 volts direct current. Considering the extreme accuracy of these machines, their complicated mechanism and the abnormal expense involved, it was considered wisest to supply energy as required by the motor design. Even a slight excess of heat radiated by the motors throws such machines out of adjustment. Also the delicate electrical indexing and checking devices are best left unchanged. Moreover, on account of the large investment, the company insisted that these machines should be in operation as soon as possible. Rewinding the motors was entirely too risky to warrant any experimenting. It was afterward found that such action would have meant a delay of six months. An attempt was made some time later on, but the rewound motors were rejected twice on account of excessive heating.

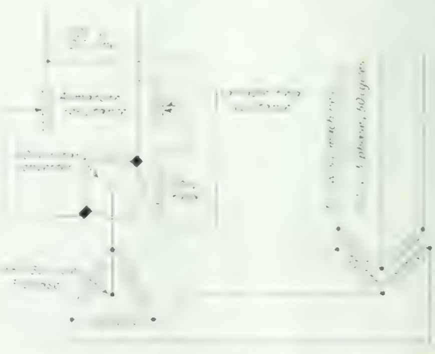
In solving the supply problem a rotary converter was found with a bank of "V"-connected transformers. The rotary was designed for 110-volt direct-current service, but it was thought that it could be operated from a 220-volt source by connecting a resistance in series. The transformers were tapped for 55-volt steps up to 550 volts. They were rated for 60 cycles, but at the reduced load which they would carry they would not overheat in 50 cycles.

In connecting the outfit a field rheostat was put in the field circuit to cut the terminal voltage down to 110 volts.

An armature resistance was placed in the armature circuit to give the proper speed to deliver 50-cycle current. By varying these two resistances the 220-volt direct current was changed to 138-volt, 50-cycle, three-phase current by the rotary. The transformers reduced the potential to 110 volts, and actual experience soon proved that the machines would operate perfectly on this service.

HERBERT L. WOLF.

New Haven, Conn.



FIFTY-CYCLE FREQUENCY OBTAINED FOR DRIVING MACHINES OF FOREIGN MAKE

Central Station Service

A Department Devoted to Commercial Policy
and Management Topics, Including Methods of Increasing the Use
of Electric Light, Power and Heat

Campaigns on Ranges Start in West—Other Good Signs

Some Interesting Significant Bits of Information that Show a Trend in Merchandising Sales by Central-Station Companies

THERE is undoubtedly a spirit of new life abroad among the men who sell for central-station companies. A few more market developments are being planned, a little more active selling is being done, a little more business is being reported from here and there all over the country. The large systems in the West are taking up again the work of pioneering the electric range and are campaigning for immediate business. The Eastern and Middle Western companies are reporting better appliance sales and a stronger feeling of expectation. It is fragmentary, just a word from here, a bit of news from there; but taken altogether it shows a quickening of the spirit of business, an evidence of better times not far ahead.

Electric Range and Water Heater Campaigns on Pacific Coast

The Great Western Power Company of California, for instance, has just announced an electric range and water-heater sales campaign that promises to assume large proportions in the company's wide territory on the Coast. In the effort to stimulate the market and induce a brisk movement of these two appliances sales will be made approximately at wholesale prices and the campaign will embrace both the sale and the installation of ranges, heaters and tank covers with the wiring complete ready for service. Nearly all standard makes of ranges and heaters will be sold. A number of the leading models, in variety sufficient to meet all usual requirements, will be stocked in quantity and to these the major impulse in the campaign will be given. Prices of other types will be quoted on request by any customer, but they will not be purchased by the company until a purchase contract has been signed by the consumer and the first payment made. The equipment will be sold either for cash or on deferred payments. Under the time-payment contract 40 per cent of the total contract price must accompany the order and the balance must be paid 5 per cent per month without interest, so that the payments will extend over a twelve-month period. A cash discount will be allowed at any time for payment of the balance then due. The price, being exceptionally low, will be offered only to bona-fide consumers on the Great Western lines, and any other sales which may be made under unusual circumstances will be at an increase of 50 per cent.

The wiring of these ranges and water heaters is to be done entirely by local contractors and billed to the consumers at the contractors' actual price. It is estimated that in San Francisco, Oakland and Sacramento the cost of installing a range and water heater complete with necessary switches will be $95, and for the range alone the cost will be $80. In the outside territory, where the construction requirements are less stringent, it should not cost more than $65 for the range and water heater together or $50 for the range alone. The Great Western Power Company recommends the use of 5,000-watt heaters and requires that these be connected to the range with a double-throw switch, so that both appliances cannot be in service at the same time. The campaign will be pressed very energetically and supported by the active co-operation of the electrical dealers. Special salesmen will be employed, and it is believed that a large amount of business will be developed. The publicity that will mark the course of this campaign and the influence of the selling itself are bound to be felt throughout that section by the entire electrical trade.

The Montana Power Company is also already pushing range business aggressively and intensively on a "cost basis." Ranges are being sold installed at the list price of the appliance. In other words, the company is making the cost of connection a premium given with the sale of a range, and this premium is covered by the profit on the range itself. The wiring is done by the contractors, who are paid by the company. This company is naturally being affected seriously by the three successive crop failures which Montana has suffered and by the widespread closing of the mines. This year's crop looks promising, however, and it is believed that a campaign of this kind will be a token of confidence and have a good effect on business. The company looks for a strong popular response and an extensive sale.

Domestic Light Bills Increased from $1.40 to $8.50 per Month

The Washington Water Power Company has never let up in its range selling, but is putting more pressure behind it now, selling at virtually list price installed, "clamp-on" water heaters being sold with ranges. The average domestic light bill in Spokane in 1920 was $1.40 for light alone, whereas the bill for light, range and water heater was $8.50. This company expects at least a 10 per cent increase in the number of ranges installed at the end of this year.

In Vancouver, British Columbia, during a recent three-month period the British Columbia Electric Railway Company in its six salesrooms sold a total of 1,193 appliances, the list including such interesting items as 651 flatirons, 74 vacuum cleaners, 76 grills, 97 small stoves, 30 water heaters, 29 ranges, 23 washing machines and in all a variety embracing 33 different appliances.

In Minneapolis the Minneapolis General Electric Company is running away ahead of its 1920 total on house wiring and reports the sale of 200 fans in June with an exceedingly brisk sale of flatirons and other heating appliances. The Northern States Power Company is negotiating to take on more than sixty small communities in its Sioux Falls Division, and this is typical of many other sections in the South and West. In Oklahoma, Iowa, Minnesota and South Dakota there are reports that villages have raised money locally to finance the construction of lines to tap the nearest power system and obtain electric service for themselves. There are a number of villages scattered across the map where residents are this summer building their own little plants and introducing electricity into their homes and business places. Times may be bad and money tight, but people are gradually deciding to go ahead and not only live but "do things" in spite of the obstacles.

So much for campaigns out West—for this is but one of the indications of more life in central station company selling.

The Central Maine Power Company has just organized a vacuum-cleaner campaign to clear out a stock of 225 on hand, and it has held a two-day sales conference to brighten up the selling men and instill in them a stronger optimism that will give them more confidence and produce more business. For there is really no buyers' strike. The buyers and the sellers have merely slowed down a little owing to the various causes that are being talked about so much. In the small New England cities served by central-station companies operated by Charles E. Tenney & Company—Fitchburg, Haverhill and Revere among them—there is a consistent gain in business this year in both energy and appliance sales. So it is in a great many other places where an effort is being made to build the business up. The seller must start the movement and the buyer will respond because he is beginning to feel that it is time to go ahead. These little random evidences show that the trade wind is freshening for the electrical man who will push out from shore and set his sails.

Business on the Increase with Tenney Companies

CYRUS BARNES, new-business manager for Charles E. Tenney & Company of Boston, stated to a representative of the ELECTRICAL WORLD last week that during June, 1921, the appliance sales of the Fitchburg (Mass.) Gas & Electric Light Company totaled $13,712, compared with $11,671 for June, 1920. The Haverhill (Mass.) Electric Company had a total output of 166,620 kw.-hr. in the week ended July 9, 1921, against 135,030 kw.-hr. for the corresponding week of last year, the outputs for industrial power being respectively 87,000 kw.-hr. and 69,400 kw.-hr. The peak loads were respectively 2,900 kw. and 2,100 kw., and the plant efficiency showed an increase, consumption being 2.84 lb. of coal per kilowatt-hour as against 3.55 lb. Appliance sales for the 1921 week were $725 against $412 a year ago and $359 two years back.

At Revere, Mass., the Suburban Gas & Electric Company has been continuing gains in output noted all through this spring and summer, the week's output being 101,800 kw.-hr. against 86,200 kw.-hr. a year ago. The maximum load increased from 2,150 kw. to 2,400 kw., and the Sunday output July 10 at this great beach resort near Boston was 14,200 kw.-hr. against 11,500 kw.-hr. for a corresponding day last year.

Customer Ownership Campaign Has Special Appeal to Housewives

THE Evansville (Ind.) Gas & Electric Company, which operates the street-car lines and gas and electric plants in that city, is issuing a series of folders and letters appealing to its customers and the citizens of Evansville to purchase stock in the company. In the campaign an especial appeal is being made to housewives to buy the stock offered by the company, and Frank J. Haas, the vice-president and general manager, says that about 30 per cent of the company's present stockholders are women. The 500 employees of the company are assisting in the sale of the stock.

From Here and There

Pueblo, Col.—W. F. Rober, vice-president and general manager of the Arkansas Valley Railway, Light & Power Company, reports that in spite of the flood in Pueblo, the sales of preferred stock to consumers have been exceedingly good. The sales for the first two weeks in July were $13,000. This is striking evidence of the growing appeal of public utility securities as their merits are becoming known by the public.

Minneapolis, Minn.—The investment department of the Northern States Power Company, Minneapolis Division, is exhibiting a large map of the city in which a pin is stuck to represent each consumer of the Minneapolis General Electric Company who has purchased securities of the local utility or the parent company. It makes a striking demonstration of the extent to which public ownership of the local electric light and power company has progressed through security ownership, and it has led to many inquiries and sales. T. C. Erringer is manager of the department.

Augusta, Me.—In the thirteen districts served by the Central Maine Power Company, including Augusta, Waterville, Lewiston and Rockland, a very successful fan campaign closed at the end of July with total sales of $7,676. Quotas were established for each division and prizes offered for the best individual selling records. Augusta led, overselling her quota 230.75 per cent. Waterville sold 209.66 per cent of her quota. The Central Maine organization is also engaged this summer in security sales to consumers which is developing a high degree of competition between districts and producing most gratifying results.

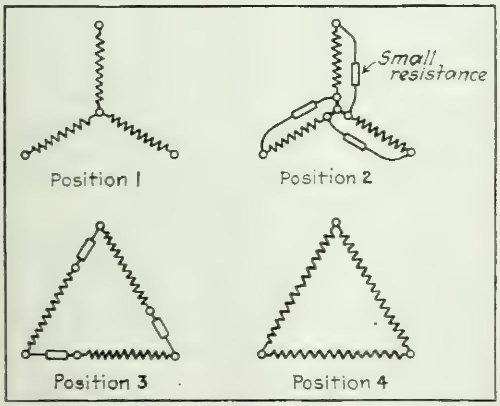
Northern Illinois.—The Public Service Company of Northern Illinois reports a considerably larger number of ranges sold so far this year than in the same period in 1920. A series of intensive campaigns have been conducted with good results in several of the cities served. Other campaigns are to follow. Flatiron, toaster, percolator and grill sales in July were better by 40 per cent than last year. It is interesting to note that at least 50 per cent of these sales have been made for cash and that there has been a considerable increase in the number of appliances sold by employees of the company. John G. Learned, assistant to the vice-president, is in charge of the campaigns.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
of the World

Generators, Motors and Transformers

Improved Y-Delta Starter for Three-Phase Motors.—W. Zederbohm.—To avoid a heavy rush of current and a necessary momentary disconnection from the line when changing over from star to delta, the author describes a novel switch, with four positions, for three-phase motors with squirrel-cage armature. Current diagrams and comparative oscillograms for the old-style and the suggested switch show the benefit of the new method. The current rush is very much smaller, and there is no break between star and delta operation.—*Siemens Zeitschrift*, June, 1921.



NOVEL STAR-DELTA SWITCHING METHOD (SIEMENS-SCHUCKERT)

Air-Insulated Transformers for Very High Voltage.—Dr. W. Hess.—In designing testing transformers for very high voltages—200 kv. and more—it is considered a matter of course to choose the oil-insulated type. Although oil makes it possible to cut down the necessary distance between the coils to one-third of the necessary distance in air, it has been proved that after the first brush discharge under oil the high initial dielectric strength of the oil is rapidly decreased along the path of discharge, leading soon to a breakdown. The author points out further that a reliable lead construction through the metallic cover of the oil tank of the transformer is almost impossible for more than about 300 kv. A Swiss firm (Haefely) investigated the possibilities of air-insulated, dry-type testing transformers and developed a new model of this type, a 200-kva., 300-kv. testing transformer, which gives good results in daily service in the firm's testing laboratory. The necessary striking and creeping distances have been obtained by properly dimensioned air spaces, the use of paper cylinders and a careful distribution of the electrostatic stress by means of metallic shields over and near the end turns. In spite of the large output (200 kva.) and very high potential (300 kv.) the finished transformer weighs only 4½ tons, or 70 per cent less than an equivalent oil-type machine. Even with a 25 per cent overvoltage, it is claimed, no discharges are visible if the machine is fully excited in the dark. The winding of the transformer is of the concentric style, and the high voltage is grounded in the middle (at the end of each of the two coil stacks). By using one or more additional transformers in series with the main transformer as much as 500 kv. against ground may be obtained safely. Such a tandem group is in use at the testing laboratories in Zurich for 400 kv. A photograph and sectional drawings of the 200-kva.-300-kv. machine are given. The author is of the opinion that the design of high-voltage power transformers should not meet with great difficulties.—*Bulletin de l'Association Suisse des Electriciens*, May, 1921.

Efficiency Test of a 30,000-Kw. Turbine.—Herbert B. Reynolds.—A report of complete tests upon a 30,000-kw. General Electric steam turbine installed at the Fifty-ninth Street station of the Interborough Rapid Transit Company in New York City, with results also of tests on the condensers and auxiliaries.—*Mechanical Engineering*, July, 1921.

Lamps and Lighting

The Principles of Street Lighting.—Louis Bell.—The author specifies the illumination requirements for congested, moderately used and residential streets and highways, at the same time pointing out what not to do.—*General Electric Review*, August, 1921.

Color Temperatures of High-Efficiency Lamps.—W. E. Forsythe.—By matching the light from incandescent lamps in color with that from a black body at some particular temperature it is possible to determine the color temperature of lamps. Results for several different types are given in a table here reproduced. The true temperatures are the actual temperatures far enough removed from the ends to be the maximum temperatures, while the color temperatures are for the lamp taken as a whole.

Lamp	Efficiency Watts per C.p.	Temperature Deg. K.	Color Temperature
50-watt carbon	3.76	2115	2150
50-watt gem	3.1	2180	2195
50-watt tantalum	2.56	2160	2260
40-watt Mazda B	1.36	2410	2460
100-watt Mazda C	1.00	2745	2740
500-watt Mazda C	0.72	2835	2880
1000-watt Mazda C	0.62	3010	2985
1000-watt stereopticon	0.52	3185	3175
900-watt [illegible]	0.46	3240	3220

—*Journal Franklin Institute*, July, 1921.

Selection of Lamps for Commercial Fixtures.—W. H. Rademacher.—To insure the right intensity of illumination lamps should be chosen to fit the fixture, and as a guide a table is given with a range of lamp sizes to fit the fourteen most commonly used commercial fixtures.—*Journal of Electricity and Western Industry*, July 15, 1921.

Street-Lighting Distribution Systems.—E. B. MEYER.—This article illustrates as well as describes good practice with overhead and underground distribution. Both armored cable and conduit systems are described.—*General Electric Review*, August, 1921.

Generation, Transmission and Distribution

Plant of the Tata Hydro-Electric Power Supply Company in India.—H. EUBELL.—To utilize the large amount of annual precipitation during the wet season, three large artificial lakes have been made on the west coast of India about 520 m. above sea level. A total of 300,000,000 cu.m. of water may be accumulated in these lakes during a period of three to three and one-half months. From the water-collecting tower two riveted-steel pipe lines of 2 m. diameter each lead down 2,700 m., splitting up from this point into five lines of 0.8 m. each. The entire right-of-way for the pipes has been blasted out of the solid rocks of the slope. At present five main turbines of the Pelton bucket-wheel type are installed, each rated at 13,750 hp. and operating under a pressure of 50 atmospheres and 300 r.p.m. Each turbine is coupled to a 10,000-kva., 50-cycle generator delivering 6,000 volts three-phase current. The power house has room for three more units. The high average air temperature of 45 deg. C. called for great liberality in designing the generators. In fact, the machines as built would be sufficient for 16,000 kva. in Northern climate. In spite of the climate the generators show an efficiency of 95.8 per cent. A test voltage of 20,000 for half an hour and an 80 per cent higher test speed had to be endured. Two 720-kw. direct-current exciter sets are available. With each generator there is a bank of three single-phase transformers of 6,000 volts to 100,000 volts to transmit the energy to Bombay, 73 km. distant. Aside from the general supply of this city a large quantity of the power is used in cotton mills. All water from the tailrace of the power house is carefully diverted into a complex system of canals to serve to irrigate the surrounding fields during the long dry spell. The author gives a very interesting account of the great difficulties which had to be faced in the erection of this plant, which would rank as a large one even in the Western world.—*Siemens Zeitschrift*, April, 1921.

Pulverized Firing in Steam Generation.—F. J. CROLIUS.—A dissertation on the advantages and limitations of pulverized fuel for steam generation covering both engineering and economic points of view.—Paper read before Association of Iron and Steel Electrical Engineers, June, 1921.

Clyde's Mill Station of the Clyde Valley Power Company.—The power distribution in the area around Glasgow, about 46 miles x 10 miles (74 km. x 16 km.) in size, is dealt with. Interconnections within this area are described as the beginning of a superpower system.—London *Electrician*, June 3, 1921.

Electrophysics and Magnetism

Photographic Registration in Polar Diagrams of Simple and Combined Alternating-Current Waves.—W. GRIX.—It is shown that it is possible to register simple and combined alternating-current waves upon a rotating photographic plate or paper by focusing the luminous spot of a Braunian cathode tube upon it. The resulting polar curves can be computed mathematically to give real values of voltage, current and phase angle. A previous calibration has to be made with direct current. The article has two parts, a mathematical treatise concerning the method and a minutely detailed second part describing the necessary apparatus, its connections and its proper use. Several examples are given and calculated, and their photographic polar curves are reproduced. The entire set-up is somewhat complex. The results from it are very exact, but it does not appear to have any advantages over the simple and customary oscillograph with its rectangular coordinate curves.—*Elektrotechnische Zeitschrift*, July 7 and 14, 1921.

Telegraphy, Telephony and Signals

Advances in French Radio Telegraphy Between and from Airplanes—III, Reception.—M. BERNARD.—The great noise caused by an airplane propeller engine does not permit the use of a crystal detector. All models of French airplane detectors employ, therefore, multi-stage audion bulbs. Two main types were in use during the war, both using a triple-stage bulb and differing only in that one had a variable inductance and the other a variable condenser. Both could receive intermittent or sustained waves of from 600 m. to 1,000 m. with an antenna of 80 m. length. The plate current was supplied from a 40-volt storage battery and the filament current from a 4-volt source. Owing to the intense cold in which the airplanes had to operate at high altitudes, it was necessary to provide some means to keep the lubricating oil from freezing and to warm the pilot's head, hands and feet. In the oil tank an 80-watt heating unit was submerged, while the pilot wore helmet, gloves and overshoes into the fabric of which a resistance wire connected to the generator was woven. The helmet absorbed 16 watts, the pair of gloves 36 watts and the overshoes 29 watts. If a machine gun was carried on the plane, its oil reservoir too had a heating unit, consuming 70 watts.—*Radioélectricité*, June, 1921.

Anticipating Thunderstorms.—H. W. SECOR.—In order to warn power-station operators of approaching thunderstorms which may bring on heavy load conditions, a scheme of aërial detection is described somewhat similar to the familiar radio antenna system. The apparatus for detecting rapid changes in atmospheric voltage gradient is described.—*Power Plant Engineering*, July 1, 1921.

Miscellaneous

Laboratory Type of Electric Furnaces.—EZER GRIFFITHS.—A description of the various types of furnaces adapted to laboratory use, classifying them according to construction and to the record in temperature. The author states that for all scientific and industrial research purposes high temperatures are obtained by means of electric furnaces, which are broadly classified as follows: (1) Wire-wound or ribbon-wound tubular furnaces; (2) graphite spiral furnaces; (3) carbon-tube furnaces; (4) tungsten and iridium-tube furnaces; (5) zirconia-yttria tube furnaces; (6) granular resistor furnaces; (7) induction furnaces, low-frequency and high-frequency types; (8) arc furnaces, and (9) cathode-ray furnaces.—*Beama* (British Electrical and Allied Manufacturers' Association), July, 1921.

Clipping File of Engineering Subjects.—HARRISON W. CRAVER.—Application of Dewey system to classifying and indexing clippings from technical magazines, pamphlets, etc., as advocated.—*Management Engineering*, July, 1921.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

Effect of Government Economy on Electrical Industry

BESIDES wrestling with the problem of lowering taxes, Congress has insisted on economies in the conduct of the government and a rapid return of the War and Navy Departments to a peace-time basis. To make certain that savings will be made, Congress has resorted to the expedient of curtailing appropriations quite drastically. This has reacted in the electrical industry as well as in some others and has brought with it serious problems, chiefly of a financial nature.

The General Electric Company and the Westinghouse Electric & Manufacturing Company, for instance, have been engaged for some time on navy work involving electric ship propulsion. This has included turbines, generators, motors and control equipment for battleships and cruisers, not to mention the vast amount of smaller electrical apparatus making up the equipment of a modern man-of-war. Orders have gone out to slow up naval construction work because of the limited naval appropriations. As a result virtually all work on ship propulsion machinery has been stopped by the electrical manufacturing companies.

According to the Washington representative of the ELECTRICAL WORLD, every effort is to be made by the Navy and War Departments to avoid cancellations of contracts as a result of the greatly reduced appropriations which will be available to these departments during the current fiscal year. High officials in each of these departments believe that cancellations can be avoided by slowing up the work and extending it over a much greater period than originally had been contemplated. At the Navy Department it was stated that manufacturers had displayed a most considerate attitude in meeting the situation and that there is every reason to think that an amicable understanding will be reached in a great majority of cases where the department will not be able to carry out its obligations in the exact manner in which it had been planned to do so.

Special Train Planned for Great Lakes Convention

THE committee having in hand the arrangements for the convention of the Great Lakes Section of the National Electric Light Association at French Lick Springs, Ind., on Sept. 21-23 is putting forth strenuous efforts to make the convention the best that any of the divisions has yet held. The program is to be arranged so that the convention sessions can be attended by all present and yet leave ample time to enjoy the social and recreational features that French Lick Springs affords for such gatherings. The transportation committee is arranging for a special train from Chicago on the night of Sept. 20, arriving at French Lick Springs the following morning, to care for those who will go that way. These arrangements are in the hands of the chairman of the transportation committee, William Coleman, General Electric Company, Monadnock Building, Chicago, and those who are going are urged to make their reservations for railway accommodations either with the secretary for the state to which they belong or with Mr. Coleman before Sept. 10. Hotel reservations are to be made directly with the French Lick, French Lick Springs, Ind. The secretaries for the several states are: Illinois, R. V. Prather, 305-306 Dewitt Smith Building, Springfield; Indiana, Thomas Donahue, Northern Indiana Gas & Electric Company, Lafayette; Michigan, Herbert Silvester, Detroit Edison Company, Ann Arbor; Wisconsin, J. B. Pulliam, 1408 First National Bank Building, Milwaukee.

Federated Technical Council Proposed for California

AS IS probably known, the technical societies in San Francisco and Los Angeles have for some time been working in the respective cities under joint organizations, the one in San Francisco having been known as the San Francisco Engineering Council and that in Los Angeles as the Joint Technical Society. These organizations include in their membership the local membership of the national engineering societies and architects, aggregating about three thousand. It is now proposed to merge these two joint organizations into the California Federated Technical Council so as to secure the benefit of united action in legislation and other questions as well as to encourage co-operation among the various members. So far the matter has not progressed beyond the preliminary stage.

Remaining Months of 1921 to Be Good Ones in Utility Field, Says Doherty

OPERATING officials and bankers closest to the situation in the public utility field believe, according to a statement of Henry L. Doherty & Company, that the last six months of this year will be the best period witnessed in the public utility industry in many years. "The first half of 1921," the statement continues, "was largely a period of readjustment, during which the public utility companies were striving to readjust operating costs in conformity with changed conditions in the labor and material fields. With many of the companies effects of rate adjustments were only beginning to be felt during the first half, and as a result net earnings for the second half of the year should show material improvement over those for the first six months. Electric light and power and gas companies report business from domestic consumers in all sections as showing good gains, while power business, especially in the large industrial centers, has shown a decrease; but any change for the better in general industrial conditions will be quickly reflected in the net earnings of public utilities.

"Almost without exception electric power companies are handicapped for lack of generating capacity to meet industrial demands, and any sudden increase of load on their power facilities through starting up of general industrial operations would put a severe strain on them in their present situation. Now is the time when these companies should be placing themselves in position to meet the great power demands which will be made upon them with a revival of the nation's industries, but the majority of companies are in no position to make this greatly needed expansion of equipment. They cannot secure at any reasonable rates the required new capital, and rather than put a heavy burden of charges on their net earnings over a period of years to come they are delaying improvements. In several states utilities are limited to a certain return on capital investment, and under present conditions new capital cannot be secured except at a cost in excess of this limited return.

"Earning statements of public utilities are now beginning to reflect a definite decline in the prices of materials, together with readjustments of labor rates and rates for services. Even electric traction companies are feeling the effect of changed conditions."

High Tariff Likely on Carbons and Electrodes

REPORTS from Washington indicate that a majority of the Senate finance committee is disposed to give the tax bill precedence over the tariff bill, in which case completion of hearings on the tariff is hardly likely for many weeks. The program for this week called for hearings on earthenware and glassware schedules, to be followed by a consideration of the metals section.

There is no likelihood of any changes in the submitted Fordney tariff bill as it affects the electrical industry. Owing to the excellent showing made by the manufacturers of carbons before the House committee, paragraph 216 of the tariff bill, devoted to carbons and electrodes, will in all probability remain as it is. The American valuation scheme, which has already been acted on favorably, gives an added protection.

Why Carbon Manufacturers Need Protection

The arguments advanced for a duty on carbon products of 35 per cent ad valorem, or even more, are based largely on the contention that the technology of the industry, the volume of production and the sources of raw material are in a highly developed state in Germany, as well as in certain other European countries. Difference in wages and the exchange condition, therefore, give a particularly important advantage at this time to the European manufacturer. The point also is made that carbon commodities have a high value as compared to weight, so that the cost of transportation is not an item of importance.

It has been pointed out to the congressional committees handling the tariff bill that the carbon industry gives employment to more than 4,000 persons, a large proportion of whom are skilled in the manufacture of the various products. The committees have been informed that the quality of the products made in the United States is equal to that attained in any other country and that the domestic industry has a capacity entirely adequate to meet the requirements of the United States. Another reason advanced for a high duty on carbon products is that a large amount of research work is necessary.

Tariff on Carbons in Fordney Bill

The ways and means committee acceded to the plea of the Associated Manufacturers of Electrical Supplies by separating carbon products from the paragraph on pottery in which they were carried in the Underwood act and by reason of which great abuses were possible. The tariff bill as it passed the House contains a separate paragraph for the carbon products, which reads as follows:

> Par. 216. Carbons and electrodes, of whatever material composed, and wholly or partly manufactured, for producing electric arc light; electrodes, composed wholly or in part of carbon or graphite, and wholly or partly manufactured, for electric furnace or electrolytic purposes; brushes, of whatever material composed, and wholly or partly manufactured, for electric motors, generators or other electrical machines or appliances; plates, rods and other forms, of whatever material composed, and wholly or partly manufactured, for manufacturing into the aforesaid brushes, and articles or wares (composed wholly or in part of carbon or graphite), wholly or partly manufactured, not specially provided for, 35 per centum ad valorem.

Carbon Provisions in Former Bills

In the Underwood act carbons came under "earthy or mineral substances, wholly or partially manufactured," dutiable at 20 per cent ad valorem. Unmanufactured carbon was dutiable at 15 per cent ad valorem; electrodes, 25 per cent ad valorem; other manufactures of carbon, 20 per cent ad valorem. Carbons made entirely from petroleum coke were dutiable at 15 cents per 100 ft., and if composed chiefly of lamp black or retort carbon, 40 per cent. Flaming-arc carbons were dutiable at 30 per cent ad valorem. A court ruling, however, excluded most of the flaming-arc carbons from the 30 per cent duty. Under the Payne-Aldrich act electrodes were dutiable at 30 per cent ad valorem; petroleum coke carbons, 35 cents per 100 ft.; lamp black or retort carbons, 65 cents per 100 ft. The flaming-arc carbons had not been developed in 1909, when the Payne-Aldrich act was written.

England and Germany Enlarging Their Standardization Work

ENGINEERS and manufacturers who have visited England and Germany have been particularly impressed by the great strides made in standardization in both countries since the war. Apparently both England and Germany are relying on standardization of products to gain greater export trade, and the work is being carried on with an intensity and on a scale that cannot escape notice. This is particularly true of Germany, where the war has seemed to cement industries and national spirit more closely than ever.

A prominent engineer and scientist who has just returned from Europe in discussing this movement in Germany with a representative of ELECTRICAL WORLD had this to say:

"In the colossal efforts which the Germans are making to rehabilitate and extend their industries and their foreign trade industrial standardization is playing a very important, albeit an inconspicuous, rôle.

"Their standardization program is centralized under the general control of a national organization, the Normenausschuss der Deutschen Industrie, which is supported by the leading industrial and technical associations of Germany. The more fundamental work, and particularly work which concerns several industries, is done by a group of technical working committees organized by this central body.

"Although the Normenausschuss was formed but four years ago, about 150 standards have been adopted and more than 500 issued in provisional form. It issues a fairly extensive semi-monthly publication in the form of a section in *Der Betrieb*, a journal of industrial management and efficiency engineering published by the German Society of Engineers.

"In addition to the central body, but in most cases affiliated with it, there are some thirty standardizing bodies, each of which is doing the special standardization work for its own industry.

"Standardization of dimensional details, of designs and of certain types of requirements is being carried much further than has been attempted in this country. For example, specifications for all the essential characteristics of distribution transformers have been agreed upon, including even the efficiency, so that the transformers of all the German manufacturers are now electrically interchangeable. Motors for mine pumps have been so standardized that they are electrically and mechanically interchangeable.

"Taken as a whole, the standardization movement in Germany is going forward on a scale and with an intensity which are of a different order from that under which the movement in this country is being carried forward. Schooled in the use of the cartel system and in the foreign trade policies of the former German Empire, the co-operation of the German industries was notable the world over. Yet German engineers state that they did not really learn the value of co-operation until the war and that the far-reaching program of standardization now under way would have been impossible in former times."

Italian Statesman Condemns Municipal Ownership of Utilities

MUNICIPAL and state ownership of public utilities was condemned by Tommaso Tittoni, president of the Italian Senate, in his lecture before the Institute of Politics at Williams College, Williamstown, Mass., which has been attended by many distinguished public men. Mr. Tittoni asserted that he was basing his statements on his observation of more than 6,000 state and city owned industrial enterprises in Italy.

"People generally expect from government industries the latest improvements and the best commodities," he said, "little caring whether or not the concern is in a financial position to pay for them. Every publicly owned industry, to content the public, must tend toward the free distribution of commodities.

"The cost of operating government or municipal industries is always much higher than that of operating private concerns, which are generally governed on the one hand by the necessity of assuring an income to shareholders and on the other by the needs of the growing industries. Generally speaking, the public undertaking is not run with any such rigorous control of expenses.

"In the second place, public money is always considered more or less everybody's money, to be spent without those restrictions attaching to private capital, and is rarely considered as invested capital for which the industry itself must pay.

"When a revenue is obtained from a government or municipal monopoly—a rare thing, but which has sometimes been known—the people generally demand that it be immediately converted into reduced rates or lowered prices, little caring what the needs of the morrow may be. Private enterprise can sell products at its own prices, but every public concern is subjected to constant pressure to lower its prices, regardless of commercial conditions."

Dr. Jewett Discusses European Water-Power and Industrial Situation

RETURNING from a three months' trip to Europe, where he represented the American Institute of Electrical Engineers on the delegation from the United States that presented the John Fritz medal to Sir Robert Hadfield, Dr. Frank B. Jewett, chief engineer of the Western Electric Company, reports that the predominant topic in technical circles abroad is the development of hydro-electricity. "Plans are now laid in virtually all European countries to harness their water power so as to produce electricity," he said. "In Switzerland, Italy, Norway, Sweden, Denmark and even England detailed plans for development of natural water power for the electrification of railroads are under discussion.

DR. F. B. JEWETT

"In those countries where there is a scarcity of coal hydro-electrical development is of vital importance," Dr. Jewett continued. "In England, while tremendous electrical development is being considered, the absence of any considerable water powers and the relative abundance of coal gives this problem a somewhat different trend from that observed in continental Europe. While the continental projects contemplate the development and linking together of hydro-electric plants, it is probable that in England the development will be along the lines of establishing enormous generating stations at or near the mine mouths and linking these stations together and to main-line distribution systems for supplying energy wherever needed in England, Scotland and Wales. As on the Continent, the scheme under contemplation in England involves extensive electrification of trunk-line railroads.

COMBINING RESOURCES OF SCANDINAVIAN LANDS

"In the Scandinavian countries the fuel situation makes a substitute for power derived from coal a matter of economic life and death. There is talk of combining the natural resources of Norway, Sweden and Denmark. The electricity could be distributed where it was needed. Norway has enormous natural water resources, Sweden not so many, and Denmark very few. The energy would have to be transmitted by submarine cable in many cases, and this fact presents some interesting engineering difficulties. However, Copenhagen utilities are now being run to a considerable extent by Swedish power brought over by submarine cable.

"The immediate difficulty in carrying out these extensive developments is the financial situation. That is all that is holding them back. They hesitate to borrow 50 per cent money which they will later have to pay back in 100 per cent money. It is probable, therefore, that little will be done until the currency has recovered somewhat from the present depreciation.

"Industrially," said Dr. Jewett, "Belgium and Germany appear to be the most active. In Belgium the destruction and dismantling of manufacturing plants was not carried out to the same extent as in northern France, and most of the machinery removed to Germany has been returned and placed in operation. This was true of the Western Electric Company's plant in Antwerp, whence a turbo-generator had been removed to a factory in Poland. It has been returned and is now operating in the Antwerp plant. This condition has enabled Belgium to get on her feet industrially before many of the other countries, and she is fabricating and exporting a considerable quantity of finished products.

RATE OF EXCHANGE HELPS GERMANY

"Little non-employment is to be seen in Germany. Manufacturers of electrical apparatus have rehabilitated their plants and are running on an eight-hour-day basis. The present rates of exchange are particularly favorable to German manufacturers, who are able to undersell foreign competition in countries where they have access and where there is no embargo. On telephone and power cable Germany is completely underselling all other countries, and for other electrical equipment she is quoting extremely low prices, endeavoring to drive an entering wedge for German-made goods. The Scandinavian countries, and to a limited extent those in southeastern Europe, afford the best markets at the present time. German manufacturers are still using a number of substitutes for raw materials which were developed during the war, such as paper for insulation, bushings and washers in place of hard rubber.

"It seems doubtful," concluded Dr. Jewett, "whether Germany can long maintain this advantage in underselling as other industrial countries are already putting up import barriers or tariffs to protect their own industries. The allied countries have stringent embargoes against importation from Germany, and, furthermore, should she be successful in rapidly developing a foreign market, the value of the mark would automatically increase and partially offset the present low production costs."

Form Council of American Engineering Societies in Argentina

TO FOSTER interests of various American national engineering organizations represented in Argentina an association of members of American national engineering societies in the Argentine Republic has been organized in Buenos Aires, according to information received by the Bureau of Foreign and Domestic Commerce. Headquarters are to be in Buenos Aires. The location has not yet been selected. Membership is restricted to members of the following organizations: American Society of Mechanical Engineers, American Society of Civil Engineers, American Institute of Electrical Engineers, American Institute of Chemical Engineers, American Society of Agricultural Engineers, American Society of Refrigerating Engineers, American Institute of Architects, American Iron and Steel Institute, American Chemical Society, American Society of Heating and Ventilating Engineers, American Society of Naval Engineers, American Institute of Mining and Metallurgical Engineers and the Society of Automotive Engineers.

Motion-Picture Industry Plans to Fight Daylight Saving

AN ACTIVE campaign against daylight saving was launched at Atlantic City on Tuesday at the convention of the Eastern branch of the Motion Picture Owners' Association, and it was declared that the screens in 10,000 theaters throughout the United States will be used next winter and spring to co-operate in the fight on changing the clocks again next year.

Delegates asserted that while adverse industrial conditions and hot weather had lowered their attendance, they blamed daylight time chiefly, as it virtually eliminated one show an evening. They declared they would be supported by the farmers in their work to have the law repealed in states where it now exists.

Insull Properties Make Excellent Showing in Customer Ownership Sales

UTILITY properties under the management of Samuel Insull report the sale of over $25,000,000 worth of their securities through the customer-ownership plan during the past eighteen months, the average to each buyer being less than five shares. Commonwealth Edison leads with over $11,000,000 common stock. The next highest was Middle West Utilities with $7,000,000 prior lien preferred, and the company has a campaign on to dispose of another $1,000,000 of the same issue. Twenty-nine operating companies under Middle West control have sold $4,000,000. The remaining $3,000,000 is divided between the Public Service Company of Northern Illinois and the Illinois Northern Utilities Company. One surprising feature is that sales of certain industrial departments greatly exceeded those of the company's regular sales department, says a Commonwealth Edison official.

Radio Fog Signal and Radio Direction Finder System

THE Bureau of Standards, in co-operation with the Bureau of Lighthouses of the Department of Commerce, has developed a system of radio direction finding by means of which the navigator of a ship can determine his position in a few minutes, using instruments under his own control. Such a device is particularly useful in time of fog or thick weather.

The Department of Commerce system of radio direction finding consists of two or more radio transmitting stations in fixed locations, either on shore or on moored light vessels, and a device called the radio direction finder or "radio compass" on board ship. The transmitting stations are of one of the types usually employed for radio communication, but are designed to operate automatically. The radio direction finder, as now developed by the Bureau of Standards for use on board ship, consists of about ten turns of insulated copper wire wound upon a rotatable wooden frame about 4 ft. square. This coil is mounted directly over and is operated from within the pilot house. When the plane of the coil is parallel to the direction from which a radio signal emanates, the intensity of the signal received will be a maximum. As the coil is revolved, the intensity of the signal diminishes until a minimum is reached, when the plane of the coil comes to a position at right angles to the line of the direction from which the signal emanates.

The Bureau of Standards has installed on the lighthouse tender Tulip a radio compass of improved design, and radio transmitting stations for fog signaling service now operate automatically at the approaches to New York harbor, on Ambrose Channel light vessel, Fire Island light vessel and at the Sea Girt (N. J.) light station. These three transmitting stations have been in commission since May 1 and are the first fog-signal stations of this kind established in this country.

National Government to Back Wireless Telephony

ASSOCIATED PRESS dispatches from Paris state that American backing of wireless telephony was the big thing of the near future revealed in the International Wireless Conference, which closed Aug. 22 after having been in session for two months.

The American delegation, headed by Major-Gen. George O. Squier, Chief of the Signal Corps of the United States Army, went to Paris with a definite program. Most of this program is said to have been adopted, although the conclusions of the conference will be kept secret until they are presented to the various governments.

The principal contention of the Americans was that certain bands of waves should be reserved for wireless telephony. This was opposed by the Europeans, as they considered that telephony would occupy too great a part of the usable waves. With the backing of Japan, however, the American viewpoint finally was adopted.

The activity of the Americans in "selectivity," or the development of the equivalent of the private line in wireless, as opposed to the present "party line," where any one may "listen in" on a conversation, met with recognition by the conference.

Among the fourteen principal questions which the conference dealt with and adopted was a recommendation by the Americans that certain waves be assigned in each country, with treaty provisions limiting each country to the use of instruments adapted to those wave lengths, so that the result would be secret wireless.

It was agreed to apportion these waves, probably designating each group by color, so that each country might have the exclusive use of certain colored waves.

It was the opinion of the conference that wireless never would supersede submarine cables, and it advocated the extension of cable facilities. The speedy elimination of static interference, which now has such serious effects upon wireless, was predicted.

The conference emphasized the need of governments interesting themselves in wireless telephony.

First Meeting of Electrical Association of Nova Scotia

THE first annual meeting of the Electrical Association of Nova Scotia opened in Halifax on Aug. 16. The principal speakers at the convention from outside the Dominion were W. D'Arcy Ryan of the General Electric Company, Samuel A. Chase of the Westinghouse Electric & Manufacturing Company, E. W. Rockafellow of the Western Electric Company and W. L. Goodwin of the Society for Electrical Development.

Mr. Ryan talked on the most modern methods of illumination, a topic of particular interest to the residents of Halifax owing to the probability that that city will have a new street-lighting system soon. Mr. Goodwin in his talk dwelt on the growth and expansion of the Society for Electrical Development and pointed out to the members of the new Nova Scotia association methods by which they could advance their profession.

Co-operation and Customer Ownership Topics at Michigan Convention

CO-OPERATION between all branches of the electrical industry in the creation of favorable public sentiment was the common theme of the addresses of President Bump and Executive Manager Aylesworth of the National Electric Light Association and William Goodwin of the Society for Electrical Development before the opening session of the Michigan Electric Light Association at Ottawa Beach on Wednesday. Mr. Bump presented the position of the N. E. L. A. as that of officially expressing the wishes of its members and not that of attempting to put over a stated program that had been formulated by a few men. The association cannot reach its members through central headquarters as effectively as it can through the state and geographic divisions that have been organized, Mr. Bump said, in describing the efforts of the association to aid its members more effectively, especially the smaller central-station organizations. The advance made during the last few years in co-operation with other branches of the industry, as evidenced by representation of the manufacturers, jobbers and others in the activities of the association, was pointed out.

Both Mr. Bump and Mr. Aylesworth stressed the importance of customer and employee ownership of electric securities and made a plea for the planning of all financing before construction programs are undertaken, the plans to cover the issue with the approval of the utilities commissions of both senior and junior securities to meet all expenditures, in place of the past practice of taking the chance of having to make up from surplus the difference between the value of issues allowed by the commissions and actual expenditures.

Mr. Aylesworth asserted that customer and employee ownership of securities is the best possible protection against anarchistic and socialistic ideas, but warned against the sale of securities on which the regular payment of dividends might by any chance be impossible.

Mr. Goodwin said that it was impossible for any division of the electrical industry to be harmed without causing a harmful reaction on the whole industry. All internal differences must be wiped out, he said, and the industry viewed as a whole and not from the selfish standpoint of any group or groups. He pleaded for help for the street railways as a matter of necessity in maintaining the welfare of all.

Nebraska Convention and Middle West Conference in Omaha

THE annual meeting of the Nebraska Section of the National Electric Light Association in conjunction with a conference of the Middle West Geographic Division of the N. E. L. A. will be held at Omaha on Sept. 15 and 16. The tentative program is as follows:

THURSDAY, SEPT. 15

9:30 a.m.—Address of welcome, Mayor James C. Dahlman; reports of officers; reports of committees, F. H. Brooks (farm line), W. O. Dunn (accident prevention), Horace M. Davis (public utility information), C. J. Snyder (inductive interference); discussion of committee reports; "Sale and Service of Electric Ranges," by K. P. Goewey.

FRIDAY, SEPT. 16

9:30 a.m.—"Practical Lighting of Home and Store," by Fred Gunther, Aurora, Neb.; "Relations of Electric Jobber and Central Stations," by George W. Johnstone, Omaha; "The Courts on Rates and Valuation," by George A. Lee, Omaha; election of officers; meeting of executive committee.

J. E. Davidson will be toastmaster at the Thursday evening banquet, to begin at 6:15 o'clock, when representatives of the Middle West Division from Missouri, Iowa and Kansas as well as President Bump and Executive Manager Aylesworth of the national body will speak.

Public Aspects of Utility Problems Mark New England Program

A STRONG program embodying varied phases of public relations has been announced for the forthcoming convention of the New England Geographic Division of the National Electric Light Association, which is to be held Sept. 6 to 9 inclusive at the Hotel Griswold, Eastern Point, New London, Conn. Bowen Tufts' presidential address will be followed by greetings from the national association by F. W. Smith, first vice-president, and M. H. Aylesworth, executive manager. Dr. E. W. Bullock will speak on "Resuscitation by the Prone Pressure Method."

The accounting session on Sept. 7 will include a report by C. M. Guilford, chairman of the Accounting Section committee, and report by the chairmen of the following sub-committees: Customers' records and billing methods, Paul Newell; accounting for purchases and stores, W. F. Stevens; accounting for construction work, F. J. Stanwood. Richard Lennihan of the Harvard University bureau of business research will speak upon "The Cost of Doing Business." In the evening there will be a dinner-dance, followed by a public relations session at which C. L. Edgar, vice-president, will occupy the chair and W. A. Prendergast, chairman New York Public Service Commission, and Mr. Aylesworth will speak. P. H. Whiting will give the report of the customer ownership securities committee.

Commercial problems will occupy the entire day on the eighth. W. C. L. Eglin, chief engineer Philadelphia Electric Company, will present a paper on "Progress and Development of Power-Factor Corrective Devices for Induction Motors," and these chairmen will make their reports: Power division, John West; lighting division, F. A. Gallagher, Jr.; rate division, J. E. Gray; electric vehicle division, A. D. Putnam; contact division, William Gould; electrical page division, L. D. Gibbs, and merchandising division, Frank J. Allen. The final report of the United States Superpower Survey will be presented by W. S. Murray. "Desirability of the Electric Range Load" will be dealt with by P. L. Miles, Edison Electric Appliance Company, Chicago, and F. J. Allen will demonstrate "What the Electric Range Will Do."

Technical topics will be discussed on the final day, the program including the address of Chairman L. L. Elden of the Technical Section and these reports: Inductive interference division, P. Junkersfeld; safety rules, W. H. Blood, Jr.; electrical apparatus, J. P. McKearin; meters, F. H. Smith; overhead systems, W. T. Oviatt; underground systems, G. F. Parsons; prime movers, Nicholas Stahl, and hydro-electric power, C. F. Mosher. Prof W. L. Robb, Troy, N. Y., will discuss "Possibilities in Power Development in Connecticut."

To Study Effects of Water Impounding on Flow

AN UNUSUAL feature of the investigation of the plans of the Roanoke River Development Company of Richmond, Va., to which has been granted a preliminary permit for a power project at Buggs Island in the Roanoke River, near Clarksville, Va., will be a study of the effect which impounding the waters of the river in its upper reaches will have upon the flow of the stream lower down. According to a statement by the Federal Power Commission, this study is made necessary because the demand of water users on the lower reaches of the stream is fairly constant, and there is a possibility that impounding the river water during the night for use during the day may have a deleterious effect on the operation of the lower plants.

The company has two years to investigate thoroughly the proposed development, which as planned will consist of a dam 60 ft. high across the river and a power house built at the dam, by which means 10,000 primary horsepower can be developed, as well as a secondary development aggregating perhaps 50,000 hp. The primary power will be used for general public utility and industrial purposes, and the secondary power will be used in operating chemical plants at Richmond.

The commission recently issued a preliminary permit to the Granite Falls Manufacturing Company of Hickory, N. C., for a 5,000-hp. development on Wilson Creek, in the northwestern part of the state, lands within the Boone National Forest being affected. The development will serve the city of Lenoir with hydro-electric power for its textile mills and furniture factories.

Syndicate Holds Meetings for Interchange of Ideas

THE so-called Harrison Williams properties, consisting of the electric light and power companies of Milwaukee, Detroit, St. Louis, Youngstown and Cleveland, have adopted the practice of regular monthly meetings of the operating staffs. The meetings are held in the above cities in rotation. One meeting dealt with the problems of the steam-power plants and another with the electric distribution systems. Other meetings planned will take up the problems of accounting, selling, purchasing, etc. The purpose of the meetings is to compare experiences in the operation of the various properties so that useful ideas developed by one company may be employed by the others.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest

New Voltage Regulator Developed.—The chemistry division of the Bureau of Standards has developed a successful voltage regulator which is independent of temperature in its operation. Its first purpose is the regulation of voltage in automatic gas analysis work.

New York Cities to Fight State-Wide Valuation of Telephones.—The city governments of Buffalo, Rochester and Syracuse, N. Y., are uniting to contest the principle of state-wide valuation of telephone companies which has met with some favor from the new Public Service Commission of New York, as exemplified recently at Syracuse.

Salt Lakers Celebrate Electrical Day.—Friday, Aug. 5, was set aside by the contractor-dealers, manufacturers, jobbers and power company people of Salt Lake City as "Electrical Day," and a highly successful outing, arranged by the Rocky Mountain Electrical Co-operative League, was held at Lagoon, a resort 15 miles north of the city.

Blackbirds Throw Towns Into Darkness.—Gloversville, Johnstown and other places in Fulton County, N. Y., were thrown into darkness for two hours one night recently, all electric service being cut off because of a short circuit caused by a flock of blackbirds which settled on the high-tension wires running into the town first named. Wholesale electrocution of the birds followed their mistake in judgment.

New Department of Commerce Publication.—The Department of Commerce at Washington has issued the first number of a new publication called the "Survey of Current Business." It takes the form of a monthly supplement to "Commerce Reports." This number bears the date of July 1. It is planned, according to Secretary Hoover, to issue this publication in the future as soon as possible after the 20th of each month to show figures of the preceding month.

London May Build Station with Ultimate Rating of 600,000 Kw.—It is said that the delay experienced in getting amendments to the electricity supply bill through the British Parliament may influence that body to grant the authority asked by the County of London company for the construction of a great central station at Barking designed to have an ultimate capacity of 600,000 kw. Since the present generating capacity at all of the sources from which London gets its electrical supply is only about 500,000 kw., it is obvious that the construction of such a station would dominate the industry in London for years to come.

Electricity as an Aid in Rafting.—Electricity is being used for rafting purposes, for the first time, it is said, in the Province of New Brunswick, at the mouth of the Nashwaak River, where rafts of logs are made up for towage to the city of St. John. Two 20-hp., two-phase motors and a crew of seventy men now do the work formerly requiring a crew of 200 men.

Southern California Edison Ready for New Power House on Big Creek.—That the demand for electrical energy exceeds the supply in its territory is the declaration made to the California Railroad Commission by the Southern California Edison Company in asking a certificate to construct an additional unit of its Big Creek development in Fresno County. The company desires to proceed with the construction of Big Creek power house No. 3, together with a transmission line connecting with the lines carrying power to Los Angeles. The Southern California Edison Company now serves nine counties in its end of the state.

Mine Operation in Western Pennsylvania.—Recently printed figures attest the fact that the West Penn Power Company alone serves 400 mining operations and during 1920 furnished the energy for the production in round figures of 40,000,000 tons of coal. "While the western Pennsylvania coal fields have yielded an enormous tonnage," remarks a newspaper published in the heart of the coal-mining country, "there remain vast acreages yet untouched, particularly in the southwestern part of the territory, and it now appears that most of this coal will be developed by companies operating completely electrified mines. The expansion of coal-mining operations has resulted in constantly increasing demand for central-station service so that a map of the coal fields of western Pennsylvania is a network of transmission and distribution lines."

Electrification of Jugoslavia.—Jugoslavia, with an area of 155,000 square miles and a population of 13,000,000, is, if the plans of the government are carried out, about to enter upon an extensive scheme of railroad electrification and general electrical development. It is estimated that the possible sources of hydro-electricity will generate 3,000,000 hp. during a hundred days of the year. In addition, there are extensive deposits of lignite and coal which will permit the building of steam-electric stations. It is hoped by the government that hydro-electric plants generating 1,000,000 hp. and steam plants producing 500,000 hp. can be built in from ten to fifteen years. Three networks are planned—a high-tension system (probably 150,000 volts) tying the more important generating plants to the principal centers of distribution and to one another, a system at probably 6,000 volts uniting the chief distributing centers to the towns, villages and factories, and a low-tension system at 220 volts or 380 volts for transmission to consumers.

Poland to Have Improved Radio System.—Representatives of the Radio Corporation of America and of the Polish Ministry of Posts and Telegraphs have signed a contract which will insure for Poland an international high-power radio station of the most modern type. The new plant will be situated near Warsaw, and it is estimated that the complete project will cost about $3,000,000. The first shipment of radio apparatus will leave the United States in about six months and construction work will begin immediately after. It will take approximately one year to complete the station, and it is expected that commercial radio communication between Poland and the United States will commence early in 1923. The new station will have a normal transmitting radius of 4,000 miles, and the Radio Corporation undertakes to provide the necessary facilities in this country.

Associations and Societies

Idaho Association of Electrical Contractor-Dealers.—This association will hold a convention at Boise, Idaho, on Sept. 4 and 5.

Association of Iron and Steel Electrical Engineers.—The Hotel La Salle has been selected as headquarters for the fifteenth annual convention of this association in Chicago on Sept. 19-23. Forty-one manufacturers will be represented among the exhibitors.

N. E. L. A. Accounting Section.—To facilitate attendance by Western members, the executive committee of the Accounting National Section will hold its next meeting at Glenwood Springs, Col., Sept. 20. This date has been fixed in order to take advantage of the convening of accountants from the Middle West and Rocky Mountain sections at the annual convention of the Rocky Mountain Division, which will be held Sept. 19, 20 and 21.

Coming Meetings of Electrical and Other Technical Societies

N. E. L. A., New England Division—New London, Conn., Sept. 6-9.

International Association of Municipal Electricians—Colorado Springs, Col., Sept. 6-10.

Pennsylvania Electric Association—Bedford Springs, Pa., Sept. 7-10.

N. E. L. A., Nebraska Section—Omaha, Sept. 14 and 15.

N. E. L. A., Great Lakes Division, and Indiana Electric Light Association—French Lick Springs, Sept. 21-23. (For program, see issue of Aug. 20, page 387.)

Association of Iron and Steel Electrical Engineers—Chicago, Sept. 19-24.

N. E. L. A., Rocky Mountain Division, and Colorado Electric Light, Power and Railway Association—Glenwood Springs, Sept. 19-21.

West Virginia-Kentucky Association of Mine, Mechanical and Electrical Engineers—Huntington, W. Va., Sept. 20-22.

Illuminating Engineering Society—Rochester, N. Y., Sept. 26-29. (For program see issue of Aug. 13, page 336.)

American Electrochemical Society—Lake Placid Club, N. Y., Sept. 29-Oct. 1.

American Electric Railway Association—Atlantic City, N. J., Oct. 3-7.

Empire State Gas and Electric Association—Lake Placid, N. Y., Oct. 6 and 7.

N. E. L. A., Southeastern Section—Chattanooga, Tenn., Oct. 18-20.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies

Contract with Municipality Not Abrogated Because Commission Increases Rates.—In City Water Company vs. City of Sedalia the Supreme Court of Missouri has held that an increase of rates granted to the water company by the Public Service Commission did not abrogate the contract between the utility and the municipality, such contracts being subject to modification by the paramount power of the state. (231 S. W. 942.)*

Dam Owner Has Right to Substitute Concrete for Flashboards.—In an action (Mills vs. Wapsipinicon Power Company) brought to enjoin the defendant company from raising the height of a dam across the Wapsipinicon River, the Supreme Court of Iowa held that a decree giving the owner of a dam the right "to use, maintain and operate said dam so raised and improved at its present height constructed in cement" authorized the construction of a concrete wall 4 ft. high to take the place of planks or flashboards. (183 N. W. 454.)

Electric Supply Company Not Liable for Death from Switch Not Installed or Controlled by It.—Suit was brought in the Appellate Court of Indiana (McFerran vs. Merchants' Heat & Light Company) to recover damages for the death of an employee of a man who had formerly generated his own power but had prior to the accident contracted for and was then receiving energy from the central station. The victim was killed through contact with exposed switches belonging to his employer's installation, which had not been changed in any way by the electric company when it connected its wires to the switchboard. The Appellate Court sustained the trial court in instructing the jury to return a verdict for the defendant company. (131 N. E. 544.)

Extent of Control of Commission Over Public Utilities.—Refusing to find the Public Utilities Commission of Ohio in error in an action brought against it by the city of Cleveland to reverse orders fixing telephone rates, the Supreme Court of Ohio made a general statement of the law governing utilities to the following effect: When the property of a public utility corporation is devoted to the public use, it must be used by the company in the performance of its duty to the public and in this behalf is subject to governmental supervision both as to its use and the compensation to be paid for it; but beyond this it has the right to control its own affairs and manage its own business, so long as it does not injuriously affect the public or exceed its charter powers. (131 N. E. 714.)

Nevada Courts Refuse to Review Commission Order Making Rates Retroactive. — Pointing out that a state commission's power to regulate and establish rates is legislative rather than judicial and is not subjected to review by a writ of certiorari, the Nevada Supreme Court dismissed a petition to review an order of the Public Service Commission of Nevada making an irrigation rate schedule retroactive. If the commission had exceeded its powers, the remedy lay elsewhere, the court held—perhaps in legal resistance to the collection of the rate. (197 Pac. 582.)

Contracting Power of Village Under Michigan Law.—The village of Plainwell, Mich., having sued the Eesley Light & Power Company, which attempted to increase its charges above those fixed in a ten-year contract with the village, the Supreme Court of Michigan found (1) that the village had stated a case for relief by injunction, (2) that the rates fixed in a thirty-year contract as modified in 1913 for a period of ten years from that date constituted a regulation by the state and were controlling, (3) that the reasonableness of rates must be determined as of the time at which the contract was made, and (4) that this contract was not unconstitutional because it allowed five months and twenty-four days to the company for preparation to perform over and above the ten-year term authorized by the statute under which the contract was made. The court held the state commission could not interfere. (183 N. W. 66.)

Right of City to Acquire Utility Property Partly in Another State.—In Superior Water, Light & Power Company vs. City of Superior, the Supreme Court of Wisconsin, declaring that the property and franchise of a public utility corporation constitute an entirety partaking of the nature of personal property, overruled objections to the acquisition of the utility's plant by the city which were based on the fact that a portion of the intake extended beyond the boundaries of the state. While the state cannot condemn property beyond its borders, the court held that there was ample power in equity to compel the company to convey to the city by sale property in another state which in its character was part of the plant to which, together with the company's franchises, the city was acquiring title; nor did such action interfere with interstate commerce. In so doing the city operated in its proprietary and not in its governmental capacity. There was nothing, the court observed, before it to indicate that the laws of Minnesota, in which the extra-state property was situated, prohibited a foreign municipality from acquiring property within the domain of that state. (183 N. W. 254.)

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*The left-hand number refers to the volume and the right-hand numbers to the page of the National Reporter System.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities

The New Jersey Public Service Railway Company Valuation.—In refusing to accept the Ford, Bacon & Davis figure of $125,000,000 as the value of the New Jersey Public Service Railway Company and adopting instead a valuation of $82,000,000, the New Jersey Board of Public Utility Commissioners made this observation anent war-time costs: "We understand that it is the contention of the company that in determining value for the purpose of establishing just and reasonable street-car fares the greater weight should be given to present day prices. In fact, this record contains the evidence of many experts employed on the part of the company in which they have testified to a value based on prevailing prices during 1920 and the early part of 1921, which inflates the value of the property to approximately twice that obtained by the use of pre-war prices. . . . Can any fair and reasonable man say at this time that the public served by this company should pay a fare based upon the abnormally high prices caused by the great world war, while prices, according to the evidence, in the last six or eight months have already declined 25 per cent, the trade papers with each issue noting further declines?"

Deposits to Cover Cost of Extensions Condemned.—In refusing approval to proposed rules of the Consolidated Gas, Electric Light & Power Company of Baltimore governing extensions and service connections, the Maryland Public Service Commission condemned the practice of requiring applicants for service extensions to make deposits covering the cost of the extensions, saying: "It is true that the duty to serve under any and all circumstances is not absolute and that reasonable regulations may be provided fixing the maximum capital outlay that the company will make to obtain new customers. A requirement that any and all applicants for service must make an enforced loan to the company is, however, a patent avoidance of duty which any reference to the rights of a utility enjoying a real monopoly only tends to emphasize. The commission cannot express too strongly its disapproval of this method of procuring capital. While we must not be understood as holding that circumstances might not arise justifying such a means of financing, yet in view of the recent undertakings and outlays of this company, and of its present financial condition as evidenced in its most recent report to the commission, no justification can be found for resort to so drastic an expedient."

Men of the Industry

Changes in Personnel—Responsibilities and Association Appointments of Men Engaged in Professional, Executive, Operating and Commercial Branches of the Industry

Horace P. Liversidge, who has been appointed chairman of the prime movers committee of the N. E. L. A., succeeding N. A. Carle, is assistant chief engineer of the Philadelphia Electric Company. Mr. Liversidge has always been actively interested in the work of various engineering societies, producing results which have won much appreciation. Although of a retiring disposition, his personal qualities have won him many close friends, and he has evinced an unselfish readiness to help others get credit for much work he himself has done. He served as chairman of the Philadelphia Section of the American Institute of Electrical Engineers in 1916-17, and during the past year he held the same office in the Philadelphia Section of the American Society of Mechanical Engineers. He has been active as a member of a number of national engineering committees and is at present chairman of the committee on steam turbines and generators of the Association of Edison Illuminating Companies, having served in this capacity since 1917. During the past year he was also chairman of the power stations committee of the American Institute of Electrical Engineers. His activities in connection with the National Electric Light Association have been directed largely to the discharge of his duties as vice-chairman of the prime movers committe and as chairman of the sub-committee on turbines. His appointment as chairman of the prime movers committee will enable him to be of still greater service to the association. Mr. Liversidge was born in Norristown, Pa., Sept. 29, 1878, and was graduated in the mechanical arts course at Drexel Institute, Philadelphia, in 1897. He then took up electrical engineering in the same school, but left before graduation to accept a position with the Edison Electric Light Company of Philadelphia, which with other independent companies was later consolidated into the Philadelphia Electric Company. Mr. Liversidge has been associated with these companies continuously, serving successively as assistant superintendent of operation, assistant superintendent of station design and construction, operating engineer in charge of all plants, and in the position he now holds. He is a tireless worker who knows how to get things done. There is nothing academic in his makeup; on the contrary, he possesses that enviable faculty of being able to see past theory into the practical considerations on which the application of theories depends. Mr Liversidge is a member of the American Institute of Electrical Engineers, the American Society of Mechanical Engineers, the National Electric Light Association, the Engineers' Club of Philadelphia and the Franklin Institute.

H. P. LIVERSIDGE

David J. Guy of the United States Geological Survey has returned from an investigation of power sites in the Big Horn Canyon of Wyoming and Montana and in the Coos Bay region in Oregon.

Robert Lindsay, who was recently elected president and general manager of the Cleveland Electric Illuminating Company, as mentioned in the Aug. 13 issue of the ELECTRICAL WORLD, has been associated with that company in an executive capacity since 1894. Mr. Lindsay succeeds Harrison Williams of New York, who has resigned as president to become chairman of the board of directors. Mr. Lindsay's early experience was obtained in the laboratories of Thomas A. Edison. From there he left in 1889 to become assistant superintendent of the Brooklyn Edison Company and through a series of promotions became assistant general manager. When the Cleveland Electric Illuminating Company was formed in 1894, Mr. Lindsay was selected for the position of general superintendent in charge of all operations. At the time he went to Cleveland the company had less than 500 customers. Today it has close to 180,000, and in addition it furnishes almost all the energy used by the Cleveland Railway Company and interurban lines running out of Cleveland. In this growth the company has been required to improve its physical property, and the foresight and managerial ability which Mr. Lindsay has shown have gained for him a rapid advancement. About 1910 he was made vice-president and general manager, which position he held until his recent election as president.

H. R. Woodrow, who has been appointed chairman of the protective devices committee of the A. I. E. E., succeeding D. W. Roper, is electrical engineer with Stone & Webster, Inc., Boston, Mass. Previous to 1917 Mr. Woodrow was assistant chief electrical engineer of the New York Edison Company. He became associated with the latter company in 1911 and was identified with various investigations and developments as an assistant to Philip Torchio. After his appointment as assistant chief electrical engineer he was closely in touch with the design and operation of the generating stations and substations of the company. Mr. Woodrow has taken an active interest in the affairs of the protective devices committee for a number of years and has devoted considerable time and study to the investigation of oil-switch failures. He was identified in a consulting capacity in the design of the Trenton Falls and Washington Street stations of the Utica Gas & Electric Company, the new developments of the Municipal Gas Company, the Miller's Ford station at Dayton, the Williamsburg station of the Brooklyn Rapid Transit Company and the government plant at Nitro, W. Va. Mr. Woodrow was born at Rock Rapids, Iowa, in 1887 and was graduated from the University of Illinois in 1909.

H. R. WOODROW

Dr. A. S. McAllister, formerly editor of the ELECTRICAL WORLD, who has since 1915 devoted his time to consulting work, has been appointed chairman of the publication committee of the American Institute of Electrical Engineers.

Dr. E. E. F. Creighton, consulting engineer of the General Electric Company, and a well-known research engineer, has been appointed a member of the meetings and papers committee of the American Institute of Electrical Engineers.

Charles H. Talmage has recently been appointed field secretary of the Rocky Mountain Electrical Co-operative League, with headquarters in Salt Lake City, Utah. Mr. Talmage brings to his new position an extensive experience, for he has been in the electrical field for more than twenty-three years. He was born on an Iowa farm in 1875, and his first electrical association was in 1898, when he joined the Advance Electric Company of Indianapolis as treasurer. In 1901 he resigned to become associated with the Western Electric Company as traveling salesman, covering the Illinois territory and later taking a desk in the Chicago office. In 1904 he was transferred to the Kansas City office of the Western Electric Company, where he acted as sales manager until 1917, when he was promoted to the position of manager of the company's Salt Lake City offices. In the spring of this year, having completed twenty years of service with the Western Electric Company, he requested a six months' leave of absence, and it was during this leave that he received his recent appointment. In his new capacity Mr. Talmage will be interested in the stimulation of sales of electricity and electrical merchandise in the Rocky Mountain States.

C. H. TALMAGE

F. E. Johnson, Jr., vice-president and general sales manager of the M. W. Kellogg Company, New York City, has sailed from San Francisco for Japan and India in the interests of his company.

Robert L. Ware, formerly advertising and sales manager of the Smith Signal Corporation of New York, has joined the publicity and service department of the Society for Electrical Development. Mr. Ware brings to the society the benefit of broad experience in advertising and sales stimulation work, having been assistant manufacturing manager of the Century Company, manager of the Meridian Press, assistant advertising manager of the Interchurch World Movement and vice-president of the Automobile Signal Association of North America.

Obituary

Robert Ten Eyck Lozier, who died of pneumonia on Aug. 21, was a well-known pioneer in electrical work. Mr. Lozier was born at South Norwalk, Conn., May 5, 1868. In 1883 he secured employment with Thomas A. Edison, and he worked on the construction of some of the early electric light plants built in this country. When Mr. Edison transferred the work of the construction department to the United Edison Company, Mr. Lozier was detailed to the Edison Machine Works and later placed in charge of the testing department. While there he assisted in the experiments on the Edison field railway and the Sims electric torpedo. At that time Frank Sprague was developing his motors, and Mr. Lozier ran the Sprague power station in connection with the demonstration made on the Thirty-fourth Street shuttle of the Third Avenue road in New York. About 1887, when the Edison Machine Works were transferred to Schenectady, Mr. Sprague opened his experimental shop in Thirtieth Street, and Mr. Lozier was placed in charge of testing and worked with him in developing the drum type of controller with its multiple contacts.

Owing to his father's ill health, Mr. Lozier gave up the work with Mr. Sprague and took up his father's real estate business. He later was able, however, to return to the Edison laboratories at Orange, N. J. Soon after that he was transferred to Chicago and placed in charge of the testing department of Leonard & Izard, who had the Western agency for the United Edison Company. When the Edison General Electric Company was formed in 1889 and the business of Leonard & Izard was absorbed, the late H. Ward Leonard took up the general management of the new company and Mr. Lozier was appointed district engineer of the Chicago office. Shortly after he was transferred to the inspection department, with headquarters in New York, and eventually he was placed in charge of that department. Later he received charge of the incandescent-lamp sales of the Eastern district, and he was advanced to be technical assistant to S. Dana Greene on the formation of the General Electric Company in 1892. When the general offices of that company were transferred to Schenectady Mr. Lozier was appointed assistant general manager of the lighting department. Soon after that, however, he resigned to enter into partnership with Aldred K. Warren, under the name of Warren & Lozier. That firm took over the repair business of the General Electric Company and also did installation work for the Siemens-Halske Company (the American concern). At the end of a year and a half he sold his interest to Mr. Warren and went abroad for several months. Upon returning he entered into partnership with George Bullock under the name of the Bullock Electric Company, which was organized to handle the sales of the Bullock Electric Manufacturing Company. The former company was eventually absorbed by the latter and Mr. Lozier was appointed Eastern sales manager and later general sales manager of the company. During that period he had a great deal to do with the development and introduction of individual motor drives and the application of the multiple-voltage and "teaser" systems of motor control. His connection with the Bullock interests covered a period of about eight years.

When the Allis-Chalmers Company bought out the Bullock company, Mr. Lozier made an alliance with Robert Lundell through which his new patents were placed with the National Electric Company of Milwaukee. About this time he was employed in a confidential capacity with Benjamin Guggenheim with particular reference to the gas-engine business which he was carrying on through the Power & Mining Machinery Company. On completion of that work Mr. Lozier opened an office in New York for Dodge & Day of Philadelphia. When that office was closed owing to the panic of 1907, he opened his own consulting office, which he carried on for three or four years and until he accepted the position of vice-president and general manager of Kountze Brothers, bankers, interested in developing public utility and hydro-electric properties. During the past few years Mr. Lozier had carried on a large practice as consulting engineer in New York City, being retained as industrial consultant for the National Conduit & Cable Company, Inc., and the Standard Underground Cable Company. During the war he was executive assistant to the consulting engineer of the naval aircraft factory at the Philadelphia Navy Yard. His thirty-eight years of successful business life included all the larger aspects of administration, engineering, production and marketing. He established a wide acquaintance owing to his genial personality.

R. T. E. LOZIER

Trade and Market Conditions

Business Reviews, Together with Market Letters
from Important Trade Centers, on the Supply, Demand and Prevailing Prices of
Electrical Apparatus and Supplies

Wage Reductions Announced by U. S. Steel Corporation

EFFECTIVE Aug. 29, the United States Steel Corporation will make a further reduction in wages paid to day labor from the rate of 37 cents an hour to 30 cents an hour, and other wages and salaries will be equitably adjusted, according to Judge Gary. This is the third reduction put into effect this year, an approximate 20 per cent reduction having gone into effect the middle of May and time-and-one-half for overtime being abolished the middle of July. Independent steel producers are reported paying rates not higher than 30 cents.

At the prevailing scale of steel prices Judge Gary states that it is necessary to lower wage rates as these prices are too low to compare favorably with production costs. Officers of other steel companies, too, are of the opinion that under present producing costs the finished price is too low to return a fair profit. Freight, fuel and labor charges are the predominating factors which are responsible for these high costs, and with these factors even approximating their present levels there is no chance for lower steel prices.

1920 Transformer Exports Reach Total of $4,803,158

WHEN drawing a comparison of transformer exports from the United States in the years 1919 and 1920 the growth of this trade is shown very clearly in an increase in value of over 25 per cent in the latter year. Exports in 1920 amounted to $4,803,158, while in 1919 they totaled $3.787,851, an increase for 1920 of over one million dollars. The figures for 1918 were $3,528,673 and for 1917 $1,747,884.

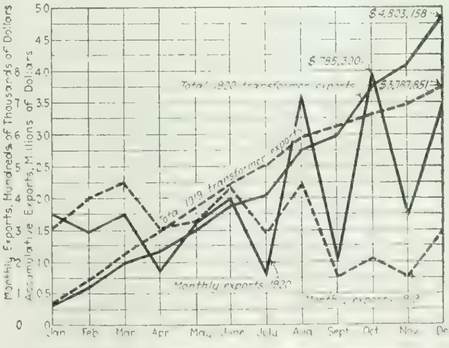
An interesting condition in the value of monthly exports is indicated in that the exports of the corresponding months in these two years as a whole go up and down together. The high and low peaks of the last half of 1920 vary tremendously. The highest monthly value in 1920 came in October with $785,300, a value greater than the total transformer exports of the year 1915. The highest for 1919 came in March with $449,077.

1920 AND 1919 TRANSFORMER EXPORTS

	Value of 1920 Exports	Value of 1919 Exports
British India	748,049	116,248
Brazil	564,636	538,325
Japan	454,676	366,167
Spain	330,735	230 513
China	329,869	192,765
Cuba	284,029	179,721
Australia	254,016	272 581
Mexico	214,328	235,224
Canada	166,811	131,689
France	124,935	194,238
Portugal	115,874	44,622
Norway	108,303	144,325
Belgium	92,245	15,667
Dutch East Indies	78 757	93,852
Panama	74,806	14,076
Peru	66,705	64,781
New Zealand	66,290	33 121
Chile	60 063	241,400
Argentina	59,220	68,049
British South Africa	57,968	60,870
Russia in Europe	51,000	3,404
Forty-four other countries importing transformers	499,843	546,213
Total	4,803,158	3,787,851

The table lists all the countries whose exports in 1920 amounted to $50,000 or more in transformers. Of these twenty-one countries sixteen took over that same value in 1919, although none of them except Russia in Europe hold their corresponding position in line for both years. British India increased her imports over six times in 1920, Panama increased over five times, Russia in Europe increased fifteen times, but her total came only to $51,000 in 1920, and Belgium increased nearly six times. Chile cut her imports in 1920 into quarters. Most of the other countries varied comparatively little in the two years, although the total net increase in 1920 was sufficient to add a million dollars.

Asia imported the most with 32 per cent of the total, Europe was next with 17 per cent, South America followed with 16 per cent, North America with 14 per cent and the islands southeast of Asia took 8 per cent. The forty-four other countries importing less than $50,000 each from the United States took just over 10 per cent of the total of transformers. In 1919 these outside countries took over 14 per cent of the total for that year. It may be of interest to note in passing that the total exports of transformers for the first five months of 1921 amount to $4,497,288, which is nearly equal to the total for the year 1920.



EXPORTS BY MONTHS RISE AND FALL TOGETHER

The figures herein were compiled by ELECTRICAL WORLD from data received from the Bureau of Foreign and Domestic Commerce.

Revival Shown in Demand for Watt-Hour Meters

MANUFACTURERS of watt-hour meters as a whole are noticing a turn for the better nod and over the past month, and certain of them report better orders each succeeding week in July and August. At the same time the demand is still well below that of last year at this time, and production is off from about 50 to 75 per cent of what it was the first of this year. As one manufacturer puts it: "It is safe to say that there is just as much demand for electricity today as there was a year ago; however, there is not the activity in reference to connecting up new consumers."

Certain sections of the country have reported considerable activity in line extensions for the most part only short extensions, though. Still, these require metering. The Southwest, Middle West and Southeast have been reported noticeable in this respect, and the New York territory has been turning in better meter orders in the past month. Home-building campaigns have borne fruit in many localities, and in some of these meter connections better than those in the same period of 1920 have been made.

Manufacturers are optimistic over the outlook for this fall. September and October have been spoken of as auspicious months for a revival in buying to overcome the hand-to-mouth buying of most central-station companies throughout this year. Ample stocks are reported in producers' warehouses, with a virtual lack of stocks in many central-station warehouses. In some cases these utility stocks of meters have been of such a nature that customers' services have not been adequately protected in the everyday run of business.

Electric Motor Market Demands Intensive Sales Efforts

"EASY times are going rather than hard times coming," remarked a leading electric motor manufacturing executive to a representative of the ELECTRICAL WORLD a few days ago in response to an inquiry as to the sales outlook in that field. It is the belief of those in closest touch with market conditions that the most intensive sales efforts will be required henceforth for a considerable period in order to supply the industries of this country with a motor output commensurate with the manufacturing resources now available. That a large potential market exists is scarcely open to question. The electrification of the home has by no means been completed, and throughout American industry more efficient use of machinery and more economical methods of production must be provided in order to meet foreign competition.

A recent survey of conditions in the plants of about a dozen motor manufacturers indicated a present output of 30 to 40 per cent of last year's business. Some foreign competition is being felt in this country, but as yet there has not been time for the quality of this equipment to have an adequate service test here. Large users of motors are therefore very slow to purchase equipment of this sort from overseas shops, apart from price considerations.

In American electric motor factories the liquidation of labor has not been completed, but there is some reason to believe that this process will not require more than two or three months more, a representative producer intimates. Raw material prices are now favorable to lower-cost production, and as stocks of higher-priced copper, steel and insulating material are worked off the situation should improve. The immediate source of business, it is believed, for integral horsepower motors is to be found in a cultivation of diversified applications along broader lines than hitherto. Small-order business must have the best engineering and commercial attention; field service by manufacturers should run to the best standards, and in fractional horsepower ratings an unsaturated field of service awaits inventive ability and first-class sales effort. Deliveries are so easy that service should make new records and new friends all along the line from manufacturer to distributer and retailer.

Canadian Conditions as Seen by Electrical Manufacturer

CONDITIONS in the electrical industry in Canada appear to be not very dissimilar to those ruling in the United States. According to the estimate of a representative electrical manufacturer in that northern country electrical manufacturers are working at a capacity of about 45 per cent and supply jobbers are purchasing stocks on an average of a forty-five-day basis although the stocks already on hand would probably average 180 days investment.

The credit situation, so far as this reporting company is concerned, is considered satisfactory. Collections are good but no extensions are being made except in cases where interest-bearing paper and sufficiently large margin of profit can justify carrying.

The electrical trade does not look for much resumption in business this year and it is felt that the present condition will extend until next spring. Generally speaking, while there is a spirit of unrest throughout the country the general impression seems to be that money is being kept out of many enterprises in the belief that there will be a general decline in prices. Unemployment amongst trade unions amounted to 16.27 per cent of the total membership at the beginning of May as compared with 16.48 per cent at the beginning of April and 2.52 per cent early in May, 1920. From a recent government report from more than 5,000 manufacturers in Canada there is a slow but steady improvement in the volume of employment.

In the building line, for the first six months of this year there has been a drop in building contracts let compared with last year. The figures for 1921 are $111,000,000 and for 1920, $145,000,000. Of this approximately $100,000,000 represents residential, commercial and industrial building, the balance going to engineering contracts, bridges, roads, etc. It is estimated that $2,000,000 of electrical materials put into these buildings in the initial stages will cover the primary electrical needs.

With the scarcity of residences in Canada there is every reason to believe that residential building will boom provided labor can be prevailed upon to accept wage reductions. There seems to be no doubt that the money for building would be forthcoming if labor prices would drop, as materials have a tendency to do; but most of the unrest appears to be centered in the building trades. The cost of the weekly family budget of staple foods continues to decline, however, averaging $12.25 at the beginning of May as compared with $12.68 in April, $16.65 in May, 1920, $13.53 in May, 1919, and $7.52 in May, 1914. This question of food prices, it is felt, is one which must be considered by the government in order that labor can be more reasonably expected to accept smaller wages.

Metal Market Situation

COPPER sales are quiet again after their improvement a couple weeks ago, when the approximate 12-cent level for electrolytic was established. Considerable tonnage was bought then, and the market apparently is satisfied for the time being. At the same time, it is felt that if money were available to finance the deals some more good sales would be made for spot delivery at 12 cents delivered. In fact, probably ⅛ cent under this figure would be accepted, delivered, for cash and quick shipment. September delivery is quoted at 12 cents also, although some producers are holding for 12⅛ cents, delivered.

Considerable attention is directed to the London market, where standard spot copper is lower by £3 12s. than it was a week ago. This is having a slight weakening effect on the outside market here, where some offerings were made at 11⅝ cents, refinery, for spot, which is about equivalent to 11⅞ cents delivered. Apparently it is the intention of the London copper companies to attempt to depress the American market through their lower quotations and thereby gain back the London Metal Exchange as headquarters for copper quotations, a position held in price quotations before the war.

NEW YORK METAL MARKET PRICES

	Aug. 16, 1921	Aug. 23, 1921
Copper	£ s d	£ s d
London, standard spot	69 17 6	66 0 0
	Cents per Pound	Cents per Pound
Prime Lake	12.25	12.25
Electrolytic	12.00	12.00
Casting	11.50	11.37½
Wire base	13.50—14.00	13.50—14.00
Lead, trust price	4.40	4.40
Antimony	4.55	4.50
Nickel, ingot	41.00	41.00
Sheet zinc, f.o.b. smelter	1[illegible].00	1[illegible].00
Zinc, spot	4.70	4.65
Tin	26.12½	26.12
Aluminum, 98 to 99 per cent	24.50	24.50

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	9.50—10.00	9.50—9.75
Brass, heavy	4.50—4.75	4.50—4.75
Brass, light	3.75—4.00	3.75—4.00
Lead, heavy	3.25—3.37½	3.25—3.37½
Zinc, old scrap	2.00—2.25	2.00—2.25

THE WEEK
IN TRADE

Prices When Quoted Are Those Prevailing at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

ACTIVITY in the jobbing trade is quite spotty this week. There is improvement in New England, however, where the number and variety of small orders are increasing. Collections, too, are improving there. In St. Louis, while unsettled wage questions are curtailing building, jobbers are making a little better turnover. Change from isolated-plant to central-station service is quite active. The steady volume of small orders is expected to provide a good month to Chicago territory jobbers, and small appliances and line materials are moving pretty well.

New York is quiet this week, although general conditions are steadily upward. Line materials are being used in better quantity again in the Southeastern States.

In the West the agricultural returns promise big reward. Good crops are reported in the Intermountain region, and more money is in circulation in some regions there. Apples are selling well in the Northwest and the salmon exports have been good. The electrical trade, however, is quiet.

NEW YORK

Jobbers report that there has been no change in conditions since last week, although the general impression is that a gradual improvement is under way. Among the encouraging signs is the fact that recently there have been several requests for bids on conduit in carload lots and jobbers are confident that more of this business is within hailing distance at last.

August sales have so far held up well with those for July, and considering that August is usually a poor month, this may be taken as a forerunner of renewed activity during the fall. Increased building activity has been noticeable both in the business and residential districts, and unless severe weather conditions are encountered this activity is expected to increase during the winter.

Little if any change has been noted in the demand for heating appliances. Irons are moving steadily and some small orders have appeared for headlight heaters. On the latter appliance dealers are inclined to wait on weather conditions and the jobbers are also inclined to mark time before ordering because of the stocks carried over.

Collections show no change, but there is little complaint of a large amount of outstanding overdue accounts.

Conduit.—In some quarters there has been a slight shading of prices during the past week, but for the most part the same level as last reported prevails. This week the following prices were quoted: For ½-in. black, in 2,500-ft. lots, $54 to $55; ¾-in., $73 to $76, and 1-in., $106 to $108. Galvanized pipe in the same sizes is quoted as follows: $60 to $63.58, $80 to $82.57 and $116.37 to $118.66. There has been some movement and several requests for bids on carload lots have appeared on the market. Stocks are ample for the usual size of orders at this time.

Flexible Armored Conductor. No particular change has been noticed in the demand for this material. Orders are only for quantities to cover immediate requirements, and stocks are fair to good. No. 14, two-wire, single-strip is quoted at $48 per 1,000 ft. A few sales in quantities have been reported at slightly less than the above figure, but there is little tendency toward price cutting.

Rubber-Covered Wire.—Stocks are good and demand remains about as reported last week. Sales are erratic and orders are for small quantities. No. 14 rubber-covered in lots of 5,000 ft. and less is quoted at $6.25 to $6.77 per 1,000 ft.

Metal Molding.—A new discount has been announced on this material. The new price figures $5.60 per 100 ft. as against $5.92 formerly. There has been no appreciable change in the demand for this material, and the stocks carried are small to moderate.

Sockets.—On sockets, pull, key and keyless, jobbers are quoting 24 to 26 per cent discount in standard packages. Jobbers' stocks are well supplied and the demand is moderate.

Non-Metallic Flexible Conduit.—Stocks are small, and what demand there is comes from outlying districts. Prices are unchanged. In 1,000-ft. lots prices quoted are, for 7/32-in., $21 to $22; ¼-in., $23 to $24, and ⅜-in., $36.

Air Heaters.—With cooler weather during the past few days there have been a few sales of heaters in the suburban districts. Sales are light, however, and as yet there has been no indication of buying for the fall and winter demand. Jobbers have fair stocks carried over from last year because of the general mild weather conditions last winter.

Heating Appliances.—Still no increase in the demand for heating devices has been noted. Jobbers, however, expect to see activity in this line within the next month.

CHICAGO

Another week of fairly steady prices has injected some optimism into the local situation. The month will run about even with July, according to several jobbers, while others report a steady flow of small orders that will give them the best month's sales since May. Business in smaller appliances has picked up in the last month, but the larger appliances, such as washing machines, vacuum cleaners, sewing machines, etc., remain very hard to move. This is easy to explain when it is considered that 150,000 Chicago wage earners are out of work. One large contractor-dealer told his jobber recently he had not sold a washing machine in four months, and this incident may be considered typical.

There has been no betterment in the building situation and sales of construction materials continue to be small, though there is some encouragement in the numerous inquiries. Residences and small apartments are being built in greater numbers than during July, but the volume of this business is not great enough to make up for the lack of industrial and commercial construction.

The slight flurry in railroad buying and the steel industry noted several weeks ago has not continued, and there have been no further signs of increased manufacturing activity. The movement of farm products has received a severe setback in the new low prices for grain and live stock. Various Chicago interests have even gone to the length of asking Middle West farmers to stay out of the market for thirty days.

Wire.—There are fairly good sales of rubber-covered wire, though orders are individually small, while weatherproof is not in such good demand. Prices seem to have become considerably more stabilized than was the case a month ago. No. 8 bare copper wire is quoted at 15½ cents per pound in 1,000-lb. lots. Weather-proof is being offered at 16 cents per pound in 1,000-lb. lots for No. 6 triple-braid. No. 14 rubber-covered is $6.50 per 1,000 ft.

Conduit.—Jobbers' stocks are running about sixty days on the basis of present demand, which is comparatively light. Not many orders are being placed. Quotations remain unchanged, and a representative price is $55 per 1,000 ft. in 5,000-ft. lots for the ½-in. black.

Schedule Material.—Prices remain unchanged, but it is doubtful whether any sort of price inducement would suffice to move jobbers' stocks much as contractors already have good supplies and are awaiting action in the building situation. Distributers have from thirty to sixty days' stocks on their shelves.

Pole-Line Hardware.—Maintenance work in rural sections and customers' extensions locally are keeping this material moving fairly well, but the uncertainty of the steel situation is discouraging heavy buying. Jobbers' stocks average about thirty days. Prices have remained steady since the middle of June.

Meters.—Demand has quieted somewhat, but sales are still good compared with those of other lines of apparatus and supplies. Local jobbers' territory is almost entirely rural and numerous inquiries are coming in from central-station companies supplying small municipalities and farm lines.

Transformers.—Distribution transformers are selling well to the small electric light and power companies in the Middle West, and deliveries are being made out of stock. Power transformers are not finding so good a market, though some sales have been made recently.

BOSTON

Further moderate improvement in trade is apparent this week in jobbing circles. Although a number of large contracts are held in abeyance, the number and variety of small orders is increasing materially. By taking losses on certain slow-moving items stocks have been lowered considerably in distributers' warehouses. Collections are also improving to some extent. Prices weakened on weatherproof wire last week and porcelain is soft on current quotations. Electrical contractors are more active, some being literally hard-pressed to complete work in progress with present facilities. Many small jobs are under way, and the letting of contracts for industrial buildings and public structures of minor importance is helping to fill the valley in the depression. Labor conditions are much better in the electrical field than for some time, the open-shop drive giving evidence of lasting success.

Wire.—Prices on good-sized orders exhibit sharp competition. Fair sales are reported, rubber-covered No. 14 wire selling around $6.25 to $6.50 per 1,000 ft. in 5,000-ft. lots. Weatherproof is moving on a 15-cent base and bare copper wire on a 14½-cent base.

Washers.—A recent price cut by a large maker has disturbed the market locally to some degree, but sales are still being recorded in very fair volume. A good fall business is expected, and assiduous cultivation of the eastern Massachusetts territory reveals that the market is very far from saturated.

Fixtures.—Activity in new schoolhouse construction and the betterment of old installations are resulting in a good sale of fixtures. Industrial fixture demand is dull, but new residential building is absorbing some material. Prices are reported close to the pre-war level and the outlook is excellent. The industrial lighting exhibit at the old Technology buildings in Boston is arousing much interest in improved methods of illumination.

Lamps.—Trade is responding to the shortening daylight hours, although no heavy business is reported except in the 21 c.p. automobile headlight lamps, 150,000 of which have recently been sold by one manufacturer since the law became effective. Extension of this business to other parts of New England is anticipated in the fall.

Porcelain.—Prices hit a new low point last week in the Boston district. Three-inch tubes sold for $4.60 per 1,000 in barrel lots at the end of the week, "Nail-it" knobs moving at $14 per 1,000 in the same lots. Until house wiring becomes more active the movement of this class of material seems likely to be slow.

Tape.—A dull market is reported, with occasional buying by large industrial or public utility customers. Prices are steady at present, 100-lb. lots of ¾-in. black tape moving at 40 cents per pound.

Rigid Conduit.—Steady prices and small-order business feature the market.

Flexible Armored Conductor.—Sales reflect somewhat better business, although nothing startling is evident in the market for wiring materials. No. 14 sold Monday at Boston around $49 to $50 per 1,000 ft. in 2,500-ft. lots.

Ranges.—Moderate sales continue and sustained sales effort is yielding occasional carload orders, according to a representative maker. Business is better than earlier in the year it is stated. Stocks are ample and prices are firm.

ATLANTA

The midsummer slump in activities is reflected in the electrical jobbing lines, business for the past week being somewhat less active than for several weeks prior. There is nothing unusual in this condition as there is always a falling off in activities at this time of the year. Jobbers report little new activity in industrial lines, but repairs by municipalities and small central stations are serving to sustain a steady market for poles, cross-arms and pole-line hardware. Electrical building materials are also steadier than for some time past. Reports from various cities in the section show a much healthier condition than has existed since 1920. Non-employment in New Orleans has fallen to only 4 per cent. Increases in the price of raw sugar and the export trade in rice, as well as increase in lumber, have served materially to strengthen conditions in this locaility, while middle and south Georgia, Florida, Mississippi and west Alabama report the outlook as improved.

Ornamental Street-Lighting Equipment.—A reduction in price has been noted in posts during the past two weeks. Business has picked up slightly, especially in the municipal field. A number of cities are extending their present "white ways" and others are putting in new systems. Manufacturers of this material are optimistic as to the immediate future. Shipments are very good.

Dry Batteries.—Though the demand has been stagnant for some time, jobbers are noting a quickening of activity this week. Prices have remained remarkably steady and stocks are in good shape.

Condulets.—With the recent price reduction of 5 to 10 per cent noted in condulets last week no stimulation of sales has been recorded. Business so far this year has been fairly good but not up to the volume reported for the same period last year. Factories are in excellent shape to give prompt deliveries and jobbers' stocks are well filled.

Fans.—The protracted period of hot weather has played into the hands of jobbers and dealers, and quite a number of fans are being sold even this late in the season. There has been no weakening in price and there is no expectation that there will be this season. It is possible that there will be a small carry-over on 52-in. ceiling fans.

Ventilating Equipment.—The demand for this equipment has been better than anticipated and, while business has been spotty, a good volume has been transacted. Prices are steady and prompt deliveries on standard equipment are being made from factory.

Annunciators.—The demand for these, together with bells and buzzers, has been very good, especially in the vicinity of Atlanta, where a number of new apartments and commercial structures have created a demand for this class of material. Jobbers' stocks are complete.

ST. LOUIS

Prospects for a settlement of the protracted controversy over wages in the building trades are diminished by the refusal of the men to accept even the compromise proposal advanced by the contractors, and as a consequence there will probably be no marked resumption of building this year. Notwithstanding the continuing low volume of business in wiring materials, it is reported that the jobbers are making more satisfactory profits than a few months ago, for liquidation of their stocks has been well taken care of and the turnover is now larger. One jobber reports that he has succeeded in getting a turnover of thirty days, whereas a few months ago ninety-day turnovers were not uncommon.

The lack of business in St. Louis itself is one of the unsatisfactory phases of the present situation, and the lack of industrial activity is the largest contributing factor. Yet, according to jobbers who have visited other cities, the situation here is better than that of the average large city because of the wide diversity of enterprise. In Missouri generally and in Illinois good trade is reported. In the Southern States, particularly Arkansas, Oklahoma and Tennessee, sales of electrical goods remain comparatively quiet. An interesting feature of the industrial situation in St.

Louis is the increasing number of inquiries of concerns with isolated steam plants that are giving serious consideration to the installation of central-station service. Appliances are moving very slowly except where special efforts are being made on particular lines. One jobber reports a good month's business in vacuum cleaners, attributable to special sales attention, while other jobbers in this line report very dull movement.

Porcelain.—Reductions of 10 to 20 per cent are reported. Movement is fairly slow and stocks are about in line. "Nail-It" knobs are now sold at $16.65 per 1,000 in barrel lots. The 2½-in. tubes are priced at $4.72 per 1,000. One jobber reports his stock of knobs to be exhausted.

Condulets.—A price reduction approximating 15 per cent is reported. Demand is very slow because of the lack of industrial activity, while moderate to heavy stocks prevail.

Wire.—Satisfactory movement of the smaller sizes of rubber-covered is generally reported, with almost no call for the larger wire. Stocks of the smaller sizes are on a rather low basis. No. 14 rubber-covered is selling from $6.35 and $6.40 per 1,000 ft. for 10,000-ft. lots to $6.80 per 1,000 ft. for 5,000-ft. lots.

Interphones.—A small amount of business is being obtained from new apartments being erected. Stocks are being maintained on a minimum basis.

Lighting Fixtures.—In industrial fixtures it is reported that there is virtually no movement and that stocks are generally heavy. In store and office fixtures sales are materially better on the average, and stocks are said to be in reasonably good shape. Reductions in "Brascolite" and "X-Ray" fixtures of about 15 per cent are reported, effective Aug. 15.

Vacuum Cleaners.—As a rule sales are very quiet, both wholesale and retail. However, one jobber reports having done as much business in this line last month as in the preceding six months by placing special sales efforts on this article. The continued high prices tend to restrict sales. Stocks are not unduly heavy.

Washing Machines.—Excellent movement of one line has obtained in the last few weeks because of a special campaign with a 30 per cent reduction in the retail price, this campaign being only locally conducted. The special price, however, terminated at the close of last week.

SAN FRANCISCO

Business conditions outside of San Francisco and the other Bay regions affected by the builders' strike are improving somewhat. Collections, however, are far slower than a year ago, averaging now about sixty days and requiring careful following. At that, few new accounts are reported except through the rather frequent reorganization of old business. The builders' strike still drags along with additional employment reported by contractors and with a growing belief that the men are about ready to capitulate.

Schedule Material.—A drastic revision of discounts has been made in which small quantity discounts were lowered from 15 to 25 per cent and the best discounts from 5 to 10 per cent. This, however, is just one feature of the new prices. Another is the reduction of maximum quantities in some cases by 50 to 90 per cent. Hand-to-mouth buying, inevitable and in fact advisable because of financial conditions, is said to be the cause of these changes.

Roughing-in Materials. — The maximum discount on "Staplex" boxes for rigid conduit, galvanized, is now 35 per cent in 100-lot packages instead of 1,000-lot. Jobbers' stocks are very high, while dealers' stocks are necessarily low.

Air Heaters.—An excellent season is predicted for air heaters. The heavy buying of fans this summer shows that comfort considerations overweigh any depression that may exist in other lines; a hot summer is usually followed by a cold winter; stocks left over from last season were about two-thirds those carried over from the previous year; attention is being paid to the larger types of heaters through appliance campaigns. Ordering was started earlier this season.

SEATTLE—PORTLAND

While in some lines of business in Seattle the bottom seems to have been reached, no improvement over recent weeks is apparent in business generally and readjustments are still taking place. Coal operators in western Washington announce that they will open within a few days nine of their largest properties and will soon have coal on the Seattle market at prices showing a reduction of from $1.50 to $3 per ton to the consumer as compared with prices of last spring. Lumber continues about the same. A gain of 1 per cent in production over a week is reported. Another report states that mills north of Seattle are putting on more men and the general situation is showing improvement. Alaskan exports during July doubled those of June. Washington orchardists are in a good position to take larger profits than at any time in recent years. A large apple crop produced at low cost is meeting a lively demand at satisfactory prices.

The limited number of miscellaneous orders, indicative of a continuation of the dull times that have prevailed for months past, still features the reports of electrical jobbers. Credits remain on a forty-five-day basis. Wire demand is moderate and stocks are in good order. No. 14 rubber-covered is selling at $7.20 per 100 lb. in 5,000-ft. lots.

Conduit.—In the ordinary sizes the demand is fair. For ½-in. galvanized the price is $7.20 per 100 ft. in carload lots.

General business conditions in Portland are slow and manufacturers report business slower that a week ago. The past three months' business has been appreciably less than in the first three months of the year, although this is perhaps partly seasonal. Jobbers report business somewhat spotty, some indicating it a little better than a week ago and others that it is merely holding its own. There seems to be an unusual interest in electric ranges in spite of their cost at the present time. Wiring devices are reported to have dropped about 8 per cent. Another cut has been made in rubber-covered wire; No. 14 is quoted at $6.75 in 5,000-ft. lots.

Contractors report very little new work in sight and dealers continue to report business quiet. There has been no fan buying this year, and probably not to exceed 10 per cent of the present stocks were disposed of this season. Jobbers are fully stocked with air heaters for the coming season from goods left over from last year. Some will place light orders soon, but others are not expecting to increase their present stock.

SALT LAKE CITY—DENVER

As the harvest season gets under way the farmers of the Intermountain region are more and more confirmed in their hope of record crops. Potato shipments are proceeding at a good rate and bringing good prices, and as a result money is circulating more freely in some sections. The labor situation is decidedly improved Railroad occupations and the building trades are slowly coming back to normal and absorbing more and more of the unemployed. Mining in most sections continues on a part-time basis. Public improvements lag and many other industries continue on a restricted basis. Upward of a quarter of a million dollars will be spent in the erection of a new terminal for electric interurban lines merging at Salt Lake City, and this project is considered by many as a certain indication that the price of building materials has about reached bottom and that labor conditions are generally favorable.

Fixture sales have been slow throughout the summer, the slight improvement recorded being an incident to the recent home-building boom. Fixtures for industrial lighting are not much in demand. Jobbers are looking forward to store lighting as a very promising field for future intensive activity. As yet it has been scarcely touched. The relative scarcity of big industrials in the Intermountain country makes this a rather unpromising field for motors. However, some good sales have been made during the summer.

With a surplus of power due to the shutdown of the copper mines the central stations are seeking an outlet through the extended use of ranges in the homes, the rate on which is about 3 cents. This summer will perhaps break the record as compared with all former years.

Manufacturers' Activities

Devoted to the Business Side of Manufacturing, Distribution and Sales, News from Jobbers and Foreign Fields and a Record of New Devices and Trade Literature

Fan-Motor Section to Meet Sept. 8 and 9

From the fact that the fan-motor section of the Associated Manufacturers of Electrical Supplies will take the two days of Sept. 8 and 9 for its fall meeting at Hot Springs, W. Va., it might be expected that a particularly interesting session is scheduled and one that will bear much fruit. W. W. Mumma, fan sale's manager of the Robbins & Myers Company, Springfield, Ohio, is chairman of the fan section.

Distributers Announced by Klaxon Company

The Klaxon Company, Newark, N. J., has appointed the following sales agents to handle the distribution of its code calling systems, industrial signals, horns, bells and relays: Metropolitan district, P. M. Farmer, 30 Church Street, New York; Philadelphia district, E. Luman Mills, Philadelphia Bourse, Philadelphia; Boston district, Henry A. Howard, 146 Summer Street, Boston; St. Louis district, Kingsland-Rawlings, Inc., 375 Arcade Building, St. Louis; Chicago district, Palmer & Knowles, 189 North Clarke Street, Chicago; New Orleans district, Pendleton E. Lehde, 609 Whitney Central Building, New Orleans. Additional sales agents will be appointed shortly at Pittsburgh, Cleveland, San Francisco and Detroit.

Appliance Distributing House Opened in Lexington, Ky.

One of the newest houses opened in the South for the distribution of electrical appliances is that of the M. H. Moise Company, which M. H. Moise, president of the company, built this spring at 214-220 East Main Street, Lexington, Ky. He was able to occupy the premises about the latter part of June. He came from Louisville, where he had been engaged in business for twenty-five years, although it is only recently that he has been identified with the electrical industry in a merchandising capacity.

The territory to be covered in this distribution is Kentucky and Tennessee and parts of Ohio, Illinois and Indiana, and among the appliances handled are Westinghouse household devices, "Laundryette" clothes washer, "Keystone" ironer, "Happy Home" dishwasher, "Ohio" vacuum cleaners, "Kelvinator" refrigerator, "Aqua" water heater, and the "More-Ease" vacuum cleaner. Warehousing space to the extent of about 10,000 sq.ft. is available on the first floor behind the store and office, while on the second and third floors there is 5,000 sq.ft. of office space for company use or for lease. The building is of brick and stone.

Talladega Foundry & Machine to Manufacture Lighting Equipment

New machinery and equipment for the manufacture of apparatus for ornamental lighting systems, both gas and electric, plain and ornamental cast iron lamp standards, etc., has been installed by the Talladega Foundry & Machine Company, Talladega, Ala. This is in addition to its present line of business, which includes the manufacture of castings for sewer systems, mining machinery, etc.

Western Electric Company Adds New Sales District

The Western Electric Company has rezoned its sales territory. A new district, called the Atlantic district, has been established with R. W. Van Valkenburgh as its first manager. It includes the area covered by the Philadelphia and Pittsburgh houses, which formerly was part of the Western district. Headquarters will be in Philadelphia.

The institution of the Atlantic district gives the Western Electric Company six strategic subdivisions in the United States. The others are the Eastern, Southern, Central, Western and Pacific districts. The new seaboard territory includes not only most of Pennsylvania but also Maryland, Delaware, southern New Jersey and southeastern Ohio.

Repel-Arc Furnace Company Formed in Indianapolis

The Repel-Arc Furnace Company, Indianapolis, Ind., has been formed under the management of Easterline & Angus, consulting engineers, to take over the manufacture and sale of the repelling arc furnaces, as formerly manufactured under the Von Schlegell patents by the Industrial Electric Furnace Company. The personnel of the new company includes several of the engineering and sales staff of the Industrial Electric Furnace Company, chief of whom are L. C. Loshbough, chief engineer and production manager, and W. B. Cooley, sales manager. The furnace will be continued as a three-phase furnace which can be adapted to single-phase, two-phase or direct current operation. Furnace sizes will range from the ⅛-ton to the 2-ton size.

Secretary Hoover to Report on Trade Associations

An official statement having to do with the activities of trade associations will be issued very soon. A promise to this effect was made by Secretary of Commerce Hoover after a conference on the subject between Mr. Hoover and members of his staff and the Attorney-General and members of the Department of Justice staff. Pending the issuance of the statement Mr. Hoover declined to comment. The Attorney-General stated that there are a great number of trade associations which are of much benefit to business and that the activities of the great majority of these organizations are not being questioned. He said the Department of Justice simply is trying to ascertain whether there are not some cases in which illegal activities are being carried forward under the guise of trade associations.

The probabilities are that the official statement which is to be issued will not go very far toward illuminating the twilight zone which covers a part of the field of some of the existing associations. Since the Supreme Court of the United States is expected to hand down during the October term an opinion in the hardwood-lumber case which may define some of the limits of the field of the trade associations, it is not probable that any executive department is going to declare a very definite policy before the rendition of that opinion.

The Department of Commerce has ascertained that there are more than 5,800 trade and industrial organizations in the country.

Export Offices of Union Carbide Centralized in New York

The Union Carbide & Carbon Corporation has about completed the centralization of the export sales departments of its scattered companies to its foreign sales department in the company's building at 30 East Forty-second Street, New York City. The last of these moves was that of the export sales department of the American Ever Ready Works from Long Island City, effected about a week ago. During July the export sales department of the National Carbon Company was moved in from Cleveland. R. G. Noble is manager of this centralized export department.

Domestic Appliances at New York Electrical Show

Virtually every bit of space available for exhibitors at the New York Electrical Show, to be held Sept. 28 to Oct. 8 at the Seventy-first Regiment Armory, Thirty-fourth Street and Park Avenue, has been taken. At this date seventy-nine exhibitors have taken the space and only two more spaces are left, on one of which there is an option.

Because of the uncertainty of having the show at the Grand Central Palace, where it has been for several years, it was necessary early this year to choose a location elsewhere and the armory was taken. Only 22,000 sq.ft. of exhibition space is available this year as against 51,000 sq.ft. available other years. Half of this was contracted for by May 1, when business conditions were at a lower ebb than they are at present.

The character of the electrical show will run very much to domestic appliances and the use of electricity in the home, although many industrial exhibits will be shown. Several prominent manufacturers will be conspicuous by their absence.

Belden Marketing Magnet Wire in New Form

The Belden Manufacturing Company, Chicago, recognizing that amateur and over-the-counter trade in magnet wire has been more of a bother than a profit to electrical dealers, has had some success in marketing magnet wire in quantities of ¼, ½ and 1 lb. on small but substantial fiber spools. The charge for the spool is negligible and is being included in the retail price of the wire.

Ajax Electric Specialty Announces Eastern Representative

The Ajax Electric Specialty Company, St. Louis, Mo., importer and manufacturer of electrical specialties, announces the appointment of A. Hall Berry, 71-73 Murray street, New York City, as exclusive district sales representative for Pennsylvania, New York, Maryland, District of Columbia, the New England States, Delaware and New Jersey.

W. H. Rastall Heads Commerce Bureau's Heavy Machinery Division

One of the new divisions recently provided for by Congress under the export industries act is the heavy machinery industrial division. The Bureau of Foreign and Domestic Commerce announces the appointment of Walter H. Rastall, Dayton, Ohio, to assume charge of this division. Mr. Rastall will study especially the problems connected with the marketing of American heavy machinery throughout the world and will keep in close touch with the centers of machinery production in this country and by personal contact endeavor to afford that industry and trade maximum service from an informational and marketing standpoint.

The situation in this respect is unusually attractive at this time, say officials of the department, owing to the strong nationalistic spirit which the experiences of the war have created in many countries. This spirit is manifesting itself particularly in Latin America and the Far East, where the business men have learned the dangers of complete dependence on outside sources for essential industrial supplies. As a result, departmental officials believe that the potential market for American heavy machinery is most promising and the hope is expressed that the work of the new division may be instrumental in the sale of much American equipment of this character in industrializing the less developed countries of the world.

Hoover Sweeper Company Holds International Convention

The first international Hoover Suction Sweeper Company convention of "maximen," division and district managers, was held in a specially built tented city just outside of North Canton, Ohio, from July 20 to 27. Nearly 200 Hoover men from all parts of the United States as well as from Canada and Great Britain attended the event, the purpose of which was to discuss efficiency in sales work under present conditions. Honored guests were the "maximen," the Hoover representatives who had scored highest in volume of sales during the first six months of the year.

Twoscore sleeping tents were arranged in a semi-circle around the mess tent, baseball lot and the "big top" wherein business meetings were held mornings and afternoons. Most of the time was devoted to serious discussions of business problems and an interchange of plans and ideas for increasing Hoover sales, speeding turnover, demonstrating, selling and serving, more efficiently increasing co-operation with dealers, hiring and training salespeople, etc.

TENTED CAMP PROVIDES COMFORTABLE QUARTERS FOR HOOVER CONVENTION

The convention was voted a great inspiration by all in attendance, and it is expected to become an annual affair. Fifty-nine thousand miles of transportation were required to return the visitors to their homes.

Increased Distribution for Conduit Fittings Maker

S. R. Fralick & Company, 15 South Clinton Street, Chicago, manufacturers and distributors of conduit fittings and wiring devices, announce the appointment of the following sales agents in the territories indicated: Watts & Barry, Inc., 50 Church Street, New York City, for the Metropolitan district; P. L. Hoadley, 609 Seaboard Building, Seattle, Wash., for the North Pacific Coast territory; J. J. Schaller, 257 Spring Street, Los Angeles, Cal., Southern Pacific Coast territory.

The company's new catalog, No. 21, is composed of five separate bulletins, each self-contained and covering a certain classification of materials. "In this way," says Bernard J. Dillon of the company, "we feel that we have obtained loose-leaf flexibility without the trouble and confusion of single sheets. These bulletins may be had either with or without the heavy loose-leaf binder. In this form they are particularly intended for use by the jobbing trade. In addition the five bulletins are to be published in a smaller self-contained complete catalog which will be intended especially for use by the contracting trade."

Export Manufacturers to Meet in October

The American Manufacturers' Export Association will hold its convention in New York City on Oct. 5 and 6, at which time the foreign trade situation will provide interesting discussion.

The Railway & Industrial Engineering Company, Greensburg, Pa., announces the appointment of F. E. I. Whitesell as its New England representative with offices at 136 Federal Street. Mr. Whitesell has been in the sales department of the company for a number of years.

The Piedmont Electric Company, electrical supply jobber of Asheville and Greensboro, N. C., has taken on the lines of magnet wire, cords, high tension and low tension wires and cables and insulating materials manufactured by the Belden Manufacturing Company, Chicago.

The Black & Decker Manufacturing Company, Towson Heights, Baltimore, Md., has appointed Robert D. Black as manager of its Philadelphia branch office, with headquarters at 318 North Broad Street. He succeeds W. C. Allen, who has been made special factory representative, with headquarters at the Cleveland branch office, 6225 Carnegie Avenue. Mr. Black was formerly assistant sales manager of the company.

The Delta-Star Electric Company, 2433 Fulton Street, Chicago, has recently established a new district office at 628 Old South Building, Boston, in charge of H. Van Rosen and R. E. Anderson.

Foreign Trade Notes

COMMERCIAL CATALOG LIBRARY, CAIRO, EGYPT.—The Bureau of Commerce and Industry of the Ministry of Finance of the Egyptian government, through a circular issued in Arabic, English and French, has recently informed the general public that it now has on file nearly 9,000 commercial catalogs which are available for reference. These catalogs, it is stated, are from the United Kingdom, Canada, Australia, the United States, France, Belgium, Sweden, Switzerland, Czechoslovakia and Germany. As these publications may not be removed and are used entirely for reference, a catalog or other descriptive literature will be in the nature of a permanent advertisement. American business firms are urged to take advantage of the opportunity by forwarding catalogs to be placed on file in this reference library.

CONSOLIDATION OF ENGINEERING FIRMS IN GERMANY.—Consolidations and mergers of industrial firms, particularly in the engineering industry, according to the *Electrician*, still continue in Germany. One of the most significant is that of the Rheinische Metallwaren under Maschinenfabrik of Dusseldorf, recently merged with the A. E. G., the Friedrich Krupp A. G. and Otto Wolff, of Cologne. At the same time the company's capital was increased by 95,000,000 marks. By this move the Rheinische company aims to become one of the leading locomotive manufacturers of the world, and its connection with the A. E. G. probably indicates that attention will be paid to electric locomotives in view of the increasing demand of electric traction. The Krupp & Wolff companies will supply raw materials and semi-finished products.

THE MASCO COMPANY, LTD., 78 Richmond Street East, Toronto, Canada, electric supply jobber, has taken over the Central Electric Company, Ltd. The latter company has moved from 36 Adelaide Street West, where it has been for many years, to 78 Richmond Street West and has been merged with the Masco Company, Ltd. Three floors of the warehouse recently purchased for the use of the combined companies.

ENCOURAGING REPORTS FROM THE BRITISH ELECTRICAL INDUSTRY.—The electrical industry at the present time, like the rest, according to the *Monthly Bulletin of Information of Overseas Trades*, is working short time and fresh orders are not being obtained. It is anticipated, however, that the result of the coal settlement will be to cause a reducion in the cost of raw maerials used by electrical machinery manufacturers and that it will be possible to deal with new orders on a much more favorable basis. Lately several encouraging reports have been issued by some of the most prominent firms dealing in electrical material. For instance a firm manufacturing cables reports that it has made satisfactory arrangements on a sliding-scale basis with its employees, and it is anticipated that labor disputes in the future will be largely prevented. At present a large amount of traveling is being done by representatives of electrical firms to overseas countries to consider he interest of their respective companies. In many cases the head of the firm has himself gone abroad in order to understand the nature of conditions there. The general activity in this direction is in Australia, South Africa and South America. There is optimism with regard to the possbility of increasing the amount of business recently done. There is a great shortage of electrical machinery which must be made up and prospective purchasers who are making inquires have had to wait until their financial position made it possible to contemplate purchase.

ELECTRICAL EQUIPMENT IN CHINA.—In most cities in China, according to *Electrical Industries*, where electric plants are installed the demand for electric lighting service generally exceeds the supply, most of the plants being overloaded, which is leading to an increasing disposition among Chinese to install small private plants. In many cities some merchants have installed small plants for lighting their own and several adjacent premises. The latest customs report states that there is a tendency in the more important establishments to install larger units, and while a few years ago 200-kw. and 400-kw. units were considered large it is now quite common to install units of 1,000-kw. and upward. A large number of orders, it is reported, have been placed for privately owned power stations for the purpose of supplying power to cotton and flour mills. The importation of electrical material into China amounted to 2,300,000 taels in 1913, 5,000,000 in 1919 and 6,300,000 in 1920.

INCREASING DEMAND FOR ELECTRICAL MACHINERY AND SUPPLIES IN NEW ZEALAND.—Owing to the rapid progress being made in the development of water power in New Zealand the prospect for the sale of electrical machinery and apparatus is very bright. What has been done in New Zealand should also be possible in Tasmania where water power is plentiful.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

An inquiry has been received from England (No. 35,315) for catalogs and prices in duplicate of domestic motor-driven refrigerators or iceboxes.

A member of a firm in South Africa (No. 35,318) is soon to arrive in the United States and desires to obtain an agency for the sale of labor-saving devices for stores and warehouses and for the handling of coal, grain, produce and dock equipment.

A doctor in Syria (No. 35,357) wants to obtain illustrated catalogs and price lists with a view of purchasing electrical medical supplies, especially X-ray supplies, and also ice-making machines suitable in size and power capacity for hotels, hospitals and homes.

A mercantile firm in Italy (No. 35,360) wishes to secure an agency for the sale of electrical apparatus and fixtures, etc.

COAL-HANDLING PLANT AND CABLES FOR POWER PLANT AT PRETORIA, SOUTH AFRICA.—Tenders will be received by the municipalitiy of Pretoria, addressed to the town clerk, Municipal Offices, Pretoria, Transvaal, South Africa, until Oct. 4, for coal-handling plant, furnishing and laying 6,600-volt cables, induced-draft and ash-handling plant, feed pumps, steam, air and water piping, etc. Further particulars may be obtained from T. C. Wolley Dod, general manager of the department, or from G. M. Clark, 40-42 Meischke's Buildings, Johannesburg, South Africa.

ELECTRICAL EQUIPMENT FOR URUGUAY, SOUTH AMERICA.—Tenders will be received by the Uruguay Board of State Electrical Stations until Sept. 9 for four electric generating units, including one rated at 300 kw. to 325 kw., 2,000 volts, three phase, 50 cycles, one rated at 175 kw., 6,600 volts, three-phase, 50 cycles and one 125 kw. and one 100 kw., three-wire, 230 volt direct-current generator—and four four-stroke Diesel engines to drive the above generators. Particulars may be obtained from the Department of Overseas Trade, 35 Old Queen Street, London, S.W.1., England

New Apparatus and Publications

ELECTRIC RANGES.—The Globe Stove & Range Company, Kokomo, Ind., is distributing a folder and price sheet on the new Globe line of electric ranges and hot plates.

INSULATION.—The National Fibre & Insulation Company, Yorklyn, Del., is manufacturing and selling a new flexible insulating paper under the trade name "Hornflex."

ELECTRIC FURNACES.—The new line of electric furnaces which has recently been added to the products of the Westinghouse Electric & Manufacturing Co., East Pittsburgh, is described in catalog 9-C, which is being distributed.

UNIT HEATER.—The Ilg Electric Ventilating Company, 2850 North Crawford Avenue, Chicago, Ill., is distributing a folder covering its "Ilgair" unit heater.

ELECTRIC VEHICLES.—The Automatic Transportation Company, 2933-2965 Main Street, Buffalo, is distributing a booklet describing and illustrating its different types of "automatic" electric cars. The company has also issued a pamphlet covering its "automatic" electric commercial car.

AUTO-STARTERS.—Operation construction and safety features of type A auto-starters are given in leaflet 161-C, which is being reprinted by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

ELECTRIC MINE LOCOMOTIVES.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has issued leaflet 1888-A, entitled "Storage-Battery Mine Locomotives."

ELECTRIC MINING PUMPS.—The Aldrich Pump Company, Allentown, Pa., is distributing a circular describing various types of electrically operated pumps for mines.

VENTILATING FANS.—The B. F. Sturtevant Company, Hyde Park, Boston, is distributing a folder entitled "Fresh Air," covering the Sturtevant propeller fans for ventilating purposes.

ALTERNATING CURRENT GENERATORS.—Bulletin 1115 issued by the Allis-Chalmers Company, Milwaukee, describes its engine-type alternating-current generators

FLUMES AND CONDUITS.—The Pacific Tank & Pipe Company, 2 Rector Street, New York City, has issued catalog No. 14 describing its wood-stave pipe and flume products.

DISCONNECTING SWITCHES.—Thoner & Martens, 463 Commercial Street, Boston, have issued their first catalog, covering their disconnecting switches, neavy-duty switches and "T & M" switch locks.

VACUUM CLEANERS.—The P. A. Geier Company, Cleveland, manufacturer of the "Royal" vacuum cleaner, is distributing a booklet entitled "By Air-Alone" on the "whys and wherefores" of electric cleaning.

DIRECT-CURRENT MOTORS AND GENERATORS.—The Allis-Chalmers Manufacturing Company, Milwaukee, is distributing bulletin No. 1106-A, entitled "Type 'E' Direct-Current Motors and Generators," which is a reprint and revision of its bulletin on this subject.

TEMPERATURE REGULATION.—The Gold Car Heating & Lighting Company, Bush Terminal, 220 Thirty-sixth Street, Brooklyn, is distributing a new catalog on its electric thermostat temperature regulating systems.

DEMAND METER.—The Esterline-Angus Company, Indianapolis, Ind., has recently developed a Graphic kva. demand meter.

BARRIER PANELS.—The C. & P. Electric Works, Springfield, Mass., have recently placed on the market a dead-front barrier panel, known as type B.

FRACTIONAL-HORSEPOWER MOTOR.—The A. C. Gilbert Company, New Haven, Conn., has recently placed on the market a 1/30-hp. universal motor for use with electric toys, small polishers, etc.

TIME SWITCH.—A self-winding time switch, known as the "Barnes" time switch, has recently been brought out by the J. O. Morris Company, Inc., 1270 Broadway, New York City.

SWITCH BOX.—A switch box, known as "Harris 1920" switch box, has recently been placed on the market by John R Harris, 102 Earl Avenue, Crafton, Pa.

SAFETY SWITCH.—The Super-Safety Electric Company, 5021 South State Street, Chicago, has recently developed a safety switch known as "Super-Safety switch" which manipulates the fuses automatically in and out of the circuit.

LIGHTING GENERATORS.—"Make Your Own Electric Lights" is the title of a four-page folder issued by the Hobart Brothers Company, Troy, Ohio, covering its ball bearing "HB" generators for 30, 100, 150 and 250 lights.

ELECTRIC WATER HEATERS.—The Automatic Electric Heater Company, Warren, Pa., is distributing a circular describing its "Sepco" circulation-type, automatic electric water heater.

OUTLET BOXES AND COVERS.—The Steel City Electric Company, 1207 Columbus Avenue, Pittsburgh, is distributing a new edition of catalog No. 33 in which attention is called to the elimination of certain outlet boxes and covers in accordance with the recommendation of the standardization committee of the A.M E.S.

SERVICE CORD.—"Super-Service Cord" is the title of a booklet distributed by the Rome Wire Company, Rome, N. Y., describing a cord recently designed by the company for heavy portable tools and other severe service.

New Companies

THE SAPIHL ELECTRIC TOOL COMPANY, Galesburg, Ill., has been incorporated by G. A. Swenson, Fred Petersen, Henry M. Hawkinson, Karl Pihl and G. H. Lorberg. The company is capitalized at $36,000 and proposes to manufacture machinery and electrical appliances.

THE ELECTRO SELF-WINDING PHONOGRAPH COMPANY, Philadelphia, Pa., has been chartered with a capital of $100,000 to manufacture talking machines with self-winding spring motors and parts. F. R. Hansell, Land Title Building, represents the company.

THE WITTE SALES COMPANY, Camden, N. J., has been incorporated by Stephen M. Paschall, John E. Fennell and Edmund A. Witte, 214 Broadway, to manufacture electrical appliances and equipment. The company is capitalized at $100,000.

THE STANDARD ELECTRIC COMPANY, Hammond, Ind., has been incorporated by W. R. Wermine, Ernest Freeman and Oliver W. Hershman, Hammond. The company is capitalized at $25,000 and proposes to manufacture electrical equipment.

THE PHOENIX BATTERY COMPANY, INC., Brooklyn, N. Y., has been incorporated by Gustav J. Frickmann, Edward Sokal and William M. Hawkins, Brooklyn. The company is capitalized at $1,250,000 and proposes to manufacture storage batteries and other electrical products. Arley B. Magee, 33 South State Street, Dover, Del., represents the company.

THE ESSEX ELECTRIC SUPPLY COMPANY, Newark, N. J., has been incorporated with a capital of $100,000 to manufacture electrical appliances. The incorporators are Harry J. Levy, 277 Market Street; Morris Levy and Emanuel D. Lasher.

Record of Electrical Patents

Notes on United States Patents

(Issued Aug. 2, 1921.)

1,386,569. INCUBATOR AND BROODER: Oscar W. Heid, Tulare, Cal. App. filed May 27, 1920. Electric heating means.

(Issued Aug. 9, 1921)

1,386,609. DIRECT-CURRENT ELECTRIC MOTOR: Alf L. Elden, Alvsjo, [illegible]. App. filed Aug. 21, 1918. Aims to generally improve and simplify a motor of this type.

1,386,634. CONNECTOR FOR ELECTRIC WIRES; Edward H. Kruse, Fort Wayne, Ind. App. filed Sept. 19, 1919. Object to secure two or more conducting wires.

1,386,679. TELEGRAPH SYSTEM; John H. Bell, South Orange, N. J. App. filed Nov. 21, 1917. Improving telegraph transmission through conductors having high electrostatic capacity.

1,386,683. TELEPHONE SYSTEM; William T. Booth, East Orange, N. J. App. filed March 19, 1918. To provide a system in which a station connected in a group can be readily disconnected therefrom.

1,386,686. CONTROLLING SYSTEM FOR AUTOMATIC SWITCHING SYSTEMS; Albert H. Bullard and John N. Reynolds, New York. App. filed Jan. 7, 1915. Economical means for operating a series of combined recording and controlling devices.

1,386,688. TELEPHONE-EXCHANGE SYSTEM; Henry P. Clausen, Mount Vernon, N. Y. App. filed June 5, 1919. To provide special service in a commercial office.

1,386,690. TELEPHONE SYSTEM; Gustavus C. Crawford, East Orange, N. J. App. filed Oct. 23, 1918. Prevents passage of high-frequency currents.

1,386,697. TESTING APPARATUS; Harvey Fletcher, New York, N. Y. App. filed July 14, 1920. Test set wherein transmitters and receivers may be efficiently and rapidly tested.

1,386,701. COIN-COLLECT SYSTEM; Charles L. Goodrum, Brooklyn, N. Y. App. filed Aug. 14, 1916. Automatic means for charging a subscriber.

1,386,714. VACUUM-TUBE HOLDER; Walter J. Leveridge, Mount Vernon, N. Y. App. filed Aug. 2, 1919. Vacuum tubes may readily be connected in a circuit

1,386,719. TELEPHONE SYSTEM; Hugh D. MacPherson, Summit, N. J. App. filed Aug. 9, 1921. Improved means for determining the code of the signals to be transmitted.

1,386,725. SIGNALING SYSTEM; Joel C. R. Palmer, New Rochelle, N. Y. App. filed Aug. 14, 1918. Electrical impulses mined and stored.

1,386,728. MACHINE-SWITCHING TELEPHONE SYSTEM; Lipa Polinkoswky, London, England. App. filed Aug. 27, 1918. Semiautomatic operator's position provided with a single key set and two or more sets of registers controlled thereby.

1,386,730. TELEPHONE-EXCHANGE SYSTEM; Arthur Raynsford, New York, N. Y. App. filed Dec. 31, 1919. Relates to systems involving an automatic exchange and a toll exchange.

1,386,731. VACUUM-TUBE REPEATER CIRCUITS; Harry S. Read, East Orange, N. J. App. filed April 12, 1919. Heating current from a common source passes through in series.

1,386,744. TELEPHONE AND MICROTELEPHONE; Robert Aernout Baron van Lynden, Utrecht, Netherlands. App. filed July 11, 1918. Earpiece can move with respect to handle.

1,386,747. TELEPHONE-EXCHANGE SYSTEM Charles White, East Orange, N. J. App. filed July 11, 1918. Relates to systems in which trunk circuits are employed.

1,386,748. SIGNALING SYSTEM; Ray S. Wilbur, Lyndhurst, N. J. App. filed Jan. 14, 1918. Number of channels for the transmission of signal control currents.

1,386,749. CALL-DISTRIBUTING SYSTEM; Samuel B. Williams, Jr., Brooklyn, N. Y. App. filed April 14, 1919. Relates to systems employing automatic switches.

1,386,804. HORN; Herman R. Saxon, Toledo, Ohio. App. filed April 17, 1916. Relates to operating mechanism for actuating vibratory diaphragm.

1,386,828. WINDINGS FOR ELECTRICAL APPARATUS; Earle G. Winston, Pittsfield, Mass. App. filed Sept. 16, 1920. Improved arrangement of parts which is both economical and readily manufactured.

1,386,831. ELECTRIC TERMINAL CONNECTOR; Albert L. Austin, Cleveland, Ohio. App. filed Jan. 31, 1920. Generally improved connector, simple in construction, cheap of manufacture and efficient in use.

1,386,834. TORSION SPRING; Albert R. Beckert, Lynn, Mass. App. filed Oct. 21, 1919. Relates to torque-producing members which are also utilized for carrying a current.

1,386,838. WINDING FOR ELECTRICAL APPARATUS; Locke H. Burnham, Pittsfield, Mass. App. filed July 17, 1918. Relates to transformers and the like in which it is necessary to interpose additional insulation between the windings.

1,386,849. ELECTRICAL APPARATUS; William O. Dwyer, Pittsfield, Mass. App. filed Nov. 17, 1920. Relates to arrangement of insulating barriers about windings, particularly for high-voltage service.

1,386,874. BOND-WIRE SUPPORT; Edward A. Everett, New York, N. Y. App. filed July 30, 1919. Relates to rail bonding used to provide electrical conductivity of rail joints.

1,386,915. INDICATING MECHANISM; Charles R. Underhill, New Haven, Conn. App. filed Jan. 13, 1917. Is adapted for indicating the relations of the speeds of rotating elements.

1,386,934. DYNAMO-ELECTRIC MACHINE; Henry C. E. Jacoby, London, England. App. filed April 19, 1918. Relates to improvements for cooling dynamo-electric machines.

1,386,977. DISINFECTING DEVICE FOR TELEPHONE AND OTHER USES; Northey V. Smith, Boston, Mass. App. filed Oct. 23, 1920. Intended to provide device for disinfecting and deodorizing mouthpieces.

1,386,992. TELEGRAPH SYSTEM; Amos F. Dixon, Newark, N. J. App. filed May 28, 1918. Relates particularly to printing-telegraph systems.

1,387,046. POLYPHASE MOTOR; Valere A. Lynn, St. Louis, Mo. App. filed Feb. 14, 1917. Designed to bring power factor of machines under control of operator, to increase efficiency and overload capacity and to provide more efficient means for starting.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

DUMMER, Me.—Application has been made to the Public Service Commission by Ira W. Jones of Lebanon and Milton, N. H., for permission to build a dam across the Androscoggin River in the town of Dummer, 8 miles north of Berlin, N. H., the power to be utilized to generate electricity. The plans include a dam, concrete power house and other structures. Dummer has not a post office.

FREEDOM, ME.—Plans have been completed for the installation of electric lamps in Freedom. Work, it is understood, will be started in the fall.

RUMFORD, ME.—The Rumford Falls Light & Water Company plans to extend its transmission line near Virginia City in the town of Rumford to Rumford Center, a distance of 3 miles, to furnish electricity for light and power in the latter village.

GARDNER, MASS.—The Gardner Reed & Rattan Company, 323 Pleasant Street, contemplates the construction of a one-story power house in connection with a new factory on West Broadway.

WESTFIELD, MASS.—The Municipal Light Commissioners have authorized extensions to the street-lighting system in upper Franklin Street from the end of the trolley line in that street to the foot of Lloyd's Hill.

CUMBERLAND, R. I.—The Blackstone Valley Gas & Electric Company, Providence, R. I., is considering the installation of an electric street-lighting system in the Grant's Mills and Abbott's Run sections of Cumberland. A petition was also presented to the Town Council by property owners on Sneechaconnet Pond Road for the installation of electric lamps from the park on that highway to connect with the circuit at Diamond Hill section.

NEW HAVEN, CONN.—Plans are being prepared for the construction of a one-story power house, 90 ft. x 100 ft., on Temple Street, to cost about $150,000, in connection with the Estate of E. Malley, 902 Chapel Street. Wescott & Mapes, Inc., 207 Orange Street, are architects and engineers.

Middle Atlantic States

AUBURN, N. Y.—The City Council has authorized renewal of contract with the Empire Gas & Electric Company for street-lighting in Auburn for ten years. The contract provides for replacing the arc lamps now in use with type C "Mazda" lamps.

GENEVA, N. Y.—The Public Service Commission has granted the Empire Gas & Electric Company permission to issue $1[illegible] in bonds for [illegible] improvements [illegible] erection of an outdoor substation on the 60,000-volt transmission line in Auburn and the installation of frequency changers, transformers, exciters, switching structures, etc.

NEW YORK, N. Y.—The United Electric Light & Power Company is contemplating the construction of two concrete coaling towers, 17 ft. x 67 ft. and 187 ft. high, to cost about $200,000 with equipment, at its power plant at Walnut Avenue, 133d to 134th Street. Thomas E. Murray, Inc., 65 Duano Street, is engineer.

NEW YORK, N. Y.—Bids will be received by the New York Central Railroad Company, Grand Central Terminal, until Oct. 1 for [illegible] requirements [illegible] flexible staybolts and parts, steel portable electric arc-welding machine and accessories, according to drawings and specifications on file in the office of W. C. Bower, general purchasing agent, Grand Central Terminal.

PHILADELPHIA, PA.—The power house of the Franklin Sugar Refinery was recently damaged by fire, causing a loss of about $200,000.

PITTSBURGH, PA. — Plans have been filed by the Union Ice Company for the construction of a two-story plant 75 ft. x 100 ft., at Beaver Avenue, to cost, with equipment, about $100,000.

BALTIMORE, MD. — Plans have been prepared by the Western Maryland Railroad Company, Continental Building, Baltimore, for the construction of a grain elevator at Port Covington, to cost in excess of $1,000,000. Considerable electrical and mechanical equipment, including loaders, conveyors, transmission machinery, etc., will be purchased.

BALTIMORE, MD.—The Gwynns Falls Paper Company, care of George W. Davis, 517 Calvert Building, Baltimore, has plans under way for the construction of a paper mill at Gwynns Falls. The main mill will be one, two and three stories, 75 ft. x 400 ft., estimated to cost, with machinery, about $250,000. Bids will soon be asked Joseph H. Wallace, 5 Beekman Street, New York City, is engineer.

HUNTINGTON, W. VA. — Extension to the ornametal lighting system on Fourth Avenue to Twelfth Street has been authorized by the City Commissioners.

LOGAN, W. VA.—Extensions and improvements are contemplated by the Kentucky and West Virginia Power Company to the plant on Little Island, to cost about $1,000,000. The plans provide for the installation of two additional 15,000-kw. turbo-generator units and six additional Taylor stokers under present boiler an added power supply of 11,000 volts will be developed and a dam constructed across Guyandotte River. H. M. Argabrite is vice-president and general manager, and Thomas Coghland is efficiency engineer; both of New York. F. R. Weller, Washington, D. C., is consulting engineer.

CLARKSVILLE, VA. — Permission has been granted to the Roanoke River Development Company, Roanoke, by the Federal Power Commission for the Development of a power project at Buggs Island near Clarksburg. The work includes a 50-ft. dam across the Roanoke River with power house to provide for a primary development of 10,000 hp. and a secondary development of 50,000 hp.

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Sept. 6, for furnishing, Specification 8641, five transformers and two watt-hour meters.

WASHINGTON, D. C.—The Bureau of Yards and Docks, Navy Department, Washington, D. C., plans the construction of power house, dispensary, reservoirs and railroad sidings at Yorktown. Applications accompanied by a deposit of $[illegible] may now be filed for plans and specifications [illegible], and necessary data for bidding will be forwarded in the near future. All communications should be addressed to the chief of the Bureau of Yards and Docks.

North Central States

DETROIT, MICH. — Construction is under way by the Ford Motor Company on a new building at Northville which will be equipped as a welding works and used primarily in connection with the manufacture of valves and valve stems.

RAVENNA, MICH.—Bids will soon be received by the Ravena-Conklin Electric Light & Power Company for the construction of a hydro-electric power plant to cost about $85,000. Holland, Akerman & Holland, 106 East Liberty Avenue, Ann Arbor, are engineers.

YOUNGSTOWN, OHIO. — The Pennsylvania-Ohio Electric Company has applied to the State Utilities Commission for permission to issue $1,000,000 in capital stock the proceeds to be used for reimbursing its treasury for expenditures already made and to provide funds for additional improvements, etc.

INDIANAPOLIS, IND.—Application has been made to the Public Service Commission [illegible] Electric Corporation with a nominal capital of $10,000, and also for the consolidation of seven electric companies, including the Merchants' Heat & Light Company of Indianapolis, Indiana Railways & Light Company, [illegible] Company, Valparaiso Lighting Company, Wabash Valley Electric Company of Clinton, [illegible] and the Cayuga Electric Company, with the new corporation. Plans under consideration provide for linking the plants of the above companies with transmission lines and establishing a central power plant of about 30,000 kw. on the Wabash River in Vigo County. The new company plans to extend the service to territory outside of the seven counties now served by the various companies mentioned in the merger. Joseph H. Brewer of Grand Rapids, president of the Merchants' Heat & Light Company, is one of the incorporators.

CENTRALIA, ILL.—The Illinois Central Railroad Company is considering the construction of an ice plant to cost about $[illegible]

CHICAGO, ILL. — Arrangements have been made by the Middle West Utilities Company for a note issue of $1,500,000, the proceeds to be used for extensions, improvements, etc., to its power plants and systems.

MILWAUKEE, WIS.—Plans are under consideration by the Chicago, Milwaukee & St. Paul Railway Company, 80 East Jackson Boulevard, Chicago, Ill., for the construction of a grain elevator and storehouse at Lake and Greenbush Streets, Milwaukee, to replace the plant known as Elevator A, recently destroyed by fire. The plant, to be 85 ft. x 285 ft., 85 ft. high, will cost about $1,500,0000 including elevator, electric motor and power equipment, boilers, etc. C. F. Loweth is chief engineer and C. P. Rawson is chief architect, with offices at Chicago.

STOCKPORT, IOWA.—The Van Buren Light & Power Company, it is reported, is negotiating with the municipalities of Lagrange, Kahoka, Canton and Palmyra, all of Missouri, for the supply of electric power service. It is planned to extend the proposed transmission lines from the company's lines at Wayland, Mo. W. E. Silver is general manager.

KANSAS CITY, MO.—Plans have been prepared by the Kansas City Power & Light Company for the construction of a one-story power house, 60 ft. x 90 ft., at Sixty-first and Forest Streets. A. E. Beltis is chief engineer.

KANSAS CITY, MO.—The City Council has authorized the installation of an ornamental lighting system between the intersection of Gladstone Boulevard, St. John and Elmwood Avenues. Sixty-two 600-cp. lamps will be installed by the Kansas City Power & Light Company.

ST. LOUIS, MO.—The Brooks Tomato Products Company, St. Louis, Mo., is considering the installation of an electric plant at Long Branch, Fla.

LEAVENWORTH, KAN. — Plans have been approved by the board of directors of the Federal Penitentiary for the construction of a power plant at the institution to cost about $145,000, including boilers, engines and auxiliary machinery. W. I. [illegible] is warden.

Southern States

LENOIR, N. C. — The Granite Falls Manufacturing Company, Hickory, contemplates the development of hydro-electric power on Wilson Creek, in connection with textile mills and furniture factories. The project includes the construction of three dams, 34 ft., 40 ft. and 60 ft. high respectively, each to be connected by short conduit to power house. The company also plans to install generating equipment of 5,000 hp. capacity.

ATLANTA, GA. — Extensions and improvements are under consideration by the Atlanta Ice & Coal Corporation to its ice-manufacturing and cold-storage plants at Atlanta, Decatur and Fort Valley, Ga. The cost of the work is estimated at $700,000, [illegible] the capacity of the Atlanta plant and $100,000 each for work and equipment at the other two plants.

SPRINGFIELD, GA.—The installation of electric lamps in Springfield is under consideration by the City Council.

[illegible] Light & Power Company, recently organized with a capital of $10,000, contemplates establishing an electric plant to furnish light and power in Merritt and vicinity. O. R. Grosse is president.

PAWHUSKA, OKLA.—Plans are under way by the City Commissioners for the construction of an addition to the municipal electric power plant in Pawhuska. A list of equipment will be prepared at an early date.

MOULTON, TEX.—The organization of a company for the purpose of building electric and ice plants in Moulton is under consideration by F. T. Fehrenkamp and [illegible]

Pacific and Mountain States

SEATTLE, WASH. — The temporary power house at Hewhalem Creek, on Skagit River, owned by the city has been put in operation. The plant has an output of 3,000 hp., which now supplies electricity for lighting the construction camp, and later the power will be utilized in the construction of the crib dam across the Skagit River and the tunnel which will eventually feed the permanent power house. Contracts on these units, it is expected, will be awarded within a few weeks.

LA GRANDE, ORE.—The City Commission has engaged Stevens & Koon, consulting engineers, to make an investigation and submit a report on the necessary repairs to the water supply system and an estimate of cost of same. The proposed work to be undertaken will include the installation of a plant for emergency use.

MEDFORD, ORE. — Steps have been taken by J. T. Gagnon, it is reported, to organize an electric company to construct an electric power plant to supply electricity to operate his mills in Medford and Jacksonville and also his electric railway line. It is proposed to install a boiler and generator in the mill at Medford. Mill refuse will be used for fuel for the proposed plant.

FRESNO, CAL.—The Southern California Edison Company has applied to the State Railroad Commission for permission to build a fourth power plant of 120,000 hp. on Big Creek. The cost of the plant, including the installation of three units, is estimated at about $6,000,000. F. F. Henry is manager of the Fresno office.

LOS ANGELES, CAL.—The county surveyor has been instructed by the Board of Supervisors to prepare plans for the establishment of a lighting district at Crescent Heights.

LOS ANGELES, CAL.—The installation of street-lamp standards and appliances on Pacific Avenue between Third and Fourteenth Streets and on a section of Hobart Boulverad is contemplated. Robert Dominguez is city clerk.

LOS ANGELES, CAL.—Bids will be received by the Department of Public Service, Room 602, Public Service Building, until Aug. 30 for electric meters and transformers in accordance with Specifications No. P-238 on file in the above office. James P. Vroman is secretary.

DELTA, UTAH. — Application has been filed with the State Engineer by R. H. Evans of Delta for the use of 2 second-feet of water from a spring branch in the Sawtooth mountains in Millard County. It is proposed to develop the power to operate a small power plant and for milling ore at the Last Chance mine.

SALT LAKE CITY, UTAH.—Car barns and rolling equipment of the Salt Lake Garfield & Western Railroad Company located at Tenth West and South Temple Street, were recently damaged by fire. [illegible]

TWIN FALLS, IDAHO.—The installation of a new lighting system on Main Avenue and Shoshone Street, to include 108 ornamental curb lamps, has been authorized by the City Council, and a revised contract with the Idaho Power Company covering the work has been approved. Material for the proposed system has already been purchased.

[illegible] right-of-way for the construction of a transmission line from Nogales to the pumping plant about 7 miles from the city.

[illegible] of Francis V. Riley, county engineer of Idaho Falls, and H. E. Robinson of Kem[illegible] irrigation project in Lincoln County. The [illegible] impound 10,000 acre-ft. of water, and a dam [illegible] at the spillway level.

Canada

[illegible] the Asheroft Water, Electric & Improvement [illegible] fire, causing a loss of about $10,000.

[illegible] Extension to the Hydro system is under consideration by the ratepayers of East Flamboro Township. For further information [illegible]

Electrical World

New York, Saturday, September 3, 1921

Circulation—What It Means to Every Reader

THE reader of a magazine is apt to think that circulation is a matter that concerns the advertiser only.

"My interest is in the contents of the publication," he says. But with a business paper of broad scope like the ELECTRICAL WORLD—the news, the trade and the technical journal of a great and growing industry — the reader *is* concerned with circulation. For here we find proof of its reading value.

The electrical industry, roughly, is made up of seven groups, as follows:

1. Manufacturers and distributers.
2. Central-station companies and municipal electric systems.
3. Industrial and private power plants.
4. Jobbers, contractors and dealers.
5. Electric railways.
6. Telephone and telegraph companies.
7. The new field of radio communication.

The production or income of these major groups shows their relative position in the industry. The per annum figures are:

Manufacturers and distributers	$1,250,000,000
Central-station companies and municipal systems	900,000,000
Industrial and private plants	200,000,000
Electric railways	800,000,000
Telephone companies	550,000,000
Telegraph and radio	250,000,000
Miscellaneous	250,000,000
Total production	$4,200,000,000

That, in round figures, is the bulk and balance of the electrical industry. Now as to the measure of the service rendered by the ELECTRICAL WORLD, as indicated by the kind and number of the men who read it.

There are two classes of men who carry the world's work—business planners and result getters. The business planners investigate, decide and direct; the result getters accept the business planners' judgment and by utilizing labor and materials work out their plans. There are more of these result getters than of the business planners. Both are vital, and in our industry both read the ELECTRICAL WORLD. Here are the figures of our circulation grouped this way:

The Business Planners—	
Executives in charge of company and engineering policy for central-station companies and electric railways	2,644
Executives in charge of company and engineering policy with industrial plants and electrical manufacturers	1,301
Executive and engineering specialists in the allied fields of generation, railway, telephone, telegraph, radio, illumination, chemistry, finance and education	5,149
	9,094
The Result Getters—	
Operating and administering executives with central-station companies and electric railways	3,459
Operating and administering executives with industrial plants, electrical manufacturers, mills and mines	6,416
Sales managers and sales engineers with central-station companies, electrical manufacturers and large contractors, dealers, jobbers and exporters, plus the miscellaneous	3,231
	13,106

From this you know that over 22,000 electrical men subscribe to this magazine you read. And it does mean something to you. For the distribution of this circulation among both business planners and result getters is an eloquent testimony to the recognition which the ELECTRICAL WORLD has won by its broad service. It is an indorsement—proof of its worth to you. If these men, week after week, study the industry, its records and its thinking here, it is a call to you also to read more broadly and to learn more fully as the industry progresses.

William Creighton Peet

An electrical engineer, contractor and advocate of co-operation who has achieved notable success in electrical contracting work, has worked intelligently to improve the National Electrical Code and has devoted his talents, personality and conscientious leadership to the betterment of the contractor-dealer group of the electrical industry.

WORKING for an industry to expand its scope and increase its productiveness is like working in a garden. It requires the constant attention of individuals vitally interested in its success. Among those few in the electrical contracting field who have given themselves without stint to the organization and development of that branch of the electrical industry is William Creighton Peet, president and founder of Peet & Powers, electrical engineers and contractors of New York City.

Born in New Orleans, La., Oct. 29, 1871, Mr. Peet entered the Massachusetts Institute of Technology in 1890. Two years later he went to Germany for a short course at Heidelberg. Forced to remain in that country because of a cholera quarantine, he continued his engineering studies at the Technical School at Darmstadt, completing the electrical engineering course in 1895. Following his graduation he accepted a position as engineer of construction with what was then the Shuckert company. While with that company he had complete charge of the electrical work of the Bavarian Exposition at Nuremberg, Bavaria, in 1896. Returning to the United States in 1897, he entered the laboratory of the American Telephone & Telegraph Company, where he was associated with Col. J. J. Carty and Bancroft Gherardi in experimental and development work. He later became associated with the George A. Williams Company of Jersey City and for that company carried out the installation of two electric lighting plants—one at Hagerstown, Md., and the other at Newport News, Va. After completion of this work Mr. Peet entered the contracting business for himself, and in 1902 he formed a partnership with Joseph A. McAnerney and Walter H. Powers. Later in that year the present company of Peet & Powers, Inc., was formed.

It was at this time that Mr. Peet became closely identified with the development and organization of the electrical contracting business. Always a silent and tireless worker, he has never been given to spectacular methods of accomplishment. In 1902 he became secretary of the Association of Electrical Contractors of New York City and later was made its president, serving also for a number of years on its executive committee. Upon the reorganization and formation of the present National Association of Electrical Contractors and Dealers at St. Louis in 1918, Mr. Peet was elected chairman, in which capacity he served for three years. He was one of the founders of the Contractors Club in 1916 and has acted as treasurer since that time. The formation of the Institute of Electrical Contractors, of which Mr. Peet was first treasurer and is now president, was largely the result of his endeavor.

Mr. Peet has also served as chairman of both the code and jobbers committees of the National Association of Electrical Contractors and Dealers and as a strong advocate of co-operative principles had the appointment of the representatives on the Council of Industrial Relations for the Electrical Construction Industry, which was successful in bringing about eighty-five settlements last year.

Throughout his career Mr. Peet's ability as an organizer and co-operator has been widely recognized as attested by his selection to discharge many responsible duties in association work. At the last convention of the National Association of Electrical Contractors and Dealers the past-president's emblem was presented to him in appreciation of his work for that organization.

Electrical World

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Volume 78 — New York, Saturday, September 3, 1921 — *Number* 10

Non-Employment in the Electrical Industry

WITH any decline in general business it is inevitable that the electrical industry should also be affected, particularly the manufacturers of electrical apparatus. However, the existing situation is not so gloomy as many think. Non-employment there is, and President Harding has called a conference this month to discuss the distribution of labor and the rehabilitation of industry. On the other hand, Secretary Hoover declares that the business situation is improving. While he is not blind to the prevalent lack of employment, he says: "It is inconceivable that America, with its surpluses of food and clothing, with housing—although crowded—and with an abundance of fuel, should allow any suffering of those among our people who desire to work." Of course, there can be no permanent remedy without the rehabilitation of industry.

If Congress would only commit itself to a constructive policy, confidence would come quickly, factories would be busy on full time and the employment problem would disappear. Not a little of the non-employment in the electrical industry is attributable to the lack of appropriations to carry out commitments already made by the army, navy and other departments of the government. If funds were voted to complete this work, entered into in good faith by the manufacturers of electrical apparatus with governmental departments, it would be a boon to the electrical industry. Unlike the farmers, cotton growers and exporters, the electrical manufacturers seek no subsidy or advances from the government; they ask only that it live up to its obligations.

A Brilliant Investigator Lost to Science

IN THE death of Dr. Peter Cooper Hewitt applied science suffers a loss that it cannot yet fully realize. Born to wealth, position and ease, he chose to spend his life and talents in productive labor rather than in purposeless luxury. Dr. Hewitt is best known to the public by the incandescent vapor lamp that bears his name. This exceedingly useful illuminant was the result of many years of patient investigation on his part, and it has found an important place in industrial lighting. He was perhaps almost equally well known for his fundamental work on the mercury rectifier—work which was followed up by other investigators until this extraordinary apparatus has become a most useful adjunct of the dynamo not only in street lighting but in some of the serious work of power distribution as well. It has not yet been brought to its full industrial value or turned to the larger uses for which in the course of time it will probably be available. Besides these notable inventions, Dr. Hewitt was constantly engaged in experimental work in many branches of physics, bringing to his investigations the resources of an exceptionally keen, alert and well-trained mind and a persistence which marks the true spirit of research. He was possessed of a most attractive and interesting personality, worthy the son and grandson of his brilliant progenitors. His inventive skill touched many things, but he will be best known in the history of science as the first successful worker in the field of what one may call electronic engineering, breaking away from the conventional lines of electrical conduction and opening, particularly in the rectifier, a new line of practical advance which leads to a goal that no man dares predict.

A host of workers have followed in the path which Peter Cooper Hewitt blazed out and which is constantly diverging into great and unknown fields. The outlook thus bestowed far transcends any material achievement of the inventor. A generation hence the world will have begun to reap some of the bigger benefits conferred by the discoveries of one who never shunned the skirmish line of science for the security of a standardized dugout.

Government Ownership and Organized Labor

NOTWITHSTANDING the country's costly experience in operating the railroads during the war and the wreck of all system and discipline which attended it, the executive council of the American Federation of Labor, in session this week, discussed a movement to bring about public ownership of steam railroads. Naturally, organized labor would look with favor on any scheme which would place it in control of public utilities and which, moreover, would mean less work and higher wages. But memory is not short-lived. This generation knows only too well what government ownership portends, and it is not likely to accept the burden a second time. However, those in control of the labor unions are shrewd and ingenious and can be counted on to make the most of their opportunities. Therefore all utilities must be prepared to combat this propaganda and to look well to their own service and its cost. Good service at reasonable cost is the best and most effective antidote for government ownership clamor, and against it no union of labor forces can prevail.

Broader Functions of the Commercial Department

A MANUFACTURING business is usually organized into three departments—production, sales, financial. The sales department is responsible for going out into the market and getting business. The production department must procure the necessary raw material and produce the goods to fill the orders that the sales department has turned in. The financial department must provide the money to finance both manufacture and sales and take care of the accounting. At the head of each department is an executive, and the managers of sales and production must have equal rank and work together like a team of good gray horses, or the business will be thrown out of balance.

The chairman of the N. E. L. A. Commercial Section at the Chicago convention pointed out that this balance of organization is as necessary for the central-station company as for any other manufacturing business and recommended urgently that all the commercial activities of light and power companies should be grouped together under one head responsible not alone for sales but for all the relationships of the company with the public. The idea is carried still further in the article by T. I. Jones in this issue. It has sound reason and practical business sense to advocate it, and the best proof of its practicability lies in the fact that there are large companies already organized this way. It is one more growing indication that the importance of the business side of the central-station organization must be recognized.

The Golden Rule Is the Safest Guide

THE simplest things are often the hardest to comprehend. This was illustrated when Alex Dow, speaking before the Michigan Electric Light Association, told the history of the dealings of the Detroit Edison Company with its public. His hearers expected to learn of some new and unusual methods. Mr. Dow told a story of three simple essentials and their application that every business man ought to know by heart, but of which, unfortunately, too many apparently have never heard. Avoidance of annoying rules and still more annoying efforts at enforcement, extreme care in making promises either directly or by implication, but promises once made to be kept at all costs, and, finally, service that gives what the customer is entitled to—these are the three foundation stones on which the success of the company has been built. "Can't do it because the company's rules forbid" is a thoughtless statement that will irritate the average man when a little careful explanation without any reference to rules would let him understand why his request cannot be met—or it may reveal the foolishness of the rule and prevent any attempt to apply it. Under the insistence of a customer it is hard for the average individual to say that no promise can be given, and too often the customer is left to believe that he has been promised something when the fact is that some one has evaded the issue by making statements that can be twisted to mean what the customer wants them to mean. Last but not least, the feeling that he has paid for something that he is not getting is one of the most galling ideas that the average human being can entertain, and the feeling rankles as few other feelings can.

These three things when thoroughly understood comprehend a very wide range of business problems. When employees are thoroughly impressed with the importance of these elementary principles and with the further fact that the truth told squarely and tactfully is always the easiest and safest way out in dealing with the public, there will be less trouble. The average man may not find the truth always palatable, but it is far more agreeable to him than evasion and a feeling that he is not getting what he believes he has paid for. When sifted to the final analysis, Mr. Dow's statement of how the task has been accomplished is only a statement of how the golden rule has been applied. "As ye would that others should do unto you, do ye even so unto them" is not an arbitrary religious command. It is the statement of a fundamental law on which all lasting human success is built.

Reduction of Rates to Pre-War Basis Must Not Be Expected

THAT the cost of turning out energy for public service has greatly increased since pre-war days is a fact unpleasantly familiar to managers of central-station companies. That they have faced the situation without making it an excuse for profiteering is a fact that ought to be familiar to the public they serve. Few persons, however, realize the extent to which rising prices have affected costs of production as compared with the small increases in rates. The study we print this week by P. M. Lincoln of the actual financial aspect of the situation is therefore just now of peculiar interest. The story of the increase in expense of production is a very striking one. The cost to the consumer has risen but a small fraction of the ratio, and a large part of the difference has been absorbed by searching and vigorous economies of management which do the executives of the companies infinite credit.

In considering the facts that Mr. Lincoln brings to the front the reader must realize that in the main the figures relate to a comparison of pre-war construction with its reproduction in whole or material part today. The considerable factor of costs due to fixed charges would, of course, change enormously as between 1914 and present-day prices. This must not be weighed too heavily, since if the facts were to come before a state commission for action very little account would be taken of the reproduction cost of a plant built and paid for in 1914. However, when increases of capital are necessary for extensions and replacements, allowance should be made for the actual prices current and the necessary rates of interest. The rate of depreciation of equipment is unchanged, but the effect of that rate is read into replacement costs effective at such times as the replacement is really made, and in changes of equipment the recovery value of discarded items is materially greater than it was. Of far more serious consequence with reference to public relations has been the very great increase in operating expenses, including fuel, and the worst of it is that this increase is likely to be permanent. The rate for money may get back to 5 per cent, but the price of coal will not follow it, and wages will not for years, if ever, drop to their pre-war figure. Moreover, every incidental item of operating expense has climbed side by side with the cost of labor and fuel.

The plain moral is that the public cannot in all fairness expect to see the price of electric service decline to a pre-war basis. If the electric light and power companies had followed the example of some of the railway systems by decreasing public service and doubling prices, there would have been a tremendous outcry. But they stood by the public, raised prices no more than was absolutely necessary to keep their heads above water, and did not cut off their less profitable customers. Therefore we believe the public will support them cordially when help is necessary.

Struggling with the Power-Factor Problem

EVER since the beginnings of power transmission the electrical supply company has wrestled with the difficulties imposed by low power factor. The case is, of course, less serious now than when induction motors were a new development. But the demand for cheap, low-speed motors and their use sometimes on very unsuitable loads call for action. It is a fact that any station with a considerable motor load suffers seriously from bad power factor, the more so since it thus loses the benefit of what would otherwise lead to an excellent diversity factor. In this issue L. R. Wilson takes up the treatment of the situation as it exists in a Western generating station of considerable size and sets forth the remedial measures taken. Broadly, the remedy is a charge for the extra capacity demanded, and the chief question for decision is how this charge shall be applied. We have long been disposed to the belief that if there were available a suitable kilowatt-ampere-hour meter the best plan would be to bill strictly on this basis, at a suitable price per unit. At least, this method would be simple and rather effective. In default of a meter to record the apparent energy directly, it can be otherwise deduced and applied to the bill.

The Tucson plan is to assume a basic power factor of 80 per cent and then to increase or decrease the discount as the power factor is above or below normal. The actual figure is 1 per cent added or subtracted for each per cent variation in power factor. The disadvantage is the added complication of the metering, necessitating two instruments, either single-phase or polyphase, as the load is balanced or unbalanced. The plan is certainly reasonably effective and fair enough to all. The whole situation should be the subject of concerted action, for while all the plans in use amount to about the same thing, they do not look quite alike and hence may draw unwarranted criticism.

Phenomena of Arc Rupture

CONTINUOUS satisfactory operation of nearly all classes of electric equipment is assured in the present state of the art as long as circuit conditions are unchanged. Changes of circuit conditions, however, introduce transient surges of energy and variations of voltage often followed by well-known disastrous results. Owing to the infinite variety of combination of circuit constants and current and voltage values, it is as yet impossible to foretell the character and magnitude of transients and so to design equipment to meet all of them.

One of the simplest of transients is that arising in the opening of a continuous-current circuit. Current and voltages are fixed at the instant of opening, and owing to the low value of the latter, electrostatic capacity probably plays no part, inductance being the chief factor. It would appear therefore that here is a promising point for an attempt to adapt design to the character of the transient. An interesting step in this direction is found in the experiments described by O. H. Eschholz in the current issue. The results indicate a definite relation between total voltage (line plus induced) and arc length at rupture, for a given value of current. This result is surprising in the light of the highly complex character of the arc, and it would appear that a wider range of conditions than described, as for example by variations of temperature, air pressure and orientation of line of break, might well introduce influences of their own. The photographic and other studies of the arc under magnetic blow-out add to the value of the paper.

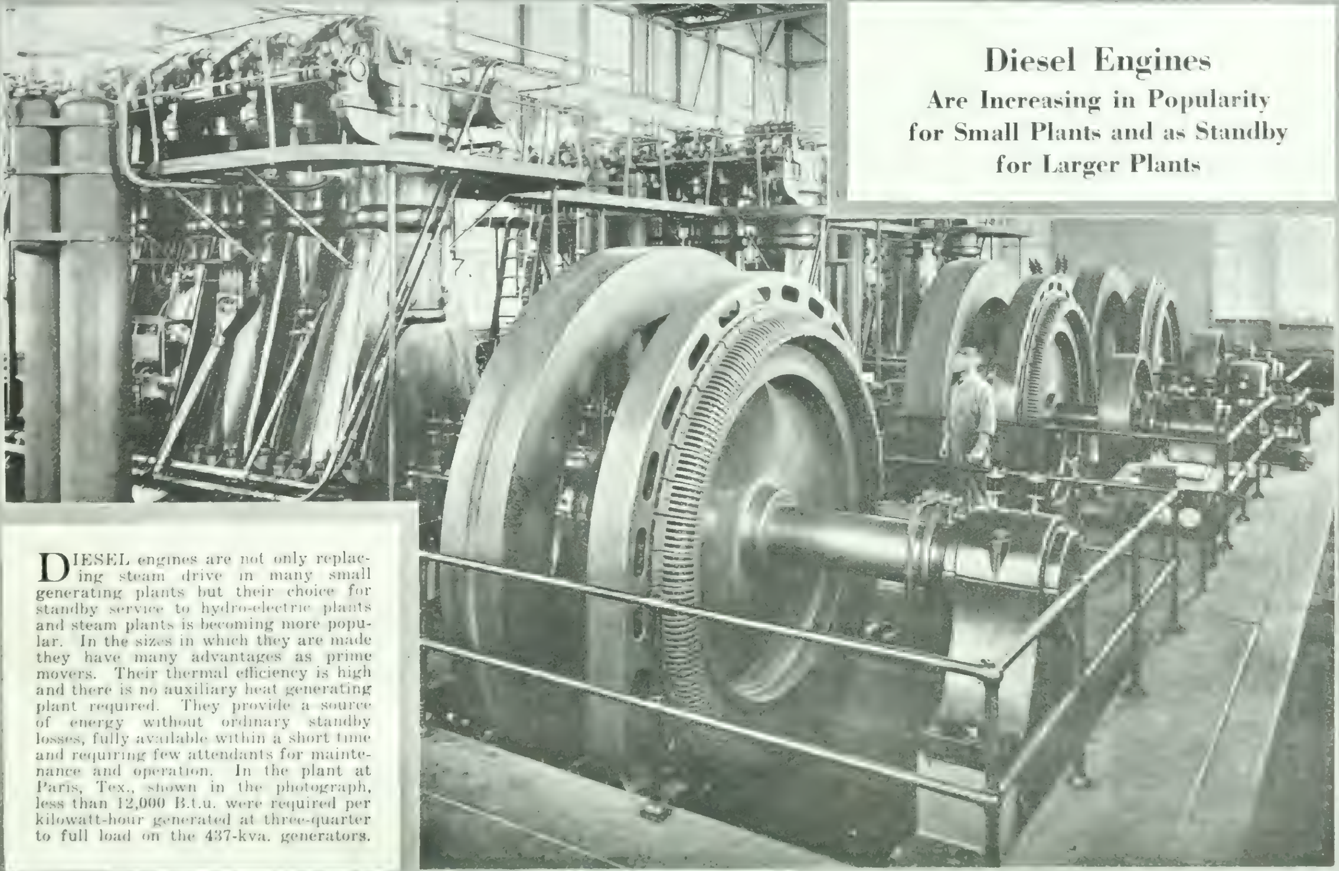
Can the Law of the Sphere Gap Be Simplified?

THE adoption by the American Institute of Electrical Engineers of the sparking distance between spheres as a standard of high voltage was probably due in great measure to the simplicity of the apparatus. It is highly desirable in a standard of this character that the quantity involved should be susceptible of definition in terms of simple physical constants such as the dimensions of the apparatus, temperature and pressure. This condition obtains for the sphere gap if both spheres are insulated, but not when one sphere is grounded. In the former case within a wide range of gaps the surface potential gradient at breakdown is a constant for a given size of sphere. In the case where one sphere is grounded, however, this simple type of relation does not hold, and it is not possible to write an expression giving the critical surface gradient for a given size of sphere; the standard must be defined in terms of a drawn curve and with specifications as to size of supports, distance from surrounding objects, etc. This is a serious drawback as it is not always a simple matter to insulate both spheres, and for the grounded case the difficulties of measurement are considerably increased.

Some time ago we called attention to an analysis of the A. I. E. E. figures by Dr. Alexander Russell (*Journal* of the (British) Institution of Electrical Engineers) in which he made the interesting discovery that if, instead of being at grounded potential, the grounded sphere be assumed at a definite fraction of the total potential difference below ground, then the grounded case reduces to the same values of critical gradient as those for the case where both spheres are insulated, and so the use of one formula becomes possible. This leads Dr. Russell to raise a question, not as to the accuracy of the measurements of gap or voltage (as suggested by Mr. Peek in his letter in our issue of June 18), but as to the correctness of the deductions of the values of the potential gradient. In this issue a letter from Dr. Russell is presented commenting on the points raised by Mr. Peek. The interesting suggestion is made that at high absolute potentials there may be some escape of electricity from the sphere, causing an alteration in the normal electrostatic gradient in the air. In the absence of experimental observations of phenomena of this character, this does not appear so strong a support of his contention as his description of an absolute voltmeter in which the attraction between two spheres depends only on the absolute potentials and strictly obeys electrostatic theory. This indicates a normal condition of the medium between the spheres, and so leaves his original comment unanswered and without explanation. In view of the importance of as great simplicity as possible in all standards, it would appear very desirable that experiments on unequal spheres as suggested by Dr. Russell, or other experiments clearing up his question as to the absolute potentials of the spheres in the A. I. E. E. experiments, be carried out. The reduction of all cases of sphere gap to one concise law would remove the most serious objection to this otherwise relatively simple standard.

Diesel Engines

Are Increasing in Popularity for Small Plants and as Standby for Larger Plants



DIESEL engines are not only replacing steam drive in many small generating plants but their choice for standby service to hydro-electric plants and steam plants is becoming more popular. In the sizes in which they are made they have many advantages as prime movers. Their thermal efficiency is high and there is no auxiliary heat generating plant required. They provide a source of energy without ordinary standby losses, fully available within a short time and requiring few attendants for maintenance and operation. In the plant at Paris, Tex., shown in the photograph, less than 12,000 B.t.u. were required per kilowatt-hour generated at three-quarter to full load on the 437-kva. generators.

Generating Costs Have Increased 100 to 175 per Cent Since 1914

Steam Plants Show Average Rise in Production Expense of 137 per Cent and Hydro-Electric Plants Show Average Increase of 167 per Cent —Itemized Production Costs and Increases in Equipment Prices

By P. M. LINCOLN
Consulting Engineer Lincoln Electric Company

IT IS well known that the cost of generating and distributing electrical energy has risen by a very marked degree during the last few years, but it may not be realized that a careful analysis shows increases of 100 per cent to 175 per cent in this cost from the year 1914 to the year 1920. In making such an analysis there are two main items of cost, namely, fixed charges and operating costs.

The fixed charges on a power plant are usually taken to consist of the items of interest, depreciation, taxes and insurance. All of these items are assessed against the first cost of the plant and equipment necessary to give service. The first step in an analysis, therefore, is to ascertain the change in cost of the plant and equipment necessary to give service today as compared with one for the same service before the late war exerted its influence in increasing prices. Steel and copper are the largest single items of raw material that enter into the cost of equipment for power plants. Iron and steel products show some very marked changes during the last five or six years. For instance, the average price of pig iron during 1919 was two and one-fifth times the average during 1914. The highest point touched by pig iron during the period of 1914 to 1919 was nearly four times the average of the year 1914. The composite average of finished steel showed just about the same variations, as might have been expected. Sheet bars, and sheet steels produced from them, show a little greater than average increase. Black sheet steel averaged 2.34 times as high in price in 1919 as it did in 1914, and the highest price touched during the period of 1914 to 1919, inclusive, was nearly four and a quarter times the average 1914 price. Briefly, the ruling price of steel products has risen to approximately double the pre-war price. Steel is the largest single item that enters the cost of a power plant.

Considering copper, the average price in New York during 1914 was 13.61 cents and in 1919 was 19.49 cents, or an increase of 43 per cent. However, in 1917 the price touched 36 cents, or more than two and one-half times the average of 1914. Undoubtedly the government's move in 1917 in fixing prices kept copper from going to a much higher level. This commodity has reacted to the law of supply and demand more readily than some others, and the present price is very nearly the same as the average price during 1914. However, if a power plant had been built during the last two or three years approximately twice as much would have been paid for copper as would have been paid if the same plant had been erected in 1914. This is the significant thing to bear in mind in making an analysis.

But, after all, it is not so much the raw materials that affect the final cost of a power plant as the actual cost of the various items that enter the finished plant. An analysis of the rise in cost of steel and copper is of interest only in showing the reason for the rise in cost of generators, transformers, switches, meters, etc., that go to make up a complete power plant. By the courtesy of one of the large electric manufacturing companies some data have been incorporated in Table I on the actual increases in cost that have taken place in various items of equipment entering a complete plant. The data cover the period from 1910 to 1920, inclusive. It is interesting, first, to note that costs remained very uniform from 1910 to 1914, there being a slight drop averaging perhaps 5 per cent between these two years. Between 1914 and 1915 most items show a slight further drop in price. Beginning in 1915 there has been a rapid and steady increase in the price of all items entering the equipment of a power house. Some naturally show more increase than others, but all show an increase.

In addition to equipment, a complete power plant must include lands and buildings. The actual amount of the increase in these items at present over what would have obtained five years or so ago is difficult to estimate, but there has been a decided increase. The building trades have shown a particularly marked increase owing largely to the much higher labor and material costs that have ruled during the last few years. There is probably no class of labor that has increased more rapidly in cost than that employed in the building trades.

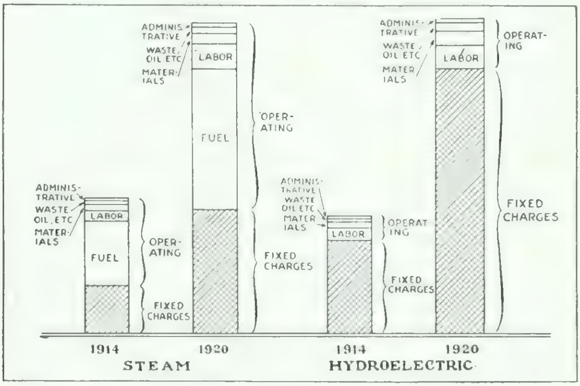
According to an article in the Jan. 29 issue of the *Literary Digest* the so-called "index figure" of all commodities has increased to nearly two and three-quarters the value it had during 1914. This "index figure" is the average price of several hundred standard commodities, each weighted according to the amount of that particular article used.

FIXED CHARGES HAVE INCREASED 125 PER CENT

Taking all these data into account, an estimate based on a considerably detailed study, and on manufacturers' quotations, shows that the cost of a plant necessary to produce, distribute and maintain electric service today is not less than 225 per cent of what the same plant would have cost in pre-war days. In making this estimate plants of the character used in any large city for supplying general service are considered.

It may be objected that this has no effect on the cost of producing power, since virtually all the capital expenditures necessary for furnishing electric service to any given center were made before the increases in cost took place, and that therefore the present consumers should not be burdened with this increase in present capital costs. This is only partly true. Any power plant is constantly growing. Ten per cent per year increase in the production of power is not at all unusual these days, and during the war period the increase in the demand on power plants was often greater than this. A plant big enough for its load in 1914 would not take care of conditions at present. The normal growth during the last five or six years would demand an increase in the normal plant to serve a community. This increase had to be put in at a higher cost. As time goes on the older parts of such a plant are amortized and eventually taken out of service and scrapped. The recently purchased part of the plant must, of course, be considered at present price levels. Whether the older portions should be considered as of the present value of equivalent equipment or as of the value at time of purchase is a question that will not be discussed at this time. It might be observed, however, that rent these days is paid on the basis of the present value and not of the original cost of the property. There is surely as much logic in power costs following the rising costs of equipment as there is in rents following the rising values of buildings and real estate.

In this connection there is another point that should be mentioned, and that is that it is not the first cost but the carrying cost that enters the final power cost. First cost is only one item in establishing fixed charges. Interest, depreciation, taxes and insurance, of course, vary with the first cost, but they may also vary independent of first cost. Thus during the last few years there has been a marked increase in interest rates. Bonds, which five or six years ago could be floated on a basis of 4 to 6 per cent return, must now pay 6 to 9 per cent. Therefore the promoter of a power plant today must not only pay more than twice as much for his equipment as he did six years ago, but when he goes into the money market to borrow his money for the plant he must pay an interest rate approximately 50 per cent higher than he did six years ago. Here again, however, the objection may be made that the plant now furnishing power was purchased at the old prices and, if wisely financed, carries the old interest rate. The writer refuses to discuss the question whether the shrinkage of the purchasing power of the dollar should be taken into consideration in fixing the rates for electric service, but will simply point out that owing to the wearing out and obsolescence of equipment this shrinkage must eventually be recognized.



COSTS OF GENERATING POWER HAVE MORE THAN DOUBLED SINCE 1914

While there may be some question as to the present value of the item of fixed charges in the cost of power, there are other items where there can be no question of the increase. Operating costs are such an item. The largest item in these costs is the cost of fuel, which has made a very marked and very real advance during the last few years. Coal costs have not only advanced at the mines, but the costs of freights have also increased. A certain plant in New England shows an average of $14 per ton during 1920, as against $5.50 per ton during 1914, or an advance of 154 per cent. Other figures supplied by Babson show that anthracite coal in New York has advanced from $5.75 in 1914 to $10.45 in 1920, or an advance of 81 per cent. Some further figures, obtained from practically every coal-producing state in the Union, show that coal at the mine mouth has increased all the way from 45 per cent as a minimum to 168 per cent as a maximum. The grand average for coal at the mine mouth shows an increase of 129 per cent in cost of 1920 over 1914. The power-producing companies must pay these advances or they do not get any coal. Considering all the data available, it is estimated that the cost of fuel today is 125 per cent above what it was in 1914.

The next item that demands attention is labor. A review of the statistics gathered by the Bureau of Labor Statistics, United States Department of Labor, shows that the rates of wage for power-plant operators during 1920 may safely be taken as 85 per cent in excess of what they were in 1914. For salaried employees the increase is estimated at 40 per cent. The total of this is small compared to the total amounts involved so that an error in this estimate is not important.

Based on the foregoing estimates as to increases in the individual items, an estimate of the increase in cost of producing power ready for distribution in a modern power plant in 1920 as compared with 1914 is given in Table II. For the purposes of the estimate it is assumed that the plant would have a maximum capacity of 100,000 kw., consisting of five units of 20,000 kw. each; that the yearly load factor is 40 per cent and the daily load factor 55 per cent; that the fuel available is bituminous coal of 13,500 B.t.u. per pound, and that this coal in 1914 cost $2.75 per ton and in 1920 $6.18 per ton; that 2.1 lb. of coal was required to produce a kilowatt-hour in both cases; that the plant cost was $60 per kilowatt in 1914 and $135 per kilowatt in 1920; that the fixed charges were at the rate of 12 per cent in 1914 and 15 per cent in 1920; that 350,000,000 kw.-hr. was generated and distributed in each case.

The accompanying diagram shows graphically the relative values given in Table II. The values are more or less typical of all steam plants—at least in so far as a comparison of 1914 with 1920 is concerned. If the location or the size of the steam plant is varied, various items of the comparison might change, but the final result would show an increase in cost of power of from two to two and one-half times as much in 1920 as in 1914.

In considering water powers in making a similar analysis, it must be remembered that fuel costs are entirely absent, but that this absence is largely offset

TABLE I—INCREASED COST OF GENERATING-PLANT EQUIPMENT FROM 1914 TO 1920

Equipment	Per Cent Increase
Turbo-generators	225
Motor-generator sets	147
Rotary converters	91
Transformers (power)	125
Transformers (distributing)	58
Voltage regulators	48
Switchboard panels	126
Oil circuit breakers	79
Watt-hour meters (single-phase)	38
Watt-hour meters (polyphase)	78
Frequency changer sets	101

by a much higher item of fixed charges. The first cost of the usual water-power plant itself is not only higher as a rule than that of a steam plant, but usually the hydro-electric plant lies at a distance from the market so that there is a considerable item of transmission cost and losses that the steam plant does not in general have to bear. An advantage possessed by the typical water-power plant is that the dams, canals and other works built in connection with it are usually of a more permanent character than a steam power plant, and they therefore carry a somewhat lower rate of depreciation. On the other hand, the metallic structures used in connection with the long-distance transmission system that must be considered as a part of any typical water-power plant should carry a somewhat higher depreciation rate than the steam plant would carry. All in all, the depreciation rate that should be applied to a water-power plant is perhaps slightly lower than that on a steam plant. The items of interest and taxes would presumably be the same for a water-power plant as for a steam plant.

The difference in first cost of a water-power plant and that of a steam-power plant depends on many indeterminate things such as the cost of dams, canals, storage reservoirs and the like, which vary over an exceedingly wide range, and the cost of the transmission system is a function of the amount of power to be transmitted and also of the distance of transmission. There is only one real limit to the cost of a water-power installation, and that is the economic consideration that the market cannot afford to pay more for water power than for the same service rendered by steam. However, the ratio between the cost of a water-power plant in 1914 and in 1920 may safely be taken to be at least as much as that determined for steam plants. For steam plants the figure of 2.25 was taken to represent the ratio of costs in 1920 as compared with 1914. There is no evident reason for departing from the same figure for water-power plants. The cost of buildings and other construction work which constitute the major part of any water-power project has certainly risen by at least as large a ratio as machinery costs.

Table II, giving the estimate of the cost of water power, uses this ratio. The other assumptions used in making the estimates are as follows: That the plant would have a capacity of 100,000 kw. (the same as assumed for the steam plant); that the yearly load factor would be 40 per cent and the daily load factor 55 per cent; that the plant cost was $140 per kilowatt in 1914 and $315 per kilowatt in 1920; that fixed charges on the water-power plant were 11 per cent in 1914 and 14 per cent in 1920; that the plant is 75 miles from its market; that 350,000,000 kw.-hr. was generated and distributed in each year.

TABLE II—INCREASE IN PRODUCTION COSTS FROM YEAR 1914 TO YEAR 1920

Item	Cost in Cents			
	Steam Power Plant		Hydro-Electric Plant	
	1914	1920	1914	1920
Fixed charges	0.206	0.579	0.440	1.260
Operation:				
Fuel	0.289	0.649		
Oil, waste and supplies	0.012	0.024	0.009	0.018
Labor	0.041	0.076	0.033	0.061
Maintenance:				
Materials	0.026	0.053	0.024	0.048
Labor	0.021	0.039	0.028	0.052
Administration	0.008	0.011	0.008	0.011
Totals	0.603	1.431	0.542	1.450

The diagram shows the comparative values. It is somewhat interesting to note that the *increase* in cost of water power has been somewhat larger than that of steam power—a ratio of 2.37 for steam power and 2.67 for water. The reason, of course, is that virtually the entire cost of water power lies in the fixed charges and that the increase in interest rate superposed on the large increase in first cost has caused the resultant cost of water power to increase even faster than has been the case with steam power. Fixed charges in 1920 in the case of water power are 2.85 times those of 1914, and this item amounts to 87 per cent of the total cost.

These estimates include only those costs that are necessary to produce the power and put it on the busbars at the steam generating plant—or the step-down substations of the water-power plant—ready for distribution from that point. To get the power to the ultimate consumer it is necessary to add the costs of distribution, metering, collection of bills, distribution losses, etc. These items vary considerably, depending upon the amounts of power distributed, the layout of the distributing system and many other items, so that it is difficult to take them into consideration in generalizing. They also have risen during the last few years, but possibly not quite so much as the tabulation indicates. The main point demonstrated is that the costs of power production and distribution have risen to two to two and three-quarters times those of six years ago.

In a future issue the question of making rates so that these increased costs may be distributed equitably between customers and power companies will be discussed.

Australia's Brown-Coal Power Scheme

RENEWED public interest in the so-called brown-coal fields of Victoria has been created, according to United States Trade Commissioner A. W. Ferrin, by the controversy, not yet entirely ended, between the brown-coal miners and the government of the state of Victoria, owner and operator of the largest of the brown-coal mines at Morwell, in Gippsland. This brown coal, which is found throughout Gippsland and in other parts of Victoria, is said to be unlimited in extent. Hitherto it has not been extensively mined because of its inferiority to black coal.

Several proposals have been made for the commercial use of the coal transformed into a fuel that will compete with black coal. One of these projects involves the briquetting of the brown coal; another is the production of electricity from the brown coal burned in special furnaces at the mines and the transmission of the electricity to Melbourne and other industrial centers. This second project is now being actively developed through a specially constituted body, the Electricity Commissioners of the State of Victoria.

Seventeen Years' Growth of Public Utilities

Stone & Webster Issue Graphic Chart to Make Clear How the Companies Under Their Control Have Prospered in This Period

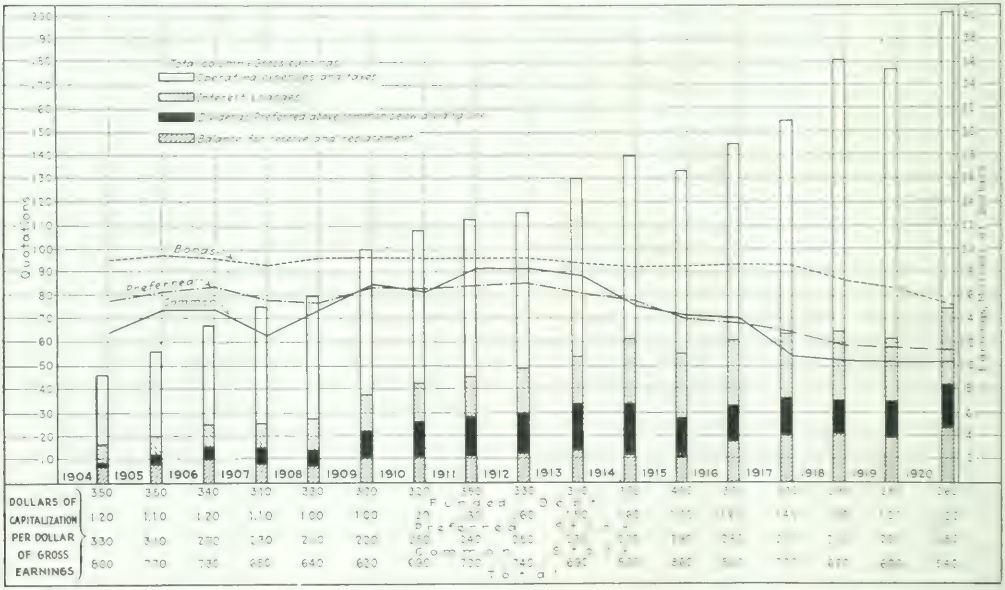
A CONVINCING illustration of the growth and stability of the public utility industry under able management is afforded in a graphic chart which has been prepared by Stone & Webster, Inc., to show the combined growth of the electric power, lighting and railway companies under the control of this firm in the last seventeen years. The chart indicates year by year the earnings of the companies, the relation of these earnings each year to the outstanding capital, and the resulting effect upon security values as reflected in market quotations. Each year all companies are included which were under Stone & Webster management for the full twelve-month period, any company in the hands of a receiver not being included. The number of companies composing this group has varied from time to time (it is now twenty-eight), but since 1910 the results indicated on the chart have not been materially influenced by such changes.

This group of companies has grown from a combined gross of about $9,000,000 and a net of $3,000,000 in 1904 to a gross of over $40,000,000 and a net of $15,000,000 in 1920. During this period of seventeen years there have been only two years, 1915 and 1919, when gross and net earnings were not larger than in the previous year. The capital outstanding, consisting of bonds, coupon notes, preferred and common stocks, has increased from approximately $73,000,000 in 1904 to approximately $219,000,000 in 1920. In 1904 for each dollar of gross earnings there was outstanding $8 of capital, divided between $3.50 of debt and $4.50 of capital stock. In 1920 for each dollar of gross earnings there was outstanding $5.40 of capital, divided between $2.60 of debt and $2.80 of capital stock.

CONSERVATIVE POLICY FOLLOWED IN RECENT YEARS

During the past five years, owing to the high cost of raising new capital, a very conservative dividend policy has been followed. This is indicated by the fact that in this period out of the combined balance (after interest charges) of $35,000,000 only $15,000,000 was distributed in dividends and more than $20,000,000 was turned back into the properties. In other words, for every dollar paid out in dividends $1.33 of earnings was invested in the properties.

Another comparison brought out by this chart is that in 1920 net earnings increased nearly $2,500,000 from an increase in gross of $5,000,000. During the previous five years, owing to abnormally high operating ratios before increases in rates and fares became generally effective, the average annual growth of net earnings was less than $50,000 from an average increase in gross of nearly $1,500,000. The curves of quotations indicate that the market for bonds has been remarkably stable, generally following the trend of money rates. The quotations for the stocks, on the other hand, have not yet reflected the actual improvement in the industry and the more favorable outlook for the future.



CONSOLIDATED CHART OF EARNINGS, CAPITALIZATIONS AND SECURITY QUOTATIONS OF STONE & WEBSTER COMPANIES

The scale for determining the number of dollars measured by these columns appears at the right side of the above consolidated chart.

The average market prices of the various classes of securities are represented by curves which refer to the scale appearing at the left of the chart. The bonds are largely 5 per cent issues and the preferred stocks are practically all 6 per cent issues.

The ratio of capitalization to gross earnings for each year appears at the bottom of the chart. This table is divided to show the funded debt (face value of bonds and coupon notes), the par value of preferred and of common stocks, and the total capitalization to each dollar of gross earnings.

Arc Rupture in Magnetic Blow-Out Switches

Arc Lengths at Which Instability Occurs Are Determined for Practical Conditions —Effect of Electrode Materials, Surfaces, Etc., Investigated—Phenomena of Arc Formation and Rupture Discussed

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Material and Process Engineering Department, Westinghouse Electric & Manufacturing Company

DIRECT-CURRENT circuit breakers or switches function by introducing in series with the line an increasing resistance. This resistance possesses transient stability and during the period of stability is of a low order. To assure current rupture, however, instability must be achieved by attaining a critical resistance value, corresponding to a quite definite arc length for given conditions, when the resistance rapidly increases to infinity. The magnetic blow-out field serves to reduce this period of transient stability, thus decreasing arc duration and switch wear from that secured when the rupture length is achieved merely by contact separation. Data are submitted giving these critical lengths, approximately, for various initial values of line current and line voltage at rupture for the usual range of flux densities employed in magnetic blow-out switches.

The utility of present-day circuit-interrupting means depend upon the development of an arc and its subsequent rupture. The sequence of phenomena occurring during arc formation is substantially as follows:

(1) Decrease of contact pressure and area as switch jaws separate, with a consequent increase in the rate at which thermal energy will develop at the contact points.

(2) Increase in current concentration and contact temperature until electron emission is achieved at the negative terminal. (Since this temperature is usually near the melting point of most contact materials electron emission is frequently accompanied by a slight volatilization of the cathode.)

(3) Slight separation of contacts and current conduction from the cathode to the anode by movement of the electrons.

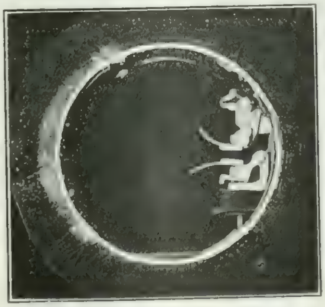


FIG. 1—EXPERIMENTAL AIR-CORE BLOW-OUT COIL AND SWITCH CONSTRUCTED TO FACILITATE OBSERVATION OF ARC PHENOMENA

(4) Collision between gaseous molecules, either of terminal vapor or atmospheric gases, and electrons, resulting in the formation of negative and positive ions.

(5) Continued collision between electrons, ions and neutral molecules with the continued increase in contact separation, the current passing from one terminal to the other as the result of the movement of electrified particles as well as the transference of charges from electron to ion, to ion, to terminal.

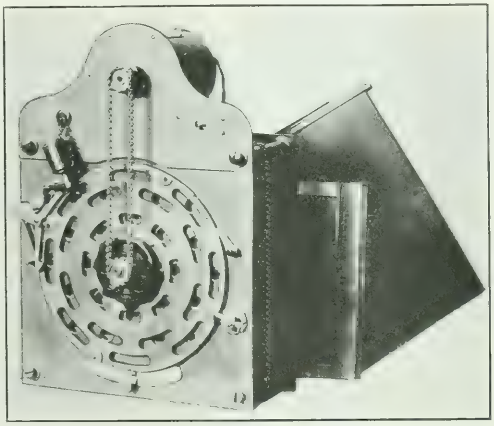


FIG. 2—POLAR, MULTI-EXPOSURE, HIGH-SPEED CAMERA, CONSTRUCTED TO RECORD ARC PHENOMENA

(6) The resulting stream of conducting gaseous material is a flexible conductor whose movement and contour may be controlled by contact separation, gaseous blast, deionizing material or a magnetic field.

The erroneous opinion prevails that arc formation and maintenance is necessarily accompanied by a heavy volatilization of the contact metals. The rate of volatilization is, however, controllable and is dependent upon such factors as thermal conductivity, specific heat, electron emission temperature and melting point of the electrodes as well as upon the rate of movement of the arc terminals on contact faces. In the construction of magnetic blow-out switches it is possible to reduce volatilization on contact and horn material so that the path of the arc terminal is barely perceptible.

The value of an arc as a means for the interruption of direct-current constant-potential circuits lies fundamentally in its ability to serve as a rapidly increasing series resistance. Since the arc is a flexible conductor, it will react to a transverse magnetic field in a manner similar to that of a solid, current-carrying conductor on a motor armature. The speed of movement, and therefore arc-length increase, is a function of the arc current, blow-out field strength, viscosity of inclosing atmosphere and shape of arc terminal path.

Contrary to the usual conception, all arcs in their development pass through a period of transient stability.

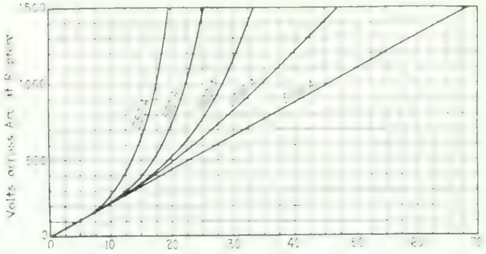


FIG. 3 — ARC VOLTAGES AT RUPTURE PER INCH OF ARC LENGTH AT RUPTURE FOR NON-INDUCTIVE LOADS

It is the object of the arc lamp, arc furnace or arc welding equipment designer to increase the duration of this stability by the selection of suitable electrode materials, arc atmosphere and stabilizing series impedance. It is the purpose of the switch or breaker designer to decrease the period of stability, consistently with such factors as economy of materials, compactness and low voltage surges, by utilizing deionizing means.

When employing the magnetic blow-out switch arc instability and subsequent rupture is achieved by rapidly increasing the arc length until the rate of energy absorption by the inclosing atmosphere exceeds the rate of energy input from the electrical circuit. In Fig. 1 is shown the characteristic functioning of the arc as an increasing resistance. For approximately 80 per cent of its period of duration this arc may be considered to have possessed transient stability. At the end of this period (0.0038 second) the arc attained approximately its maximum length. During the period of instability (0.001 second) the arc resistance rapidly increased to infinity. It is evident that the period of transient stability greatly exceeds that of instability. However, this relation is influenced by the amount of energy stored in the electric circuit, density and distribution of the magnetic field, as well as by the condition of the atmosphere through which the arc is passing.

Since the duration of an arc is chiefly determined by the time required to achieve unstable arc lengths, a knowledge of these arc lengths is an essential requirement in the determination of flux distribution, contact separation and switch contour. As the length of arc at rupture approximates that at the period of instability, it may be used as the criterion of unstable arc lengths.

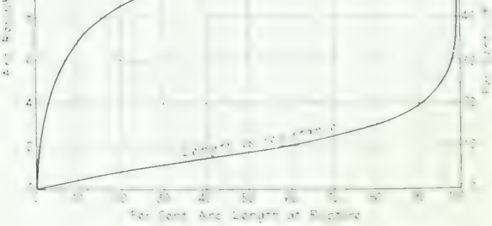


FIG. 4—CHANGE IN ARC RESISTANCE WITH INCREASE IN ARC LENGTH

This illustrates the comparatively long period of transient stability and short period of instability during rupture. Circuit and arc data are given in Table IV

TABLE I—ARC LENGTH AT RUPTURE: CARBON ELECTRODES

250-Volt Non-Inductive Direct-Current Circuit

Initial Line Current, Amp.	Arc Duration, Sec.	Approx. Maximum Arc Length, In.
60	0.182	5.5
180	0.265	10.5
180	0.245	[illegible]
310	0.285	12.3
360	0.292	[illegible]

ELECTRODE MATERIAL AFFECTS ARC LENGTH

In Table I are shown the maximum arc lengths when rupturing the initial indicated line current on a 250-volt direct current non-inductive circuit by permitting a pointed upright carbon cathode to fall from a carbon anode without auxiliary blow-out field. The values of arc length were computed from the arc duration recorded on an oscillograph film and the known distance-time curve of electrode separation.

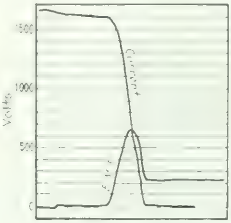


FIG. 5—CURRENT AND VOLTAGE CHANGES DURING ARC RUPTURE. CONDITIONS GIVEN IN FIGS. 3 AND 4 AND TABLE IV

In Table II are given the observations when using a pointed ½-in. (1.27 cm.) diameter lower copper cathode of ½-in. (1.27 cm.) diameter and a 1¾-in. (4.44 cm.) flat stationary copper anode.

It will be noted that the maximum lengths obtained with these forms of copper contacts approximate the lengths obtained with carbon electrodes. With both upper and lower copper contacts of 1¾-in. (4.44-cm.) diameter and slightly crowned to assure arc formation in their center, the same maximum arc lengths were obtained provided that the terminals did not move across the contacts. If the terminals are propelled across the contact faces, the added energy required to sustain the arc from an initially cold surface results in a shorter duration and a decreased length at rupture. If the surfaces of crowned copper electrodes, ½-in. (1.27 cm.) in diameter, are highly polished, a marked decrease in arc-length duration is obtained (Table III).

It will be noted from this that a slight erosion of the contact surfaces suffices to increase greatly the arc length at rupture. When breaking an arc between polished copper electrodes one or more globules were invariably formed on the anode surface with a corresponding pitting of the cathode surface. These globules are apparently produced by the condensation of cathode vapor evolved during the initial process of developing the arc. The globule size or number did not appear to

TABLE II—ARC LENGTH AT RUPTURE: COPPER ELECTRODES

250-Volt Non-Inductive Direct-Current Circuit

Initial Line Current, Amp.	Arc Length at Rupture, In.
60	5.6
192	9.3
360	12.0

TABLE III—ARC LENGTHS AT RUPTURE; CONTACT SURFACE POLISHED

250-Volt Non-Inductive Direct-Current Circuit, Copper Contacts of ½-In. Diameter

Test No	Initial Line Current Amp.	Contact Surface	Arc Length at Rupture Inches	Rupture Length, with Surface Greatly Eroded
1	175	Polished	1.3	6.5
2	390	Polished	1.75	12.0
3	457	Highly polished...........	1.18	13.5
4	600	Eroded by test No. 3......	3.7	15.5
5	562	Eroded by tests Nos. 3 and 4	9.94	15.0

increase with increase in arc duration or rupture length. Similar globular protrusions may be observed on switch and breaker contacts.

On reviewing these data it is apparent that a large variation in arc length at rupture may be obtained, owing solely to the condition of the contact surfaces. The maximum length obtainable within the experimental observations is approximated by the empirical relation $L = 0.0028E\sqrt{I}$.

In order to obtain a record of the arc length at rupture under the deionizing conditions existing in magnetic blow-out switches, high-speed photographs were obtained for each arc as it was blown between two parallel air-core blow-out coils. Fig. 1 shows the appearance of one type of experimental switch as well as the construction of the blow-out coil. In Fig. 2 is shown the high-speed camera employed, described by J. W. Legg on page 510 of the December, 1919, issue of the *Electric Journal*. A complete sequence of arc stream photographs from arc formation to arc rupture is shown in Fig. 6. The duration of each exposure is approximately 0.00015 second, the interval between exposures approximately 0.00028 second. The oscillograph record is shown in Fig. 5 and the relation of arc length to arc resistance and duration in Fig. 4. Some of the data obtained for this arc are given in Table IV.

Stored circuit energy serves to increase the period of arc stability, and if the magnetic field extends beyond a contour necessary only for the rupture of a current flowing in a non-inductive circuit also increases arc length and arc voltage. In the above case, if the circuit had been non-inductive, the arc length at rupture and arc duration would have approximated 11.5 in. (45 cm.) and 0.0035 second respectively.

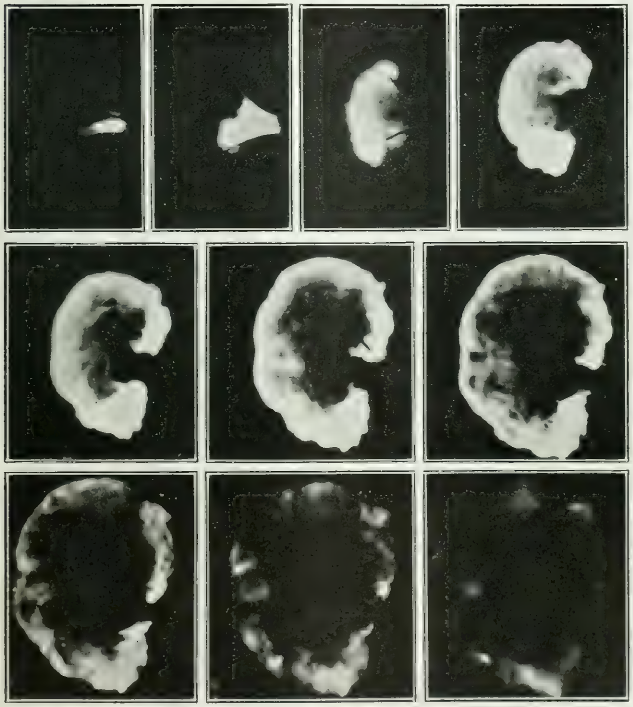


FIG. 6—SEQUENCE OF ARC PHOTOGRAPHS SHOWING CHANGE IN ARC CONTOUR DURING PERIOD OF ARC DEVELOPMENT AND RUPTURE

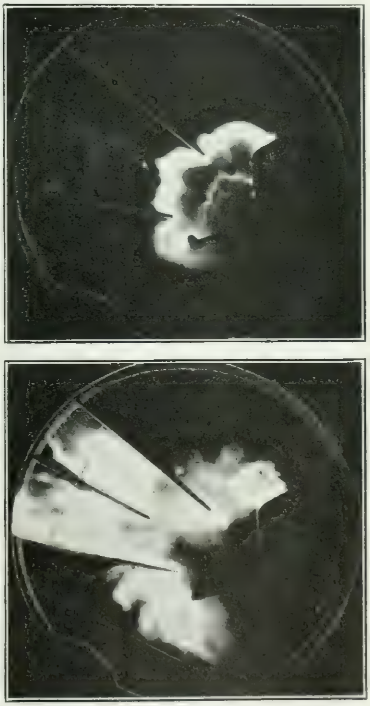


FIG. 7—CONFINEMENT OF A LONG ARC STREAM WITHIN A RELATIVELY SMALL ARC BOX CONTOUR BY THE EMPLOYMENT OF BAFFLES

Switch structures may be designed to give approximately the same arc length at rupture on inductive or non-inductive circuits, although the arc duration will be greater in the former case. If arc duration is the important criterion, the structure may be modified to

TABLE IV—ARC RUPTURE WITH MAGNETIC BLOW-OUT SWITCH

Initial line current, amp	450
Initial line potential, volts	260
Circuit inductance, millihenrys	4
Flux density across path, lines per sq. in. (Blow-out coil in series with line)	9,000
Arc duration, second	0.0048
Maximum voltage across arc	650
Maximum length at rupture, in.	20
Maximum velocity of arc-stream extension, [illegible] per second	10
Average velocity of arc-stream extension, [illegible] per second	2.3

give but slightly greater arc duration on inductive load, with, however, a greatly increased maximum arc length and arc voltage.

Upon obtaining simultaneously arc-contour variation, through the use of the high-speed polar camera, and voltage and current variation, by means of the oscillograph described by J. W. Legg* in the July, 1920, *Journal* of the Institute and the *Electric Journal* for December, 1920, a complete record of arc characteristics for various circuit conditions and air-gap flux densities may be obtained. In Fig. 3 data are shown expressing the relation between initial circuit current and arc volts at rupture per inch of maximum arc length for various total voltages at the instant of rupture. It will be observed that the voltage per unit arc length is asymptotic to approximately 22 volts when employing a magnetic blow-out field to destabilize the arc.

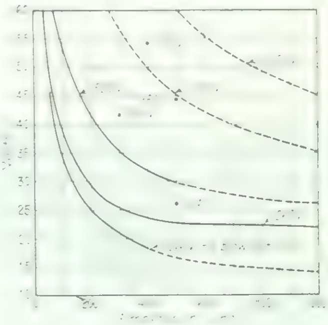


FIG. 7—DATA FROM FIG. 3 REARRANGED TO SHOW APPROXIMATE ARC LENGTH AT RUPTURE FOR DIFFERENT CONDITIONS

Through interpolation and extrapolition of the various data obtained it was possible to construct a family of curves of a practicable degree of accuracy (Fig. 7), showing the relation between length of arc at rupture and line voltage at rupture for various initial line currents. When a non-inductive circuit is interrupted this voltage is equivalent to the initial line voltage, but when an inductive circuit is opened it corresponds to the sum of initial line voltage and the surge voltage produced by the discharge of stored circuit energy.

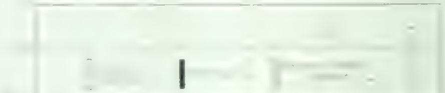
In view of the long arc lengths required to produce instability when interrupting high initial current or voltage, it is common practice to increase the effectiveness of a given flux distribution by inserting baffles or "splitters" in the path of the arc. These serve to distort the stream as well as to assist in its deionization.

Banker's Study Proves Worth of Electrical Utility Securities

THE accompanying chart, prepared by Paisly Brothers & Company of Philadelphia, bankers, is based on a careful study of the development of the electric light and power industry, of its earnings over a long period of years and of the future prospects for the business. In making this study the bankers utilized reports from twenty-three of the larger electrical utilities of the United States, these being the Niagara Falls Power Company, Montana Power Company, Commonwealth Edison Company, Pacific Gas & Electric Company, Potomac Electric Power Company, Southern California Edison Company, Puget Sound Power & Light Company, Consumers' Power Company, Cleveland Electric Illuminating Company, Pennsylvania Water & Power Company, Detroit Edison Company, Consolidated Gas, Electric Light & Power Company of Baltimore, Scranton Electric Company, Public Service Company of Northern Illinois, New York Edison Company, Buffalo General Electric Company, Southern Power Company, Texas Power & Light Company, Northern States Power Company, Public Service Electric Company of New Jersey, Philadelphia Electric Company, Union Electric Light & Power Company, and Edison Electric Illuminating Company of Boston. The chart shows the gross revenue, net revenue and balance after interest payments of these companies for the nine years 1912 to 1920 inclusive.

The figures in the chart show a gain in gross earnings in every year from 1912 to 1920 inclusive. During this period net earnings have shown an increase over the previous year in every year except 1917, in which year there was a decrease in net of $1,210,000. In this connection it is worth noting that two hydro-electric companies and one company 65 per cent of whose capacity is hydro-electric contributed an aggregate decline in net earnings of approximately $1,750,000. From 1912 to 1916 the balance after interest charges shows an annual increase; 1917 and 1918 show a balance somewhat under that for 1916; 1919 a substantial gain, and 1920 a final result approximately equal to that obtained in 1919.

"It is well known," say the bankers, "that in the past five years there has been a very large increase in those items composing the operating expenses of an electric light and power company—that is, in the cost of coal, in the price of materials for repairs, in labor costs, etc. Light and power companies have, however, fared better than other types of public utility companies for two reasons: first, because it has been easier for such companies to obtain increases in rates to offset increasing operating expenses, and, second, because wages constitute a smaller item of operating costs than they do in the case of railways, and electric light and power companies have been largely relieved of this particular burden."



GROSS REVENUE, NET REVENUE AND BALANCE AFTER INTEREST PAYMENTS FOR TWENTY-THREE UTILITIES

There is no form of business which is today in a sounder position than is the electric light and power business, the firm concludes, and well-protected securities of competently managed companies of this class constitute one of the soundest forms of investment.

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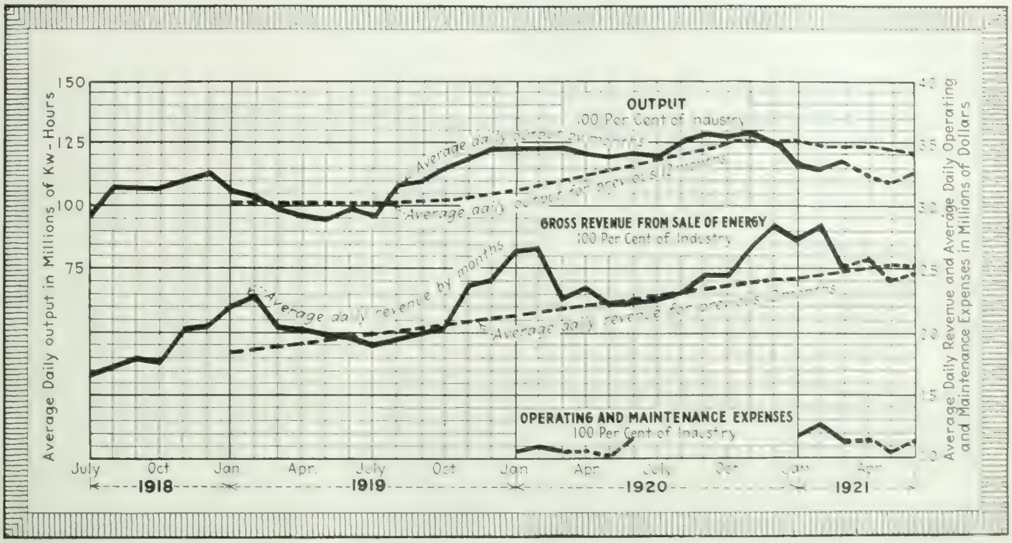
*The author wishes to acknowledge his indebtedness to J. W. Legg for the design and development of the special apparatus employed in this study.

Operating and Maintenance Expenses Materially Decrease



CENTRAL STATION OPERATIONS INCREASE DURING JUNE

REPORTS received by the ELECTRICAL WORLD for the month of June from central generating and distributing companies representing 78 per cent of the installed rating of the country indicate that increased operations were general in every section of the United States. A study of the returns for the past three years would lead to the conclusion that this upward swing in the amount of energy consumed is normal for the month of June. Industrial conditions appear to have remained generally stable during the month, and the increased output of the electric light and power companies is, with but few exceptions, probably due to an increased lighting load.

From an economic viewpoint the figures on revenue and operating expenses are most interesting. A comparison with returns received for June, 1920, indicates that while the total revenue for the month of June of this year increased by about $6,500,000, the operating and maintenance expenses, exclusive of interest, taxes, depreciation and sinking fund, actually decreased to a figure slightly below that reported for June, 1920. Similar relations held true for every section of the country, but were slightly exaggerated in the Atlantic States, where the revenue showed an increase of 15.2 per cent over June of 1920, while the operating expenses increased only 2 per cent during the same period. In January the electric light and power companies of the Atlantic States reported that their revenue for that month had increased by 15.3 per cent over that received for January, 1920, but during the same period their operating and maintenance expenses had also increased by 17.8 per cent. Such figures point in no uncertain way to the manner in which the electric light and power industry is sailing through the trough of general industrial depression left by the receding wave of prosperity. Reports of industrial conditions during June in the various sections of the country indicate that while there was a slight acceleration in some industries, there was

TABLE I—CENTRAL-STATION RETURNS FOR TWELVE MONTHS

	Percentage of Installed Ratings Represented	Kw.-Hr. Output (Companies Reporting)			Percentage of Installed Ratings Represented	Revenue from the Sale of Energy (Companies Reporting)		
		1920 Thousands	1919 Thousands	Per Cent Increase		1920 Thousands	1919 Thousands	Per Cent Increase
July	71	2,677,131	2,234,215	20.0	66	46,608	36,265	28.5
Aug	71	2,769,175	2,303,099	20.1	66	47,410	36,713	29.1
Sept.	71	2,734,179	2,327,460	17.4	66	49,224	38,209	28.5
Oct.	71	2,797,625	2,499,488	11.9	66	51,370	41,055	25.1
Nov	71	2,741,705	2,503,402	9.6	66	54,620	44,711	22.0
Dec.	71	2,792,554	2,648,746	5.4	66	57,697	48,580	18.6
		1921	1920			1921	1920	
Jan	76	2,765,632	2,943,349	-6.0	70	58,855	50,861	15.8
Feb	76	2,453,671	2,711,800	-9.4	70	55,540	48,633	14.3
Mar	77	2,806,609	2,989,581	-6.1	72	55,513	49,071	13.3
April	78*	2,675,949	2,895,067	-7.0	72*	55,326	49,064	12.8
May	78†	2,668,455	2,889,141	-7.7	72†	53,900	47,930	12.6
June	78‡	2,674,693	2,888,449	-7.4	72‡	52,567	47,912	9.8

	Percentage of Installed Ratings Represented	Operating and Maintenance Expenses (Companies reporting)			OPERATING RATIO					
					Steam Plants		Hydro Plants		Combined Systems of Steam and Hydro	
		1921 Thousands of Dollars	1920 Thousands of Dollars	Per Cent Increase	1921	1920	1921	1920	1921	1920
Jan	40	14,562	13,085	11.3	56.1	55.3	26.8	27.0	38.1	45.6
Feb	43	15,085	13,640	10.5	55.6	54.5	22.[illegible]	26.0	44.1	47.3
Mar	53	18,757	17,249	8.7	56.1	57.7	23.4	19.6	40.2	44.8
April	53	17,815	16,641	7.1	53.0	56.[illegible]	23.[illegible]	19.8	41.4	43.3
May	53	17,274	16,727	3.1	55.4	56.8	24.2	22.9	40.6	44.8
June	54	18,665	18,675	0.1	56.2	62.[illegible]	20.4	21.6	45.0	50.9

*Includes estimates for forty-five companies representing 9.4 per cent of the total installed rating of all central stations.

†Includes estimates for fifty companies representing 9.8 per cent of the total installed rating of all central stations.

‡Includes estimates for ninety-six companies representing 18.6 per cent of the total installed rating of all central stations.

TABLE II—CENTRAL-STATION RETURNS BY SECTIONS OVER A TWELVE-MONTH PERIOD

Month	New England States: Percentage of Installed Ratings Represented	New England States: 1920 Thousands	New England States: 1919 Thousands	New England States: Per Cent Increase	Atlantic States: Percentage of Installed Ratings Represented	Atlantic States: 1920 Thousands	Atlantic States: 1919 Thousands	Atlantic States: Per Cent Increase	North Central States: Percentage of Installed Ratings Represented	North Central States: 1920 Thousands	North Central States: 1919 Thousands	North Central States: Per Cent Increase	South Central States: Percentage of Installed Ratings Represented	South Central States: 1920 Thousands	South Central States: 1919 Thousands	South Central States: Per Cent Increase	Pacific and Mountain States: Percentage of Installed Ratings Represented	Pacific and Mountain States: 1920 Thousands	Pacific and Mountain States: 1919 Thousands	Pacific and Mountain States: Per Cent Increase
KW.-HR. OUTPUT																				
July	82	190,668	159,000	20.0	66	881,241	714,485	23.5	74	841,351	702,302	19.7	56	138,937	106,460	30 1	79	614,934	551,959	13.4
Aug.	82	194,028	171,002	13.5	66	905,170	728,097	24 2	74	891,712	750,787	18.6	56	147,082	111,573	32.0	79	631,183	541,640	16 5
Sept.	82	194,730	170,593	14.1	66	905,872	758,737	19.5	74	878,237	758,017	15 9	56	147,524	113,649	30.0	79	607,816	526,464	15.5
Oct.	82	196,310	191,132	2.7	66	964,739	841,694	14.5	74	896,241	817,757	9 5	56	157,267	126,769	24.1	79	583,068	522,136	11 7
Nov.	82	193,231	183,624	5.4	66	953,436	825,011	15.5	74	895,229	861,352	10 5	56	144,889	125,438	15.0	79	554,920	507,977	9 2
Dec.	82	210,494	227,403	-7.4	66	969,909	917,945	5 7	74	903,628	852,264	5.9	56	140,485	133,419	5 3	79	568,038	517,715	9.6
		1921	1920			1921	1920			1921	1920			1921	1920			1921	1920	
Jan.	81	200,269	247,800	-19.2	77	1,003,223	1,043,650	-3.9	73	860,643	956,078	-10.0	62	144,936	145,336	-0.3	81	556,561	550,685	1.1
Feb.	81	178,694	216,890	-17.6	77	902,030	970,539	-7 0	73	789,539	882,873	-10 6	63	131,654	132,537	-0.7	81	451,754	508,961	-11 2
Mar.	81	205,348	230,309	-10 8	79	1,029,120	1,119,428	-8.1	73	894,500	941,893	-5 0	63	139,381	136,017	2 4	81	538,260	561,934	-4.2
April	81	196,680	227,008	-13.3	79	963,659	1,052,716	-8.4	73	828,457	894,028	7 3	63	132,075	135,421	-2.5	88	555,048	586,894	-5.4
May	82	191,141	219,298	-12.8	79	934,971	989,375	-5.5	73	819,506	899,657	-8.9	63	136,573	138,416	-1.3	89	586,264	642,495	-8.7
June	82	191,525	218 646	-12.4	79	941,368	1,004,019	-6 2	73	801,874	891,351	-10.0	63	135,629	134,649	0 8	89	604,297	639,778	-5.5
REVENUE		1920	1919			1920	1919			1920	1919			1920	1919			1920	1919	
July	82	$5,009	$3,802	28 5	65	$16,899	$13,438	25.5	57	$12,822	$9,793	30.9	54	$2,747	$2,194	35.0	79	$9,131	$6,948	31.5
Aug.	82	5,075	4,093	24 0	65	17,210	13,731	25.9	57	13,497	10,151	32.9	54	3,168	2,281	38.1	79	8,460	6.457	31.1
Sept.	82	5,409	4,296	25 9	65	18,081	14,456	24.5	57	13,834	10,522	31.5	54	3,262	2,386	36.5	79	8,638	6.549	32 0
Oct.	82	5,675	4,623	22.7	65	19,201	15,722	22 0	57	14,458	11,667	23 9	54	3,504	2,551	37 3	79	8,532	6.492	31.5
Nov.	82	5,898	5,017	17.5	65	20,938	17,119	22.2	57	15,158	12,561	20 8	54	3,853	2,910	32.4	79	8,775	7,104	23 5
Dec.	82	6,548	5,744	14.0	65	22,332	19,149	16.7	57	16,004	13,142	21 8	54	3,722	3,113	19 8	79	9,091	7,432	22 3
		1921	1920			1921	1920			1921	1920			1921	1920			1921	1920	
Jan.	81	6,379	6,170	3 5	74	22,180	19,225	15 3	59	16,818	14,436	17 3	62	4,155	3,484	19.3	81	9 323	7,546	23 6
Feb.	81	5,925	5,728	3 4	74	21,492	18,327	17 4	59	15,971	14,070	13 6	62	3,915	3,329	17 6	81	8,237	7,179	14 7
Mar.	81	5,784	5,566	3 8	76	21,822	18,934	15 3	59	15,853	14,103	12 4	63	3,747	3,246	15 5	81	8,307	7,222	15 0
April	81	5,665	5,554	2 0	76	21,504	18,609	15 8	60	15,506	13,822	12 2	63	3,744	3,312	13 2	88	8,817	7,767	13 6
May	82	5,362	5,342	0 4	76	20,794	17,611	18.1	60	14,866	13,558	9 8	63	3,516	3,179	10 7	89	9,362	8,240	13 7
June	82	5,265	5,366	1 9	76	20,107	17,456	15 2	60	14,507	13,486	7 9	63	3,524	3,171	11 2	89	9,164	8,433	8 7
OPERATING EXPENSES:		1921	1920			1921	1920			1921	1920			1921	1920			1921	1920	
Jan.	34	$1,098	$1,288	-14 7	48	$6,373	$5,411	17.8	28	$3,941	$3,451	14.2	37	$1,015	$905	12.2	54	$2,135	$2,030	5 2
Feb.	35	1,069	1,242	-13.9	53	6,799	5,937	14.5	29	3,958	3,445	14 8	44	1,217	1,053	15 5	55	2,042	1,963	3 9
Mar.	45	1,576	1,651	4 5	59	7,969	7,241	10 0	35	4,570	4,228	8.2	51	1,776	1,514	17.2	79	2,866	2,614	9.7
April	45	1,418	1,479	4 1	59	7,590	7,168	5 9	36	4,347	4,112	5.7	51	1,567	1,403	11.6	79	2,393	2,479	16.8
May	48	1,548	1,577	1 8	56	6,921	6,660	4.0	37	4,274	4,292	-0.4	52	1,563	1,486	5 2	81	2,969	2,713	9 5
June	46	1,696	1,779	4 7	56	6,933	6 804	2 0	39	4,772	5,102	6 4	60	1,786	1,656	7 9	83	3,478	3,334	4 3

a corresponding further curtailment in others, resulting in almost a dead level, on an average, in the industrial load of the central generating stations. In New England textile mills showed decided increased activity during June, woolen and worsted mills operating at nearly normal and cotton mills at about 75 per cent capacity. The shoe industry also reported increased activity. Opposing this increased energy consumption was a material decrease in operations in the paper industry, due to strikes, and further production curtailment in the metal industries. It is probable that as a whole the industrial load of the electric light and power companies of New England was nearly stable, and that the slight increase in average daily energy consumption in that section may be attributed almost entirely to an increased lighting load.

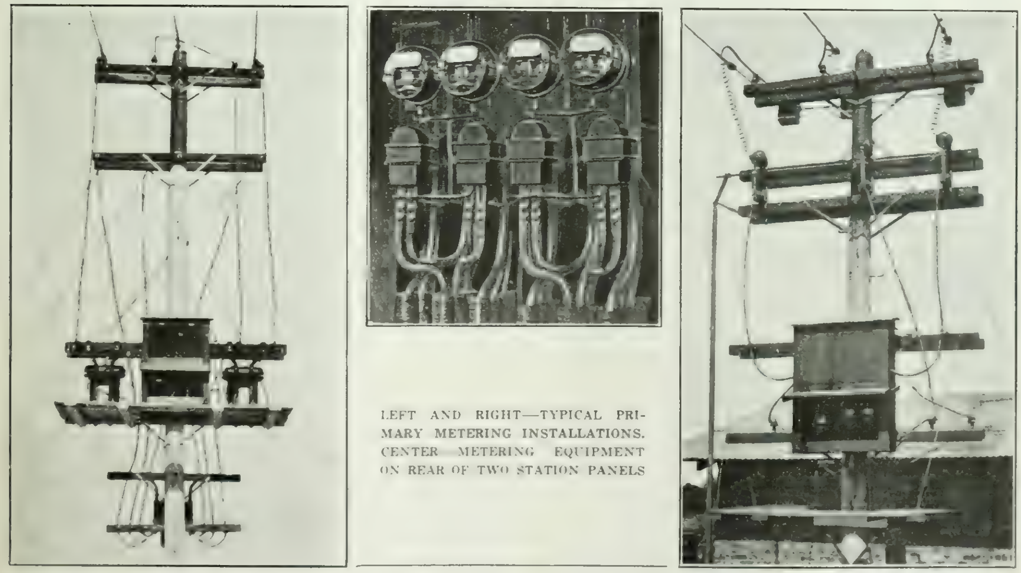
The iron and steel industry of the Middle Atlantic States reported a greater depression during June than has been experienced in many years. Steel mills in the Pittsburgh district were operating at about 20 per cent of capacity, or 15 per cent below the average rate for the first six months of the year, and steel plants in the lake region of this section were operating only at from 10 to 20 per cent of capacity. On the other hand, the textile mills of the South Atlantic States increased operations from 1 to 6 per cent over May, despite serious strikes in some of the larger mills. It appears from the returns that the energy requirements of these

TABLE III—AGGREGATE OPERATING RATIO OF COMPANIES REPORTING DATA MONTHLY TO THE "ELECTRICAL WORLD"

Type of Generating Plant and Month	New England States				Atlantic States				North Central States				South Central States				Mountain and Pacific States			
			Average for Year				Average for Year				Average for Year				Average for Year				Average for Year	
	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920
Steam Plants:																				
January	54 0	60 8	54 0	60 8	53 5	50 9	53.5	50 9	61.2	61 8	61.2	61.8	53 1	53 7	53.1	53.7	69 0	60.5	69.0	60 5
February	54 3	59 5	54 2	60.3	52 3	53 0	52 7	52 1	63 0	57 9	62.1	59.8	59.1	51.2	56.2	52.3	60 2	60 3	64 3	60 3
March	64 0	70.0	56.7	62.5	54 5	56 7	53.3	53.7	58 4	59 7	60.8	59.8	53 3	50 9	55.0	51.9	68 4	62 5	65 9	61 2
April	59 4	63 5	57.3	62 7	50 9	54.3	52 8	53.8	54 8	61.2	59.3	60.2	54 1	52 8	54.7	52.1	53 7	53 7	61 8	58 6
May	63 2	69.1	58 3	63.8	56 2	58 6	53.4	54 5	54 7	63.3	58 5	60.8	53 3	56 0	54 4	53.0	55 0	57 0	59 9	58 3
June	60 1	71 2	58 7	64 9	55 8	59 5	53.8	55.3	56 6	68 3	58 3	61 8	55 3	60 0	54 6	53 8	53 4	56 2	58 6	57 8
Hydro Plants																				
January	26 5	35.2	26 5	35.2	21 2	21 2	21.2	21.2	25 0	20 8	25.0	20.8	26 4	20 1	26.4	20.1	27 5	27 3	27 5	27 3
February	30 1	46 5	26 8	35.6	20.1	20 6	20 7	20.9	24 1	20 6	24.6	20.6	28 6	21.4	27.4	20 5	23 9	27 0	26 0	27 6
March	29 9	30 0	26 9	35 3	21 0	20 6	20 8	20 8	23 0	20 6	23 5	20 6	30 4	23 2	28.4	21.3	24 9	19 0	25.8	25.6
April	24 6	34 7	26 5	35 2	18 2	18 8	20 2	20 3	24 8	20 8	24.2	20 7	22 4	25 0	26.8	21.2	27 3	19 2	26 0	24 2
May	26.5	25 6	26 5	34.3	15.5	17.4	19 2	19 7	21.5	20 1	22.5	20.5	27 9	21 2	27 1	21 2	29 8	22 9	26 6	24 0
June	29 2	21 5	26 6	33 8	17 6	18 8	19 0	19 6	21 1	19 5	22 8	20 2	27 3	18 3	27 1	20 7	30 3	27 4	27 6	24 2
Combined Systems of Steam and Hydro Plants																				
January	45 3	53 5	45 3	53 5	43 5	45 8	43 5	45 8	39 5	38 6	39 5	38 6	38 6	46 6	38.6	45 6	35 2	45 6	35 2	45 5
February	44 3	60 0	44.7	58 8	41 8	41 9	42.6	43.8	42 4	49 8	41.9	48 2	41 7	39 6	40 5	42 0	39.6	43 8	37 4	44.7
March	49.7	53.8	47.3	56.0	39 7	47 3	42 0	45 3	41 3	46 0	41.8	47.3	38 6	39 2	40 2	41 2	36 4	39 7	36 9	43 0
April	46 6	48 5	47.1	53 5	42 9	43 9	41 9	44 8	45 0	48 3	42 7	47 5	43 6	48 6	40 7	42 8	37 0	36 8	37.0	41.0
May	49 2	48 5	47.6	52.3	39 8	44 2	41.4	44 7	47 0	52 8	43 7	48 8	40 7	39.6	40 6	42 2	35 0	38 3	36 4	40 3
June	58 5	56 3	49 6	53 2	42 3	45 8	41 6	44 9	50 1	62 2	45 0	51 6	45 1	44 8	41 3	42 7	38 8	44 3	37 0	41 1

two major central-station customers about offset each other. Similarly the slightly increased energy requirements of the lumber industry were offset by a further curtailment in the shipbuilding industry. It appears probable, therefore, that the industrial load of the Atlantic States as a whole was about on a level with that reported for May, and that the slight increase in average daily output by the electric light and power companies of this section was the result of an increased lighting load throughout the section.

Industrial operations in the North Central States were virtually on a par with those during May. A slight decrease was reported by the iron and steel industry, and the automobile plants as a whole decreased operations by about 5 per cent under those reported for May. Activity in the copper-mining regions remained almost entirely suspended and the iron mines were operating on only part time. The textile industry was the only primary industry in this section which appears to have called for additional electrical energy, but a slight increase in the lighting load was also probable. The sum total of these various loads was that the electrical energy sold by the central generating companies of the North Central States was slightly in excess of that sold during May.



LEFT AND RIGHT—TYPICAL PRIMARY METERING INSTALLATIONS. CENTER METERING EQUIPMENT ON REAR OF TWO STATION PANELS

In spite of a cut in the iron and steel production in the Birmingham district and a material curtailment in crude-oil production, the average daily energy output in the South Central States was about 160,000 kw.-hr. in excess of that reported for May.

Operations in the mining sections of the Mountain States were still at a low ebb during June, the active mines operating on part time only. In the South Pacific section industrial operations appeared to be more nearly normal than during May, and almost every electric light and power company in that section reported increased energy requirements over those of May. In the Pacific Northwest the lumber industry reported increased activity, but other industries in that section were operating at about the same level as during May. The industrial load as a whole and the lighting load were slightly increased in the Mountain-Pacific States during June, resulting in an average daily output by the central generating stations of the section of about 1,400,000 kw.-hr. in excess of that reported for May.

Improving Load Power Factor by Premium and Penalty

Discounts Are Allowed When Power Factor Is in Excess of 80 per Cent and Penalties Are Imposed for Lower Values—Methods of Measuring

BY LYNDON R. WILSON
Meter Engineer the Tucson Gas, Electric Light & Power Company
Tucson, Ariz.

PERHAPS no other problem has been thrust before the eyes of the central station industry lately in such a forceful manner as has the much-discussed question of dealing with the low-power-factor consumer. Its effects are felt by the majority of stations, both large and small, in a very decided manner, and probably in a manner far more serious than is actually realized by the average small station.

The latest definition of polyphase power factor may fill a much-needed vacancy, but how about measuring it? Shall one use the momentary power factor at the time of maximum demand as a basis, or should equipment be installed so that the power factor is integrated over a given period, thus giving the average power factor? Shall a penalty and premium be placed on loads below and above a certain power factor used as a basis? If so, what shall that basis be and what shall the penalty and premium be? Shall the rendered bill be figured on the reading of the watt-hour meter and a credit or penalty be taken care of as a cash discount or addition, or shall the indicated kilowatt-hour be altered

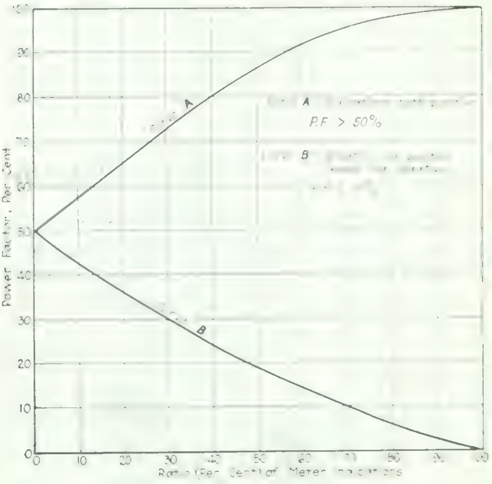
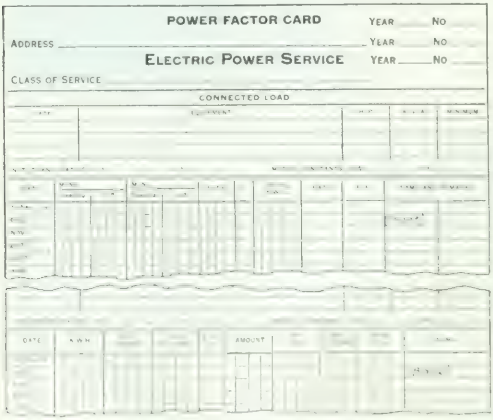


CHART FOR DETERMINING POWER FACTOR FROM INDICATIONS OF TWO SINGLE-PHASE WATT-HOUR METERS

to an approximation of the kilovolt-ampere-hour by the use of a multiplier dependent upon the power factor? In other words, the problem of dealing with power factor is a complicated one and simmers down to the available methods of metering.

If the load is balanced, then the metering becomes simple, for two single-phase watt-hour meters properly connected will register both the actual kilowatt-hours and the average power factor. The sum of their readings gives the kilowatt-hours, while from the ratio of their readings the average power factor can be readily determined.

After a somewhat detailed study of local conditions it has been found that most of the large loads are very well balanced, consisting largely of three-phase transformers and motors. For these loads it has therefore been decided to use two single-phase meters, with perhaps a polyphase meter as a check. On the loads which are not balanced two polyphase meters must be employed, one for measuring the active component while the other registers the reactive component. These, however, are in the minority.

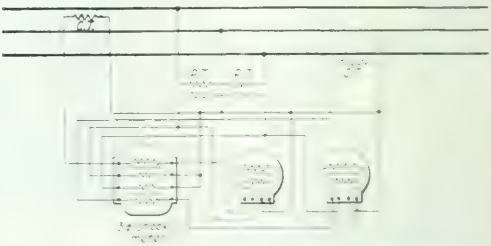

POWER FACTOR CARD
YEAR ____ NO ____
ADDRESS ____ YEAR ____ NO ____
ELECTRIC POWER SERVICE
YEAR ____ NO ____
CLASS OF SERVICE ____
CONNECTED LOAD
DATE
K.W.H.
AMOUNT

FRONT AND BACK OF PRIMARY SERVICE AND POWER FACTOR RECORD

To establish an incentive for improving power factor, it has been decided to demand an average power factor of 80 per cent, and if the power factor of any load is above this base value a discount is allowed amounting to 1 per cent of the bill for each 1 per cent that the power factor is above 80 per cent. For lower power factors a penalty of the same percentage is charged. Despite the fact that considerable opposition appears to have arisen to the discount allowance for power factors above the basic figure, it seems to the writer that such a method is the only really effective one to be used in approaching the average consumer of power.

If a few of the larger patrons find that they can secure an 8 or a 10 per cent discount on their power bills there is probably no better incentive for them to so alter their equipment or make whatever changes are necessary that their power factor may run around 90 per cent. A few such customers with such a power factor will result in a far greater benefit to the plant capacity than a much larger number of 80 per cent customers. In other words, the discount allowed for the high power factor will more than be annulled in added station capacity and, hence, in returns.

The solution of the power factor problem was carried still further in the case of the local company by the establishment of a new service record card devised to care especially for primary power consumers. A reproduction of the card is shown herewith. The card is similar to all other electric-service cards, with the exception that the two sides of the card are not alike. On the front are the two meter readings (the card being designed for two single-phase meters) from which the total kilowatt-hours is derived. By computing the ratio of the readings of the two meters and referring to the power factor curve, the average power factor for that month is an easy matter to determine. The total kilowatt-hours is carried over to the reverse side of the card and the gross bill figured; if the customer is under the primary power rate the customary discount of 5 per cent is deducted. The percentage penalty or discount is entered in the next column, as developed from the power factor determination on the front of the card. Columns for the surcharge and the total bill complete the card.



TWO SINGLE-PHASE METERS AND CHECKING METER CONNECTED FOR DETERMINING POWER FACTOR

Without the power factor chart or table the calculations would be a tedious process, but by reference to them it becomes only necessary to determine the ratio of the lesser meter reading to that of the greater.

Both the table and chart are developed from the formula:

$$\cos\theta = \cos\left[\tan^{-1}\left(\sqrt{3}\,\frac{P_1 - P_2}{P_1 + P_2}\right)\right]$$

where P_1 and P_2 are the kilowatt-hour indications of the two meters.

In cases where the load is not balanced and it becomes necessary to employ active and reactive component meters the ratio of the two, of course, cannot be applied to the chart, since in this case the ratio of the two readings is the tangent of the angle whose cosine is the power factor.

Readers' Views and Comments

This is a readers' forum. Comments on questions before the electrical industry presenting economic, financial, engineering or commercial aspects and new or supplementary viewpoints on published articles are cordially invited

Serious Objections to Dipping Lights to Flash Correct Time

To the Editors of the ELECTRICAL WORLD:

The editorial in the Aug. 6 issue of the ELECTRICAL WORLD on the Uruguayan "time dip" rather understates the benefits to be derived from this interesting but not entirely novel scheme. Flashing the time by a momentary cessation of service, at least in our crude Western communities, would certainly "make every citizen think once every day of the electric light company."

Hearty popular approval may be especially expected from the farmer, turning out to restart his pumps, with the alternative of losing a night's irrigation; from the motion-picture director, retaking a ruined scene; from the night crew at the new dam, digging the rocks out of the gyratory crusher, so that it may be restarted; from the surgeon, performing a delicate operation, as he sews up the results of the slip made in the moment of darkness; from the substation operator, getting the synchronous apparatus under way; from the naval radio station, repeating an interrupted message to Honolulu.

Think of the delightful "panicky kick" in the hotels and theaters, the lively stepping about in the gas works, the "verve" displayed in the cotton mill, and the bright smiles in the Maple Street Presbyterian Church as the organ kicks out during the wedding march and the bride stops en route to set her new jeweled wrist watch, the gift of her rich uncle from Spokane!

Not the least of the benefits will be the nightly test of the surge arrester, the reverse power relay, the undervoltage release, the overspeed trip and the nerves of the inductive interference committee.

And last, but by no means least, observe the central-station manager catching the midnight boat for extraditionless Uruguay, the land of courteous but not always continuous service.

L. M. KLAUBER,
General Superintendent.
San Diego Consolidated Gas & Electric Company,
San Diego, Cal.

Sparking Voltages

To the Editors of the ELECTRICAL WORLD:

I have read with much interest F. W. Peek's letter in your issue of June 18 (page 1427) in which he comments on a paper by the writer on sparking voltages. In that paper I analyzed, by calculating the disruptive stresses, the results of spark voltages given in the "Standardization Rules" of the American Institute of Electrical Engineers, which are in world-wide use. When the potentials of the electrodes are equal and opposite, the results prove in the most convincing way that this calculated disruptive stress has a constant value for a given pair of electrodes. Doubtless many other experimenters have noticed this. F. W. Peek's formula for this stress applies with wonderful accuracy both to his own experiments and to experiments with much smaller electrodes and apparatus carried out in different parts of the world during the last thirty years. We are, therefore, able to predict the spark voltages for any size of electrodes over a wide range provided that they are of equal size and that their potentials are equal and opposite at the instant of discharge.

When we come to the case where one of the electrodes is grounded, the disruptive stress appears to be variable, gradually increasing as the gap widens. If we make the apparently ridiculous assumption that the potentials at the instant of the discharge, instead of being E and zero, are $0.57E$ and $-0.43E$ respectively, then the disruptive stress is constant and Mr. Peek's formula still applies. It is puzzling to see any reason for this. I think that the mathematical formulas for the maximum electric stress can be applied with high accuracy. It is quite possible that the physical conditions in the interspace—the convection currents of electrified air, etc.—are so altered when one electrode is grounded that Mr. Peek's formula needs amendment.

The history of the discovery that for a given pair of electrodes not too close together the maximum disruptive stress at the instant of discharge is constant is instructive. The experiments made by William Thomson (Kelvin) in 1860 led him to prophesy that the disruptive stress would be found to be constant provided that the electrodes were not too close together. Later experiments by many physicists did not support this view. Schuster in a paper in the London *Philosophical Magazine* in 1890 showed that it was only a rough approximation. He, however, merely considered the case when the potentials of the spheres were E and zero. For the next fifteen years it was orthodox—at least in England—to think that the disruptive voltage was only slightly governed by the maximum electric stress. In a paper to the London Physical Society in 1905 in which the complete formulas were used the writer proved that in the case of 2-in. spheres the results obtained by different experimenters—notably by Steinmetz—made the disruptive stress constant over a very wide range. He somewhat hastily concluded that it would be found to be constant for spheres of all sizes. Further analysis of experimental results soon showed that the disruptive stress depends on the size of the electrodes.

In a further paper to the London Physical Society, read in 1910, on the stress at which ionization begins in air, the writer was led by the analogy of the corresponding thermal problem of the convection of heat from cylinders and spheres to conclude that the maximum electric stress would be given by an algebraical expression of the form $A + (B \div \sqrt{R})$, where A and B are constants and R is the radius of the cylindrical or spherical electrode. Applying this crude theory, he found that $32 + (9.5 \div \sqrt{R})$ gave all J. B. Whitehead's experimental results for a cylindrical wire (July, 1910) with a maximum inaccuracy of about 1 per cent. He failed, however, to make it agree with Kowalski and Rappel's experiments on spherical electrodes, which had then just been published. Later on Mr. Peek published the true formulas.

It will be seen that the ordinary electrostatic theory is only a help toward the solution of the problem. The disruptive stress, although constant for a given pair of electrodes, yet depends on their size, and simple theory no longer suffices. We have to consider the evaporation of the high-pressure electricity that takes places at the electrodes. It may well happen that the effects produced by evaporation of electricity from the insulated sphere only when the other is grounded may be appreciably different from the case where electricity is evaporating from both. Before accepting this, however, the writer wants to find out whether there is any explanation of why the spheres in the American experiments when one was grounded acted as if their potentials were $0.57E$ and $-0.43E$ respectively.

Having had experience in the use of an absolute high-pressure voltmeter in which the voltages are measured directly by the attractions between two electrified spheres, the writer has verified that these attractions depend on the absolute values of the potentials and are in strict accordance with electrostatic theory, although no special precautions are taken to keep the spheres at a great distance from neighboring objects. He is, therefore, loath to give up his belief that the maximum value of the stress is the governing factor which causes a disruptive discharge. Careful experimental results made with unequal spherical electrodes would probably settle the question. ALEXANDER RUSSELL.

Faraday House, London, England.

A Way to Eliminate Mystery of Watt-Hour-Meter Reading to Customer

To the Editors of the ELECTRICAL WORLD:

The dial indication of electric watt-hour meters was recently criticised quite severely by Harford Powel, Jr., Editor *Collier's Weekly*, and it appears that his point is well taken. The railroad timetable has nothing on our modern watt-hour meter when the average customer tries to read it.

Of course, central-station men try to educate their customers and instruct them in the correct reading of a meter, but how many of them ever learn well enough to be sure of themselves when they do attempt to read it? How many of our meter readers, in fact, are proof against errors in reading? Take a look at a meter with all four pointers on the 9's. How long does it take an experienced man to figure out what the meter actually reads? This test should be sufficient to illustrate that the meter reading is as much a mystery to customers as the cost mark on Chinese furniture.

The present trend in relations with the public is to invite the confidence of the customer. Stock is sold to him on easy payments, and he is invited to attend stockholders' meetings and to share in whatever earnings the company is able to make. Clerks are trained to make "friend customer" feel at home when he comes to the office and to let him know that his troubles are the company's troubles and that the company is just as anxious to give him a square deal as he is to get one. And yet we sell him appliances marked in watts, set up a meter marked in volts and amperes, take a look at the four dials which appear "out of joint" to him, and send him a bill for kilowatts!

Now, if it is impracticable to give the customer a meter reading directly in dollars and cents, we can at least give him a meter on which he can read the number of kilowatts used. Wouldn't he feel a lot better about it if the face of his meter were somewhat similar to the odometer on his car, for instance, with a regular register moving up from month to month and an additional "trip" register which could be set back at any time he might see fit?

The gas-meter people tried this once, but unfortunately chose an unreliable mechanism, and so they abandoned the whole idea. With the accurate and sensitive register mechanisms on the market today, why cannot our watt-hour meters be equipped with registers of this sort so that a customer can read his meter at a glance and know what it is doing? R. E. THOMPSON.

Deming Ice & Electric Company,
Deming, N. M.

Cost of Producing Power Low at Station of Springfield (Mass.) Company

To the Editors of the ELECTRICAL WORLD:

Since reading Mr. Sargent's article on page 216 in the July 30 issue of the ELECTRICAL WORLD we have selected at random a log sheet showing operating performance of our steam plant. The data presented prompt us to venture the opinion that the results we are obtaining average up well with efficiencies as shown by reports from other places. L. T. SCOTT,
United Electric Light Company, Manager.
Springfield, Mass.

LOG SHEET OF STEAM PLANT OF THE UNITED ELECTRIC LIGHT COMPANY

[illegible] 1921

Boiler hours in service	[illegible]
Banked boiler hours	27
Pounds of [illegible] weighed [illegible]	[illegible]
Pounds of water weighed in	5,020,000
Station output	265,000
Pounds of coal burned	510,391
Pounds of coal per kilowatt-hour	1 92
Pounds of water per pound of coal	9 83
Pounds of water per kilowatt-hour	18 94
Kilowatts per boiler-hour	2,431
Graphite used	[illegible]
Alum used	[illegible]

Palestine Being Electrified

To the Editors of the ELECTRICAL WORLD:

The development of the Holy Land is progressing considerably under the British administration, hydro-electric projects being reported on the Jarkon and Jordan Rivers. The one on the Jarkon River, in the region of Audscha, will be connected with a steam generating plant at Tel-Awiw for supplying domestic and industrial needs such as railway shops and irrigation loads. The plant on the Jordan will be rated at 30,000 hp.

It may interest ELECTRICAL WORLD readers to know that considerable American capital is being invested in enterprises in Palestine. HENRY L. GEISSEL.

Beaurivage, Thoune, Switzerland.

Industrial and Station Practice

Installation, Operation and Maintenance of
Generating and Distribution Equipment and Economical Utilization of Electrical Energy
in Mills and Factories, Including Testing and Repair Methods

Steam-Flow Meters Show When Boilers Are Not Used Economically

A RECORDING steam-flow meter will help greatly in operating boilers at a certain percentage of their rated capacity in order to obtain the greatest efficiency. A boiler may be dirty, have a leaky setting, poor draft or a variety of other ills that may prevent its being worked to capacity. The steam-flow meter will show if this is the case. The following example serves to illustrate the usefulness of such a meter. It was found that the midnight-to-morning load of a certain central station should be carried on two boilers to obtain the most efficient results. Orders were therefore given the night chief to drop the boilers out gradually during the night as the load dropped off until the minimum of two boilers was reached. Apparently this was being done. Some time later, however, it was decided for various reasons to install steam-flow meters on all the boilers. After these meters had been in service a sufficient time to be adjusted and have dependence put on them it was immediately noticeable that the order was not being carried out. This gave rise to the suspicion that it never had been carried out faithfully. From the late night readings on the steam-flow charts it was easily seen that more than two boilers were in use all night. The chart of one boiler which was used all night did not show any noticeable rise in load in the late hours, when only two boilers should have been carrying the load.

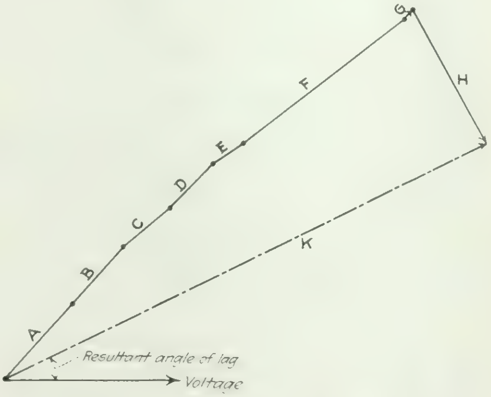
E. G. RALSTON,
Chief Electrical Engineer.
Indianapolis Light & Heat Company,
Indianapolis, Ind.

Analysis of Motor Load in 400-Ton Cyaniding Plant

A STUDY of the load requirements of a silver cyaniding plant that had originally been designed for 200 tons per day and gradually been increased to 400 tons per day revealed the fact that with twice the capacity the number of installed motors and the power required has not increased in proportion. This would seem to indicate that the mill was originally overmotored. However, a study of each individual drive showed that under wide variations of mill output the power required by some machines varied but little.

This mill, which is located at a large silver mine in Honduras, has been in operation for ten years. It is supplied with power from two hydro-electric plants and all motors of 15 hp. and over are operated on 2,200 volts. For the smaller motors and lights transformers are provided to give 110-volt service. The table on page 472 gives a list of the motors in use and follows the different stages of ore treatment in regular order. In a mill of this type the motor loads are quite steady, the mill load factor being quite high in consequence.

The two gyratory crushers at the head of the mill were originally each driven by a 25-hp. motor. Several years ago it became desirable to install a motor of the same size elsewhere about the plant. It was decided to run both crushers on one of the motors as the average load on each was barely 8 hp. A countershaft was accordingly installed and one motor belted to it has given satisfactory operation since. This is the only instance in the entire mill where there appeared to be a case of overmotoring.



POWER FACTOR IN 400-TON CYANIDE MILL REDUCED BY SYNCHRONOUS MOTOR DRIVING STAMPS

The power required for the stamps, of which there are twenty, weighing 1,850 lb. each, is not affected by the amount of ore put through them in a day, provided their speed is not changed. The quantity that can be crushed is dependent on the fineness to which it is desirable to crush the ore, but this is a purely metallurgical problem. The two synchronous motors used in this drive, one of which is for reserve, were originally alternators in an old plant. Their use for the stamp-battery drive has resulted in a great improvement in the mill power factor, as shown in the accompanying curves.

LINES SHOW CURRENTS TAKEN BY VARIOUS MOTORS

Letter	Motor	Amperes	Power Factor, Lag
A	Precipitation pump motors, shop [illegible] motors	28	0.65
B	Rich-solution pumps	21	0.65
C	Compressor	17	0.76
D	Solution pump	17	0.68
E	Compressor for agitation and lights	10	0.84
F	Three tube mill motors	57	0.78
G	Crusher	[illegible]	[illegible]
H	Synchronous motor for stamping	43	[illegible]

The four classifiers were originally all the 4½-ft. size. With the introduction of two 6½-ft. classifiers to replace two of the old ones a 3-hp. motor had to be installed in place of one of the 2-hp. motors, an increase of 1 hp. The three tube mills are carrying 400 tons per day with less load on the motors than when 200 tons was the output. A tube mill well loaded with pebbles and stems takes less power in general when once running than a lightly loaded one. In starting, of course, the torque required is greater, but the 75-hp. slip-ring induction motors, originally installed, have proved entirely satisfactory.

A 25-hp. motor was installed for the small compressor which was found necessary to aid the agitation compressor when the number of Pachuca tanks was increased. This motor also drives the four thickeners, of which there were at first only three, run by a 2-hp. motor.

It was found necessary to augment the three Aldrich triplex solution pumps with an additional unit, as the amount of cyanide solution carried was increased. A Cameron centrifugal pump being available, it was belted to a 20-hp. spare motor. These pumps serve to pump the overflow solution from the thickeners back to the top of the circuit, where it is used again in the stamps and tube mills. One of the Aldrich triplex pumps, No. 2, has a float switch to control the motor, an automatic panel being provided to start and stop the motor as the solution in the overflow tank varies.

Air agitation in the Pachuca tanks is taken care of by an Ingersoll-Rand compressor of the Imperial type driven by a 75-hp. motor. When the number of tanks was increased from six to eight it was found necessary to install an additional compressor. This is driven by a 25-hp. motor mentioned before. Following the Pachuca tanks are two mechanically agitated tanks driven by a 15-hp. motor and a storage tank driven by a 1-hp. motor. In this latter the movement of the rakes is very slow and only serves to prevent the slimes from settling to the bottom of the tank.

After leaving the filter presses, the rich solution is pumped up to the zinc house by the rich-solution pumps. When the mill was first built one of the Aldrich triplex pumps operating continuously and one intermittently were enough to take care of the load. One pump was then available as a spare. As the mill output increased it was found necessary to operate two pumps continuously and one intermittently.

The Crowe or vacuum process is a recent innovation at the mill and serves to reduce the amount of zinc dust necessary to precipitate the silver in the rich solution. A 3-hp. motor pumps the solution into a tank and the 2-hp. motor, belted to a vacuum pump, exhausts the air from the tank. After the zinc dust is introduced, three triplex pumps, called the precipitation pumps, send the precipitated material through five small presses, from which the precipitate is removed, dried in electric ovens and refined and cast into bars. Two ½-hp. motors are used for the blowers on the oil-fired furnaces. The 5-hp. motor in the slag house, belted to a small slag crusher, ball mill and Wilfley table, is only used several days a month.

INSTALLED MOTORS IN 400-TON CYANIDE MILL AND AVERAGE LOADS

Service	Machines Driven		Rated Hp. of Motor	Ave. Load, Hp.	Speed	Drive	Remarks
Crushers	2 A. C. Gates gyratory crushers, style K ..	No. 4	25	11	1,200	Belt	
Stamps	20 1,850-lb. stamps		200	110	600	Belt............	Synchronous motor
			150	...	720	Belt............	Synchronous motor, spare
			35	...	600	Belt............	Starting motor
Classifiers	2 6-ft. Dorr classifiers		3	3	1,200	Belt	
	2 4½-ft. Dorr classifiers................		2	2	1,200	Belt	
Tube mills.........	3 5 ft.x22-ft. A.C. El Oro tube mills.	No. 1	75	75	600	Flexible coupling	
		No. 2	75	75	600	Flexible coupling	
		No. 3	75	75	600	Flexible coupling	
Elevator	Pebble elevator.................... . .		2	2	1,200	Belt	
Thickeners	4 10 ft.x35-ft. Dorr thickeners............						
	1 Small compressor for agitation....... ..		25	20	600	Belt	
Solution pumps	3 Aldrich triplex pumps.................	No. 1	25	25	900	Flexible coupling	Pump: Size 10 in.x10 in., 115-ft. head
		No. 2	25	20	900	Flexible coupling	Size 10 in.x10 in., 115-ft. head
		No. 3	15	15	900	Geared.........	Size 6 in.x9 in., 115-ft. head
	1 Cameron centrifugal pump............		20	18	900	Belt............	115-ft. head
Agitators	I-R compressor, Imperial type..........		75	65	720	Belt	For 8-15x45-ft. Pachuca tanks
	2 Agitating tanks 10 ft.x35 ft		15	15	900	Belt	
	1 Storage tank 10 ft.x35 ft.		1	1	1,200	Belt	
Presses	2 90-Frame Merrill presses........... ..		3	...	900	Belt............	Used only occasionally
Rich-solution pumps	3 Aldrich triplex pumps	No. 1	35	30	900	Geared.........	Pump: Size 6 in.x9 in., 314-ft. head
		No. 2	20	20	900	Geared.........	Size 5 in.x6 in., 314-ft. head
		No. 3	20	10	900	Geared.........	Size 5 in.x6 in., 314-ft. head
Crowe process	1 Centrifugal pump		3	3	1,800	Belt	
	1 Vacuum pump......................		2	2	1,200	Belt	
Precipitation.......	3 Aldrich triplex pumps................	No. 1	20	20	900	Geared.........	Pump: Size 5 in.x6 in.
		No. 2	15	15	900	Geared	Size 6 in.x9 in. Low pressure
		No. 3	20	5	900	Geared.........	Size 5 in.x6 in.
	Zinc mixer..............................		½	...	1,200	Belt............	Used only a few hours daily
Refinery...........	Blowers on furnaces....................	No. 1	½	...	3,600	Direct..........	
		No. 2	½	...	3,600	Direct..........	
	3 Electric precipitate-drying ovens—equivalent			25			
Slag house	Crusher, ball mill and Wilfley table		5		720	Belt	Used only several days per month
Totals.........			987½	662	Number of motors.. .. 31		

It will be seen that, aside from utilizing two spare pumps and installing an additional one, very little extra motor load was connected in as the mill production increased. True, all machines were operated more hours per day with the result that the average mill load has increased from approximately 400 kw. in 1913 to 500 kw. in 1921. With an output more than doubled (the mill has averaged in excess of 400 tons per day recently) the average power consumed has increased but 25 per cent. The power consumption of nearly 30 kw.-hr. per ton of ore milled compares favorably with that of other mills of this type and size.

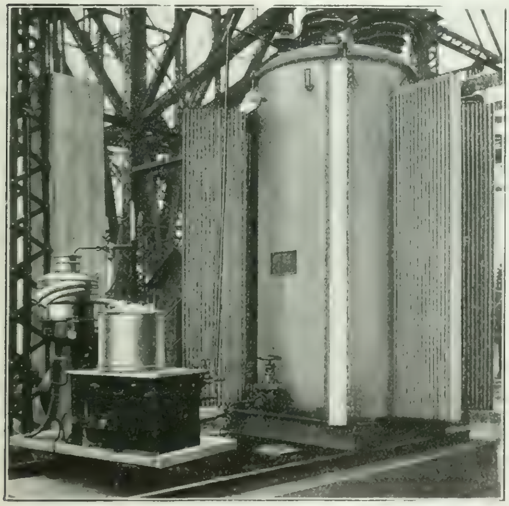
The discrepancy between the load shown by the table and the power-factor curves is due to the fact that the latter cover the whole mill substation load, which includes the shops, laboratory, sawmill and lights.

Frederick Krug.
New York & Honduras Rosario Mining Company,
San Juancito, Honduras, C. A.

Dehydration of Transil Oils by Centrifugal Force

SUCCESSFUL operation in many central stations of centrifugal oil purifiers to remove water and dirt from used lubricating oil has resulted in the manufacture of these machines for dehydrating transformer oil. This centrifugal purifier is guaranteed to deliver an oil having a dielectric strength of at least 40 kv. (old-style test cup) or 22 kv. (new-style test cup). Although this is the guaranteed performance of the machine it has been found in service that the oil passed through it will consistently test considerably higher, some individual tests running as high as 55,000 volts (old-style cup).

In the operation of the centrifugal oil purifier the oil is drawn from the bottom of the transformer and is pumped through an electric heater to the top of the purifier. Moisture and other impurities are removed in the bowl of the machine by centrifugal force, and the pure oil delivered from the outlet is pumped back into the top of the transformer. The pumps which are necessary to handle this oil, as well as the electric heater which is used to increase its fluidity, are provided as a part of the portable outfit described later on.



CENTRIFUGAL OIL PURIFIER RAISED BREAKDOWN VOLTAGE FROM 13 KV. TO 25 KV. IN 145 MINUTES

As an example of the performance of this machine it is interesting to note the results obtained in a recent test at the Central Hudson Gas & Electric Company's plant, Poughkeepsie, N. Y., on a 1,500-kva. transformer holding 1,200 gal. of oil. The installation of the machine for this test is shown in the accompanying illustration. The oil in this transformer tested at 13,000 volts, using the new standard gap. As soon as circulation of the oil was started the oil from the machine delivered to the top of the transformer tested consistently at 25,000 volts. Circulation was continued for two hours and twenty-five minutes at the rate of 375 gal. per hour. At the end of this time oil from the bottom of the transformer could not be broken down at 25,000 volts even though the potential was maintained in the test cup for periods of longer than five minutes at a time.

Although the character of the oil does not affect the thoroughness of dehydration, it does affect to some degree the capacity of the machine in that burned or emulsified oil should be run at a lower rate. On ordinary oil which has not become burned or emulsified a capacity of 300 gal. per hour can be obtained from the large-size machine. A smaller-size machine is made which gives a normal capacity of 100 gal. per hour. Under normal conditions the machine will dehydrate from 2,000 gal. to 3,000 gal. of oil before it becomes necessary to clean the bowl.

This purifier can be installed for stationary service or mounted on a truck containing all the necessary auxiliary equipment connected up for immediate use. To purify the oil in the transformer it is only necesary to make two pipe connections and one electrical connection. Short lengths of flexible hose are employed to make pipe connections to and from the transformer. The same machine can be used also for cleaning up batches of lubricating oil.

The general construction of the machine is similar to that of the centrifugal apparatus used to purify lubricating oil. Under ordinary conditions of service the machine is used as a clarifier only, discharging pure oil, and all the moisture and sediment are retained in the bowl.

Where the oil is emulsified or a large amount of free water is present, the substitution of a part in the bowl converts the machine into a purifier or separator which permits both water and pure oil to be discharged through separate spouts. The sediment in either case is retained in the bowl. When either of these types of bowls is used, however, there is an extra cover on the machine, known as the overflow cover. In case the bowl of the machine becomes clogged or the amount of oil fed into it is greater than it can properly handle, the oil is discharged from this spout. This construction eliminates all chance of having to put the entire contents of the transformer through the machine again because of wet oil becoming mixed with that which has been dehydrated.

C. H. HAPGOOD,
Engineering Department.
De Laval Separator Co.,
New York, N. Y.

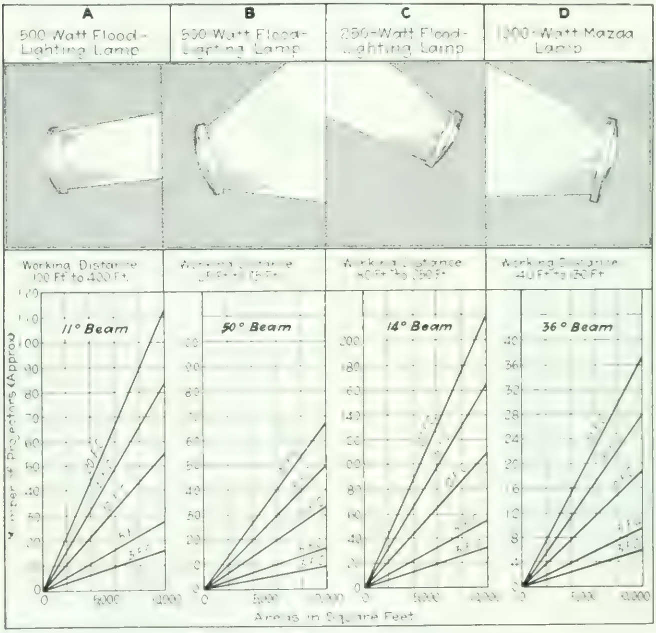
Selecting Lamps for Flood-Lighting

BEST results in flood-lighting depend mainly on selecting the correct number of lighting units and the correct type of projector. To demonstrate how the proper choice may be made, the curves and tables reproduced herewith will prove helpful. These show the four common types of flood-lighting units made by one manufacturer. The different types of lamps have beams which diverge at different angles, the smallest being 11 deg. and the largest 50 deg. The first two units come regularly equipped with 500-watt lamps, the third unit with a 250-watt lamp and the last unit with a 1,000-watt lamp. For each type there is a chart which tells how many projectors will be required to illuminate a certain area in square feet to a certain foot-candle intensity.

As an example to explain the method of using the charts, suppose that it is desired to flood-light an area of 40 ft. x 100 ft. (4,000 sq.ft.) located in the residential section of a town and that the surface is medium dark in color and flood-lights can be placed at a distance of 25 ft. Referring to the line just under the drawings of the lamp, it is seen that the lamp suitable for 25 ft. distance is the projector *B*. From the table of intensities for flood-lighting it is noted that for lighting medium-colored buildings in a residential section 10 foot-candles is the necessary intensity. Referring then to the chart underneath lamp *B* and to the 10 foot-candle curve upon this chart, it is found that for 4,000 sq.ft., approximately thirteen projectors will be necessary to furnish the proper illumination. Other problems may be worked in a similar manner.

In using the chart the angle between the axis of the beam and the lighted surface must not be less than 70 deg. The working distances are given for convenience in selecting the proper projectors. Local conditions may sometimes require a change. It must be noted that in some cases more than one type of projector might be used for the same purpose. For instance, if the working distance were 100 ft. type *A*, *C* or *D* might be used. Local conditions will determine which unit is best such as the width of the surface to be illuminated, etc. It must also be remembered that the lamps of higher wattage are more efficient and consequently their operating cost will be less for a certain intensity of illumination. This and the first cost of the equipment and wiring and the cost of cleaning must all be considered where there is a choice of more than one type of reflector. H. E. BUTLER,

Illuminating Engineering Laboratory.
General Electric Company,
Schenectady, N. Y.



TYPE AND NUMBER OF FLOOD-LIGHTING UNITS DETERMINED BY THIS CHART

In using this chart the angle between axis of beam and surface lighted must not be less than 70 degrees. Working distances are given for convenience in selecting the proper flood-lighting projector. Local conditions may necessitate a change in some cases.

TABLE OF INTENSITIES FOR FLOOD LIGHTING

	Character of Surroundings		
	White Way, Foot-Candles	Residences, Foot-Candles	Parks, Foot-Candles
Dark colored buildings	[illegible]	15	10
Medium colored buildings	15	10	5
Light colored buildings	10	[illegible]	3

Some Experience with Overhead Ground Wires

A SUMMARY of experiences with overhead ground wires was presented in a recent committee report of the Northwest Electric Light & Power Association. The report states that although the conclusions are only partly decisive, the net effect of deduction from these records is to place a serious question against the practice. Despite certain instances where considerable benefit has been indicated, the bulk of experience with it has been negative or inconclusive.

On the other hand, experience does not indicate that the troubles directly occasioned by overhead ground wires are necessarily serious, or at least that the problem of reducing them to an inconsiderable amount is unsurmountable. This minimization of troubles may, however, involve considerably more expensive construction than hitherto has been the practice in the way of increased size of overhead ground wires, increased strength of fastenings and increased clearances. It is believed that many of the troubles experienced would have been avoided by reasonable care in inspection and maintenance.

Where the policy of a high degree of conservatism in plant design is maintained the logical practice would probably be to continue the use of overhead ground wires. However, it would seem justifiable, as a general procedure, for a company which has hitherto used overhead ground wires as standard practices to omit them from at least a portion of future construction. For a company whose policy has been not to use overhead ground wires and whose experience with lines so constructed has been reasonably satisfactory the record of experience available does not warrant a change in policy.

A summary of the records showed that overhead ground wires do afford a certain protection to insulators. Quantitatively, however, the extent and value of this protection are not determined. They do not afford any appreciable protection to wooden poles in addition to that given by individual grounding wires on each pole, except possibly in regions where grounding conditions are exceptionally poor. There is evidence that they do afford protection to station apparatus. They tend to give better relaying conditions on systems with grounded neutral. Their value in this respect will depend upon type of relays employed, individual ground connections and other local conditions. They add to the longitudinal stiffness of transmission line structures when attached directly to the structure, and to a small extent when carried in a bayonet or crossarm. The extra wire, however, increases the wind and ice loading on the line.

FIELD EDITOR ELECTRICAL WORLD.
San Francisco, Cal.

Strap Coils Reinsulated with Cotton Sleeving to Save Time

By use of cotton sleeving to reinsulate the strap-copper coils, a rotary converter which burned out recently was put back in service in a very short while. This was a 600-volt (direct-current) 300-kw., 1,200-r.p.m. machine with ninety-six coils. The coils were 27 in. long by 12 in. wide, with slot sections 13 in. and 14 in. long. Each coil consisted of three straps of 0.064-in. by 0.25-in. double-cotton-covered ribbon wire. The insulation on the individual wires was so badly scorched that new coils had to be made, or the wires reinsulated. Not having any of this wire in stock, and as the coils were not bent out of shape, it was decided to reinsulate them. They were then put into a boiling cleaning solution and left for five hours. After they were removed and rinsed in clean water the old insulation came off easily.

Upon trying to tape the individual straps it was found very hard to keep the coil in shape as the weight and tension on the taping reel bent the straps. To avoid this and still use the reel meant lost time, as the tape would have to be applied slowly.

At this point cotton sleeving was thought of and when a length was tried it slid over the strap with ease. The method seemed to solve the problem, so all the straps were reinsulated with the tape. A pointed horn was made out of tin that would just fit over the end of the strap, and tapered down to a blunt ⅛-in. point. This eliminated filing the ends of the straps to prevent the sleeving catching on the corners. The sleeving was cut into lengths that would reach to the middle of the diamond point at the rear end of the coil, two pieces being required for each strap. The two ends of the sleeving were taped at the place where they met with 0.004-in. cotton tape, while the lead ends of the sleeving were glued down. The two outside straps only were sleeved, the middle strap being left bare, except around the diamond point and leads, which were taped with 0.004-in. by ¾-in. cotton tape half-lapped. This taping extended into the coil 3 in. The three straps were then taped together with 0.004-in. by ¾-in. cotton tape spaced, and dipped in plastic varnish, the coils being allowed to soak in the paint, after which they were baked.

Before proceeding with the complete set one coil was insulated but not dipped, and then tested between straps. The coil did not break down when 1,200 volts alternating current at 60 cycles was applied for three minutes.

After dipping, a 2½-turn mica and fishpaper wrapper was applied to the slot section. The ends were taped with one layer of 0.008-in. by ¾-in. treated-cloth tape, half-lapped, this tape extending onto the slot section ¾ in. A layer of 0.007-in. by ¾-in. cotton tape was then applied half-lapped on the ends and spaced on the slot section, and then the coils were dipped in clear varnish and baked.

The coils reached the shop on Friday noon, and were sent out the Monday morning following. They were boiled Friday afternoon and one man stayed until 9:30 o'clock and cleaned and tinned enough coils to start insulating Saturday morning. The coils were all cleaned, leads tinned, sleeved, taped together and first dipped Saturday; on Sunday three boys finished the last taping and dipped the coils.

The cotton sleeving saved about four days that would have been required if the ordinary method of insulation had been employed and the machine has run satisfactorily ever since.

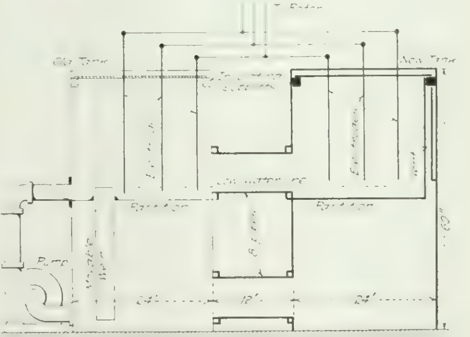
A. C. Roe.

Detroit, Mich.

Liquid Rheostats Rebuilt to Increase Hoisting Speed

At one of the coal mines of the Union Pacific Coal Company of Wyoming difficulty with the liquid rheostat used for controlling the hoist motor was experienced in that the proper resistance for giving gradual acceleration was too great to permit the motor to run up to full speed. When the resistance of the solution was decreased to permit full-speed operation the rate of acceleration was too great when taking up slack rope, making it necessary to apply the hand brake to prevent the first car being derailed. After numerous trials no one solution density was found which gave all of the results desired. The difficulty was finally overcome by the addition of an auxiliary tank to the original tank, as shown in the accompanying drawing.

The new tank was connected to the old by two 8-in. pipes, one connecting the upper chamber and one the lower chamber. In starting, only the plates of the original tank are in contact with the solution and easy acceleration is the result. At "full on" position of the weir all plates are submersed.



EASY ACCELERATION WITH FULL SPEED ACHIEVED BY ADDING EXTRA TANK TO LIQUID RHEOSTAT

The rheostat is used to control a 400-hp. motor hoisting up a slope 7,500 ft. long on a 6-deg. pitch. When purchased, the hoist was supposed to have a rope speed of 1,500 ft. per minute, but it was found that a maximum of only 1,300 to 1,350 ft. per minute was reached. The motor speed originally reached a maximum of 510 r.p.m., which was equal to 15 per cent slip, although the name-plate rating was 575 r.p.m. With the additional tank the rate of speed of 575 r.p.m. is reached and the mine tonnage is increased 150 tons per day. The tank is made of ¼-in. steel plate and measures 24 in. x 60 in. x 60 in. Most of the welding was done with an electric arc and the total cost of the new tank installed was approximately $300.

D. C. McKeehan,
The Union Pacific Coal Company, Chief Electrician.
Rock Springs, Wyo.

Central Station Service

A Department Devoted to Commercial Policy
and Management Topics, Including Methods of Increasing the Use
of Electric Light, Power and Heat

Functions of Modern Sales Department of a Central-Station Company[*]

By T. I. Jones
General Sales Agent Brooklyn Edison Company, Inc.

OUR industry is a comparatively young one. Only forty-one years ago the first commercial application of Edison incandescent electric lighting appeared, and but thirty-nine years ago the first commercial central station was equipped. During the early stages of our development the energies of central-station companies were of necessity directed to the engineering side of our business and the perfection of ways and means of manufacturing and distributing our product. While it is true that this engineering period is by no means ended and that much work along these lines remains to be accomplished, our principal endeavor now is to devise ways and means to market our product. It is our duty so to perfect our organization that we may make and pursue plans of organization which will produce similarly efficient commercial results.

Let me be specific. As the engineer has all to do with the development of the technical side of our business, so should the sales manager's efforts be centered on all that relates to our commercial activity. If we men in charge of the commercial activities of our companies have the conception that these activities should be limited to the signing of applications and canvassing for wiring contracts, the result must be that we shall surely become a small and decreasingly important element in our organizations. Not only will we fail to progress, but we must atrophy, for development in our modern complex civilization follows the law by which the blacksmith's arm grows strong with use while the gloved hand of the idler becomes white.

Commercial Functions Increase

On the other hand, if the conception of our functions and possibilities is broad, coterminous only with the superintendence and direction of all the public relations and activities of our companies, then at the present stage of central-station development we are bound to grow and become an important factor in our organization. The characteristics and conditions of our industry vary, and our conceptions and activities must vary accordingly. It is my contention that at the present stage of development the conditions are such as call for the widening and broadening of the activities of our commercial departments, and we must either step forward to meet the situation or else take a back seat for a long time to come.

When the time arrived at which it was possible to generate electricity in large blocks and distribute it economically and efficiently, the urgent problem was how to dispose of the product profitably. This was the real beginning of the sales department. It was required to inform and educate the public, to develop new uses for electricity, to devise contracts and rates, to organize and direct salesmen and sales campaigns, to create and publish proper advertising—to perform all three of the sales and advertising director's tasks—arouse interest, create desire and intensify desire into resolve to buy. Our energy during this era was principally devoted to convincing managers of large enterprises of the superiority of electricity over any other motive power and that they could buy energy from us cheaper than they could generate it; or to convincing storekeepers that they could use electricity in their businesses to their great advantage; or to convincing householders of the desirability and attractiveness of electricity for lighting and other household requirements.

Financing and Public Relations

While it is true that this period is by no means ended and that much work along the lines indicated remains to be accomplished, there has been within the past few years another shift, so that the most important problems that confront the industry today are those connected with financing and public relations. By public relations I mean two things—first, the arranging of our conduct, the marshaling of our methods and the training of our forces so as to create the right kind of contact between our organization and the public, the kind of contact that will result in a minimum of friction and a maximum of good will; second, the presentation to the public of our communities in a convincing way of the facts in regard to the operations and methods of our companies—the reasonableness of our rates or the requirement for higher rates, the logic of our practices, and our side of all those questions which as public service corporations we encounter and upon which it is to the mutual advantage of company and public that the latter have accurate knowledge. We cannot be sure of fair play—our future is not safe—until this is done, and for some time to come, until the public is informed on such questions from the standpoint of the central-station company, and until our forces are so organized and trained that we can handle our business with the public satisfactorily, this is going to be the most important work before us. As a matter of fact, its importance cannot be overestimated, as our future depends upon it.

It is my contention that the work done by our sales departments during the past ten or fifteen years has equipped us to do this larger commercial relations work better than any other department or element of our organizations. As a matter of fact, outside and beyond the sales department, what department of the average central-station company *has* dealt largely with the public in such a way as to fit its personnel to handle such delicate and important relations? The question answers itself. The burden and responsibility must be ours. So I feel that we must either organize ourselves to handle our job in a big way or else step aside for some one who can and will. We must have a big conception of our department as one in which are concentrated not only all the business-getting activities, including the advertising, but, as set forth in the address of the chairman of the Commercial Section at the recent N. E. L. A. convention, such public relations activities as the campaign sale of company securities to the public, wiring and service inspection work which brings the employee in contact with the applicant and the contractor, the handling of complaints, the dealing with inquiries as to delayed service, incorrect accounts and high bills, including the making of necessary adjustments, and the engineering of co-operation between the company and other elements in the electrical business; in fact, the handling of all publicity relations. This will make for a unity hitherto impossible and for a very desirable minimizing of the number and variety of employees.

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[*] A paper read at the Sales Managers' Association Convention, Association Island, N. Y., July 18, 1921.

You can see that the title "sales department" is a misnomer as applied to all this work. The correct title, it seems to me, should be "commercial department," and the man in charge should be "general commercial manager." I believe the time is coming, if we see this matter in the right light and act accordingly, when the head of such a department will be a vice-president in charge of commercial relations and activities. This has been the tendency for some time in many business organizations. Witness those banks which have enjoyed development and expansion during the past five or ten years—you will find in many cases a vice-president in charge of the commercial activities of these institutions. Such a man in our companies would be an important part of the executive direction of the organization, competent to advise and assist in all matters connected with rates, customer questions, relations and transactions with public service commissions and city and state officials, sale of securities and such problems.

This means responsibility and plenty of work. It means that while we must not neglect the selling of our service both in large and small ways, while we must continue to originate campaigns and produce profitable business, we must also extend our activities to new fields and must train and direct an expanded force, so that all public relations shall be safe in its hands and it can be trusted to develop and conserve public good will. I hope to see our new commercial department taking its proper place in the new order of things, coming gradually to handle all functions and activities of our companies in which there is direct dealing or relationship with the public.

Citizens, City Officials and Utility Men Meet and Talk Things Over

A PRACTICAL example of the friendly spirit of co-operation that should prevail between cities and utilities is to be seen at Clinton, Ind., where the Chamber of Commerce recently held a public meeting at which the question of electric light and power service was discussed by private citizens, city officials and officers of the Wabash Valley Electric Company. At this meeting the citizens told what they thought of the service, city officials discussed the rates, and company officers spoke of their plans for extensions and improvements. The result has been that all three factors contributing to the success of public service are now in sympathy. Each knows the problem of the others. Officers of the company took occasion to explain that its earnings can in no case become excessive, dwelling on the ruling of the Public Service Commission granting a rate that allows something less than 7 per cent return. This return, it was hardly necessary to point out, is less than the current rate of interest at the local bank.

This meeting proved extremely interesting alike to the citizens, the city officials and the utility men, as was evidenced by the number and character of the questions and the active discussion that developed. It has undoubtedly produced a far better mutual understanding.

From Here and There

Chicago, Ill.—At the "Pageant of Progress" exposition which opened in Chicago on July 30 the Public Service Company of Northern Illinois installed in its exhibit a large map showing the location of its stations, electric and gas, its lines, the communities it serves and the nature of the service performed in each town. It attracted much attention, and representatives of the company were on hand to explain the details to all inquirers.

Spokane, Wash.—The Washington Water Power Company by consistent range campaigns for the last few years has developed one of the largest electric cooking loads in the country, with nearly 3,200 ranges connected, representing a load of over 20,000 kw. The company has a cooking rate of 3 cents and has found that the sale of an electric range and water heater raises the monthly income from the average home from $1.40 for lighting only to $8.50 for light, range and water heater. This company has found that ranges have such a diversity factor that each one can be reckoned as a 1½-kw. load, though rated in connected load as 6.5 kw. It is expected that the number of ranges in use in Spokane by the end of 1921 will be fully 10 per cent greater than at the end of 1920.

Pittsburgh, Pa.—The manager of the trade and industrial bureau of the Chamber of Commerce of Pittsburgh has recently made a wide distribution of a circular letter on the subject of power and fuel. This letter was addressed to manufacturers throughout the country and suggested that if their expansion program contemplated branch plant locations, Pittsburgh offered ideal conditions. The letter was printed as a four-page folder, the center spread displaying a map of the Pittsburg district on which were indicated the power houses and main transmission lines of the two local operating companies, the Duquesne Light Company and the West Penn Power Company, with reproductions of ten photographs of the stations and other service equipment of these companies. On the front page were statistics and testimonials on the power and fuel resources of the "Steel-Electric City," as it is now called.

Digest of Electrical Literature

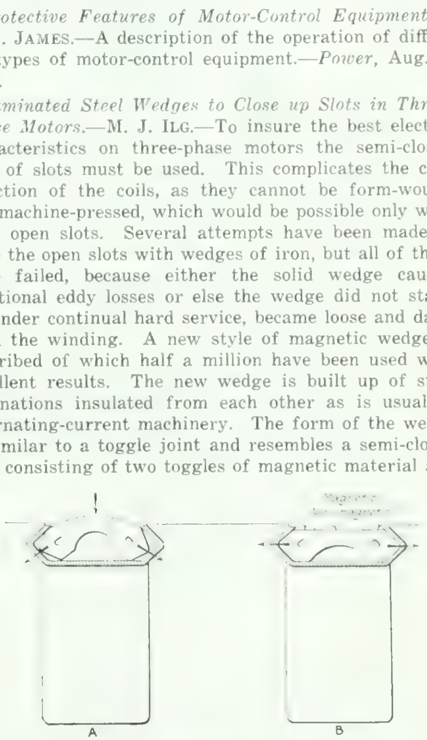
Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
of the World

Generators, Motors and Transformers

Electric Starters for Gas and Gasoline Engines.—M. DIGEON.—Directions are given in this paper for the proper choice of the size of a starting motor for small (automobile), medium and large gas engines, taking into consideration the necessary torque, minimum starting speed and gear ratio.—*Revue Générale de l'Electricité*, July, 1921.

Protective Features of Motor-Control Equipment.—H. D. JAMES.—A description of the operation of different types of motor-control equipment.—*Power*, Aug. 2, 1921.

Laminated Steel Wedges to Close up Slots in Three-Phase Motors.—M. J. ILG.—To insure the best electric characteristics on three-phase motors the semi-closed type of slots must be used. This complicates the construction of the coils, as they cannot be form-wound and machine-pressed, which would be possible only with fully open slots. Several attempts have been made to close the open slots with wedges of iron, but all of them have failed, because either the solid wedge caused additional eddy losses or else the wedge did not stand up under continual hard service, became loose and damaged the winding. A new style of magnetic wedge is described of which half a million have been used with excellent results. The new wedge is built up of steel laminations insulated from each other as is usual in alternating-current machinery. The form of the wedge is similar to a toggle joint and resembles a semi-closed slot, consisting of two toggles of magnetic material and a non-magnetic middle piece. The finished wedge is insulated at the sides and the bottom and inserted into the open slot, and by a few blows with a hammer the middle part of the wedge is driven down, thus separating the toggle. This sets the wedge exceedingly solid. Several illustrations of this wedge are given.—*Siemens Zeitschrift*, June, 1921.



MAGNETIC WEDGE TO CLOSE SLOTS IN THREE-PHASE MOTORS

Resonator, Dissonator and Quench Transformer.—G. BENISCHKE.—Much has been written recently about means to diminish the flow of current during a "ground." Some have advocated the use of resonating circuits; others have suggested the opposite way, that is, dissonating circuits. It has also been contended that dangerous resonance may occur with the use of a so-called "quench transformer." The author endeavors to throw some light on these vexing problems by mathematical investigations and comes to the conclusion that every generator and transformer has, so to speak, a natural dislike to come into resonance with its own fundamental frequency.—*Elektrotechnische Zeitschrift*, June 30, 1921.

Lamps and Lighting

Evolution in Street Lighting.—ELIHU THOMSON.—A brief history having special reference to the early lighting of streets by electricity, with a description of some of the early generating equipment.—*General Electric Review*, August, 1921.

Generation, Transmission and Distribution

Greatest Possible Span of Overhead Lines.—H. SCHENKEL.—The author investigates mathematically the longest possible span of wires and comes to the conclusion that it is permissible to go to spans of 2,000 m. and even more and yet be within safety limits. Theoretically spans up to about 2,000 m. could be used, employing copper or aluminum cables, but this would give a sag of about 700 m. and would therefore not be practicable. If, however, steel or bronze is chosen for the conductor, a 2,000-m. span will give a sag of only about 150 m., which is perfectly feasible for long river or valley spans. For the exact calculation of very long spans the customary parabolic formula gives too small values. The catenary formula should be used instead. Several actual examples are calculated in full detail.—*Elektrotechnische Zeitschrift*, July 7, 1921.

Switching Stations of One or More Stories.—H. PROBST.—One of the best protections against overvoltages is a station lay-out which gives the greatest possible simplicity of all apparatus installed. It is an established fact that more troubles are caused by faulty switching than by any electrical reason. Many four-story switching houses are in operation which generally have the cable potheads and disconnecting switches on the ground floor, instrument transformers on the second floor, oil switches on the third floor and the buses and their disconnectors on the top floor. The author points out how many steps it requires along the corridors and up and down stairs to locate possible trouble with this apparatus. Long experience seems to indicate that a two-story arrangement, with cable potheads, instrument transformers, oil switches and disconnectors on the first floor and buses with their disconnectors on the upper floor, gives not only the safest operation but is also the cheapest to build. Then the author compares the two-story arrangement with the American out-of-door, or one-story, station, and comes to the conclusion that for present conditions in Germany the two-story, indoor station is cheaper. The reason is quite interesting: Owing to the present great coal shortage porcelain is hard to obtain and very expensive. As a substitute, bushings made of paper are used extensively, which, however, would not stand outdoor service. Another reason is that buildings and building labor are very cheap. For example, the cost of the building is only 10 to 15 per cent (with and without including the cost of the transformers respectively) of the total cost of a two-story, indoor switching station. It is also mentioned that in American outdoor stations twice as many oil switches and disconnectors are used as in indoor stations. Oftentimes objections are raised against an outdoor arrangement, as it is very undesirable to do outdoor work on the switches during a rain or snow storm. As a remedy remote-controlled oil switches are recommended, which entails again a far higher investment. While there may be cases where an outdoor arrangement might be better, in most instances a two-story housed-in station will be cheaper at present (in Germany).—*Elektrotechnische Zeitschrift* and Allgemeine Elektricitäts Gesellschaft *Mitteilungen*, May and June, 1921.

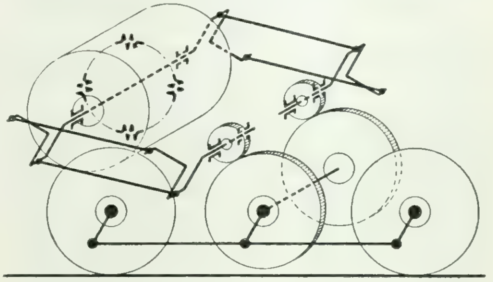
Alternatives to Coal for Power Production.—PERCY E. RYCROFT.—In summarizing the consideration which should be given to the matter of choosing a fuel substitute, the author sets down the following: (1) The fuel cost of evaporating 1,000 lb. of water; (2) labor costs for the same work (including cost of handling fuel, firing and removal of ash or residue); (3) maintenance costs for evaporating 1,000 lb. of water (including cleaning, renewals and repairs); (4) the capital cost of the plant. For the year ended March 31, 1919, the author gives the following figures to show the method of generation of nearly 5,000,000,000 kw.-hr.:

	Kw.-Hr.
By coal and coke	4,623,000,000
By waste heat	68,000,000
By exhaust steam	58,000,000
By refuse	28,000,000
By tar fuel	4,000,000
By gas and suction gas	61,000,000
By oil engines	23,000,000
By water power	11,000,000

The methods of generating electrical energy other than by coal and coke are then discussed in detail.—London *Electrician*, June 24, 1921.

Traction

Possible Developments of Electric Main-Line Locomotives.—E. SEEFEHLNER.—This paper gives the results of a very interesting and exhaustive study of existing and newly suggested methods of mechanical drives between the motor or motors and the drivers of electric locomotives. It is beyond doubt that electric traction on main lines has proved its superiority over steam locomotion, but the details of the driving system proper—involving the respective merits of the direct gearless type, the simple gear drive and the great variety of rod drives—are still in the experimental stage. Each of the drives mentioned has its inherent advantages and shortcomings, and it is very desirable to devise some new drive embodying as many advantages of all the existing types as possible without their disadvantages. The gearless type with motors directly on the shafts is considered by the author as the one least suitable for future developments. Its only desirable feature is the steady and uniform torque. The rod drive with intermediate gear and a jack shaft is held to possess the greatest merit. Using a double 90-deg. crank shaft on either side of the motor and the gear-jack shaft, a very steady pull may be achieved, as shown in the accompanying sketch. The following locomotive types are suggested: F, for slow and heavy freight engines for grades; C + C, same for double-unit engines; 1E, for medium-speed passenger engines for grades; 1D1, for heavy express engines for medium grades; 1B + B1, same for double-unit engines; 2C1 and 2B2, high-speed passenger engines for level tracks. For this whole gamut of service four sizes of motors will suffice, as shown in the accompanying table.—*Schweizerische Bauzeitung*, July 9 and 16, 1921.



DOUBLE CRANK-AND-GEAR-MOTOR DRIVE FOR ELECTRIC LOCOMOTIVES

No. Shafts	Engine Type	Motor Type	Output
2	B	I	1.0
3	C, 1B	II	1.5
4	D, 1C, 1B1, B + B	2 × I	2.0 = 2 × 1.0
5	E, 1D, 1B1, 1B2	III	2.5
6	F, 1E, 1D1, 2C1 2B2, C + C, 1B + B1	II	3 = 2 × 1.5
7	1D2	IV	3.5
8	D + D, 1C + C1, 2B + B2	4 × I	4 = 4 × 1.0

Electrophysics and Magnetism

Recent Application of Infra-Red Radiations.—M. LARIGALDIE.—In the focus of a gilded parabolic reflector a small set of platinum-tellurium thermocouples is placed, the ends of which lead to a very sensitive galvanometer. Such an arrangement will detect very small and distant centers of heat, or, as in this particular case, any body the temperature of which differs from its surroundings, as, for example, floating icebergs. A reflector of about 10-in. (25.4-cm.) diameter will suffice for a distance of 8 miles (12.8 km.).—*Bulletin de la Société Française des Electriciens*, April, 1921.

Telegraphy, Telephony and Signals

Tests and Experiences with Wireless Rapid Telegraphy.—F. BANNEITZ.—The idea of operating the different well-known and established rapid telegraph systems by wireless is not new, but an impetus has been given to it since the establishment of the new German state wireless network by the desire to increase the economy and capacity of this system. Promising results, however, have been possible only since the use of audion tubes as senders and amplifiers. The author describes a number of experiments made with rapid telegraph systems of the Wheatstone, Siemens-Halske, Baudot, Hughes and pendulum types. Using a 1-kw. audion sender, a distance of 300 km. can be covered safely. It is expected to standardize the wireless Siemens type of rapid telegraph in the German Republic.—*Elektrotechnische Zeitschrift*, July 7, 1921.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

Germans Fear Muscle Shoals Nitrate Competition

REPRESENTATIVES of the American Farm Bureau Federation appearing before the Senate finance committee to ask that ammonium sulphate be left on the free list charged that the men advocating a duty of $12 a ton on ammonium sulphate to facilitate the development of the by-products of coke represent the same interests that were largely responsible for the defeat of the proposed government operation of the nitrate plant at Muscle Shoals. In the course of the testimony it was asserted that while domestic producers of by-product ammonia are afraid of German air-fixed nitrogen production, the Germans in turn see in the Muscle Shoals plant the greatest possibility of competition.

Senate Committee Hears Objections to Tariff on Mica

GENERAL dissatisfaction with the mica paragraph in the tariff bill as it passed the House has been manifested before the Senate finance committee. The manufacturers and dealers in mica suggest that the paragraph read as follows:

> Mica valued at not above 15 cents per pound, 6 cents per pound; valued above 15 cents per pound, 30 per cent ad valorem; mica splittings, 30 per cent ad valorem; mica plates and built-up mica and all manufactures of mica or of which mica is the component material of chief value, 60 per cent ad valorem; ground mica, 25 per cent ad valorem.

The domestic producers of mica would have the bill amended so that the paragraph would read:

> *Mica*—Unmanufactured or rough trimmed only and mica splittings, 25 cents per pound and 50 per cent ad valorem. Cut, stamped, or trimmed, built-up mica, and all manufactures of mica or of which mica is the component material of chief value, 50 cents per pound and 50 per cent ad valorem. Phonograph diaphragms, 10 cents each and 50 per cent ad valorem. Crude, raw, scrap or refuse, 1 cent per pound and 50 per cent ad valorem. Ground, flakes or dust, 2 cents per pound and 50 per cent ad valorem.

C. W. Jefferson, the manager of the Mica Insulator Company of New York, in the course of his testimony before the committee, said:

"Mica board to be of universal use for electrical purposes must be made of mica splittings from mica of low resiliency and extreme softness. It so happens that the mica we obtain from India combines these two features to a greater extent than any mica mined in this country. If mica splittings for making mica board are not in competition with domestic miners—and I maintain they are not—what use can a tariff be except to produce revenue for the government? The lower the price of mica board, the less use of substitutes would be made. Most of these substitutes are in some form or other of wood pulp.

"Then, again, if the cost of mica splittings be lowered so that their use could be extended, the result would be an improvement in the quality of all kinds of American electrical machinery.

"As a general insulation mica stands on a pedestal high up above any other, and it is the rending of sheet mica into films—the films being the foundation of the business—that enables mica to be used economically in the electrical industry. It is our raw material in the same sense as cotton after it is ginned is the raw material in the cotton industry."

Michigan Expects to Have Rural Service Rules

FINANCING of rural extensions by the consumer with maintenance by the utility and a method of charging based on a fixed charge plus an energy charge were favored in the report of the overhead-lines committee of the Michigan Electric Light Association at its recent Ottawa Beach meeting. The committee in connection with utility commission representatives expects to work out a method for handling the service. The methods so far discussed seem to parallel closely those that have found favor in other Middle Western states. Commissioner Potter, in his address before the convention, asserted that it was necessary to find a satisfactory method by which this service could be given profitably to both the consumer and the utility. It is not unlikely that before the work is done the matter of overhead rules and possibly that of inductive interference may have to be considered.

Navy Department Makes Arrangements with Electrical Manufacturers

IN THE opinion of Admiral Robert F. Griffin, head of the Bureau of Engineering of the Navy Department, no cancellations of contracts for electrical equipment for the navy will be made necessary by the reduction in naval appropriations. Satisfactory arrangements already have been made with most of the contractors. As a result of the reduction in appropriations it will be necessary to slow down the construction program. This of necessity will affect the manufacture of electrical equipment, since approximately one-sixth of the cost of a battleship is represented by things electrical.

It was the plan of the Navy Department to spend about $20,000,000 on electrical equipment during the current fiscal year. The reduction in the appropriation, however, has made it necessary to reduce that amount to $10,000,000. The remaining $10,000,000 worth of equipment will be taken, however, but deliveries must be extended for at least six months after the end of the current fiscal year, and it may be that it will be necessary to spread them throughout 1922-23.

Dr. Peter Cooper Hewitt, Noted Inventor, Dies in Paris

CABLE dispatches from Paris announce the death of Dr. Peter Cooper Hewitt on Aug. 25. Death resulted from an attack of pneumonia which set in following an operation for abdominal trouble.

Peter Cooper Hewitt, electrical and mechanical inventor and engineer, bore by inheritance the names of two among the most eminent New Yorkers of a preceding generation. His father was Abram Stevens Hewitt, a leading iron manufacturer and merchant, Representative in Congress, Mayor of New York and promoter of many civic, educational and philanthropic causes. His mother, Sarah Amelia (Cooper) Hewitt, was a daughter of Peter Cooper, inventor, manufacturer, railroad builder and benefactor of New York in the gift of the Cooper Union for the Advancement of Art and Science, more commonly known as Cooper Institute. Peter Cooper Hewitt was born in New York City on March 5, 1861, and was educated at the Stevens Institute of Technology at Hoboken and at the Columbia University School of Mines. In boyhood he manifested a strong inclination toward mechanics, and his courses of study were directed toward the mechanical, chemical and electrical sciences, in which he developed much proficiency. One of his earliest inventions was that of improved machinery in his grandfather's famous glue factory, and this was followed with new forms of centrifugal machines, evaporators and other devices for use in breweries. The early experiments in motor vehicles and flying machines enlisted his interest, and he made a number of inventions relating to them and in later years devoted considerable time to the study of the helicopter. But about 1898 he began to devote serious attention to electrical science and in that field achieved his greatest success.

PETER COOPER HEWITT

In engineering circles Dr. Hewitt was probably best known for his work with the mercury vapor arc. Four fundamental inventions—the vaporized mercury electric lamp, the static converter or rectifier used to convert alternating currents into direct currents, the electrical interrupter and the wireless receiver—were developed by him as the result of years of experimentation with electric currents passing through mercury vapor. He devised a telephone relay and electric wave amplifier as well as apparatus for use in connection with the wireless telephone and telegraph.

Because of his scientific attainments during the world war Dr. Hewitt was made first vice-chairman of the Naval Consulting Board and in that capacity did much valuable patriotic service. He was a director or trustee of the Cooper Hewitt Electric Company, the Hewitt Realty Company, the Hexagon Realty Company, the Lehigh & Oxford Mining Company, the Midvale Water Company, the Madison Square Garden Company, the New York & Greenwood Lake Railroad Company, the Cooper Union and the House of Rest for Consumptives. He was a member of the American Institute of Electrical Engineers, the American Physical Society, the American Geographical Society, the Society of Naval Architects and Marine Engineers, the New York Electrical Society, and the General Society of Mechanics and Tradesmen, and also of the Century Association, the Aero Club of America, the Automobile Club of America, and the Union, Knickerbocker, Manhattan, Engineers', Players', Lambs', Brook, Racquet and Tennis and Tuxedo clubs.

Pinchot Opposed to Acceptance of Ford's Muscle Shoals Offer

HENRY FORD'S offer for the government properties at Muscle Shoals, Ala., still continues to attract attention. One of the latest public men to delve into the proposition is Gifford Pinchot, who after studying Mr. Ford's offer comes out flat-footedly against it. In an open letter issued from his office in the Real Estate Trust Building, in Philadelphia, under date of Aug. 25, Mr. Pinchot said:

> The recent offer of Henry Ford to take over government property at Muscle Shoals on the Tennessee River is so important that I take the liberty of laying certain essential facts before you.
>
> The first part of the Ford offer is to lease the Wilson Dam and Dam No. 3 for 100 years, with indefinite renewals, provided the government will complete them and install machinery to produce 850,000 hp. Mr. Ford offers to pay 6 per cent on the $28,000,000 which he estimates will be necessary to complete this work, or 3.4 per cent on $48,000,000, Mr. Ford's own estimate of the whole government investment in dams, locks and power houses. Even if we add all other annual payments (the so-called amortization payments and payments for the repair, maintenance and operation of dams, gates and locks), the total would be equivalent to interest at the rate of only 3.6 per cent. Mr. Ford offers also to give the government 300 hp. for the operation of the locks.
>
> Please note that for the water power itself Mr. Ford would pay nothing and that he would be free from all taxes on the property. Other lessees of water-power rights from the government not only bear the total cost of building their own dams and power houses and pay taxes on them, but they also pay for the water power in addition. The Ford offer is like offering a man 3.6 per cent on the cost of his factory as rent and then asking him to throw in a coal mine to supply fuel for the engines for nothing.
>
> There is no allowance for depreciation, and the government would beyond question have to pay the cost of injury to the dams or locks from floods or other causes. Moreover, there is nothing in the offer to indicate that the government, in order to protect its own property, would not have to bear the expense of replacing enormously costly machinery when it had been worn out in Mr. Ford's service.
>
> The second part of the Ford offer is to buy Nitrate Plant No. 1, which cost the government in round numbers $13,000,000; Nitrate Plant No. 2, which cost the government in round numbers $70,000,000, and other property which brings the total cost to $85,000,000, and to pay $5,000,000 for it all. The property for which this offer is made includes steam machinery to produce 160,000 hp., which alone is worth far more than Mr. Ford's offer for the whole. In addition, the government is to buy from the Alabama Power Company the land upon which certain of the foregoing structures were built and to turn that over to Mr. Ford also.
>
> In return for the lease, for the purchased property and for the water power without charge Mr. Ford offers, in addition to the payment mentioned above, to do three principal things:
>
> First—"To maintain Nitrate Plant No. 2 ready to operate

. . . in time of war for the production of explosives," and in the event of war to turn it over to the government for that purpose.

Second—"To operate Nitrate Plant No. 2 to approximate present capacity in the production of nitrogen and other fertilizer compounds," and in this business to limit his net profits from the manufacture and sale of fertilizer products to 8 per cent.

Third—The offer as writeen suggests producing, but contains no direct proposal to produce, fertilizer for the benefit of American farmers. That could, of course, be corrected in the final contract, for I have no doubt that Mr. Ford desires to make fertilizer at a total net profit of 8 per cent. Nitrate Plant No. 2, however, is not adapted to making fertilizer, but only cyanimide, one of several materials used for the production of fertilizer and not one of the best at that.

The fact is that the Ford offer is not mainly a fertilizer proposition. It is seven parts water power to one part fertilizer, even if the fertilizer part should work out. For, if Nitrate Plant No. 2 were to be permanently employed in the manufacture of fertilizer, it would consume but 100,000 hp. out of the 850,000 hp. installation. This is the heart of the whole matter.

CONTRARY TO ROOSEVELT POLICY

As a water-power proposition the Ford offer is in every important point directly contrary to the Roosevelt water-power policy, which after fifteen years of struggle was finally enacted into law last year. The Roosevelt policy provides that all water-power leases shall be limited to fifty years. The Ford offer asks for 100 years with indefinite renewals. The Roosevelt policy provides for return of the government works at the end of fifty years. The Ford offer provides for indefinite private possession of the government works. The Roosevelt policy provides for regulation of the price to the power consumer. The Ford offer, so far as the United States is concerned, provides no check on what the power consumer must pay. The Roosevelt policy provides that public water power taken for profit shall make a return to the public. The Ford offer asks for many hundred thousand horsepower for nothing.

The amount of power Mr. Ford could develop under his offer is greater by half than all that is now being developed at Niagara Falls. If Mr. Ford were to pay for it at the rates charged by the government to other companies that build their own works, as Mr. Ford would not, it would cost him about $150,000 a year.

Beyond question Nitrate Plant No. 2 ought to be maintained in condition for producing explosives in case of war. Most certainly it ought to be used for making fertilizer for American farmers. The wisdom of developing the water power on the Tennessee and its tributaries is beyond question. But all these things can be done with fairness to the public.

I do not believe that Mr. Ford's offer should be summarily rejected. I do believe that it should be changed, first, to make it fit the Roosevelt water-power conservation policy, now the law of the land; second, to make it pay for the property of the people something approaching what that property is really worth, and, third, to make what it offers to the farmers clear beyond doubt.

It is said that certain Wall Street magnates who hate Mr. Ford are anxious that his offer should be rejected. What these men think about Mr. Ford and his offer is surely no reason for giving him public property of enormous value for a consideration wholly inadequate and on terms utterly unfair to the public.

I should be glad to see Mr. Ford make money, and plenty of money, out of taking over the property of the people as he proposed to do, but not such perpetual and gigantic profits as his offer would assure. It is fair to consider the public also, and to remember that all the annual payments Mr. Ford offers to make would amount to only one-third of the yearly taxation necessary to meet the interest charged (at the Liberty loan rate of 4½ per cent) on the government's net investment in the property he proposed to take over, and that he would get the water power for nothing.

Morton Resigns as General Manager of National Contractors' Association

FORMAL announcement of the resignation of W. H. Morton, general manager and secretary-treasurer of the National Association of Electrical Contractors and Dealers, has been made by James R. Strong, national chairman, as follows:

> It is with regret that I announce to the membership the resignation of W. H. Morton as secretary-treasurer of the national association.
>
> Mr. Morton is leaving us to become secretary and general manager of the Sanborn Electric Company, Indianapolis, and while I feel Mr. Morton's resignation as a personal loss and a serious loss for the association, I sympathize with his desire to re-establish himself in the electrical construction business and wish him every success in his new undertaking.
>
> The national executive committee at its last meeting at Buffalo appointed a sub-committee with power to fill the vacancy in case Mr. Morton's resignation was offered (negotiations were pending at that time), and upon receipt of Mr. Morton's resignation the committee canvassed the subject and received among others an application from Mr. Farquson Johnson, our editor, for the position of secretary-treasurer.
>
> The committee gave the matter careful consideration and after a full discussion voted unanimously to accept Mr. Johnson's application, being fully convinced of his capabilities, great interest in the success of the association and positive wish to carry on the association work along the lines laid down by Mr. Morton.
>
> Mr. Johnson does not lack experience in managerial lines, although his activities have been largely devoted to publishing and printing interests. He was at one time the general manager and superintendent of a large printing establishment in Chicago, employing a hundred or more workmen; for five years he was publicity director and office manager of a prominent publishing company in New York City, afterward becoming sales manager, and during the world war he was employment director of a government explosives plant. Since 1919 Mr. Johnson has been a close associate of Mr. Morton at national headquarters and naturally he has become familiar with the requirements of his new office.
>
> Mr. Johnson will assume his duties on Sept. 1 and on his behalf, I ask your earnest and hearty co-operation.

W. H. MORTON

Ever since the association was founded twenty years ago Mr. Morton has been one of its most active workers. He was the first secretary and has held that office continually since 1901, except during the five-year period 1913-1918, in which he developed his personal interests in Porto Rico. In 1918 he returned as general manager of the association and its official publication. Last year he was made treasurer also. The Sanborn Electric Company, of which Mr. Morton is to become secretary and general manager, is generally recognized as one of the strongest contractor-dealer organizations in the Middle West.

Although his resignation came as a surprise to many of his associates and is a source of regret as far as the association is concerned, friends of Mr. Morton are congratulating him on his new connection.

Harding to Call Conference on Non-Employment

PRESIDENT HARDING has decided to call a national conference in Washington on non-employment. The Department of Commerce in co-operation with the Department of Labor is to formulate the plans, which it is expected will be ready for the President some time during the week. In making the announcement at the beginning of the week Secretary Hoover said:

"The object of the conference will be to inquire into the volume of needed employment, the distribution of non-employment, to make recommendations as to measures that can properly be taken in co-ordinated speeding up of employment by industries and public bodies during the next winter, and in addition a broad study of the economic measures desirable to ameliorate the employment situation and give impulse to the recovery of business and commerce to normal. Many constructive suggestions have been made to the department by employers, the governors of states and city officials.

"While the business situation is steadily improving, yet some sections of the workers may have exhausted their savings by the coming winter, and they must be a matter of extreme solicitude. It is inconceivable that America, with its surpluses in food and clothing, with housing—though crowded—and with an abundance of fuel, could allow any suffering among those of our own people who desire to work. It is necessary that we should be forehanded in the preparation of such measures as will prevent any such suffering."

New Stock Dividend Plan for General Electric

THE General Electric Company has decided to substitute for the present semi-annual stock dividend of 2 per cent an annual dividend of 5 per cent, payable in shares of $10 par value not participating in future stock dividends but entitled to fixed cash dividends of 6 per cent. This is in addition to the regular cash dividend. Because of the delay involved in securing appropriate legal and corporate action the Jan. 15 stock dividend of 2 per cent will be paid in the present stock of the company.

In making this announcement to the stockholders, C. A. Coffin, chairman of the board, said:

"The yearly rate of orders received for the first thirty-three weeks of 1921 is $180,440,000. The orders for 1914 to 1916 were: 1914, $83,748,521; 1915 (excluding $33,980,000 for munitions), $98,385,891; 1916 (excluding $2,416,000 for munitions), $167,169,058. The 1916 orders were more than 50 per cent greater than the orders for any year prior to 1915 in the history of the company. Profits for the year 1921 promise to provide for the cash and stock dividend requirements for the year.

"As far as can be foreseen no financing on the part of your company will be necessary for some years. Your company has in excess of $40,000,000 cash on hand, has large receivables and no current liabilities other than monthly accounts and federal taxes. It has ample manufacturing facilities in the highest condition of mechanical efficiency to take full advantage of such increased demands for its products as may come with a return of business activity. It is appropriate to call your attention to the fact that the company's present surplus and reserves exceed by $20,000,000 the book value of all its manufacturing plants, machinery, equipment and real estate. These facilities represent a cost of $182,271,111 at Dec. 31, 1920, and were carried at a book value of $66,536,682 as of that date."

Earl E. Whitehorne to Investigate Business Problems of Electrical Industry

EARL E. WHITEHORNE, who has been a contributing editor to the ELECTRICAL WORLD for a number of years, will hereafter devote his entire time to the paper as chief commercial editor. The editors and publishers of the ELECTRICAL WORLD see at this time a peculiar need for the ascertainment of fundamental facts and for business leadership to bring about the early recuperation of business in all branches of the electrical industry. In addition to the service the ELECTRICAL WORLD has always furnished in reflecting the trend of events within the industry, special investigations will be conducted to analyze and interpret constructively current opinion on problems of primary importance to electrical manufacturers, jobbers and electric light and power company executives. These investigations Mr. Whitehorne will conduct. He will inject into them that straightforward commercial thinking and individuality which have always characterized his writings.

EARL E. WHITEHORNE

For this work Mr. Whitehorne is particularly fitted. His practical experience has brought him into contact with central-station companies, jobbers, contractors and electrical manufacturers. In addition, as an editorial writer and business counselor for the past thirteen years, he has studied all phases of the problems of market development and better selling.

Mr. Whitehorne was born in 1881 at Verona, N. J. His first position was with the Morton Trust Company, New York City, where he became an accountant in the company's foreign department. This work he gave up to take up selling, and his opportunity came first in the marketing of electric signs. In this connection Mr. Whitehorne interviewed large central-station companies as far West as Denver and as far South as Richmond. He attended the first commercial session of the N. E. L. A. in Denver in 1906, which consisted of one morning session, and since that time he has followed closely the commercial development of that organization.

In 1907 Mr. Whitehorne became interested in an electrical contracting business in Newark, N. J., which he conducted until Percy Ingalls and C. W. Lee, then respectively general agent and advertising manager of the Public Service Corporation of New Jersey, started the C. W. Lee Company to conduct a central-station advertising service. Mr. Whitehorne became associated with this company and was successful in conducting advertising and good-will campaigns among central-station companies throughout the country, the need of better selling methods in their commercial departments having at that time come to be recognized. In 1907 the C. W. Lee Company, with the assistance of Frank B. Rae and Mr. Whitehorne, started the publication *Selling Electricity*, afterward known as *Electrical Merchandise*. Mr. Whitehorne was associated with that journal continuously in an editorial capacity until it was sold to the McGraw Publishing Company and consolidated with *Electrical Merchandising* in July, 1916. For a few years previous to that date Mr. Whitehorne built up an advertising business and counselor service mainly to manufacturers who sold through central-station companies and to electrical jobbers. Mr. Whitehorne has been a member of many important commercial committees of the N. E. L. A. and for years has acted in an advisory capacity for the Society for Electrical Development. Since 1915 he has served as a contributing editor to the ELECTRICAL WORLD and *Electrical Merchandising*. He will continue this relationship with the latter.

Southern California Is to Have High-Tension Experimental Laboratory

THE Southern California Edison Company has contributed funds for erecting on the campus of the California Institute of Technology a high-tension laboratory where extensive investigations on the transmission of energy at high voltage will be made. These studies will be conducted by the engineering staff of the Southern California Edison Company and by the physics and electrical engineering departments of the Institute under the direction of Dr. R. A. Millikan and Prof. R. W. Sorensen. Dr. Millikan, who is now professor of physics at the University of Chicago and who has gained world-wide distinction for his original researches on the electron and the structure of matter, has just been appointed director of the Norman Bridge laboratory of physics and chairman of the executive council of the California Institute of Technology.

The new high-tension laboratory will represent an investment of about $75,000. Other research work, such as studies of the constitution of matter and its relation to the phenomena of radiation, will be undertaken.

Change in Practice of Holding Institute Meetings

A COMMITTEE of the American Institute of Electrical Engineers is now at work formulating plans for the meetings of the Institute in accordance with the resolutions adopted by the board of directors changing the present practice. So many sections have been formed that it is impossible to give to each one of the regular monthly meetings of the Institute. It has therefore been decided to make these monthly meetings section meetings instead of meetings of the national body. In addition, the board has decided to hold four general meetings of the national body, besides the annual business meeting, one of them to be the annual convention. The detailed recommendations for making these plans operative are expected to be ready for the consideration of the board at its October meeting.

Consolidation of Radio Interests Under Way

THROUGH the acquisition by the Radio Corporation of America of the coastal stations of the International Radio Telegraph Company, considerable progress has been made toward the consolidation of the two companies. The Radio Corporation of America operates under Marconi, General Electric and American Telephone & Telegraph radio patents. When this company was formed a year or so ago there was a pooling of patent interests.

About the same time the Westinghouse Electric & Manufacturing Company acquired control of the International Radio Telegraph Company through subscription to $2,500,000 of its capital stock and by terms of a patent license agreement gained exclusive rights under the group of patents of the International company for the manufacture of apparatus for all purposes and the use thereof for all other purposes than commercial wireless communication for the public. The most important patents thus acquired were the Fessenden and Armstrong patents.

Under the new consolidation, through which the Westinghouse company has acquired a substantial interest in the Radio Corporation of America, it is learned that there will be a pooling of all radio patents. General Guy E. Tripp, chairman of the board of directors of the Westinghouse Electric & Manufacturing Company; L. A. Osborne, president of the Westinghouse Electric International Company; E. J. Nally, president of the Radio Corporation of America; O. D. Young, vice-president of the General Electric Company, and his assistant, J. W. Elwood, sailed for Europe Aug. 23 on the Aquitania. It is understood that Mr. Young's and Mr. Nally's object in making the trip at this time is to complete negotiations in England, France and Germany for establishing radio service between those countries and the United States.

Plans for Greater Participation in N. E. L. A. Technical Committee Work

IN ORDER to permit of maximum participation in committee work by committee members, Chairman N. A. Carle of the Technical Section of the N. E. L. A. has departed somewhat from the procedure in past years by arranging, in addition to the main-group meetings, sub-group and dual-group meetings in different places, for the most part simultaneously with the main-group meetings. The minutes of the East and West meetings are to be consolidated and issued by the committee chairman as the minutes of his committee.

Each committee chairman will designate some one to represent him to handle the main-group meeting and will outline in advance to this representative what he wants done specifically at this meeting for his general committee work.

The group meetings will be held as follows:

SEPTEMBER. — *Main-Group Meetings.* — St. Louis: Electrical apparatus, Sept. 21 and 22; inductive interference, Sept. 19 and 20; meter, Sept. 19 and 20; prime movers, Sept. 22 and 23; safety rules, Sept. 22 and 23; underground systems, Sept. 19 and 20.

Sub-Group Meetings. — St. Louis: Overhead systems, Sept. 21 and 22; hydraulic power, Sept. 21 and 22.

Dual-Group Meetings. — Salt Lake City: Overhead systems, Sept. 28 and 29; hydraulic power, Sept. 28 and 29.

Sub-Group Meetings. — Salt Lake City: Electrical apparatus, Sept. 28 and 29; meter, Sept. 26 and 27; safety rules, Sept. 29 and 30; inductive interference, Sept. 26 and 27; prime movers, Sept. 29 and 30; underground systems, Sept. 26 and 27.

OCTOBER.—*Main-Group Meetings.*—Philadelphia: Prime movers, Oct. 24 and 25.

NOVEMBER. — *Main-Group Meetings.* — Cleveland: Inductive interference, Nov. 14 and 15; meter, Nov. 14 and 15; prime movers, Nov. 17 and 18; safety rules, Nov. 17 and 18; underground systems, Nov. 14 and 15.

Sub-Group Meetings. — Cleveland: Electrical apparatus, Nov. 16 and 17; overhead systems, Nov. 16 and 17; hydraulic power, Nov. 16 and 17.

Dual-Group Meetings.—San Francisco: Electrical apparatus, Nov. 16 and 17; overhead systems, Nov. 16 and 17; hydraulic power, Nov. 16 and 17.

Sub-Group Meetings. — San Francisco: Inductive interference, Nov. 14 and 15; meter, Nov. 14 and 15; prime movers, Nov. 17 and 18; safety rules, Nov. 17 and 18; underground systems, Nov. 14 and 15.

JANUARY.—*Main-Group Meetings.*—New York: Inductive interference, Jan. 23 and 24; meter, Jan. 23 and 24; prime movers, Jan. 26 and 27; safety rules, Jan. 26 and 27; underground systems, Jan. 23 and 24; electrical apparatus, Jan. 25 and 26; overhead systems, Jan. 25 and 26; hydraulic power, Jan. 25 and 26.

FEBRUARY.—*Main-Group Meetings.*—Pittsburgh: Prime movers, Feb. 27 and 28. Springfield, Ill.: Meter, not set.

MARCH. — *Main-Group Meetings.* — New York: Meter, not set.

Alex Dow Tells Reasons for Detroit Edison Success

THE question as to how the Detroit Edison Company has succeeded in maintaining the good will of its public was answered by Alex Dow, the president of the company, at the banquet of the Michigan Electric Light Association, by a citation of the company's three fundamental policies. These three principles are to maintain the fewest possible rules for the consumer and exercise the utmost care to avoid offense in their enforcement, to avoid promises unless it is certain that they can be kept, and to maintain service at all hazards. The making of numerous rules and their enforcement without intelligent efforts to give the customer a thorough understanding of the reasons for them was held to be a prolific source of misunderstanding.

At the Thursday morning session W. W. Potter, a member of the Michigan Public Utilities Commission, told the delegates that a municipal rate franchise is never valuable unless it is unjust. Either the public must receive service at less than cost or the company must receive more than a fair profit to make such a grant valuable. He expressed the opinion that the clock would not be turned back in regulation matters and that home rule would not be re-established.

James V. Oxtoby of the Detroit bar characterized the term franchise as a term lease under which the holder could not afford to do other than make provision to amortize the property used in giving service. In Michigan franchises are limited by a constitutional provision to a maximum of thirty years. He pointed out that too many utilities are proceeding on the theory that term franchises will be made permanent by renewals and as a result are facing serious trouble when the franchises expire.

The committee on safe wiring recommended through its chairman, J. C. Langdell, co-operative work with the inspectors, contractors and others interested. In the discussion that followed, the State Director of Public Safety, Roy C. Vandercook, pledged the assistance and co-operation of the state in the work. W. S. Boyd, secretary of the Western Association of Electrical Inspectors, pledged the co-operation of that organization and spoke against any attempt to draw a new set of rules when the product of many years of work in the form of the National Electrical Code was available.

The officers elected for the coming year are: President, J. K. Swanson, Jackson; first vice-president, E. Holcomb, Alma; second vice-president, S. B. Tuell, Houghton; secretary-treasurer, H. Silvester, Ann Arbor.

August Financing Considerably Below that of July

STOCKS and bonds of electric light and power utilities totaling $20,944,100 and yielding on an average 7.6 per cent were offered the investing public during the month of August. The large decrease which the month's total denotes under that of July in the volume of investments offered is occasioned by a falling off in both the size and number of the single issues. There were only thirteen single issues during August against twenty during July. Only one issue exceeded $3,000,000 in August, while seven exceeded this amount in July. August, 1920, showed a similar drop from the total of the preceding month. There was no appreciable change in the rate of return yielded the investor. The flotations consist entirely of long-term investments, the periods running from five to thirty years.

Name of Company	Amount of Issue	Period	Class of Security	Purpose of Issue	Rate of Interest	Per Cent Yield	Offered At
West Penn Power Co.	$3,000,000	25-yr.	First mortgage gold bonds, series D	Reimbursement for extensions	7	7.15	98.25
Middle West Utilities Co.	1,500,000	20-yr.	Secured gold notes, series C.......	Retire outstanding notes, reimbursement	8	8.05	95.25
Utah Light & Traction Co.	1,401,000	12-yr.	First mortgage collateral gold bonds	Replace matured issue.........	8	8.05	99.5
Southern California Edison Co...	6,000,000	27-yr.	General and refunding mortgage gold bonds of 1917....		6	7.07	88
Great Western Power Co. of California......................	500,000	30-yr	First and refunding mortgage sinking-fund gold bonds, series B	Reimburse for capital expenditures	7	7.33	96
Havana Electric Railway, Light & Power Co..................	1,500,000	5-yr.	Secured convertible gold notes...	Extensions	7	7.75	97
Consolidated Gas, Electric Light & Power Co. of Baltimore	2,500,000		Cumulative preferred stock, series A		8	8	100
Wisconsin Traction, Light, Heat & Power Co.	1,500,000	30-yr.	First mortgage bonds of 1901		7½	7.80	98
Northwestern Electric Co., Portland, Ore.	1,000,000		Cumulative preferred stock	Extensions and additions	7	[illegible]	91
Western United Gas & Electric Co.	600,000	10-yr	Gold notes of 1917		6	8.30	90
Arkansas Light & Power Co.......	650,000	10-yr.	Convertible bonds, secured sinking-fund gold notes...........	Floating debt, extensions.	8	8.50	96
Danville, Champaign & Decatur Railway & Light Co.	233,100	5-yr.	Bond-secured gold notes.........		7½	8	98
Lexington Utilities Co.	560,000	15-yr.	First lien and refunding gold bonds, series B	Extensions and improvements	6	8.00	82.5
Total	$20,944,100						

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest

Swedish Water-Power Developments.—At the close of 1920, says a Swedish business journal, the aggregate power utilized in water-power stations in that country amounted to about 1,200,000 hp., to which must be added about 260,000 hp. (135,000 hp. for the state and 125,000 hp. for private concerns), for which equipment was in process of installation.

Tulsa, Okla., Announces Electrical Exposition.—The first annual electrical exposition to be held at Tulsa, Okla., is announced for the week beginning Monday, Oct. 17. Fifty thousand square feet will be devoted to the display of "everything appertaining to electricity," and Sol Dan, managing director, says that the show will be the most elaborate affair of its kind ever held.

San Diego to Increase Capacity.—The San Diego (Cal.) Consolidated Gas & Electric Company will, it is announced, build an addition to its station in that city to house a new 15,000-kw. turbo-generator, the business of the company having expanded so rapidly that even with the additional capacity provided by the purchase of the street railway company's generating station last winter the available output is no longer adequate.

Orizaba Hydro-Electric Plant to Be Enlarged.—S. Pearson & Son, Ltd., the British firm of contractors and oil operators, are planning to enlarge their hydro-electric plant near Orizaba, Mexico. It is said that about 50,000 hp. will be added to the plant and that transmission lines will be extended to a number of towns and industrial centers not now reached. At present a string of cotton mills near Orizaba, as well as that city, Puebla and other towns, are supplied with electric lights and power from the plant.

Heat and Electricity.—According to a nameless but "well-known" individual described as a specialist, who has succeeded in breaking into sundry British newspapers, people do not suffer directly from prolonged heat so much as from the "electricity in the air." If any one doubts this, he need only read the following lucid statement to become convinced that electricity is the maleficent agent in the case: "Mercurial, vivacious people have been the most disturbed. There have been many cases of hysteria and dangerous nervous excitement among them. The reason is apparently the magnetic response of the electricity in their bodies to the electrically charged atmosphere."

Electricity in Vorarlberg.—There prevails at present a great activity in electrical undertakings in the little country of Vorarlberg, in Austria, which is said to be at the present time the only country in Europe without unemployed labor. Large electrical power stations are being erected at the lakes of Spuller and Luener. The Luener hydro-electric plant will be a winter power station of great size, and is to furnish electrical energy to the amount of 30,000 hp.

Commission to Look Into San Francisco's Electrical Supply.—Declaring that it does not desire to charge unjust rates for electricity and resenting attacks upon it made by the municipal authorities, the Universal Electric & Gas Company of San Francisco has petitioned the California Railroad Commission for a revision of its scheduled rates. The company buys electricity at wholesale and sells it at retail in San Francisco. It asks that the commission compel the Pacific Gas & Electric Company, the Great Western Power Company and the Sierra & San Francisco Power Company to sell it at wholesale such hydro-electric power as it may need. The Pacific Gas & Electric Company is now furnishing power to the Universal under a contract assumed when it leased the Sierra & San Francisco Power Company. The petition charges that the Pacific company refuses to supply it with more than the amount called for in the contract and that the Great Western Power Company refuses to furnish it with any power.

New York University Orders Automatic Substation.—In order that its students may keep abreast of the new developments in the electrical industry, the New York University will install a 75-kw. synchronous motor-generator set, with automatic switching equipment. This installation, which will be supplied by the Westinghouse Electric & Manufacturing Company, will be arranged so that it can be started or stopped by push-button stations at various points around the building. In addition to its use for exhibition purposes, it will be employed as a source of direct-current energy for the testing buses. The self-starting, two-phase, synchronous motor will be rated at 112 hp., 100 per cent power factor, 60 cycles, 220 volts and 1,200 r.p.m. The generator is to be a 75-kw., 250-volt, direct-current, 1,200-r.p.m., compound-wound, commutating-pole, two-wire machine, type "SK." The apparatus will be arranged so that on excessive overload series resistors will be automatically cut into circuit to reduce the line voltage to approximately 80 per cent of normal. At the same time an alarm bell will be rung. This, it is thought, will afford an opportunity of reducing the load without shutting off the laboratory direct-current energy. In case the warning of the alarm bell is disregarded, the station will shut down in the time interval necessary to operate the grid thermost

West Penn Company Helps to House Its Employees.—The West Penn Power Company has awarded a contract for the erection at Springdale, Pa., of ten houses, at a cost of $4,881 each, for the use of operating employees of its new six-million-dollar power plant and their families. The site selected overlooks the plant and is among the best available in that section. It is planned to begin work immediately and an effort will be made to finish the houses before winter. They will have six rooms and bath and will be of hollow-tile and stucco construction.

New Kentucky Hydro-Electric Development.—A site has been chosen for a power plant four miles below Burnside, Ky., on the Cumberland River, to supply electricity to a score or more industrial sections in Pulaski, Whitley, McCreary, Wayne, Russell, Clinton, Cumberland and Rockcastle counties. The power house, which will cost $700,000, will, it is said, be erected by West Virginia and New York capitalists as soon as federal engineers approve the site. They have been surveying and will soon submit their report to the Federal Power Commission at Washington.

Associations and Societies

N. E. L. A., Southeastern Division.—Dates for the convention of this division at Chattanooga, Tenn., have been changed from Oct. 18, 19 and 20 to Oct. 17, 18 and 19.

Electrical Jobbers' Association, Pacific Division.—The semi-annual meeting of this division was scheduled to take place on Aug. 29, 30 and 31 at Paradise Valley in Rainier National Park. Delegates representing from seventy-five to a hundred electrical jobbers were expected.

Coming Meetings of Electrical and Other Technical Societies

N. E. L. A., New England Division — New London, Conn., Sept. 6-9. (For program see issue of Aug. 27, page 436

International Association of Municipal Electricians — Colorado Springs, Col., Sept 6-10.

Pennsylvania Electric Association—Bedford Springs, Pa., Sept. 7-10.

N. E. L. A., Middle West Division and Nebraska Section — Omaha, Sept. 14 and 15. (For program see issue of Aug. 27, page 436.)

N. E. L. A., Great Lakes Division, and Indiana Electric Light Association — French Lick Springs, Sept. 21-23. (For program see issue of Aug. 20, page 387.)

Association of Iron and Steel Electrical Engineers — Chicago, Sept. 19-24.

N. E. L. A., Rocky Mountain Division, and Colorado Electric Light, Power and Railway Association — Glenwood Springs, Sept. 19-21.

West Virginia-Kentucky Association of Mine, Mechanical and Electrical Engineers—Huntington, W. Va., Sept. 20-23

Illuminating Engineering Society—Rochester, N. Y., Sept. 26-29. (For program see issue of Aug. 13, page 336.)

American Electrochemical Society — Lake Placid Club, N. Y. Sept. 29-Oct. 1

American Electric Railway Association — Atlantic City, N. J., Oct. 3-7

Empire State Gas and Electric Association — Lake Placid, N. Y., Oct. 6 and 7

N. E. L. A., Southeastern Section — Chattanooga, Tenn., Oct. 17-19.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities

Utility Companies Must Be Enabled to Keep Pace with Community Growth.—In granting to the Consolidated Gas, Electric Light & Power Company a temporary increase in gas rates, the Maryland Public Service Commission took the opportunity "again to emphasize the importance to the whole community of keeping the company in a sound condition financially, not only that it may continue to render service to its present customers, but that it also may increase its facilities to meet the increasing demands for service. The intensive campaign to promote industrial development of Baltimore and the extensive projects which the Public Improvement Commission and the municipal government now are contemplating for the development of the large territory recently annexed to the city," said the commission, "accentuate the importance of the Consolidated company being in a position to finance the large extensions which it must necessarily make in order to keep pace with the industrial and home-building growth."

Proper Distribution of Costs on Hydro-Electric System.—An order of the Railroad Commission of Wisconsin granting increases in electric rates in what are called the "loop system" communities of the Wisconsin-Minnesota Light & Power Company has been stayed in the courts. In its report to the judicial body before which complaint against the commission's decision was made, the latter body said: "Cost was not the only factor to be considered in fixing the rates either as between classes of service or as between localities. We wish to call attention to one error in method in all of the studies introduced on behalf of the plaintiffs which we consider vital. All of the distributions of cost, except as to purely local costs, which were introduced on behalf of the plaintiffs were made entirely upon an output basis. In a hydro-electric property a very substantial proportion of the total cost to serve is unrelated to the number of kilowatt-hours generated or consumed. The capacity which the generating stations must have to meet the demands of the customers is a much more important factor in determining the total cost than is the number of kilowatt-hours sent out. The most important differences between the viewpoint of plaintiffs and that which the commission took in its opinion are: (1) Whether an advantage should be given to localities situated relatively close to the sources of hydro-electric power; (2) whether rates should be fixed in each locality strictly upon the basis of the power cost plus the local costs in that locality. . . . Within the past few years there has been a very marked change in the characteristics of the electrical supply in Wisconsin attendant upon the development of large transmission systems and sources of hydro-electric supply. As long as the communities were served by their isolated plants, the plants could within certain limits be developed to meet the established market. This was true generally of the plants generating electricity by steam or internal combustion engines. A decidedly different condition was encountered upon the development of the large hydro-electric plants. Except for the addition of certain units of equipment it was not practicable to develop these plants in a piecemeal manner. The greater part of the investment had to be made before any part of the plant could be placed in operation. It was not possible to develop the hydro-electric plants unit by unit to meet the requirements of an existing market. Consequently, in order that the larger hydro-electric developments of the state might be made it was necessary to have a market for all, or at least for very substantial quantities, of the energy to be generated. . . . In fixing the rates we took into consideration the differences in conditions involved in supplying energy in different communities and groups of communities. . . . We do not believe that the commission is bound to base a schedule of rates or the distribution of costs among the schedules for several classes of service solely upon the analysis of the costs."

Increasing Rates on Which Consumers Have Based Uncompleted Operations.—In granting to the California-Oregon Power Company an increase of 5 or 10 per cent over previous schedules, the California Railroad Commission said: "Applicant's rates, when compared with those charged by other utilities in other parts of the state, are found to be relatively low, and applicant can hardly be expected to continue to earn a low rate of return while charging its consumers less than they would be charged for similar service from other utilities. On the other hand, rates which were initially established at the low levels have been made the basis of uncompleted business operations of its consumers and in a period of decreasing prices cannot be too sharply increased. Moreover, approximately 80 per cent of the energy delivered in California is sold to three special irrigation consumers at a remote part of its system and in competition with its own hydro-electric plants. With these limitations in mind, it is plainly apparent that the revenue from consumers served under the rate schedule specified in the application cannot and should not be increased to insure the return on applicant's property which under more favorable conditions and in a more highly developed territory might be considered reasonable."

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies

Missouri Limitation on Security Issues for Reimbursement Unconstitutional.—The Missouri Supreme Court has declared (State ex rel. vs. Public Service Commission) that the statutory limitation placed upon the authority of the Missouri Public Service Commission prohibiting the approval of security issues for reimbursement purposes where the expenditure was made more than five years prior to the filing of the application for approval with the commission is unconstitutional, at least in so far as bona fide issues under mortgages antedating the effective date of the law are concerned, in that it impairs the obligation of contract within the meaning of the Federal Constitution.

Humanitarian Doctrine.—In Albright vs. Joplin Oil Company the Missouri Court of Appeals made this statement of the "humanitarian doctrine" in injury cases: When one is oblivious to danger or, for physical reason or want of time, is apparently not going to get out of danger, and this attitude becomes apparent to one using an instrumentality that will cause injury, and the attitude of the one in danger is apparent for a sufficient length of time for an ordinarily reasonable person, using ordinary vigilance, to discover it, and the user of the instrumentality has the means at hand to avoid the injury by the exercise of ordinary use of the same, it is his duty so to manage the instrumentality as not to cause injury, and a failure so to do constitutes negligence." (229 S. W. 829.)[*]

Not to Cut Off Current on Primary Wires Raised to Permit Moving House an Act of Negligence.—Where a telephone wireman was killed while assisting to raise various wires that impeded the passage of a house undergoing removal because of contact with a 4,000-volt power line belonging to the city from which current had not been cut off notwithstanding due notification, a verdict for damages was justified, according to the Supreme Court of Nebraska (Graham vs. City of Lincoln). The fact that the employer's negligence concurred with the negligence of the city in causing the injury did not bar the employer's right to subrogation, and it was not erroneous to fail to instruct the jury that the amount of plaintiff's recovery should be diminished by the amount of compensation already paid to plaintiff by the employing company under the terms of the workmen's compensation act. (183 N. W. 569.)

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[*] The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel—Responsibilities and Association Appointments of Men Engaged in Professional, Executive, Operating and Commercial Branches of the Industry

A. H. Sweetnam, who for the last four years has been connected with Stone & Webster, Inc., Boston, in the capacity of electrical engineer, has resigned to accept the position of assistant superintendent of the electrical engineering department, Edison Electric Illuminating Company of Boston. Mr. Sweetnam was born in 1880 in Ligonier, Ind., where he received his early education. After service in the Spanish-American War he was employed in the construction department of the Commonwealth Edison Company and the Detroit Electrical Company, leaving the latter to enter Purdue University, from which he was graduated in the course of electrical engineering in 1905. For two and one-half years he was connected with Sargent & Lundy, designing engineers, resigning to become electrical engineer of the Cosmopolitan Electric Company, Chicago, a position he held until the company was taken over by the Commonwealth Edison Company in 1913. From this time until 1917 he was attached to the engineering department of the Commonwealth Edison Company, having supervision of installation and repairs of Edison, railway and 60-cycle substations. During the last four years he has had charge of the design of electrical installations in power stations and substations and industrial properties, as well as report work, devoting considerable time to properties under the management of Stone & Webster, Inc. Mr. Sweetnam is a member of the A. I. E. E., the National Electric Light Association, the Boston City Engineers and the Woodland Golf Club.

A. H. SWEETNAM

Philip Torchio, chief electrical engineer of the New York Edison Company, is in Europe on a pleasure trip. Much of his time has been spent in Milan, but he has also visited Trieste, Rome and Naples. Recently he has been in Paris. He is expected to return about Sept. 17.

William C. Yates, who has been appointed chairman of the industrial and domestic power committee of the American Institute of Electrical Engineers, is manager of industrial control sales of the General Electric Company. Mr. Yates was graduated from Union College, Schenectady, N. Y., with the class of 1898 and, after serving in the Spanish War, entered the testing department of the General Electric Company, with which company he has specialized in the field of controlling appliances and equipment. He has held successively the positions of engineer of the rheostat department, industrial control specialist at the New York office and commercial engineer of the industrial control department at Schenectady, and he is now manager of industrial control sales with headquarters at Schenectady. He has taken an active part in the control standardization work of the Electric Power Club and in the compilation of the safety standards of the Electrical Safety Conference. He has also served on committees dealing with the standards of the National Fire Protection Association and the American Iron and Steel Electrical Engineers, and last year was a member of the Institute committee of which he is now appointed chairman.

W. C. YATES

E. T. Franklin, general manager of the Trumbull Public Service Company. Warren, Ohio, was elected vice-president of the Ohio Electric Light Association at its recent annual convention. Mr. Franklin has been connected with the central-station industry for nineteen years, having been appointed chief engineer of the Easton Power Company, Easton, Pa., in 1902, a short time after his graduation in electrical engineering from McGill University, Montreal. In 1906 he was advanced to be superintendent of that company, and five years later he was made secretary. The Eastern Pennsylvania Power Company was formed in 1912 by a consolidation of the electrical power companies in and around Easton, and Mr. Franklin was appointed general superintendent of the group. He resigned this position the year following the consolidation to accept the position of plant superintendent of the Empire District Electric Company, Joplin, Mo., and in 1914 organized and directed the results engineering work for the properties of the Cities Service Company in Missouri, Kansas, Oklahoma and Nebraska. Later in the same year he was made general manager of the Trumbull Public Service Company, the position he holds at the present time. During the period of his management the sales of the company have increased from 7,000,000 kw.-hr. in 1914 to 92,000,000 kw.hr. in 1920, and the plant capacity from 2,000 kw. to 40,000 kw.

E. T. FRANKLIN

C. Jerome Abbey, superintendent of the Skowhegan district of the Central Maine Power Company, Augusta, Me., now holds the record of being the oldest central-station man in Maine, having served for thirty-two years at Skowhegan. Mr. Abbey is also a pioneer in transmission-line construction. He worked on the building of a line from Skowhegan to Norridgewock in January, 1899, just prior to the electrical installation made in the Hoosac Tunnel. Twenty-five years of Mr. Abbey's experience was with the Skowhegan Electric Light Company, where he worked his way up from lineman to superintendent. When that company was acquired by the Central Maine Power Company Mr. Abbey was retained in the same position.

Kazutada Sakurai, equipment engineer of the Tokyo (Japan) municipal bureau of electricity, is making a tour of the United States to study electric railways.

Millard C. Ernsberger has been appointed professor of heat-power engineering of Sibley College, Cornell University. He entered Sibley College in 1906 and was graduated with the degree of mechanical engineer in 1908. For a year after his graduation he was instructor in charge of the junior course in power engineering. In 1909 he entered the University of Rochester to act as professor of mechanical engineering.

T. C. Martin has just received from India a version of his "Life of Edison," written a few years ago in association with Frank L. Dyer, of the Edison Laboratory legal and patent staff, and published in two volumes by Harpers. The author of the translation is Rewashanker O. Sompara, of Palitana, India. Mr. Martin confesses to a fair working knowledge of two or three languages, but admits his inability to test the accuracy of this performance, which is in one of the oldest written tongues of Hindustan. At the present moment negotiations are in progress for a translation of the same successful book into Japanese.

J. H. Walker, superintendent of central heating of the Detroit Edison Company, has been elected president of the National District Heating Association. Mr. Walker has been active in the affairs of the society since 1912, and the handbook on heating engineering soon to be issued by the association is due largely to his efforts. He is a graduate of the University of Michigan, class of 1911, and became connected with the Detroit Edison Company shortly after finishing college. He was appointed to his present position in 1918. He is a member of the American Society of Heating and Ventilating Engineers and the author of a number of papers presented before this society. He is also a member of the American Society of Mechanical Engineers. In conjunction with the late Prof. John R. Allen he wrote "Heating and Ventilation," a textbook which is widely used in technical schools.

J. H. WALKER

J. F. Owens, vice-president and general manager of the Oklahoma Gas & Electric Company, Oklahoma City, has been elected an honorary member of the Engineering Society of Oklahoma University, and has been presented with a gold emblem by that body in appreciation of his services to the public utility industry in that state. Mr. Owens was born in Illinois in 1878 but received his education in Kansas, where he attended country school, Kansas State Normal College and Kansas State University. He entered the public utility business through the gas field in 1905 at Baldwin, Kan. In 1906 he installed a gas plant at Wagoner, Okla., and managed it for two years. In 1908 he was made general superintendent of the Coney River Gas Company. He joined H. M. Byllesby & Company in 1911 as superintendent of their gas plant at Muskogee, Okla. In 1917 he was made manager of the Muskogee Gas & Electric Company and in 1918 became vice-president and general manager of the Oklahoma Gas & Electric Company as a result of the consolidation of all Byllesby properties in Oklahoma under that name.

J. F. OWENS

Obituary

A. H. Winslow, manager of the appropriations department of the National Lamp Works of the General Electric Company, was killed in an automobile accident near Malinta, Ohio, on Aug. 26. Mr. Winslow was born at Marblehead, Mass., Nov. 17, 1863. He was first associated with the Thompson-Houston Company, which later became the General Electric Company. He was head accountant of the Lynn works, General Electric Company, from August, 1892, until July, 1893, when he was made paymaster, which position he held until April, 1894. At that time he was made disbursement clerk for the General Electric Company, with offices in Schenectady. He served in that capacity until July, 1903, when he was made general auditor of the National Lamp Works, Cleveland. In 1914 he became manager of the newly created appropriations department.

Frank A. Egan, who for many years had been employed by the Adirondack Power & Light Corporation and its predecessors and who had had charge of important construction work for this company, died at Glens Falls, N. Y., recently, at the age of forty-five.

William C. Robinson, vice-president and chief engineer of the Underwriters' Laboratories, died July 31 at the age of fifty-three. He had been associated for thirty years with the work of testing materials by electrical and other means as an aid in fire prevention and had attained a wide reputation in his chosen field.

Louis J. Goldman, president of the Cincinnati Electric Tool Company, one of the largest companies in its line in the Middle West, is dead. Mr. Goldman, who was seventy-one years old, had been in failing health for several months. He had resided in Cincinnati nearly all his life and had long been connected with the electrical industry.

J. M. Smith, sales manager of the Ivanhoe Regent Works, Cleveland, Ohio, died at Utica, N. Y. Aug. 24, while on a business trip. Mr. Smith had been influential for a long time in the development of industrial lighting. While connected with the Buckeye Lamp Company Mr. Smith was able to contribute to the practical side of this development owing the fact that he himself had been a mill man.

Chandler Robbins, formerly president of the Robbins & Myers Company, Springfield, Ohio, died at Baltimore, Md., on Aug. 18 of pulmonary embolism. He was seventy-seven years old. Mr. Robbins was one of the founders of the firm which bears his name and which was originally in the foundry business, and he remained with it until about the time that it took up electrical manufacturing in the late nineties.

Jules Carpentier, one of the founders of the French journal *L'Industrie Electrique*, recently lost his life as the result of a motor-car accident. He was born in Paris in 1851 and educated at the Ecole Polytechnique. His activities were largely devoted to devising arrangements for rapidly and accurately measuring electrical quantities, and he was closely concerned in the production of the instruments for the measurement of electric currents made at the Ruhmkorff workshops. He was, it is said, an important factor in much of the work associated with the names of D'Arsonval, Marcel Duprez and Baudot. Mr. Carpentier was a member of the French Academy of Sciences and a commander of the Legion of Honor.

Trade and Market Conditions

Business Reviews, Together with Market Letters from Important Trade Centers, on the Supply, Demand and Prevailing Prices of Electrical Apparatus and Supplies

Lower Prices on Some Poles and Cross-Arms

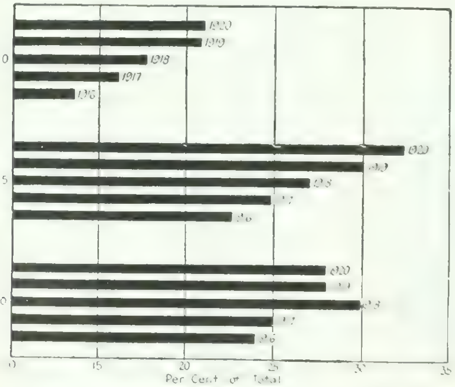
REDUCTIONS are reported this week in certain poles and cross-arms. Chicago, St. Louis and New York territories report that Northern white-cedar poles in lengths from 25 ft. with 4-in. top to 35 ft. with 7-in. top were reduced about Aug. 19 in varying amounts from 15 to 25 per cent, depending on size, grade and classification. Utilities around St. Louis showed a tendency to hold off buying until the fall lighting demands made it necessary, and the reduced prices are stimulating pole sales. Present inquiries indicate a rather healthy business for the next few months. Stocks are in good shape.

Around Chicago the demand has been slow and uneven, and pole movement has not reacted as yet to the price cut. Buying around New York, too, is rather quiet.

Yellow-pine cross-arms have come down about 10 per cent in the past ten days. No change has been reported in fir arms. Railroads and utilities in the Southwest are providing a fairly good call for yellow-pine arms.

Lamp Voltage Tending Strongly Toward 115 Volts

WHILE from the report of the lamp committee presented before the N. E. L. A., in Chicago early last June it was shown that in the distribution of lamps by voltages during the last eight years the voltages of 110, 115 and 120 predominated, it is evident that if there is any one voltage toward which there appears to be standardization it is 115 volts. In 1920 the distribution at these three voltages totaled 81.2 per cent of all large lamps, of which the 115-volt class took 32.3 per cent of the total, or 39.8 per cent of these three classes. In 1919 the 115-volt lamps took 38.1 per cent of the total of these three classes, and in 1918 36.2 per cent.



115-VOLT DISTRIBUTION HAS GROWN IN STEADY LEAPS

The distribution of the 115-volt lamp has grown fast and virtually in a straight line since 1913. The 110-volt lamp since that date has varied within rather narrow limits, the last two years being even and below 1918. The 120-volt lamp has grown in the last eight years, but 1920 showed little increase over 1919. The 112-volt size has fallen off fast till in 1920 it represented only 5 per cent of the total distribution. All the other odd voltages are below the 5 per cent value and are keeping low except the 125-volt size, which has been holding around 5 and 6 per cent in the last three years.

Of course, the assistance of the lighting companies has been invaluable in reducing the number of lighting voltages, but there is still much to be accomplished in the adoption of lamps of standard voltage within narrower limits.

The lamp committee sent out a questionnaire to its member companies and received answers from 520 companies, or 46 per cent. Of these 498 used one or more standard voltages. Of the thirty-two which used odd-voltage lamps fifteen have reported their decision to standardize and eleven are considering the matter.

During the year 1920, of the companies reporting to the questionnaire, 26.2 per cent raised their voltage, 15.6 per cent lowered it, and 58.2 per cent made no change in voltage. On Jan. 1, 1920, 79.2 per cent of these were completely standardized, while on Jan. 1, 1921, 96 per cent were completely standardized. The committee believes the information obtained from the replies is fairly representative of the practice of the central stations in the United States, inasmuch as the practice of member companies throughout all sections of the country is represented in the result. Consequently it is expected the committee's report next year will show even better results than this year.

Some Factors Affecting Fan Motor Prices

A CONSIDERATION of the costs of fan motors naturally involves costs of the component parts. Manufacturers are at this time studying costs of next year's fans. That electric fans can be produced starting this summer for next season's demand at a cost lower than that encountered for the past season's fans should go without saying. Raw materials, however, must be purchased for the most part this summer if they have not already been purchased. Production undoubtedly is well under way in most plants.

For comparative purposes prices have been taken as of Jan. 1, 1921, and Sept. 1, 1921. No. 2 foundry pig iron, Pittsburgh, is quoted now at \$21.96 per ton, as against \$34.96 on Jan. 1, a drop of 37 per cent. Black steel sheets, Pittsburgh base, have dropped from 4.35 cents per pound to 2.75 cents, 37 per cent. Since May, 1920, electrical sheets have dropped between 40 and 50 per cent.

Magnet wire prices follow bare copper wire prices quite closely. Bare copper wire at the mill, net, is now 13.25 to 13.50 cents per pound as against 16.25 cents last January, a drop of 18 per cent. Both high and low sheet brass are 18 per cent lower in price now than on Jan. 1.

Insulation prices have dropped in varying amounts. Representative quotations show vulcanized fiber and fishpaper off about 10 per cent, 10-mil varnished cambric off 30 per cent, 5-mil off 5 per cent and 5-mil varnished silk off 22 per cent. A good high grade of shellac is 44 per cent lower than on Jan. 1, while insulating varnishes are reported to have changed little. No change is recorded on mica plate for commutator segments of small motors, although it is 26 per cent lower for large motor use. Cotton tape is 46 per cent off and friction tape in 1,000-lb. lots is 22 per cent lower.

No consideration has been given to separate labor charges in this discussion, but in general the labor charge is less now than it was on Jan. 1.

Wire Makers to Consider Monthly Publication of Statistics

MANUFACTURERS of insulated wire are to meet on Sept. 13 in New York City, at which gathering W. M. Steuart will be present as the representative of Secretary Herbert Hoover. These manufacturers will be represented by four groups—bare wire, rubber covered wire, weatherproof wire and magnet wire—and they have been brought together with a view to discussing with Mr. Steuart the best methods to adopt for obtaining from each group monthly reports on production, current stocks and distribution of their respective industries. These reports may be published monthly by the Department of Commerce, the same as is now being done under twenty headings for other industries in the monthly *Survey of Current Business*, of which Mr. Steuart is director.

New Bill Would Repeal Tax on Electric Fans

AS FAR as can be determined at this writing, the revised tax bill which was introduced into the House of Representatives on Aug. 15 and passed by that body on Aug. 20 contains no provision for an excise tax on electric fans. The federal tax laws which became effective Feb. 25, 1919, imposed a tax of 5 per cent on portable electric fans, this tax being paid by the manufacturer, producer or importer of these fans. Apparently this tax is to be repealed if this bill is made law. It is expected that this bill will be taken up by the Senate at the end of its recess, on Sept. 21, but meanwhile it is said to be in the hands of the Senate committee on finance, which committee undoubtedly will hold public hearings with a view toward possible changes in the bill.

The 5 per cent tax on automobile, automobile truck and motorcycle accessories, under which electrical accessories such as batteries, magnetos, etc., are included, is retained when these accessories are sold to other than the manufacturers or producers of these automobiles, etc.

Portable lighting fixtures, including lamps of all kinds and lamp shades if sold for more than $10, will carry a tax of 5 per cent in the new bill as at present drafted. The old law, after May 1, 1919, carried a tax of 10 per cent on this equipment on the amount in excess of $25 each.

July Electrical Exports Amount to $6,417,336

FOR the month of July the total value of electrical exports came to $6,417,336, the lowest month registered to date this year and the lowest since January, 1920. It is less than half the value of exports of last February, but only slightly below the figure of last July. The figures, however, do not present a like condition when volume of exports is considered and when factory production is considered because of the decrease in price of electrical goods since last fall. During the winter the factories were able to concentrate on back orders for exports, because of slackened domestic demand, and extra large amounts of goods went through and were shipped during those months, giving the returns large values.

	July		Seven Months Ended July	
	1920	1921	1920	1921
Batteries	$497,657	$183,525	$3,832,467	$2,810,523
Carbons	119,309	29,317	791,688	277,794
Dynamos and generators	536,400	790,634	3,534,164	4,508,119
Fans	87,892	37,566	805,590	1,129,703
Heating and cooking apparatus	124,485	54,262	1,046,060	1,253,816
Insulated wire and cable	558,791	496,928	4,242,444	7,046,022
Interior wiring supplies	336,881	79,327	1,851,701	1,433,016
Arc lamps	2,004	.	15,613	8,514
Carbon-filament lamps	5,303	10,802	63,766	104,897
Metal-filament lamps	244,010	153,689	2,298,822	2,652,230
Magnetos, spark plugs, etc.	304,702	85,173	2,224,144	992,079
Meters and measuring instruments	202,612	214,660	1,525,273	2,039,690
Motors	709,086	1,121,583	6,822,986	11,975,300
Rheostats and controllers	26,283	61,755	397,477	776,868
Switches and accessories	299,615	280,258	2,482,289	3,325,800
Telegraph apparatus	33,150	39,107	411,438	793,913
Telephones	215,384	273,533	2,130,025	3,479,206
Transformers	165,728	788,719	2,050,456	5,830,651
All others	2,018,754	1,716,498	16,685,796	19,763,189
Total	$6,488,046	$6,417,336	$53,212,172	$70,236,330

July's figures are almost $900,000 below those of June, or 12 per cent. Still, during July a record for the year to date was established in dynamos and generators and more transformers were shipped from the country than in March, April, May and June. June figures were bettered in switches and accessories and in telegraph equipment. In almost every other line, though, low records for the seven months were hung up.

Considering total exports for the first seven months of this year, these amount to $70,236,330, $17,000,000, or 32 per cent, ahead of the figures for last year in the same period. This fact, it would seem, gives some hope for the industry. The figure for the entire year indicated at this time is more than $120,000,000, 20 per cent over 1920's actual figure.

The figures presented in the attached table were received from the Bureau of Foreign and Domestic Commerce, Washington.

Loom Prices Back to Pre-War Levels

DURING the last week manufacturers of non-metallic flexible conduit reduced prices another five points, or about 14 per cent, bringing the discount up to 70 per cent. This figure is a very fair pre-war price for loom, especially when it is considered that the lowest discount the material has taken at any time is 75 per cent and that was only under the most extreme pressure. Although buying is only on a moderate scale, still reports from certain quarters show that there has come an upward turn to the market, and orders are coming in in a little better volume since this reduction.

Metal Market Situation

THE copper market presents a firmer tone and a firming in price of ⅛ of a cent is noted. Electrolytic in producers' hands is being held at from 12 cents a pound to 12⅛ cents, delivered, for spot copper, with a tendency on the part of all to hold to the 12-cent figure. October is worth one-eighth more. There have been moderate sales by producers for domestic use during the past week, and the outside market seems to have fared equally well.

For export shipment electrolytic is quoted at 11.75 cents, f.a.s., for September and 11.87½ for October. London standard spot copper has strengthened £1 12s. 6d. since last week and presents a much firmer tone following the upset there a fortnight ago.

Galvanizers are in the market again for zinc, but the quantities moving, while larger than a few weeks ago, are still small in volume. The price is slightly easier under close competition in the selling market.

NEW YORK METAL MARKET PRICES

	Aug. 23, 1921	Aug. 30, 1921
Copper	£ s. d.	£ s. d.
London, standard spot	66 0 0	67 12 6
	Cents per Pound	Cents per Pound
Prime Lake	12.25	12.25
Electrolytic	12.00	12.00
Casting	11.37½	11.50
Wire base	13.50–14.00	13.25–13.50
Lead, trust price	4.40	4.40
Antimony	4.50	4.50
Nickel, ingot	41.00	41.00
Sheet zinc, f. o. b. smelter	11.00	11.00
Zinc, spot	4.65	4.62½
Tin	26.12½	26.87½
Aluminum, 98 to 99 per cent	24.50	24.50

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	9.50–9.75	9.50–10.00
Brass, heavy	4.50–4.75	4.50–4.75
Brass, light	3.75–4.00	3.75–4.00
Lead, heavy	3.25–3.37½	3.25–3.37½
Zinc, old scrap	2.00–2.25	2.00–2.25

THE WEEK
IN TRADE

Prices When Quoted Are Those Prevailing at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

The electrical market as a whole this week shows little improvement over last week, but, to say the least, is holding its own. New York is on an even rate of buying. The Chicago market is spotty, although building permits issued in the month of July were 100 per cent above those in June. Still, there is a heavy increase in inquiries for farm-line distribution apparatus. In Boston there is little change in the situation, but building operations are improving. The Southeastern States find that the expectation for a profitable cotton crop is lending a firmer tone to the market. St. Louis territory reports a better tone to the jobbing market. Energy sales for June were better than those of the same month last year, and the market for pole-line materials is better.

In the Intermountain and Western States crop, stock-raising, lumber and kindred industries are in a satisfactory state, and the San Francisco building strike finally has been settled, with a lower rate of pay.

Price reductions are announced in loom, Western white cedar poles, yellow-pine cross-arms, link belt, pulleys and pole-climbing equipment.

NEW YORK

Little if any change in conditions was reported by the jobbers this week, although the general sentiment is that the low point is well past and a slow and steady improvement is under way. The demand for conduit, wire and schedule material continues on an even keel, orders for the most part being for small and moderate-size quantities, indicating that most work is being done in residences and small business buildings. There has been some demand for material for repair and maintenance work, and at least one jobber reports activity in industrial lighting fixtures.

Prices on standard material remain about the same. However, one manufacturer of pole-climbing equipment has announced a general reduction in prices, effective Sept. 1, and another manufacturer of power-transmitting appliances has announced a lower price schedule, giving as the reason lower manufacturing costs for labor and material.

Heating appliances in general are moving sluggishly and fall buying has not yet appeared. Flatirons only are moving, and the steady demand of the past month has resulted in a temporary shortage. For the larger higher-priced appliances there is little demand.

Collections remain slow, although there is no great uneasiness regarding outstanding accounts. Electrical credit men are, however, extending new credit with a great deal of caution.

Conduit.—Prices quoted for conduit this week remain at the same levels as last reported. The following prices were quoted. For ½-in. black, in 2,500-ft. lots, $54 to $55; ¾-in. $73 to $76, and 1-in., $106 to $108. Galvanized pipe in the same sizes was quoted as follows: $60 to $63.58, $80 to $82.57, and $116.96 to $118.65. Demand continues light but fairly steady and small to moderate-size orders are the rule. Stocks are fair to good in all sizes.

Flexible Armored Conductor.—Demand for this material has not increased but continues steadily for use in wiring new homes. No. 14, two-wire, single-strip was quoted this week at $45 to $47 per 1,000 ft. in 1,000-ft. lots. Stocks are good and some price competition has appeared.

Rubber-Covered Wire.—Stocks are good and demand is on a par with other materials mentioned. Sales are usually in small lots. No. 14 rubber-covered in lots of 5,000 ft. was quoted at $6.25 to $6.85 per 1,000 ft.

Sockets.—Demand is fair and stocks are good to large. Discounts of 25 and 26 per cent in standard package lots have been quoted this week.

Tape.—Prices remain about the same as last quoted. Ordinary friction tape in 100-pound lots is quoted at 35 cents per pound, and rubber tape in the same quantity is quoted at 38 cents.

Heating Appliances.—There has been a steady demand for electric irons, and some jobbers have reported difficulty in obtaining sufficient quantity to fill customers' orders. Other heating appliances are moving very slowly.

Washing Machines—Vacuum Cleaners.—There has been no increase in the sale of washing machines since the 10-per cent reduction went into effect in July. Vacuum cleaners are also proving slow movers. The higher prices of these appliances appear to defer sales at this time.

Pole-Climbing Equipment.—Mathias Klein & Sons, Chicago, have made a general reduction in their line of pole-climbing equipment and tools, effective Sept. 1. On one or two lines there has been a price revision upward.

CHICAGO

A spotty market has prevailed during the past week with a bright spot here and there, but in the main the quietness of the last three months still continues. Jobbers report an unusually heavy influx of inquiries for farm-line distribution apparatus, but so far the orders have failed to come in in proportionate numbers. Prices on most lines have been unchanged, although it is reported that large buyers are able to obtain some concessions. Manufacturing is at a low ebb with little indication of betterment for some time. Makers of electrical automotive equipment increased their July production about 2 per cent over June. They are still far below normal. Retail business has been extremely quiet for several weeks, the fan season being almost entirely over and other lines waiting for the fall buying season.

Building permits for July were 100 per cent ahead of those for June and approximately the same percentage ahead of the monthly average during the period from 1914 to 1919. It must be taken into consideration, however, that a great deal of this building will not go ahead until some decision is reached on the wage scale tangle, and for that reason operations may not actually begin until next spring. Activities in the steel industry in Chicago continue to be sporadic but are better than a month ago. Steam-coal production is still subnormal, with sales negligible, indicating that central-station companies in the Midwest are not purchasing despite predictions of a possible famine.

Wire.—The market has weakened again and bare copper wire may be obtained as low as 14 cents per pound with very few buyers in evidence. The improvement in sales of rubber-covered wire reported last week has not lasted and a new low quotation of $6.15 per 1,000 ft. of No. 14 has been recorded in several transactions. Weatherproof prices are nominally the same as last week, with little demand.

Motors.—No change is discernible in conditions in this line. A few orders for small sizes for shop work continue to come in but make hardly any impression on the large stocks carried by all distributers. There are no price changes.

Dry Cells.—This item is moving in normal quantities. Prices average from 30 to 32 cents. Stocks are good but are not quite so topheavy as they were earlier in the spring.

Porcelain.—Prices are unsettled and movement is slow locally, though sales in the smaller towns in Illinois are improving. The charge for packing has been reduced to 90 cents per barrel.

High-Tension Equipment. — Manufacturers report increased sales of outdoor substation equipment for use in supplying coal mines and manufacturing plants.

BOSTON

Little change in trade is evident this week although factors tending to improve business are plainly at work. Prices weakened last week on non-metallic flexible conduit, and on orders of 2,500 ft. or over sharp competition is evident in flexible armored conductor. Stocks are slowly being liquidated. Inquiries maintain a healthy tone and collections continue to reflect better banking conditions. Building operations are slowly reviving. In the textile and leather fields previous improvement in conditions seems to be well sustained. Appliance trade is dull, featured by substantial reductions in washing-machine prices. With the close of the vacation season a distinct improvement in trade is anticipated. The deflation of labor continues here and there.

Wire.—The demand is very quiet this week, with excellent stocks in hand. In 5,000-ft. lots No. 14 rubber-covered sells around $6.25 per 1,000 ft. Central-station construction is still on a cautious scale.

Flexible Armored Conductor.—Moderate sales are noted, with close competition. No. 14 sells nominally at $51 per 1,000 ft. in 2,500-ft. lots, prices running as low as $44.50 per 1,000 ft. on large orders. Prices are open above 2,500 ft.

Rigid Conduit.—Fair sales are reported, with good stocks. No new price movements appeared during the week. Representative quotations are: 1-in. black, $107.35 per 1,000 ft.; galvanized, $117.55; black, ½-in., $57.92, galvanized, $63.03, all in less than 2,500-lb. lots. Fittings are moving rather slowly.

Fans.—Revived warm weather Monday facilitated renewed movement of fans out of retail stocks, but the season is virtually over so far as the jobber is concerned.

Meters.—Demand is very spotty, varying considerably from day to day. No difficulty in meeting current requirements is heard of, and if building operations quicken this fall, local stocks will be depleted enough to arouse interest in manufacturing propositions.

Air Heaters.—Advance sales for fall business have begun on a moderate scale. The continued high price of domestic fuel bids fair to insure a healthy demand for these equipments before New Year's.

Motors.—Small-order business is all that is reported, but inquiries are fairly active and considerable rehabilitation work in industrial plants is in the air. Sales efforts are largely concentrated on betterment aspects of motor application.

Non-Metallic Flexible Conduit. — Prices were easier at the close of last week, with moderate demand and satisfactory stocks in relation to delivery requirements. The following net prices have been established: 7/32-in., coil to 1,000 ft., $23; 1,000 ft. to 5,000 ft., $20; 5,000 ft. or over, $18.50. For ¼-in. lots, coil to 1,000 ft., $27; 1,000 ft. to 5.000 ft., $22.50; 5,000 ft. or over, $21.

Washing Machines.—Prices are lower on a number of representative makes. A leading dealer quotes $110 retail price on new machines of a well-known make, which he features as the pre-war figure. Jobbers are working energetically to get the fall trade into shape, and sales reflect increased interest on the part of the public.

ATLANTA

The fears expressed in some quarters that this fall would again witness low-priced cotton have been largely dissipated by preliminary information that the government's estimate would show a crop of only 7,000,000 bales, a shrinkage of approximately 1,000,000 bales since the last estimate. If this estimate is correct, as all things indicate it is, not only will this year's cotton bring a profitable price but cotton held over from last year will be marketed at an enhanced figure. This outlook is lending a much firmer tone to business in general, and it can be conservatively said that a much better feeling is in evidence all over the territory. Of course, the midsummer dullness is still to be noted, but on every hand are signs of fall activities. Large contractors and builders report increasing interest in construction on the part of industrial plants, while electrical jobbers report the receipt of heavy orders from central-station companies for construction material. The bulk of the jobbers' business, however, is still going to the small contractors engaged in wiring homes, apartment houses and small stores.

Collections have not yet assumed a favorable aspect, though they are somewhat improved over the period of three weeks ago.

Bell-Ringing Transformers.—Activity in this line has been well sustained throughout the spring and summer, owing to the residential boom now under way. Outlying sections are coming into the market, jobbers reporting very satisfactory business. Prices remain firm and stocks are in good shape.

Automotive Cables.—Inquiries of jobbers have increased materially during the past week and an increase of actual sales has been reported, especially on the reinforced, single and twin, No. 14 type armored conductor. Ignition cable shows a more healthy condition as confidence in the future accessory business is increased.

Non-Metallic Flexible Conduit.—A price reduction of 15 per cent in this line was effective last week and has served to check rather than stimulate sales, which up to the time of the reduction have been fairly good. Jobbers' stocks have become somewhat spotty, though shipments are reported very good.

Conduit.—An unusual situation is in evidence in this market, a number of manufacturers taking orders for pipe at prices offered by the buyers. One of the larger jobbers, however, reports a fairly satisfactory volume of sales at standard market quotations. Stocks of both black and galvanized are in fair shape.

Safety Switches.—Interest in this line continues, stimulated by the adoption of rules requiring their installation. The 30-amp., three-pole type is the most popular, although there is a fair movement of all other sizes. Stocks are fair to spotty, with factory shipments good.

Poles.—The last few weeks have produced a brisk demand for all varieties of poles, the number of orders now being about equally divided between chestnut, cedar and creosoted pine. Stocks and shipments are quite satisfactory.

Pole-Line Hardware.—Heavy orders were placed by the larger central stations during the last ten days, the equipment being for both standard and N. E. L. A. types. Stocks are in good shape throughout the territory.

Pins and Insulators.—Unlike pole-line hardware, these lines are very dull, the movement of insulators being particularly slow. No price reductions have been made recently and stocks are in good condition.

ST. LOUIS

A slightly better tone to business is reported by jobbers this week. Some are inclined to believe that gradual betterment may now be expected, others that the week marks but one of the small peaks of the fluctuating curve of demand for electrical goods. However, it seems apparent that the usual fall improvement in certain lines will be experienced this year, but perhaps to a modified extent. Lamp orders show a tendency to increase, there is improved demand for pole-line materials for small extensions and dealers are placing orders for portable lamps. Some report slight improvement in purchases by the railroads. Inquiries from industrial concerns, while not yet developing into appreciable orders, are indicative of possible improvement in the sale of motors, rubber-covered wire, safety switches and the like. The sales of central-station energy in St. Louis continues to exceed each month the sales for the corresponding month of last year.

One jobber reports considerable activity in the sale of repair parts, especially of motors, explaining that industrial concerns are making their old equipment last longer than would ordinarily be the practice. The shoe manufacturers continue to buy considerable quantities of new equipment. All purchases, however, of whatever nature, are for small amounts.

Pole-Line Hardware.—Improved business is reported, orders still being for small amounts and to meet only immediate requirements.

Lamps.—Demand is reported normal for this time of year and normal demand is expected throughout the coming winter. Jobber stocks are inclining toward heaviness. Dealer stocks are in fairly good shape. A continued demand for automobile lamps is reported, and demand for low-voltage lamps for farm lighting is said to be increasing.

Loom.—A 10 per cent reduction has been made but movement is fairly slow. Stocks are in satisfactory shape.

Safety Switches.—Though the turnover continues to be fairly small, there is some improvement in the demand.

Porcelain.—A slight flurry in the prices for porcelain occurred during the week, but the resultant price is unchanged. No material change in the demand can be found.

Rectifiers and Motor-Generators.—One jobber reports that there is little call for motion-picture rectifiers but that a fairly good business is being secured in motor-generator equipment, principally in the smaller Illinois towns. In some sizes shipment from factory stocks can be given, and not more than thirty-day shipments are asked in any others. Battery-charging rectifiers are experiencing a reasonably good demand and delivery from St. Louis stock is available.

Wire.—Slightly easier prices prevail in rubber-covered, No. 14 being priced at $6.10 per 1,000 ft. in 10,000-ft. lots, a reduction of about 30 cents from last week. Weatherproof and bare wire vary in base price from 14½ cents to 15¾ cents per pound. Improvement in sales of rubber-covered are reported, and there are increasing inquiries for it in industrial sizes.

Metal Reflectors.—The demand for reflectors for industrial plants is exceedingly light. Prices are about 10 per cent lower. Stocks apparently are in about normal condition.

Lightning Arresters, Choke Coils and Disconnecting Switches. — Improved buying from the Southern States, especially Tennessee, is reported. Increased attention is being given throughout the entire territory to the advantags of better lightning protection.

SAN FRANCISCO

After sixteen weeks of curtailed building activity, the builders' strike has now been unofficially declared ended. By a vote of approximately four to one the men voted to return to work as individuals on the best terms obtainable, although previously by a vote of two to one they had declined to return as unions. These terms are reported to be at a rate of pay 7½ per cent lower than the previous rate of $10 per day. Various building jobs are now being besieged by ex-strikers, although it is probable that one or two weeks will elapse before things are again running smoothly. The completion of the Western Pacific extension from Niles to San Jose will tap a rich fruit district. Under competitive conditions the canneries are now working at top speed and good prices have been obtained by the growers.

Radiators.—Large stationary sizes are being featured in the present campaign on heavy-duty devices instituted by the Great Western Power Company, and it was reported that a gratifying number of installations both in remodeled and new apartment houses have been arranged.

High-Tension Insulators.—A 10 per cent reduction on the smaller sizes of Thomas porcelain insulators is announced. Present business on the higher-voltage insulators in holding up well despite the fact that the larger jobs have all been allotted and in many cases installed. Still, because of the completion of smaller distributing systems and isolated orders from smaller companies fairly consistent demand is reported.

Lamps.—This is the quiet lamp season, although business has been surprisingly good right up to the end of June. An intensive campaign on Christmas tree outfits has resulted in the virtual completion of dealers' stock arrangements for the coming season.

Wire.—New prices on wire and cord provide that the maximum discount shall be given on coil lots instead of on 2,500-ft. lots as formerly. The new price on cotton-covered twisted in coils runs about $14.50 per 1,000 ft., and it is about $27 per 1,000 ft. on silk twisted, a decrease of about 25 per cent from the previous standard.

SEATTLE—PORTLAND—SPOKANE

An electrical jobber who returned recently from a business trip covering most of western Washington reports conditions considerably improved throughout this section, and it is now anticipated that the coming fall months will see business well on the road to normal conditions. All major crops are excellent and they are finding a ready market. As the farmers are beginning to market their produce money is becoming somewhat easier. Additional lumber mills have opened up during the past week and others are planning to resume operations about Sept. 1. In line with the above, jobbers report more inquiries pointing at new business during the past week than during several weeks previous. Power companies are taking advantage of the low price of copper and are buying heavily to fill their copper requirements. Building is holding up well. Gradual price adjustments downward amounting to from 5 to 10 per cent are still taking place on electrical supplies in general. Household appliances of all kinds are moving normally.

The Portland reports both by manufacturers and by jobbers for the past week are that business is somewhat improved, and some are very positive in regard to the improvement. Stocks are in fairly well balanced shape in most cases, but some overstock in motors and air heaters is noted. Slight reductions during the past week of 8 to 10 per cent have been made in certain lines of wiring devices, tape, solder, loom and general house wiring materials. Some jobbers report collections improved, while others say they are unchanged. This probably comes from the fact that new accounts and current accounts are being taken care of in better shape than formerly while old standing accounts are being paid off as funds become available.

General retail stores report activity in buying from customers in the agricultural section, which indicates a general improvement resulting from the movement of fall crops.

A much better feeling is apparent among the Spokane jobbers. They are optimistic over the prospects for a good fall business, particularly in the appliance line. One company is looking for an especially good washing-machine business following a cut in price to be announced shortly. Orders are coming in more freely and collections are somewhat easier. Deliveries continue to be prompt, with stocks in good condition but light to correspond with the demand that has heretofore existed. The general sentiment seems to be that the worst is over, and that business here should continue to show steady improvement.

SALT LAKE CITY—DENVER

As a purchasing unit the copper mines have been reduced virtually to the point of zero. Thousands of employees have been laid off and salaries and overhead reduced in every possible way. No industry has been harder hit in an indirect way by the shutdown of the copper plants than the electrical. Formerly they bought electrical equipment in large consignments and were among the best customers of the distributing jobbers. Now they purchase only enough to keep the plants in a state of repair pending resumed operations. Salt Lake City has been the meeting place of a convention of the American National Live Stock Association, which spent two days considering ways and means to put the live-stock industry on a better basis. If its recommendations to Congress are carried out in the way of stabilized and systematized freight rates, much good will come to the Intermountain West.

Fans.—The fan season may be said to be at an end in this part of the country. The sales this summer have not been up to the average mark, and jobbers still have excessive stocks in most sizes. Dealers are pretty well cleaned out as they have only purchased to meet their needs from week to week.

Manufacturers' Activities

Devoted to the Business Side of Manufacturing, Distribution and Sales, News from Jobbers and Foreign Fields and a Record of New Devices and Trade Literature

Link-Belt Finds Orders Increasing in Size

Another factor indicating the gradual improvement in industrial activity is shown in the increase in orders received by the Link-Belt Company, New York, during the last month. While the orders have not increased so much in number, they have increased considerably in size, indicating a return from the hand-to-mouth buying to a more stable basis. At the same time inquiries have become more numerous. Effective Aug. 22, the Link-Belt Company made a reduction of approximately 10 per cent on its general line of malleable iron and steel chains, sprockets, buckets, etc., and it is expected that this reduction in price will have a still further effect in increasing buying.

The New York territory seems to be the leader in the increased business, although the Far Western states are opening up in better shape. The Philadelphia, Middle West and Southern districts have shown little increase of late.

Larger Quarters for Motor Repair and Rental Company

The American Electric Service & Maintenance Company, 51-57 Taylor street, Springfield, Mass., announces that on Oct. 1 it will move to its new building on Liberty street, where it will occupy twice as much floor space as was formerly occupied and will increase its operating force. The increase in the business of electrical repairs of all kinds and in motor rentals necessitated this step.

Twenty-four Hundred Washers Sold in Six Weeks by St. Louis Concern

A spcial campaign recently conducted by the Domestic Electric Company of St. Louis, distributer of the Eden washer, gave the highly gratifying result of the sale to the public of about 2,400 washing machines in a period of six weeks. The territory covered includes eastern Missouri and southern Illinois. About 90 per cent of the sales were made in St. Louis.

The special feature of the campaign was a reduction in the list price from $160 to $109 for the period of the campaign only. Newspaper advertising was heavily employed, and in St. Louis a force of thirty worked directly in the homes. Two hundred and sixty-four machines were sold the first day. Based on the rate sales were made immediately prior to the campaign, only 400 machines would have been sold during this six weeks' period had it not been for the special means used, and consequently the campaign resulted in a net increase in sales of 2,000 machines. An interesting feature is that although normally sales for cash amount to about 10 per cent of the total, the cash sales during this period amounted to nearly 30 per cent.

The results obtained cause the Domestic Electric Company to believe that a field for good washing-machine business exists and that the public is ready to buy when the prices are lowered sufficiently to indicate a substantial reduction from the peak prices heretofore prevailing.

Salt Lake City White Way Uses Steel Shaft Standards

The Union Metal Manufacturing Company, Canton, Ohio, announces that the lighting standards to be used for the installation of street lighting in Salt Lake City's business district have cast-iron bases and pressed-steel shafts. The standards of the previous installation of ornamental lighting on Main Street were also made of these materials. It was announced on page 335 of the Aug. 13 issue of the ELECTRICAL WORLD that these standards were of ornamental casings of cast iron, and this occasion is taken to make this correction as noted by the manufacturer.

A. I. Mehan Starts New Company in Philadelphia

Andrew I. Mehan has inaugurated an electrical repair company and established a business as dealer in electrical power equipment at 309 Race Street, Philadelphia, under the firm name of Andrew I. Mehan Company. Mr. Mehan was formerly a partner in the Delta Equipment Company, Philadelphia.

Expansion in Foreign Commerce Bureau

New Foreign and Domestic Divisions Created and "Commerce Reports" Changed from Daily to Weekly

Beginning Monday, September 5, it is planned to change *Commerce Reports* from a daily to a weekly publication and to alter its physical arrangement from a rather unsystematized mass of important reports to a weekly trade paper scientifically prepared and classified on a commodity and geographical basis. The daily *Commerce Reports* was discontinued with the issue of Aug. 31. This plan has been under consideration for some time. Spot news will be handled through some other method.

In connection with this change the Bureau of Foreign and Domestic Commerce is rapidly organizing a number of special divisions, known as industrial or commodity divisions, which will specialize on important export commodities, among which are iron and steel, industrial machinery and electrical goods and machinery.

"The men being placed in charge of these divisions are recognized experts in their particular fields," says *Commerce Reports*. "They will keep in close personal touch with the centers of each industry through trade associations, trade papers and the manufacturers and dealers individually in an effort to ascertain the exact nature of the official assistance most urgently needed or which will be most generally useful. They will then proceed to obtain the required facts immediately through the department's existing world-wide facilities, making use of their expert knowledge in that industry or trade, to obtain information which will be readily understood in [illegible] true significance by American manufacturers.

"It is planned to have these commodity experts perform an important function in contributing specific trade information for the new weekly and for the various trade and news papers. They will also pass upon and interpret for the benefit of American business reports relating to such commodities as they are received from the trade representatives of this country now stationed at foreign posts. This elaborate attention to specific American industries was made possible by Congress in appropriating money and in transferring funds from other departmental activities for that purpose.

"From a geographical standpoint the bureau is now well fortified, with special divisions covering eastern Europe, western Europe, Latin America, the Far East and the Near East. The eastern and western European divisions were created within the past few days. They take the place of the former more general European division.

"From a technical standpoint, the bureau's facilities have recently been greatly strengthened by the creation of a division of commercial laws, which will pay special attention to the commercial codes of the important markets of the world, and this division will contribute to the new publication.

"The bureau is also giving special attention to transportation problems through the assistance of an expert on that subject recently appointed, dealing with freight problems both by land and by water."

Program for International Cost Conference Issued

The final program of the second international cost conference, to be held under the auspices of the National Association of Cost Accountants, at Cleveland on Sept. 14, 15 and 16, has been issued. Among the subjects to be discussed at the different sessions are the executive uses of a cost system, the distribution of overhead under abnormal conditions, cost of systems as a means of preventing waste and uniform methods and standardizing costs. Most of the railroads have granted reduced fares under the certificate plan for this conference, and it is expected that the largest and most representative gathering of cost men which has ever assembled in this country will meet in Cleveland. The national headquarters of the association are in the Bush Terminal Sales Building, 130 West Forty-second Street, New York City.

Lower Production and Sales Costs for Medart Pulley Company

The Medart Patent Pulley Company, Inc., St. Louis, in its August issue of the *Dart*, announces that since labor and materials have gradually taken a drop, the prices on its complete line of power-transmitting appliances have been reduced. The substantial reductions, effective Aug. 10, were further made possible through successfully establishing greater efficiency in production and consequently in the reduction of production costs.

Business conditions are steadily improving, says E. T. Cregier, sales manager of the company, and he expects good business during the balance of the year 1921.

Trumbull Company Declares Safety Switch Prices at Bottom

In a vigorous message to the trade in the August issue of *Trumbull Cheer* the Trumbull Electric Manufacturing Company, Plainville, Conn., calls attention to the fact that the latest price reduction (effective July 28) on safety switches represents a saving of from 20 to 40 per cent on prices effective four months ago, and points out that these prices are now at the 1916 level and are unlikely to decrease further. One of the causes leading to a stagnation in buying, says the company, has been the deep conviction of the buying public that prices must come down sharply. Distributers have kept their stocks at the scantiest minimum, ordering only from hand to mouth lest they get caught with high-priced material. Industrials have held off on making many needed improvements for the same reason.

After several years of wild scrambling to get orders out many a plant has become more or less in need of repair, and now that the price drop has come, the company states, purchases can be made on a pre-war basis. In 1916 externally operated entrance switches took a discount of 40 per cent in the trade. These are now 35 per cent. The company maintains that the present time is ripe for modernizing wiring installations and that switch costs to the consumer are as low as they are likely to be for years to come.

Fuse Manufacturer Goes on Full Time

The Ensign - Bickford Company, manufacturer of safety fuses at Simsbury, Conn., has inaugurated full-time factory production following a period of reduced weekly running. H. E. Ellsworth, vice-president, informed the ELECTRICAL WORLD last week that while there is no marked revival in orders as yet, the character of the orders received indicates that the stocks of the company's products held throughout the country are relatively small, and that the business received indicates actual consumption of finished material. Orders are still far from large but are better than in the early months of the year. A gradual improvement rather than a boom in business is anticipated, and the former seems likely to be accompanied by fluctuations in demand.

American Wiremold Company Issues Net Price Sheets

The American Wiremold Company, Hartford, Conn., has recently begun to issue net price sheets in place of the former list and discount notifications, and officials of the company say that a number of congratulatory letters have been received from the trade expressing appreciation of the revised method. In the company's Card No. 10 dated Aug. 22, 1921, thirty-nine items are shown, with prices quoted to contractor-dealers on standard-package, unit-package and less-than-unit quantities. Each of the items listed in the price schedule is illustrated on the border of the sheet, with corresponding number and title to make identification easy.

Electrical Sheet Maker Holds Sales Convention

Follansbee Brothers Company, Pittsburgh, called its salesmen and district office managers in to a conference the last week in August. The company manufactures electrical sheets for motors and generators at its Follansbee (W. Va.) plant and at the present time makes its automobile sheets and other steel at that plant.

The purpose of the meetings was to get the outside viewpoint on the steel market, with the ultimate aim of opening up the company's new sheet plant at Toronto, Ohio, if this should appear advisable. This would take some of the other sheet production to Toronto and leave more capacity for electrical sheets at Follansbee. The Follansbee plant has been working full time for the last four or five weeks and still has several full weeks' production on its books. Reduced automobile prices have kept up the demand for automobile sheets, but the automobile makers seem to be hesitant on the market because they are buying for only a short time ahead.

Steubenville, Ohio, was picked out as the convention place because of its accessibility both to the Follansbee plant and to the Toronto plant. About fifty-five of the sales and managerial staff were present, and the convention was considered a distinct success.

Hurley Machine Increases Officer Personnel

At a meeting of the board of directors of the Hurley Machine Company, 24 East Jackson Boulevard, Chicago, held on Aug. 22, the number of vice-presidents of the company was increased from three to five, Edward N. Hurley, Jr., and James A. McCoy being elected to fill the vacancies thus created. John Proudfoot, who had been assistant treasurer of the company, was elected treasurer to fill the vacancy created by the promotion of Mr. McCoy. Mr. McCoy also is secretary. The other three vice-presidents are Myer Hurley, Alva J. Fisher and Thomas J. Casey. Edward N. Hurley is chairman of the board and Neil C. Hurley is president.

Brazilian Bonds Issued for Purchases in United States

The United States of Brazil is offering a new issue of $25,000,000 twenty-year 8 per cent (non-callable) external gold bonds, dated June 1, 1921, in denominations of $500 and $1,000, exempt from all Brazilian taxes, present or future.

The proceeds of this loan are to be employed in part for the purchase in the United States of materials required by the government of Brazil, and as it is understood that government has extensive irrigation plans under way in northern Brazil, it is probable that irrigation and pumping equipment will be purchased in the United States.

The Delta-Star Electric Company, Chicago, has established a district office at 310 Security Building, Minneapolis, in charge of J. E. Sumpter.

The Tubular Woven Fabric Company, Pawutcket, R. I., has filed amendments to its charter increasing its capital stock from $350,000 to $600,000.

The Lincoln Electrical Company, Cincinnati, with an office in the Mercantile Building, has leased a four-story building at 32 East Front Street for warehouse purposes. The main offices of the company are in Chicago.

The Hopewell Insulation & Manufacturing Company, Hopewell, Va., has appointed Charles A. Etem, 917 Marquette Avenue, Minneapolis, and the Coast Equipment Company, 766 Folsom Street, San Francisco, as its representatives in these respective territories.

Foreign Trade Notes

EXTENSION OF ONTARIO HYDROELECTRIC SYSTEM INTO RURAL DISTRICTS. — In order to bring electricity within the reach of a greater number of farmers in the Province of Ontario, Canada, the provincial government, according to the *Empire Mail*, is to grant a bonus of 50 per cent toward the extension of hydroelectric power transmission lines into new rural districts. Thousands of farmers throughout Ontario already have electric light and power, and one farm in every five has a telephone.

ELECTRICAL INDUSTRY IN AUSTRALIA.—More than 200 new industries, according to the *Electrician*, London, have been established in Australia since 1914, and under the influence of the high tariff and of the government encouragement new factories are rapidly increasing. A larger portion of the new works is occupied in the manufacture of iron and steel goods, agricultural machinery, gas, steam and oil engines, electrical machinery and apparatus. Among the electrical equipment now produced in Australia are batteries and parts, circuit breakers, conduit, tubing and fittings, motor controllers, motors, generators, fuses, porcelain insulators, mica for electrical purposes, radiators, resistors, starters, switches, etc.

PROPOSED HYDRO-ELECTRIC SCHEME IN GREENVILLE, AUSTRALIA. —An engineer has been engaged by the Greenville Shire Council to report on a hydro-electric power project near Scarsdale, Greenville, Australia.

PROPOSED ELECTRIC RAILWAY FOR PEKING.—Arrangements have been made by the municipal authorities of Peking with the Banque Industrielle de Chine for the construction of electric railways. The capital of the tramway company is to be $4,000,000 half of which is to be raised by public subscription. Work will not be started on the project until the funds are raised.

PROPOSED WATER-POWER DEVELOPMENT IN FINLAND.—The Finnish Ministers of the Interior, Industry and Transport, according to the *Electrician*, decided in May last to start on the work of developing the series of waterfalls known as the Imatra group of rapids. If fully developed, it is estimated that 150,000 hp. of electrical energy will be available. It has been decided to appropriate the land that will have to be flooded and to begin work about 1922. An expropriation of 20,000,000 Finnish marks was made in the budget for 1921 and this sum is being expended in connection with preliminary work. The total cost of the project, including land to be purchased, is estimated at 267,000,000 Finnish marks. The rapids of Ritikka, Mansikka, Ranankoski and Linnankoski, as well as the big Imatra Falls, are included in the scheme. The rapids are distributed over a distance of 4½ km., and have a fall of 24 m.

THAMES VALLEY PROJECT, NEW ZEALAND.—The Thames Valley Electric Power Board, according to *Electrical Industries*, has decided to ask the ratepayers to approve a further loan of £350,000 to complete the electrical scheme. The board, which has already borrowed £200,000, has completed 40 miles of transmission lines and has connected Paeroa with Waikino. A number of transmission lines have been extended in different directions from Paeroa.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

A motion-picture industry company in Hungary (No. 35,371) desires to secure an agency for the sale of motion-picture electrical equipment, principally projectors, lamps, etc.

A mercantile firm in Spain (No. 35,386) having facilities for the marketing of merchandise all over Spain desires to be placed in touch with manufacturers of motors, electrical machinery, telephones, ventilators, counting machines, adding machines, all kinds of lighting fixtures, accessories and installations, turbines, generators, insulating materials, wire, cable, etc. It is the desire of this house to secure exclusive representation of these products.

A representative of a firm in Venezuela (No. 35,373) is in the United States for the purpose of purchasing and securing an agency for the sale of hydraulic equipment, scientific instruments, etc.

New Apparatus and Publications

ELECTRICALLY DRIVEN KITCHEN EQUIPMENT.—The Maxim Manufacturing Company, 700 West Twenty-second Street, Chicago, has recently perfected a dish-washing, vegetable-peeling and ice-cream-freezing machine in one combination, known as "Maxim Maid." A six-page pamphlet describing this device is being distributed.

TRANSFORMER TEMPERATURE INDICATOR.—Bulletin No. 46,041 issued by the General Electric Company, Schenectady, N. Y., describes the type H-2 A-C temperature indicator for transformer windings recently developed by the company.

PYROMETER.—The Brown Instrument Company, Philadelphia, has just made improvements in the automatic compensating features of its "Thermo-Electric" pyrometers.

CONTROL SWITCH. — The South Bend Current Controller Company, South Bend, Ind., announces its new R-C-O-C remote-control switch for station control of outdoor lighting and other loads.

FITTINGS.—The Erie Electrical Equipment Company, Inc., Johnstown, Pa., has issued discount sheets dated July 15 and two new catalog sheets on split porcelain insulators and pipe-frame fittings and caps.

ELECTRIC FURNACES.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, has issued catalog 9-C, on electric furnaces.

SPOT WELDER. — A new bench-type spot welder, the S-4-B, has been placed on the market by the Taylor Welder Company, Warren, Ohio.

TRACTOR CRANE. — A full revolving tractor crane, types BC and BT, for operation independently of rails has been developed by the Industrial Works, Bay City, Mich.

HYDRAULIC TURBINES. — The Wellman-Seaver-Morgan Company, Cleveland, is distributing bulletins Nos. 64 and 65, entitled "Hydraulic Turbine Equipment for San Francisquito No. 2 Plant" and "Turbines for Niagara's High-Head Plant" respectively.

MOTORS. — The Mechanical Appliance Company, Milwaukee, has issued bulletins Nos. 401, 402, 403, 404 and 405, covering the "Watson" direct-current motors, alternating-current motors, multi-speed motors, slip-ring and high-torque motors and ball bearing motors respectively.

OIL CIRCUIT BREAKERS.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has issued special publication 1643, entitled "Application of Oil Circuit Breakers."

BATTERY EQUIPMENT.—S. R. Orum, 503-505 North Eleventh Street, Philadelphia, manufacturer of battery shop equipment, has issued a new catalog covering his products.

SAFETY SWITCHES AND PANELBOARDS. — Catalog 12-A issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., includes new types of safety motor starters and safety panelboards.

PANELS.—The Automatic Electrical Devices Company, 120 West Third Street, Cincinnati, is distributing bulletin 624, describing its new "Unipanel" refinements.

ELECTRIC WELDER.—The Automatic Electrical Devices Company, 120 West Third Street, Cincinnati, has issued bulletin 623, describing its automatic arc welder.

GENERATORS, MOTOR-GENERATORS AND DYNAMOTORS.—The Electric Specialty Company, Stamford, Conn., has issued bulletin 237, superseding bulletin 231, describing the "ESCO" high-voltage generators, motor-generators and dynamotors.

INSULATORS.—The Porcelain Insulator Corporation, Lima, N. Y., is distributing bulletins No. 1 and 2, covering its "Pinco" insulators.

WALL CASE. — The Hart & Hegeman Manufacturing Company, 342 Capitol Avenue, Hartford, Conn., is distributing a four-page leaflet describing its new "H & H" sectional wall case.

CANOPY PULL SWITCH.—The Bryant Electric Company, Bridgeport, Conn., has recently brought out a new pull switch for use inside the canopy of ceiling or wall fixtures.

EVAPORATOR WALL SET.—A complete evaporator set for providing small quantities of distilled water has recently been developed by the Griscom-Russell Company, 90 West Street, New York City.

BATTERY IGNITION SYSTEM.—A new battery ignition system for Ford automobiles has recently been brought out by the American Bosch Magneto Corporation, Springfield, Mass. The company is distributing a small folder describing this type (FI-513) of Bosch battery ignition system.

New Companies

THE CLINTON ELECTRIC COMPANY, 266 Springfield Avenue, Newark, N. J., has been organized to manufacture parts for electric motors and operate a general motor and repair works. Edward Snyder is interested in the company.

E. L. WESTERVELT, INC., Lawrence, N. Y., has been chartered with a capital of $50,000 to manufacture electric motors, etc. The incorporators are E. L. Westervelt, L. H. Hall and W. Schneider.

THE DOMAN MANUFACTURING CORPORATION, Elbridge, N. Y., has been incorporated with a capital of $200,000 by A. E. Doman, Elbridge, and others. The company proposes to manufacture electrical and mechanical equipment.

THE ACME ELECTRIC COMPANY, Charleston, W. Va., has been incorporated with a capital of $25,000 to operate an electric light and power system in the vicinity of Charleston. John B. Ray and W. D. Payne, Charleston, are interested in the company.

THE SUNSHINE LAND & POWER COMPANY, Knoxville, Tenn., has been chartered with a capital of $20,000 to furnish electricity for light and power purposes in the vicinity of Knoxville. J. E. Dupes and M. L. Wolf are interested in the company.

THE SANDERSON (TEX.) ICE, WATER & LIGHT COMPANY has been chartered by John Kerr and W. H. Mansfield to operate an electric light and power system in Sanderson. The company is capitalized at $50,000.

ALEXANDER MORRISON & COMPANY, INC., Newark, N. J., has been incorporated by Morris A. Potter, L. M. Scheer and E. T. Adams, 11 Gotthart Street. The company is capitalized at $100,000 and proposes to manufacture boilers and other power equipment.

THE C. & D. LIGHTING & FIXTURE COMPANY, Paterson, N. J., has been incorporated with a capital of $10,000 to manufacture electrical equipment. The incorporators are Peter M. DeRuyter, M. L. and R. Harold Clement, 90 Washington Street.

THE HOWLAND LAMPS MANUFACTURING COMPANY, Malden, Mass., has been incorporated with a capital stock of $50,000 to manufacture incandescent lamps. The incorporators are Fred C. Howland and Thomas Murphy, Malden, and Charles M. Waugh, Cambridge.

THE RIALTO ELECTRICAL COMPANY, New York, N. Y., has been incorporated by E. and R. Goldberg and C. Diringer, 185 Madison Avenue. The company is capitalized at $10,000 and proposes to manufacture electrical specialties.

THE ALFRED COVERED WIRE COMPANY, Brooklyn, N. Y., has been chartered with a capital stock of $15,000 to manufacture electrical wires. The incorporators are A. Gleckel, J. H. Johansen and J. C. Von Glahn, 115 Broadway.

THE GUERIN THEATER SEATING SYSTEM, Iberville Street, New Orleans, La., has been incorporated with a capital of $500,000 to manufacture an electrical indicator board for theater seating. Morinville Guerin is president of the company.

THE NAGEL BATTERY & ELECTRICAL COMPANY, Springfield, Mass., has been incorporated by Clarence L. Nagel and E. S. Hahn, Cambridge. The company is capitalized at $35,000 and proposes to manufacture electrical equipment.

Record of Electrical Patents

Notes on United States Patents

(Issued Aug. 9, 1921)

1,386,607. Electric Water Heater; Adrien [illegible], Montreal, Canada. App. filed Oct. 4, 1920. Heating elements will cover a relatively large area.

1,386,616. Cigar and Cigarette Lighter; Felix [illegible], New York, N. Y. App. filed Nov. 18, 1919. Pressure of the cigar or cigarette upon a resistance coil will complete circuit.

1,386,650. Separator for Storage Batteries; Paul E. Norris, Pittsburgh, Pa. App. filed March 10, 1920. Separator for batteries of the lead and acid type.

1,386,689. Telephone System; Roy D. Conway, Chatham, N. J. App. filed June 6, 1918. Provision of improved signaling means.

1,386,705. Electrically Heated Container; James T. Griffin, Oak Park, Pa. App. filed Sept. 24, 1920. Heating element is made readily accessible for repair or replacement.

1,386,830. Method of and Apparatus for Producing and Distributing Electric Current Waves of Radio Frequency; Ernst F. W. Alexanderson, Schenectady, N. Y. App. filed Aug. 5, 1915. To provide apparatus for producing an electric current wave which is the equivalent of two electric current waves of different frequencies and of substantially constant amplitudes.

1,386,840. Radio Signaling System; Reginald C. Clinker, Rugby, England. App. filed Nov. 29, 1919. To render receiving apparatus more readily portable and more compact.

1,386,844. Automatic Operating Means for Internal-Combustion Engines; Henry K. Cowen, Milwaukee, Wis. App. filed March 1, 1920. Means for automatically starting and stopping.

1,386,861. Constant-Speed Motor; Chester L. Hall, Fort Wayne, Ind. App. filed Jan. 28, 1920. To make the speed of the motor substantially constant irrespective of variations both of voltage and frequency.

1,386,877. Conduit-Body Angle Adapter; Homer G. Knoderer, Englewood, N. J. App. filed Oct. 18, 1920. Mounted upon the outlet box and provided with means for securing thereto the covers which are ordinarily secured directly to the outlet boxes.

1,386,884. Electrical Fittings Connection; John A. McKaw, New York, N. Y. App. filed Oct. 25, 1919. Relates to electrical fixtures connections.

1,386,885. Motor Control for Hoists; Robert H. McLain, Schenectady, N. Y. App. filed May 7, 1919. Provides improved means whereby motors may be started and stopped and generally controlled.

1,386,895. Storage Battery; Charles Olsson, Milwaukee, Wis. App. filed April 3, 1919. To increase durability by protecting separator plates at points where the deterioration is most rapid.

1,386,898. Protection of Systems of Distribution; David B. Rushmore, Schenectady, N. Y. App. filed March 21, 1918. Protection from damage by reason of abnormal events occurring in the system.

1,386,912. Container for Insulating or Impregnating Compounds; William A. Timm, Berwyn, Ill. App. filed July 8, 1918. Relates to portable supply tank for replenishing supply of insulating or impregnating compound.

1,386,946. Terminal Structure for Electric Batteries; Paul E. Norris, Pittsburgh, Pa. App. filed Feb. 18, 1920. Effective to prevent leakage of the liquid contained in the battery.

1,386,972. Automatic Control of Electric Generating Sets; Leo Sunderland and Gilbert C. Pillinger, Westminster, London, England. App. filed Feb. 18, 1918. Emergency or stand-by for lighting purpose.

1,387,016. Wrapping Machine; John Scherner and Edward Hutchens, Milwaukee, Wis. App. filed April 3, 1916. Wrappings for automobile tires.

1,387,[illegible]. Method of and Apparatus for Treating Metal; Herbert D. Swift, New York, N. Y. App. filed March 27, 1920. Relates to the annealing of metals.

1,387,047. Polyphase Motor; Valere A. Fynn, St. Louis, Mo. App. filed Feb. 14, 1917. To enable motors to be started and brought up to speed with a small current while keeping full control of power factor.

1,387,048. Speed-Regulating Apparatus; Valère A. Fynn, St. Louis, Mo. App. filed July 5, 1919. Electromagnetic means for regulating speed of prime movers.

1,387,076. Motor Vehicle; Jabea F. Shawhan, Dayton, Ohio. App. filed Jan. 19, 1917. Electric driving motor supplied with power from an electric machine driven by a prime mover.

1,387,149. Voltage-Regulating Apparatus; Valere A. Fynn, St. Louis, Mo. App. filed June 26, 1918. Applicable where the speed of prime mover is likely to vary over wide range.

1,387,162. X-Ray Tube-Controlling Mechanism; Harry A. Mulvany and Harry E. Kennedy, Berkeley, Cal. App. filed Jan 24, 1918. Controlling the current flow through X-ray tubes.

1,387,171. Telephone-Exchange System; Lipa Polinkowsky, New York, N. Y. App. filed Feb. 20, 1919. Connections extended in part by automatic switching apparatus and in part by use of operators' link circuits.

1,387,174. Machine-Switching Telephone System; Winifred T. Powell, East Orange, N. J. App. filed Aug. 16, 1918. Related particularly to overflow trunking arrangements.

1,387,180. Telephone System; John N. Reynolds, Greenwich, Conn. App. filed Nov. 21, 1917. Relates to form of automatic switching apparatus.

1,387,181. Telephone Exchange System; William A. Rhodes, New York, N. Y. App. filed Sept. 30, 1918. Provides improved means for establishing communication between desk operator and switchboard operator.

1,387,189. Combined Tool Pouch and Testing Device; Albert E. Sharkey, Cuyahoga Falls, Ohio. App. filed March 6, 1920. Adapted for electrician in repair and testing of lines and apparatus.

1,387,210. Method and Means for Correcting Irregularities in Transmission Lines; Morton Sultzer, Brooklyn, N. Y. App. filed Dec. 18, 1916. Multiple condenser may be adjusted.

1,387,228. Selective System; John H. Bell, East Orange, N. J. App. filed July 26, 1917. For use in printing telegraphs and the like.

1,387,229. Telegraph System; John H. Bell, South Orange, N. J. App. filed April 9, 1918. Object to provide an effective and reliable remedy for the so-called "wandering zero."

1,387,250. Telephone-Exchange System; Clarence B. Fowler, New York, N. Y. App. filed Sept. 23, 1919. Relates to a line circuit for use in such systems.

1,387,251. Telephone System; Clarence B. Fowler, New York, N. J. App. filed Dec. 16, 1919. Production of improved signaling means.

1,387,252. Test Connectors; John Fredricks, Kingsbridge, N. Y. App. filed Feb. 14, 1918. Adapted to occupy little more space than apparatus terminal itself.

1,387,255. Telephone-Exchange System; Charles L. Goodrum, New York, N. Y. App. filed Dec. 31, 1919. Relates to circuit arrangements for selector switches.

1,387,262. Receiving Apparatus for Wave-Signaling; Ralph V. L. Hartly, East Orange, N. J. App. filed Sept. 30, 1915. Adapted to receive telephonic or telegraphic messages.

1,387,270. Signaling and Telephone System; Charles W. Keckler, Newark, N. J. App. filed March 27, 1918. Object of the invention is to provide improved means for developing pulsating signaling current.

1,387,271. Telephone System; Charles W. Keckler, Newark, N. J. App. filed March 26, 1918. Relates to trunking arrangements used between an intercommunicating system and an exchange.

1,387,276. Electric Vaporizing Gasket; Wilber Kutsche, Western, Neb. App. filed April 7, 1921. Relates to improvements in fuel vaporizers.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

DAMARISCOTTA, ME.—The power plant of the Lincoln Power Company and the leather-board mill of the Damariscotta Leather Company were recently destroyed by fire, entailing a loss of about $[illegible].

CHARLESTON, MASS.—The Charleston Gas & Electric Company contemplates rebuilding its coaling tower at Arlington Avenue and Hamblen Street, recently destroyed by fire. The loss is estimated at $[illegible].

GREAT BARRINGTON, MASS.—The Southern Berkshire Power & Light Company has awarded contract to the F. T. Ley Company, Springfield, for the construction of power house, dam and penstock on the site of the old Rockdale Mills in Williamsville. Contract has also been awarded by the company for building the new dam at its plant on Upper Main Street in Great Barrington

WORCESTER, MASS.—Plans have been completed for the proposed automobile manufacturing plant of the R. H. Long Company to be erected on Millbrook Street, to cost about $200,000. A one-story power house to cost about $22,000 is included in the project.

FORESTDALE, R. I.—Plans have been completed by the Forestdale Manufacturing Company for the construction of a new power plant at its cotton mills.

NEW BRITAIN, CONN.—Extensive additions and improvements are being made by the Connecticut Light & Power Company to its local system. The cost of the work is estimated at $250,000 and will include a distributing station and substation now being installed at Corbin Place. The Black Rock substation is being rebuilt to enable it to handle the current when the present supply from Bunker Hill, Waterbury, is stepped up from 33,000 volts to 66,000 volts.

Middle Atlantic States

BROOKLYN, N. Y.—Bids will be received by Edward Riegelmann, president of the Borough of Brooklyn, Room 21, Borough Hall, Brooklyn, until Sept. 7 for general construction, including electric work, of a public bath at the corner of Metropolitan and Bedford Avenues, Brooklyn.

FAR ROCKAWAY, N. Y.—The Public Service Commission has granted the Queens Borough Gas & Electric Company permission to issue $2,229,000 in capital stock, part of the proceeds to be used for extensions and improvements.

LOCKPORT, N. Y.—The Wickwire Limestone Company, River Road, Buffalo, contemplates rebuilding the power plant at its local properties, recently destroyed by fire. The loss is estimated at about $[illegible].

NEW YORK, N. Y.—Bids will be received by Thomas J. Drennan, Fire Commissioner, Eleventh Floor, Municipal Building, New York City, until Sept. 6 for construction of a portion of the underground fire alarm system in the Borough of Brooklyn. Blank forms and further information may be obtained at the above office.

NIAGARA FALLS, N. Y.—The Niagara Falls Power Company contemplates the erection of a new electric transmission line from Niagara Falls to Buffalo, through Grand Island. Work on the proposed line, it is said, will begin as soon as the Public Service Commission gives its approval of the project.

POUGHKEEPSIE, N. Y.—The Central Hudson Gas & Electric Company has applied to the Public Service Commission for permission to build an addition to the electric plant in the town of East Fishkill.

UTICA, N. Y.—The board of directors of the Utica State Hospital, Utica, it is said, will soon call for bids for a new cold storage plant, 70 ft. x 100 ft., to cost about $65,000.

ATLANTIC CITY, N. J.—The Board of Publicity Commissioners has granted the Atlantic Electric Company permission to issue $144,100 in capital stock, the proceeds to be used for proposed extensions and improvements.

EAST ORANGE, N. J.—Bids will be received by the Board of Fire Commissioners, East Orange, N. J., until Sept. 6, for construction of 5 miles of underground conduits.

GLASSBORO, N. J.—The Borough Council has entered into a contract with the Electric Company of New Jersey, Salem, for lighting the principal thoroughfares of the borough with electricity, to replace the gas lamps now in use.

JERSEY CITY, N. J.—The plant of the Vulcan Iron Works, at Hudson and Essex Streets, Jersey City, including power house, machine and pattern shops, was badly damaged by fire recently, causing a loss of about $250,000.

POMPTON LAKES, N. J.—The Borough Council has authorized the Water and Light Department to arrange for additional water supply to double the capacity of the municipal electric light plant.

ALLENTOWN, PA.—Plans have been approved by the City Council for extending the street-lighting system on Hamilton Street from Penn to Second Street, and on Seventh Street from Hamilton to Walnut Street.

HARRISBURG, PA. — Steps have been taken by the North Second Street Business Association to secure better street lighting and street-car service in that district of the city.

PHILADELPHIA, PA.—Plans have been filed by the James Doak, Jr., Company, 2185 East Norris Street, for the erection of a one-story power house at its manufacturing plant.

PHILADELPHIA, PA. — Contract has been awarded by the Philadelphia Rapid Transit Company, 1520 Spruce Street, for the construction of a one-story car repair works at Thirty-first and Dauphin Streets, to Henry E. Baton, 1713 Sansom Street. The cost is estimated at about $50,000.

PLEASANT GROVE, PA.—The York Haven Water & Power Company, York Haven, is planning to erect a new transmission line to Pleasant Grove.

READING, PA.—The Philadelphia & Reading Coal & Iron Company contemplates extensions to its high-tension transmission system in the territory adjacent to Shenandoah.

READING, PA.—The installation of an electric lighting plant at the Maidencreek pumping station is under consideration by the City Council.

BALTIMORE, MD. — Plans are under consideration by William F. Broening, Mayor, for the installation of electrical conduits in Guilford Avenue from Thirty-third Street to University Parkway and in Twenty-fifth Street from Greenmount Avenue to Hartford Road.

CUMBERLAND, MD.—Work, it is understood, will begin at once on the first unit of the new plant of the Paragon Motor Car Company, to be located on Mount Savage Road. The plans call for a structure 165 ft. x 480 ft., with several smaller buildings and a power plant.

OXFORD, MD.—The Board of City Commissioners has made application for authority to establish an electric power plant for municipal service. Bonds for the proposed plant will be issued in the near future

SYKESVILLE, MD.—The Freedom District Electric Light Company, recently incorporated, contemplates building an electric light and power plant. John T. Scott, Sykesville, is one of the incorporators.

WASHINGTON, D. C.—The Potomac Electric Power Company has been authorized by the Public Utilities Commission to issue $2,235,115 in bonds, the proceeds to be used for reimbursing the company for expenditures already made and for extensions and improvements to be made during the remainder of the year.

WASHINGTON, D. C.—Plans are being prepared by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for the construction of a power house at Lake Denmark, N. J.

North Central States

ALMA, MICH. — The City Commission has voted to extend the ornamental lighting system on East Superior Street from Gratiot Avenue to the Race Bridge. Extension of the ornamental lighting system on State Street is being agitated.

INDIANAPOLIS, IND.—Extensions and improvements to the power house at the County Jail are under consideration by the County Commissioners.

INDIANAPOLIS, IND.—Plans are under way by the Active Coal Company, 607 Board of Trade Building, for the construction of a coal-handling plant at Fourteenth and Senate Streets, to cost about $50,000. Bacon & Teislow, 30 West Ohio Street, are engineers. P. M. Gale is president.

KENDALLVILLE, IND.—Arrangements have been made by the City Council for a one-story addition, 50 ft. x 100 ft., to the municipal electric light plant.

PERU, IND.—Extensions and improvements to the power house at the high school, to cost about $80,000, are under consideration by the Board of Education. Ammerman & McCall, Occidental Building, Indianapolis, are engineers.

PORT WING, WIS.—The Northern Wisconsin Hydro-Electric Power Company, recently organized, is planning to develop a water power site at Orienta Falls on the Iron River, where it is estimated that 3,385 hp. can be developed. Work on the project, it is understood, will be undertaken early next spring. The cost is estimated at $375,000.

BEATRICE, NEB.—The City Commissioners have instructed W. H. Anderson, city electrician, to prepare an estimate of cost of installing an electric plant of sufficient capacity to supply electricity for domestic and commercial purposes for the city.

DUNN CENTER, N. D.—The local electric light plant and elevator was recently damaged by fire, causing a loss of about $30,000.

HADDAM, KAN.—Plans are being prepared by W. B. Rollins, engineer, 209 Railway Exchange Building, Kansas City, Mo., for the erection of a transmission line and distribution system in Haddam, to cost about $22,000. E. L. Bowman is city clerk.

Southern States

LENOIR, N. C.—Preliminary plans, it is reported, are under way by the Caldwell Power Company, recently incorporated with a capital stock of $300,000, for the construction of a hydro-electric power plant. J. H. Beall and J. L. Nelson are among the incorporators.

COLUMBIA, S. C.—The Columbia River & Navigation Company has been authorized by the Federal Power Commission to construct a canal 25 miles long and 200 ft wide, to connect the Santee and Cooper Rivers, also to erect an electric line from Columbia to Greenwood and to construct a dam to develop 30,000 hp. The cost of the project is estimated at $5,000,000. G A. Guignard is president.

ATLANTA, GA.—The Lullwater Company, Atlanta, recently organized with a capital stock of $2,000,000 has acquired a six-story building, containing about 110,000 sq.ft., which it will equip for the manufacture of automobile equipment and accessories. A portion of the works will be used for battery repair operations. Lionel J. Kahn is manager.

APALACHICOLA, FLA.—The Apalachicola Land & Development Company is considering the installation of an electric power plant at its properties. J. J. Abbott is manager.

DAYTONA BEACH, FLA. — Plans are under way by the Peninsula Ice & Cold Storage Company, recently organized, for the construction of an ice-manufacturing plant with an initial output of 30 tons daily. The company also plans to erect a cold-storage plant. Guy G. Bailey is president.

KEY WEST, FLA.—Extensive improvements are contemplated by the Key West Electric Company, including the construction of a building, installation of a 750-hp. cross-head type crude oil engine and [illegible]

PENSACOLA, FLA.—A preliminary permit has been granted by the Federal Power Commission to Fred Bingham for power project No. 55. The present plans provide for the construction of two dams and power houses with equipment to develop hydro-electric power on Perdido River, about 8 miles south of Muscogee, a dam 13.5 ft. high, a dam 13 ft. high 1 mile north of Muscogee, a dam 17 ft. high above Barrineau, and a dam 25 ft. high on Styx River about 8 miles north of Spanish Trail. The work will be under the supervision of the United States Geological Survey.

CHATTANOOGA, TENN.—Plans are under way by the Chattanooga Warehouse & Cold Storage Company, 212 King Street, for a two-story and four-story addition to its cold-storage plant. Bouchard & Company, Nashville, Tenn., are engineers.

CROWLEY, LA.—Improvements are contemplated to the municipal electric light plant, including the installation of two engines.

KINGSTON, OKLA.—The local electric light and ice plant and municipal waterworks station was recently damaged by fire, causing a loss of about $25,000.

PAWHUSKA, OKLA.—At an election to be held Sept. 6 the proposal to issue $113,000 in bonds for extensions and improvements to the municipal electric light plant will be submitted to the voters.

TAHOKA, TEX.—Electric light bonds to the amount of $14,000 have been voted.

TEXLINE, TEX.—Bonds to the amount of $55,000 have been voted for the construction of a municipal electric light plant and water system in Texline. J. H. Bender, Clayton, N. M., is engineer in charge of the work.

Pacific and Mountain States

SEATTLE, WASH.—An ordinance authorizing the installation of ornamental lamps in the McKinley Park district has been introduced in the City Council.

SPOKANE, WASH.—Plans have been filed for a two-story addition to the power plant of the Sacred Heart Hospital, to cost about $10,000.

FRESNO, CAL.—Plans are being prepared by the San Joaquin Light & Power Corporation for the erection of a one-story building, 130 ft. x 150 ft., to cost about $25,000.

OAKDALE, CAL.—Application has been filed with the Federal Power Commission by the officials of the Oakdale and South San Joaquin Irrigation District for permission to develop power in connection with an irrigation project at the Melones dam. It is proposed to supply electricity for irrigation and domestic purposes in both districts. The cost of the work is estimated at $1,500,000.

SAN FRANCISCO, CAL.—The Mount Shasta Power Corporation has petitioned the Federal Power Commission for a preliminary permit for two projects, known as Developments Nos. 3 and 4, each to consist of a dam, tunnel and power station, located on Pit River.

LEONIA, IDAHO.—The Idaho Gold & Ruby Mining Company is reported to be considering the installation of a 2400-hp. electric plant to supply electricity for lamps and motors at its property in Leonia.

PHOENIX, ARIZ.—The Arizona Power Company contemplates extensions and improvements to its system, involving an expenditure of about $120,000.

Canada

GLACE BAY, N. S.—A report is being prepared by N. H. Brown of New Glasgow on the centralization of the electric light and power plants.

CHATHAM, ONT.—The Hydro-Electric Power Commission will start work at once on the erection of a transmission line from Chatham to Kent Center. Two other lines in Kent County, one to Louisville and the other into Raleigh, are under consideration by the commission.

TIMMINS, ONT.—The Hollinger Consolidated Mines, Ltd., is planning a hydro-electric development, to cost about $2,000,000. [illegible] are engineers.

TORONTO, ONT.—The Hydro-Electric Power Commission will soon apply to the provincial government for approval of plans for primary line extensions covering [illegible] with work in the townships of Nepean, Edwardsburg, Nottawasaga, Howich, Saltfleet, Niagara, Howard, Ancaster, Dorchester, Beverly, Sandwich and West Flamboro.

Directory of Electrical Associations

Printed in the First Issue of Each Month

Alabama Light and Traction Association. Secretary-treasurer, J. P. Ross, Birmingham Railway, Light & Power Co.

American Association of Engineers. Secretary, C. E. Drayer, 63 East Adams St., Chicago, Ill.

American Electric Railway Association. Secretary, E. B. Burritt, 8 West 40th St., New York City. Annual convention, Atlantic City, N. J., Oct. 3-7.

American Electrochemical Society. Secretary, Prof. J. W. Richards, Lehigh University, Bethlehem, Pa. Annual meeting, Lake Placid, N. Y., [illegible]

American Engineering Standards Committee. Secretary, P. G. Agnew, 29 W. 39th St., New York City.

American Institute of Consulting Engineers, Inc. Secretary, F. A. Molitor, 35 Nassau St., New York City.

American Institute of Electrical Engineers. Secretary, F. L. Hutchinson, 33 West 39th St., New York City. Board of directors meets monthly. Sections and branches in the principal electrical centers throughout the country.

American Physical Society. Secretary, Dayton C. Miller, Case School of Applied Science, Cleveland, Ohio.

American Society for Testing Materials. Secretary-treasurer, C. L. Warwick, 1315 Spruce St., Philadelphia, Pa.

American Welding Society. Secretary, H. C. Forbes, 29 W. 39th St., New York City.

Arkansas Utilities Association. Secretary, S. E. Dillon, Hot Springs, Ark.

Associated Manufacturers of Electrical Supplies. General secretary, C. E. Dustin, 30 East 42d St., New York City.

Association of Edison Illuminating Companies. Secretary, Preston S. Millar, Electrical Testing Laboratories, New York.

Association of Iron and Steel Electrical Engineers. Secretary, John F. Kelly, Empire Building, Pittsburgh, Pa. Annual convention, Chicago, Ill., Sept. 19-24.

Association of Municipal Electrical Utilities of Ontario. Secretary, S. R. A. Clement 190 University Ave., Toronto.

Association of Railway Electrical Engineers. Secretary-treasurer, Joseph A. Andreucetti, Chicago & Northwestern Railway, Chicago, Ill.

British Columbia Association of Electrical Contractors and Dealers. Secretary-treasurer, Capt. W. J. Conway, 406 Yorkshire Building, Vancouver, B. C.

Canadian Electrical Association, affiliated with N. E. L. A. Secretary-treasurer, Eugene Vinet, Shawinigan Water & Power Co., Montreal, Canada.

Colorado Electric Light, Power and Railway Association. Secretary-treasurer, M. B. W. Baker, Denver, Col. Annual convention, Glenwood Springs, Col., Sept. 19, 20 and 21.

Conference Club. Secretary, Sullivan W. Jones, 19 West 44th St., New York City.

Eastern New York Section, N. E. L. A. Secretary, J. L. Hemphill, General Electric Co., Schenectady, N. Y.

Electric Hoist Manufacturers' Association. Secretary-treasurer, E. Donald Tolles, 52 Broadway, New York City.

Electric Furnace Association. Secretary, Dr. C. G. Schluederberg, Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.

Electrical Manufacturers' Club. Secretary, F. L. Bishop, Hartford Faience Co., Hartford, Conn.

Electrical Manufacturers' Council. Executive secretary, Frederic Nicholas, 522 5th Ave., New York City.

Electrical Safety Council. Secretary, Dana Pierce, 25 City Hall Place, New York City.

Electrical Supply Jobbers' Association. General secretary, Franklin Overbaugh, 411 South Clinton St., Chicago, Ill.

Electrical Supply Jobbers' Association, Atlantic Division. Secretary, E. Donald Tolles, 52 Broadway, New York City.

Electrical Supply Jobbers' Association, Pacific Coast Division. Secretary, Albert H. Elliot, 502 Flatiron Building, San Francisco, Cal.

Electrical Trade Association of Canada. Secretary, William R. Stavely, Royal Insurance Building, Montreal, Canada.

Electric Power Club. Secretary, C. H. Roth, 1410 West Adams St., Chicago, Ill.

Empire State Gas and Electric Association. Secretary, Charles H. B. Chapin, Grand Central Terminal Building, New York City. Annual convention, Lake Placid, N. Y., Oct. 6-7.

Florida Engineering Society. Secretary, J. R. Benton, Gainesville, Fla.

Great Lakes Division, N. E. L. A. Secretary, R. V. Prather, 305 De Witt Smith Bldg., Springfield, Ill. Annual convention, French Lick Springs, Ind., Sept. 21-23.

Illinois State Electric Association. Secretary-treasurer, R. V. Prather, Springfield, Ill.

Illuminating Engineering Society. General secretary, Clarence L. Law. Sections in New York, Philadelphia, Pittsburgh, Cleveland, Chicago and Boston. Annual convention, Rochester, N. Y., Sept. 26-29.

Indiana Electric Light Association. Secretary, Thomas Donohue, Lafayette, Ind.

Industrial Electric Heating Association. Secretary, Homer Kunz, Toledo Railways & Light Co., Toledo, Ohio.

Institute of Radio Engineers. Secretary, Alfred N. Goldsmith, College City of New York, New York.

International Association of Municipal Electricians. Secretary, C. R. George, Houston, Tex. Annual convention, Colorado Springs, Col., Sept. 6-10.

International Electrotechnical Commission (international body representing various national electrical engineering societies contributing to its support). General secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England.

Iowa Section, N. E. L. A. Secretary-treasurer, M. G. Linn, Des Moines, Iowa.

Jovian Order. Jupiter (president), Arthur J. Binz, Houston, Tex.

Kansas Public Service Association. Secretary-treasurer, W. W. Austin, Cottonwood Falls, Kan.

Michigan Section, N. E. L. A. Secretary, Herbert Silvester, Ann Arbor, Mich.

Mississippi Electric Association, affiliated with the N. E. L. A. Secretary, E. S. Myers, Vicksburg, Miss.

Missouri Association of Public Utilities. Secretary-treasurer, F. D. Beardslee, 315 N. 12th St., St. Louis, Mo.

National Association of Electrical Contractors and Dealers. Secretary, W. H. Morton, 110 West 40th St., New York City, N. Y. State associations in Alabama, Arkansas, Connecticut, Georgia, Kansas, Illinois, Indiana, Iowa, Louisiana, Maryland, Massachusetts, Michigan, Minnesota, Missouri, New Jersey, New York, Ohio, Oregon, Pennsylvania, Tennessee and Wisconsin.

National Council of Lighting Fixture Manufacturers. Secretary, C. W. Hoffrichter, 8410 Lake Ave., Cleveland, Ohio.

National Association of Electrical Inspectors. Secretary-treasurer, William L. Smith, Northeastern College, Boston, Mass.

National Association of Railway and Utility Commissioners. Secretary, James B. Walker, Public Service Commission of the State of New York.

National Electric Light Association. Executive manager, M. H. Aylesworth, 29 West 39th St., New York City.

National Electrical Credit Association. Secretary, Frederic P. Vose, 1350 Marquette Building, Chicago, Ill.

National Fire Protection Association. Secretary of electrical committee, Ralph Sweetland, 141 Milk St., Boston, Mass.

Nebraska Section, N. E. L. A. Secretary-treasurer, H. M. Davis, Brandeis Theatre Bldg., Omaha, Neb. Annual convention, Omaha, Neb., Sept. 14 and 15.

New England Electrical Credit Association. Secretary, Alton F. Tupper, 15 State St., Boston, Mass.

New England Geographic Division, N. E. L. A. Secretary, Miss O. A. Bursiel, 149 Tremont St., Boston, Mass. Annual [illegible]

New Mexico Electrical Association. Secretary-treasurer, Charles E. Twogood, Albuquerque, N. M.

New York Electrical Credit Association. Secretary, W. J. [illegible] St., New York City.

New York Electrical Society. Secretary, George H. Guy, 29 West 39th St., New York City.

North Central Geographic Division, N. E. L. A. Secretary, H. E. Young, Minneapolis General Electric Co., Minneapolis.

Northwest Geographic Division, N. E. L. A. Secretary-treasurer, Stacy Hamilton, Portland Railway Light & Power Co., Portland, Ore.

Ohio Electric Light Association. Secretary, D. L. Gaskill, Greenville, Ohio.

Ohio Society of Mechanical, Electrical and Steam Engineers. Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus.

Oklahoma Utilities Association. Secretary, H. A. Lane, 611 State National Bank Building, Oklahoma City.

Pacific Coast Geographic Division, N. E. L. A. Secretary, S. H. Taylor, Electric Railway & Manufacturers' Supply Co., San Francisco, Cal.

Pennsylvania Electric Association, State Section N. E. L. A. Secretary, H. M. Stine, 211 Locust St., Harrisburg, Pa. Annual convention, Bedford Springs, Pa., Sept. 7-10.

Public Service Association of Virginia. Secretary, R. M. Booker, Newport News & Hampton Railway, Gas & Electric Co., Hampton, Va.

Public Utilities Association of West Virginia. Secretary, A. Bliss McCrum, Charleston, W. Va.

Radio Club of America. Secretary, T. J. Styles, 1112 S. Curtis Ave., Richmond Hill, Queens Borough, N. Y.

Rocky Mountain Geographic Division, N. E. L. A. Secretary, A. C. Cornell, Denver, Col. Annual convention, Glenwood Springs, Col., Sept. 19, 20 and 21.

Society for Electrical Development, Inc. Assistant to the president, W. L. Goodwin, Guaranty Building, 522 5th Ave., New York City.

Society for the Promotion of Engineering Education. Secretary, Dean F. L. Bishop, University of Pittsburgh, Pittsburgh, Pa.

Southeastern Geographic Division N. E. L. A. Secretary-treasurer, Charles A. Collier, Georgia Railway & Power Co., Atlanta, Ga. Annual convention, Chattanooga, Tenn., Oct. 17, 18 and 19.

Southwestern Geographic Division N. E. L. A. Secretary, H. A. Lane, Oklahoma Utilities Association, Oklahoma City, Okla.

Southern California Electrical Contractors and Dealers Association. Secretary-treasurer, J. E. Wilson, 425 Consolidated Realty Building, Los Angeles, Cal.

Southwestern Electrical and Gas Association. Secretary, H. S. Cooper, [illegible] Slaughter Building, Dallas, Tex.

Southwestern Society of Engineers. Secretary, C. E. [illegible], 721 First National Bank Building, El Paso, Tex.

Toronto Electrical Contractors' Association. Secretary, E. F. W. Salisbury, 615 Yonge St., Toronto, Ont.

Tri-State Water and Light Association. Secretary-treasurer, W. F. Steights, Columbia, S. C.

Vermont Electrical Association. Secretary-treasurer, A. B. Marsden, Rutland Vermont.

Western Association of Electrical Inspectors. Secretary, W. S. Boyd, 175 West Jackson Blvd., Chicago, Ill.

Western Society of Engineers, [illegible] Section. Secretary, [illegible] Nethercut, 1735 Monadnock Block, Chicago, Ill.

Wisconsin Electrical Association. Secretary, W. M. Chester, 1408 First National Bank Building, Milwaukee, Wis.

Wyoming Utilities Association. Secretary, C. Luscombe, Cheyenne Light, Fuel & Power Co., Cheyenne, Wyo.

Electrical World

New York, Saturday, September 10, 1921

Better Business Is Coming—Prepare for It Now

BUSINESS revivals come without the blare of trumpets. Frequently they are under way before their arrival is realized, and it requires evidences of increases in the business of associates and competitors whose operating policies combine boldness with caution to awaken a confidence in the future. Preparedness for better times amid talk of depression is the history of stable organizations made stronger at the expense of the wavering ones. Business is good or bad according to the standard which the individual uses in making his comparison. If compared with the feverish demands and production at the height of the war, it is bad; if compared with the past nine months, it is not so bad. Contrasted with the year 1915 the comparison is still more favorable, and certainly business is not worse than in the panic of 1907 and 1908. The difficulty comes in placing the proper interpretation on the needs of American industries when producing more small orders at small profits and fewer large orders at large profits.

No one thinks for a minute that American business has contracted an incurable malady. Many see certain signs of convalescence. Yet, just as no one expects a very sick person to run breathlessly to a doctor, but expects the doctor to go to the patient, so also must the American business man seek out his customers who need attention. Patiently sitting by and waiting for natural forces to run their course in the recovery of business is neither scientific nor economical. It is more likely to be disastrous to the surplus and reserves that have been set up for just such contingencies. In good times as well as bad confidence in the future must be accompanied by an intelligent combination of boldness and caution. But this combination must have as its basis economic facts and a careful analysis of the needs of all industry.

The furnishing of such business-building data has always been one of the fundamental planks in the editorial service of the ELECTRICAL WORLD, and in obtaining them the publishers have never restricted expense. At this time an exhaustive economical survey of all phases of business in the electrical industry is being conducted. The results will appear in the Oct. 8 issue. These results as thus far obtained are most optimistic and justify the opinions that have been heretofore expressed editorially concerning the stability of the electrical industry and its ability to make an early recovery. We believe that better business is not far distant, and our slogan is "Prepare for it now."

Robert Andrews Millikan

Scientist and educator who has gained worldwide distinction for original researches in physical science will direct extensive investigations in transmission of electrical energy at high potentials.

EVIDENCES of the practical application of scientific research and adequate support from the industries benefited are healthy signs in American engineering. Theory and practice originally started without much mutual recognition. They have just now reached the stage of good understanding. In time they must become inseparable, for if necessity is the mother of invention, economical production and operation is the mother of scientific research.

From the Pacific Coast comes another example of broad vision and co-operation of scientists and business men in the appointment of Dr. Robert A. Millikan as director of the Norman Bridge Laboratory of Physics at the California Institute of Technology and chairman of the executive council of the institution. Besides being selected to build up a school of science and engineering of the first rank, Dr. Millikan was able to attract the co-operation of the Southern California Edison Company in the erection of a high-tension laboratory that will represent an investment of about $75,000. Here extensive investigations of the problems in the transmission of electrical energy at high potentials will be conducted jointly by the engineers of the company and the staffs of the physics and electrical engineering departments of the institute under the direction of Dr. Millikan.

To the worldwide distinction which Dr. Millikan has gained from his original researches in all phases of physical science words of eulogy will add little. Suffice it to say that he is among the foremost American scientists, with an unusual ability to interpret the results of his investigations in practical benefits to mankind as well as in additions to the unsurveyed realms of scientific knowledge. He is best known for his researches on the structure of matter and the behavior of the individual electrons.

Dr. Millikan was born March 22, 1868, at Morrison, Ill., and was graduated from Oberlin College in 1891. He received the degree of A.M. from Oberlin in 1892 and the degree of Ph.D. from Columbia University in 1895. During 1895 and 1896 he studied at Berlin and Gottingen and he became a member of the staff of the physics department at the University of Chicago in the latter year. He has since received the honorary degree of doctor of science, in recognition of his scientific attainments, from Oberlin College, Northwestern University, the University of Pennsylvania, Columbia University and Amherst College. In 1913 the Comstock prize was awarded to Dr. Millikan for his researches in electricity by the National Academy of Sciences. He was the Hitchcock lecturer at the University of California in 1917 and Clark lecturer at Amherst in the same year. During the war Dr. Millikan served as vice-chairman of the National Research Council, as lieutenant-colonel in the Signal Corps and as chief of the science and research division of the Signal Corps.

Dr. Millikan is foreign secretary of the National Academy of Sciences and a member of the American Philosophical Society, and he has been named honorary member of the Royal Institution (London) and of the Société Batave de Philosophie Expérimentale of Rotterdam. He was president of the American Physical Society from 1916 to 1918. He is the author of textbooks on physics which are extensively used, of a book on "The Electron" and of numerous scientific papers. Dr. Millikan has had a part-time connection with the California Institute of Technology since 1917.

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Shall Economics or Politics Decide the Muscle Shoals Case?

THE goal of the electric light and power industry is a vast interconnected network of generating stations and transmission systems serving great sections of the country. As in probably no other branch of industry, economy and reliability are best secured by such interconnection and centralization. It is the *sine qua non* of efficiency and conservation. By this means the benefits of electricity are brought to the smallest village as well as to the largest city, and continuity with low cost of service is assured. Water power helps water power, steam helps steam, and both assist each other in a way that begets a maximum of service with a minimum of investment. This is sound engineering and good economics. For that reason government engineers, long before the question of sale came up, laid particular stress on the great economy possible from linking the Muscle Shoals developments with the large interconnected system already in existence in the southeastern section of the country. They therefore emphasized the desirability of legislation under which Muscle Shoals power, then as now inhibited by law from interconnection with private enterprise, might take its appropriate place with the Southern power scheme. Nothing else than a careful survey and an engineering analysis of the power situation in Alabama and Georgia led them to this conclusion, and in the light of Mr. Ford's offer for Muscle Shoals their finding is most interesting.

The crucial question which awaits an answer is, will the government follow the advice of its own engineers, made after a careful study of the general power situation, or will it disregard their recommendations and accept Mr. Ford's offer, which is admittedly against public policy and economically unsound? Certainly we have reason to expect that in such a case economics and not politics will prevail and that Muscle Shoals must eventually be operated as a public utility and interconnected with the other Southern power systems for the benefit and further development of the Southeastern States. The logic of the situation is plain, and there can be no other conclusion.

Manufacturing Taking Turn for the Better

NORMAL production in the electrical industry within a short while is indicated in a survey made by the ELECTRICAL WORLD among manufacturers of electrical apparatus and supplies. Depression has about run its course, and from now on a change for the better should be distinctly noticeable. Nothing short of an exaggerated spirit of pessimism can account for the long-deferred return to prosperous times. The wonder is that they are not already here. Stocks of all kinds certainly must be at a very low ebb, and the futility of continuing a hand-to-mouth purchasing policy when liquidation has run its course ought to be apparent. The electric public utilities have sold securities exceeding in amount by 25 per cent those sold last year. Indeed, the total new capital raised this year almost equals that raised by the steam railroads of the country and exceeds that raised by all other groups, including foreign governments, with the exception of municipalities and railroads.

Only a fifth of the new capital in hand is required for refunding, so that the appropriations for new plants, additions, extensions and betterments must have their effect, although other business must approach normal before the electrical manufacturing industry can take its wonted place in the industrial world. Depression has not visited the manufacturers of communication systems. These have enjoyed and will continue to enjoy normal business. Nor, for obvious reasons, have the manufacturers of the smaller electrical supplies been so hard hit as the manufacturers of heavier apparatus. When the billion dollars appropriated by Congress for farm credits and the half-billion dollars made available to the railroads begin to flow through the arteries of commerce it is certain that manufacturers of heavy equipment will experience better times. In the meantime it is enough to know that business conditions in the industry have turned the corner and that more prosperous times are not far off.

Merchandising, Not Technical, Viewpoint Must Prevail in Power-Factor Rate Schedules

AMONG the causes contributing to delay in establishing a satisfactory basis for considering power factor in rate schedules is the complication that has so far attended the attempt to enforce power-factor clauses. A recent analysis of the National Electric Light Association's rate book reveals that a large number of the schedules having these clauses are used by Pennsylvania companies where the growth of industrial load has forced the plant peak loads to the working hours of the day and intensified the power-factor problem. The clauses, however, are largely confined to the schedules that affect the large user, and observation indicates that there has been little effort to enforce even these clauses because of the complication and difficulty involved in placing the records in such shape that the customer can see the reason for the charges. This situation constitutes an important phase of the work of the committees that are charged with the task of investigating the problem.

With the technical solution of the problem must come a statement of the bases for power-factor adjustments that will not force the sales departments of the central-station companies to involve the consumer in complicated technical details that he has neither the inclination nor the ability to comprehend. The success of any recommendations that committees may make will depend altogether on the ability of the salesman to convey the idea to the ultimate consumer, which means the American public. From the results of studies now under way it is reasonable to expect that rate schedules will gradually undergo marked changes. Before this can be done the methods must pass the scrutiny of state commissions and probably in many cases that of the courts also. This means that the discussions of the problem will not be confined within the industry. Any recommendations that the committees make must be, therefore, in language non-technical men can readily comprehend.

Any other result than this will mean wasted time for those concerned in the investigation work. With recommendations properly stated after the technical basis is determined, the battle for the establishment of the power-factor basis of charging for service will be nine-tenths won. In brief, the technical must be subordinated to the merchandising viewpoint in this as in all phases of general business.

Time to Consider Substitution of Copper for Steel Wire

MANY steel-wire lines have been erected in the last few years where small loads had to be carried at considerable distances from the main transmission lines and where there was little likelihood of these loads becoming dense. Under these conditions and at that time, when copper prices attained unparalleled values, such practice was usually justified, but conditions have changed. There is greater necessity for considering conductor losses than previously, and since copper is now lower than it has been for seven years it is possible that installations will be found where substitution of copper for steel will be warranted on economic grounds. The losses in iron and steel wire have always been recognized, but it may pay readers who are operating iron-wire lines to study the data on page 515 of this issue of the ELECTRICAL WORLD and make their own economic balances.

Where Industrial Heating by Electrical Methods Scores

INDUSTRIAL engineers who have installed well-designed and carefully applied electric heating equipment in process work formerly carried on by steam or gas are often amazed by the increase in production resulting from the most modern methods. Men whose lives have been spent in the purely electrical field often have little conception of the difficulties under which their mechanical brethren have labored in trying to utilize less flexible and cleanly means of localized heating in and about specialized machinery. Uneven expansion of steam piping carried inside rotating shafts has sometimes resulted in sagging and breaks, followed by flooding of costly material in adjacent departments; intense discomfort due to the use of open-flame burners has made it hard to maintain production at special machines in hot weather, and dirt and drippings have contributed in numerous installations to impair the quality of the material in process. The cleanliness of industrial heating by electrical methods, the wonderful flexibility of control associated with these and the field for the use of temperature-recording apparatus and automatic positive cut-off and cut-in switches appeal so strongly to many industrial executives that relative cost becomes a purely secondary consideration. More cost data are needed, but the decision to install electric heating often hinges on other factors.

Influence of Newspapers in Electrical Problems of Public Interest

AT LEAST one great metropolitan newspaper has not only made the discovery that comparatively few fires can be traced to defective wiring but also sees the need for enlightening the general public regarding the safety of electric wiring and the responsibility for electrical fires when they do occur. In an editorial about half a column long, headed "Faulty Insulation" and commenting on the recent fire on the army piers at Hoboken, N. J., the New York *Times* recently made the following observations:

"Indeed, whenever the authorities don't know how a fire started they attribute it to faulty insulation. . . . It is, of course, possible that the North River pier fire was due to faulty insulation. If it was, the officers responsible for the upkeep of the property are responsible for the faulty insulation. If the wiring on the piers was done as it should have been in the beginning and was kept under intelligent inspection, there was no chance for faulty insulation. If the work was not done well originally or if inspection and repairs were neglected, the insulation may have gone wrong. In that case the blame rests with the men charged with upkeep of the plant.

"The fact is, the charge that faulty insulation is responsible for fires is a convenient way of hiding ignorance. Nobody is likely to come to the defense of the wiring. Far fewer fires than are generally supposed originate in electric apparatus, and such apparatus is as safe as any human device can be when it is properly installed and treated."

The influence of such straightforward editorial comment in a serious newspaper is far-reaching among the business men and taxpayers of any community. The blame for the failure of more of it to appear lies squarely on the shoulders of every electrical man who in any way is responsible for the good name of electric service in his city, town or hamlet. Editors of reputable newspapers as a rule strive to protect the business interests of their community, and when they are permitted to come into the inner councils for facts and data on which to form their opinions of any question of public interest there is less chance than otherwise for garbled facts and antagonistic viewpoints. In fact, it is only when responsible representatives of respectable newspapers are kept on the outside looking in and are handed brief scraps of carefully worded generalities that their suspicion is aroused and their instinct for news forced into unreliable channels, with the resulting publication of unfortunate statements that full confidence and details of the situation freely given might have prevented. The newspaper wields a great influence over public opinion, an influence which every public utility manager, electrical contractor—in fact, every electrical man—can help to expand to the benefit of the electrical industry if the aid of editors and news gatherers is cultivated and counsel with them is sought from the self-interest viewpoint of electric service in community development.

The Public Is Prepared to Pay for Essential Service

DESPITE the burden of high material and labor costs, public utility service must continue to expand. It has long since become a necessity of life, and as such it will be developed and provided, for the public wants it. To rail against plant expansion to meet a growing demand for service, as did a recent speaker in a commission hearing, simply because such enlargement of facilities is costly, leaves the public unsatisfied.

Wise managers of central stations have "played safe" during the war in committing their companies to line extensions of dubious profit, but as the tide of public demand for service rises the time comes when the service must be furnished. Guarantees may be required of a reasonable amortization of the extra investment; initial rates may be established to offset temporary low density of patronage, subject to later reductions as business grows, and customers may have to bear part of the prime cost of reaching them, but when the demand for service attains sufficient headway it must and will be supplied. If the public makes up its mind to have a particular service, knowing its true cost, further argument is wasted energy. Prudent management will make the costs clear to the reasonable mind; it will refrain from rash ventures in response to pseudo public opinion; but when the weighted reality of the demand becomes unmistakable, notwithstanding present costs, orders to start work must follow. To know what the public wants and what it is prepared to pay is therefore a fundamental problem today of the utility manager.

Possibilities in Saline-Solution Testing of Waterwheels

METHODS of testing waterwheel installations have never been fully satisfactory from the field standpoint because of the complications and expense involved in preparing for tests and the extreme care that is required in the tests to avoid the introduction of errors due to lack of care or experience. A temporary weir in a tailrace seldom proves satisfactory, among other reasons because it is almost impossible to prevent leakage around or under the structure. A permanent weir presents objections from an operating standpoint, and the difficulties involved in the Pitot tube method need no review. The last few years have brought considerable discussion of saline-solution testing, or, as some have called it, the titration method. With reasonable care in the taking of readings and samples and the running of tests over a sufficient period of time to insure getting tailrace samples that are properly mixed with the saline solution, it has seemed to offer a much simpler method, combined with a higher degree of accuracy, than any of the other means. The chief difficulty is in "rigging up" to supply the necessary quantity of salt solution. In the case of a large unit the physical difficulties are very real, but once these are overcome the method is relatively simple. For this reason the description of its application to the Kerckhoff plant of the San Joaquin Light & Power Corporation given elsewhere in this issue by R. C. Starr is timely.

Many have been led to believe that the method is so simple that little care need be exercised in preparation for it. Mr. Starr's description indicates that the same care must be taken that would be taken in any other series of tests. With this lesson thoroughly learned study of the article with a view to applying the tests is well worth while. Whether it will come within the expense that may be considered justified in any particular case will usually depend to a large extent on the ease with which the necessary tank and other equipment can be taken to the location and erected. The actual tests are comparatively simple and require no extraordinary ability or training on the part of the observers.

Exploration of the Field About an Insulator

THE distribution of potential over the surface and in the air immediately surrounding a line insulator obviously has an important bearing on its rating and performance. The electrostatic field between two conductors has a simple and symmetrical shape in a few cases only, such as parallel planes or concentric cylinders. In the case of the transmission line the line conductor and the point of support on the tower obviously form a highly complicated relation not readily permitting modification for obtaining a symmetrical field. Even if it were possible to propose shapes for the line and tower arm which would avoid regions of high potential gradient and produce an approximately uniform field distribution, the necessity of protecting the insulating surfaces from the weather by petticoats or other sheds would always render the problem too complex for the simple conditions which it is desired to bring about.

Much study has been given to the design of porcelain insulators with this problem in mind. A number of theoretical treatises, principally by foreign authors, have appeared from time to time based on the dielectric properties of air and porcelain and the shapes and dimensions of the insulator. Perhaps one of the most important contributions to this subject was made several years ago in this country by Messrs. Chubb and Fortescue, who pointed out the importance of so designing insulators that the porcelain surfaces should be either parallel or perpendicular to the lines of electrostatic force. Although the value of the principle was clearly proved, apparently little effort has been made to incorporate it in the design of commercial insulators. The difficulty lies in the open question as to the shape of the field distribution and, as stated above, in the complication which is introduced by the porcelain petticoat.

Obviously the first step toward correction of insulator troubles arising from unsymmetrical fields is a definite knowledge of the actual shape of the field. It is doubtful whether a theoretical analysis of the highly irregular conditions found at transmission-line supports can be safely relied on except in a very broad way. It would therefore be particularly desirable if an experimental method of investigation of the electrostatic field could be devised. Such a method would need to determine potential gradients which vary sharply within very short distances over porcelain surfaces and through the air. The difficulty in measurements of this kind is the fact that any exploring device introduced into the field will of necessity have certain physical dimensions and would therefore disturb to a greater or less extent the quantities which it is the desire to measure.

New York-Chicago Telephone Cable Equivalent of Eight Open-Wire Pole Lines

THE completion of an important [illegible] cable between New York and Chicago [illegible] the American Telephone and Telegraph Company reporting that the New York-Pittsburgh section will be ready for service the latter part of this year. This very cable has not been made possible by any one or two developments but by the accumulation of diverse forms of apparatus and equipment. For instance, consider the vacuum tube and loading coil, [illegible] at the right, which have furnished great help in the development; [illegible] the essential [illegible] and four-wire repeater circuits used for the telephone and telegraph systems, composite sets permitting simultaneous telephone and telegraph messages and special types of actual construction. The cable used in this line will provide 200 to 250 telephone circuits and 175 to 200 telegraph circuits or the equivalent of eight open-wire pole lines. The project is particularly interesting in view of the rugged country traversed and the construction method required

Electrical Business Has Turned the Corner

Replies to Questionnaire Indicate that While Production Declined During First Half of Year from 73 to 52 per Cent of Capacity Renewed Buying Should Result in Healthy Market Next Spring

THE worst is apparently over and business in the electrical industry is once more looking up. Manufacturers for the most part are optimistic and looking forward with considerable confidence. While production is still far below capacity the indications are that it has reached the low point and to a considerable degree is beginning to increase. Not a few manufacturers of electrical materials are looking forward to next spring, when they believe the market will again be healthy. In order to determine exactly the situation in the production of electrical and allied materials ELECTRICAL WORLD directed a questionnaire to a number of manufacturers and from the large number of replies the following analysis has been made:

It would appear that on July 1, 1921, the electrical industry was operating on a schedule embracing 52 per cent of its capacity. On Jan. 1, 1921, electrical manufacture was on a schedule covering about 73 per cent of its capacity. During the first six months of this year, therefore, electrical production has decreased approximately 33 per cent.

CAPACITY MUCH GREATER

It must be remembered, however, that when these manufacturers turned the corner into the year 1921 they had manufacturing capacity probably nearly double that existing in 1916, and it would hardly be expected that all this capacity could be utilized to 100 per cent in a period immediately following the boom period resulting from the close of the war. A reduction in manufacture was inevitable, but the essential part was to keep that production going as near to 100 per cent as possible.

It was just a year ago that the electrical industry ran into the head winds and found it necessary to give way a little. Much heavy apparatus in process of construction was continued in production last fall, but production of supplies and smaller equipment fell off till on Jan. 1, 1921, it was about 73 per cent of the producing capacity of the mills. Last spring was a relatively quiet period and dark clouds appeared in the skies of the manufacturing world from time to time. But none the less production in this industry decreased only about 33 per cent more. Considered on the basis of mid-1920, electrical production is off in the neighborhood of 48 per cent.

These figures should be considered more in the light of individual manufacturers than of total output. Production in total units was probably higher on July 1 than 52 per cent of capacity, but that figure was obtained by considering all manufacturers at the same value, irrespective of their individual output. From the returns tabulated, 57 per cent of the companies replying suffered a decrease in production on July 1 over Jan. 1; 20 per cent reported no decrease in production, while 6 per cent showed an actual increase in production within that period. Answers from the remainder could not be tabulated.

For purposes of closer analysis the manufacturers have been divided into three groups according to their products—generating, transmitting and distributing, utilizing. In the first group are included steam and water generators, boiler-room equipment and switchroom equipment. In the transmitting and distributing group will be found wire and cable, high-tension and low-tension switching equipment and wiring materials, transformers, meters, towers, etc. In the utilization group have been placed motors and control apparatus, electric furnaces, etc.

GENERATOR PRODUCTION 50 PER CENT

Generating apparatus has declined from a figure of 74 per cent on Jan. 1 to a figure of 44 per cent of capacity on July 1. Considering the relative output of the companies reporting, however, these figures should undoubtedly be nearer 80 and 50 per cent. In the strictly electrical generating part of this equipment the production figures are better than those offered to boiler-room equipment. But it is the makers of this latter equipment who report the return of better buying. The transmitting and distributing equipment is holding very close to the figures given for total output, the percentage of the capacity on Jan. 1 being 70 and that on July 1, 52. Wire and cable makers were on about a 73 per cent basis on Jan. 1, while on July 1 they were about 42 per cent of capacity as a whole. Of course, among these manufacturers there are some whose production on July 1 was considerably above 42 per cent of capacity; but at the same time certain other mills were sailing very close to the rocks. No reports showed higher production on July 1 than on Jan. 1.

Transformer production was nearly 90 per cent at the first of the year, but it had dropped to 55 per cent by July 1. Meter production probably was as high on Jan. 1 as that of any other piece of electrical equipment. That with measuring instruments was ranging around 90 per cent in January and by July 1 had dropped to about 66 per cent.

HIGH TENSION MATERIALS STEADY

High-tension switching equipment and outdoor substation equipment have been holding an even course as a whole, changing only from 62 per cent capacity to 60 per cent during the first six months of this year. Here, though, one manufacturer increased his production during that period from 75 to 100 per cent, reporting capacity production on July 1. High-tension insulator production showed the highest consistent rate of all equipment. This averaged almost capacity on Jan. 1 and fell off only about 15 per cent by July. Much of this trade, however, was in the foreign market.

Current utilizing equipment changed from about 75 per cent of capacity to 50 per cent during this six-month period. Here again more emphasis might be placed on certain of the larger companies if individual production were considered, and these figures might be raised a couple of points. About 70 per cent of the returns showed lower production at the end of the period than at the beginning, and about 23 per cent showed no change. Other returns were uncertain. No manufacturer reported an increase in that time over his January production.

Motor-control equipment on Jan. 1 was reported on a basis of 83 per cent of capacity, while on July 1 it had fallen to 70 per cent production as a whole. Still, more than half the returns showed no diminution during that period, and the falling off of the remainder was not great. One producer apparently held to capacity during this period.

Miscellaneous equipment production was about 52 per cent on July 1, on a level with general average production. Its Jan. 1 rate, though, was only about 62 per cent of capacity.

BOTTOM REACHED

That there has been a turning point in the decreasing amount of business transacted is not strictly shown in the replies at hand. But that the bottom has been reached is quite evident. In the first instance 46 per cent of the replies stated that there was no direct evidence that the tide had turned based on their actual orders received. As opposed to this, 42 per cent of the answers showed from a slight to a decided turn for the better as based on orders received. Others were uncertain in their findings, although they showed an increasing interest apparent in the trade because of the increase in inquiries received.

Manufacturers of equipment of the class purchased by central-station companies are particularly hopeful concerning the future outlook because of the heavy financing which these utilities have undertaken this year. One maker of boilers anticipates no prompt resumption in business and believes there will be none until the railroads receive the money owed them so that they can start to buy their requirements. These requirements cover such a broad variety that their purchase would produce a very much better feeling all over the market, in the opinion of the president of this company. During July there was a little more activity in the power boiler field, however. Automatic stoker buying is reported better.

Wire and cable manufacturers foresee no improvement in their business to amount to anything before the first of next year. Some gradual improvement is looked for this fall and winter, however, but it is considered only a seasonal increase.

BETTER TRANSFORMER SALES

Transformer orders seem to be on the increase, especially distribution transformers, July business having shown up well over that of the previous months. With them buying of house meters is expected to increase this fall, and it is thought that these two classes of supply will find quite a normal market by next spring. The president of a prominent meter company feels that business would be at least 25 per cent better right now if people would quit talking hard times—in other words, if there were not so much pessimism abroad. Measuring-instrument trade is holding a level of about 55 per cent this summer, and it is anticipated that this will hold throughout the fall.

From certain quarters in the high tension insulator field a turn for the better was noticed about the middle of the year, and from that time on production has been at 100 per cent of capacity and it is hoped it can be held there throughout the year. Not all makers hold this same view, though a very bright outlook is taken of the future in this field. Not all of the insulator production goes to the domestic market, however, for the foreign field is providing a very profitable outlet and it is expected to continue to do so. Steel-tower makers are getting some business from domestic sources, but it is not without its ups and downs. The foreign market here too is providing a fruitful field, and several large orders have been taken this year.

High-tension line and switching equipment provides a topic on which there seems to be some disagreement among manufacturers. On the one hand is the report of better business since last spring and greater output in July over January, while on the other hand the trade is said to be dull and the outlook not very promising; still, the majority of replies predict a very promising future starting next spring.

BETTER FALL BUYING OF MOTORS PREDICTED

While the majority opinion states that there has been no improvement in motor business this summer, this opinion wins by only one vote. Dates ranging from the middle of June to the first of August are given as the times that an increase has been noticeable in buying. Motors of all descriptions compose this list. But the general opinion is that an improvement will be found this fall and a substantial market uncovered in the spring. One manufacturer puts the blame for his quiet business on the high taxes and high freight rates, and expresses the feeling that when these get within reason business will revive.

HEAVY CONTROL PRODUCTION

Motor control is tied up closely with motor trade in normal times, but it has been running at a higher rate than motor production this year. One producer reports capacity output on all classes of control. Another one is only five points below capacity. In general no indication is apparent of any increase in this trade, and it is the opinion that it will be well into next summer before any real improvement is seen. Fundamentally better economic conditions are, however, causing a better feeling.

Electric furnace production is one to which manufacturers are looking with great hope because of the economies to both the ferrous trade and the non-ferrous trade. Inquiries have been heavy this year and some good orders also have been placed. With the return of business to the steel and brass trades it is expected that electric furnace production will pick up another 25 per cent by spring.

A bright spot is shown in the better business encountered this summer in the magnet wire trade. This is of interest in that it promises well for the motor trade. Electrical sheet business, too, has increased in a slight degree since July 1.

Quick and Economical Waterwheel Test

High Degree of Accuracy in Measuring Discharge Through Wheels Is Attained—Method Requires Use of Saline Solution—Test of 15,000-Hp. Units Shows How Data Are Obtained and Results Worked Out

By R. C. STARR
Construction Engineer San Joaquin Light & Power Corporation

ONE of the difficult problems to be dealt with in tests of hydro-electric units in place is the accurate determination of the discharge through the wheels. The electrical measurements of the generator output and generator efficiency at all values of load may be determined with all desired accuracy, but it is more difficult to measure the power delivered to the waterwheel. The saline solution method, however, offers a means of determining the discharge to a degree of accuracy generally acceptable to the manufacturer and user alike. This permits a good estimate of penstock losses and goes a long way to insure reasonable accuracy in determining the power delivered to the wheel. The method consists of inserting at a constant rate a known saline solution into the penstock at a sufficient distance above the waterwheel to insure a complete mixture before the water passes through the wheel, then taking samples at the tailrace and determining by chemical methods the quantity of salt in the tailwater. It should be observed that the method is especially applicable to plants which employ long penstocks.

Some tests made at the Kerckhoff power plant of the San Joaquin Light & Power Corporation are given here in some detail in order to make the method clear to engineers desiring to apply the method to other plants. This station consists of three 15,000-hp. Allis-Chalmers (Francis type) vertical single-runner hydraulic turbines, operating under an effective head of between 315 ft. and 340 ft. (96 m. and 104 m.) at 360 r.p.m., directly connected to three vertical Allis-Chalmers generators, and two turbine-driven exciter units, rated at 500 brake-hp., operating under the same head. Each unit is connected to a steel penstock line varying in diameter from 8 ft. (2.4 m.) at the portal of the tunnel to 7 ft. (2.1 m.) at the waterwheel and is aproximately 900 ft. (270 m.) long.

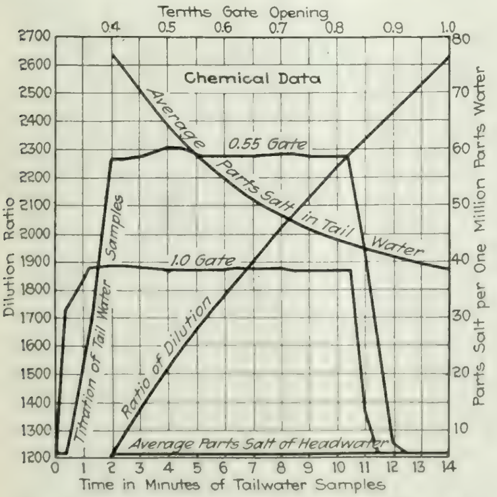


FIG. 1—HOW SALINE SOLUTION INDICATES WATER RATE

Salt solution is introduced into penstock at a fixed rate. By determination of the dilution in the tailwater the flow of water through the wheel is estimated. It is shown that a fixed relation exists between parts of salt in the tailwater (or dilution) and gate opening.

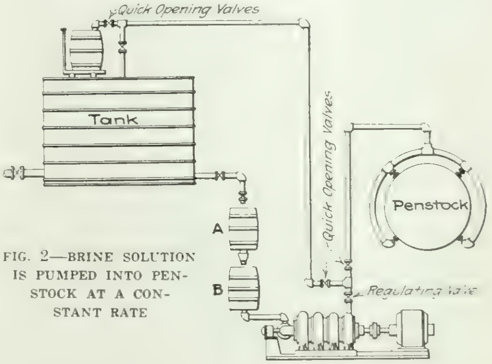


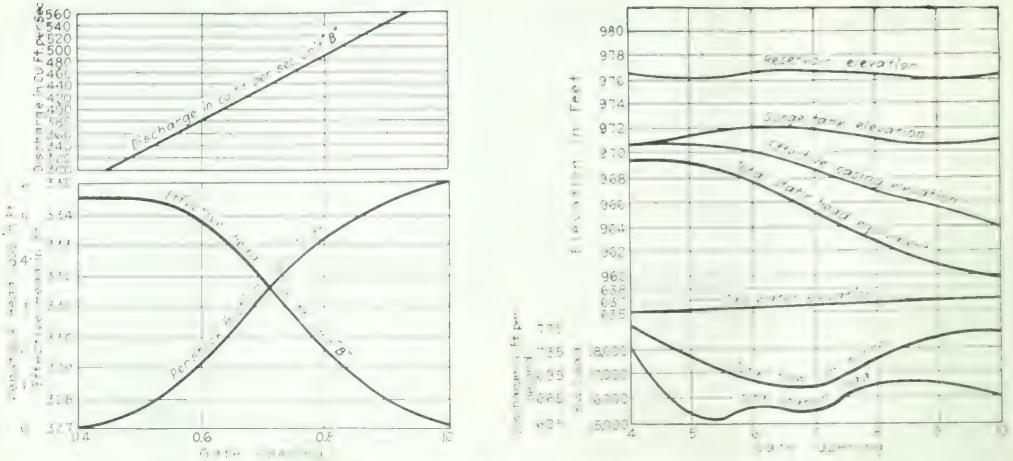
FIG. 2—BRINE SOLUTION IS PUMPED INTO PENSTOCK AT A CONSTANT RATE

The amount of dilution of the solution determines the quantity of water passing through the wheel. The cubic feet per second is equal to:

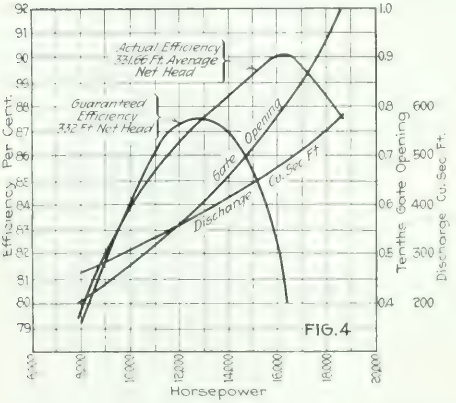
$$\frac{\text{the ratio of dilution} \times 62.4 \times 1.09248}{14.905}.$$

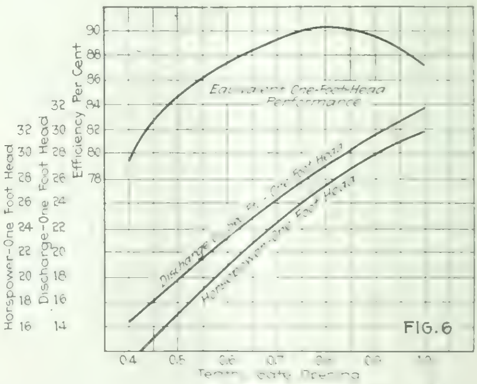
The ratio of dilution is the ratio of the parts of salt to 1,000,000 parts of fresh water in the saline solution to the parts of salt in the tailwater after the saline solution has been inserted, and in this case varies from six to eighty parts of salt to 1,000,000 parts of water in the tailwater. This is illustrated by Fig. 1. For instance, referring to the curves for two different gate openings, it will be seen that there are approximately six parts of salt in the normal water, and with 14.905 lb. (6.76 kg.) of solution inserted per second with 0.55 gate opening, there are approximately fifty-nine parts of salt to 1,000,000 parts of water. The weight of one cubic foot of water is 62.4 lb. (0.792 kg. per cu.m.) and 1.09248 is the specific gravity of the solution inserted. The weight in pounds of salt solution inserted is 14.905 per second.

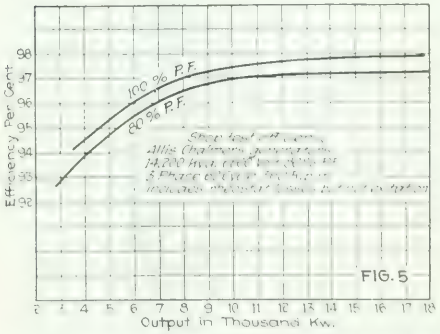
In making this test it was necessary to run at a fixed gate opening while inserting the solution, in order to insure constant velocity in the penstock. The load was made constant by carrying the total load of the station on two units, running the unit not under test on the governor so that it would take up any variable demand on the station.

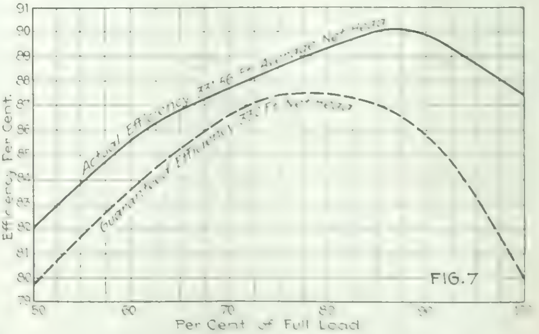


FIGS. 3 AND 3A—HYDRAULIC DATA FOR TEST OF 15,000-HP. WATERWHEEL









FIGS. 4, 5, 6 AND 7—PERFORMANCE CURVES FOR 15,000-HP. WATERWHEEL OPERATING AT KERCKHOFF STATION, SAN JOAQUIN LIGHT & POWER CORPORATION

Fig. 4—Actual efficiency obtained by test runs well above guaranteed efficiency, reaching 90 per cent at a load of a little over 16,000 hp.

Fig. 5—Generator efficiency as determined by shop tests. The units are rated at 14,200 kv.-a., 6,600 volts, 360 r.p.m. Blower losses are included but not excitation.

Fig. 6—Equivalent 1-ft. head performance of wheel.

Fig. 7—Efficiency curves shown to larger scale.

TABLE I.—FRICTION LOSS IN 7.6-FT. STEEL PENSTOCK, 950 FT. LONG, UNIT *B*

Gate Open	Elv. Surge Tank	Casing Inlet, Lb	Casing Inlet, Ft	Elv. Casing Inlet	Elv. Casing Inlet*	Penstock Loss	Disch. Sec. Ft.	Vel.
0.4	970.6	136.0	313.8	969.5	970.6	0.02	263.7	5.85
0.6	971.9	135.1	312.0	967.7	970.0	1.84	388.5	8.65
0.8	971.1	133.0	307.0	962.7	966.3	4.78	483.5	10.75
1.0	970.9	131.7	304.0	959.7	964.8	6.10	575.0	12.8

*Plus entrance velocity head

TABLE II.—FRICTION LOSS IN UNLINED TUNNEL, LENGTH 16,943 FT., AVERAGE AREA 320 SQ.FT.

Gate Open	Dam Elev.	Surge Tank Elv.	Tunnel Loss, Ft	Unit *A*, Disch., Sec.-Ft.	Unit *B*, Disch., Sec.-Ft.	Exc. *A*, Disch., Sec.-Ft.	Total Disch., Sec.-Ft.	Vel., Sec.-Ft.
0.4	976.5	970.6	5.92	505	263.7	5	773.7	2.41
0.6	976.6	971.9	6.12	291	388.5	5	684.5	2.14
0.8	976.4	971.1	5.32	228	483.5	5	711.5	2.22
1.0	976.3	970.9	5.38	180	575.0	5	760.0	2.37

TABLE III.—SUMMARY OF DATA, EXCITER GENERATOR B
500 hp., 250 volts, 900 r.p.m.

Volts	Amperes A	Amperes B	Total	Kw	Contr. Gen.	Gen. Eff.	Brake, Hp.	Turb. Eff.	Effect. Head	Disch., Sec.-Ft.
157	240	200	440	69	5	78	127.5	65	328	5
162	210	205	415	67	5	78	124	65	332.7	5
135	200	224	424	57	5	73	113	62	333	5
185	190	240	430	80	4.9	81	138	66	333	5

TABLE IV—SUMMARY OF KW. BY CALIBRATED TESTING INSTRUMENTS

Gate Open	Meter Z Rev Av. Rev.	Meter Z Rev Cor. Rev.	Meter W Rev Av. Rev.	Meter W Rev Cor. Rev.	Total Rev.	Aver. Secs.	P. F.	Kw.
0.4	11.48	11.54	18.02	17.95	27.49	80.8	93	5,680
0.6	20.82	20.78	23.49	23.40	44.18	74	94	9,295
0.8	28.19	28.11	30.84	30.72	58.83	77.2	99	11,860
1.0	28.47	28.39	30.51	30.42	58.81	67.2	99	13,610

The equipment used to introduce the salt solution at constant rate was set up as shown in Fig. 2. A 10,000-gal. (37,800-l.) wood-stave tank was filled with 7,500 gal. of water and 6 tons of common dairy salt. Four ⅜-in. (10-mm.) pipes, radiating from the center at 90 deg. apart, drilled with ⅛-in. (3.2-mm.) holes and connected to an air line having a pressure of 100 lb. (7 kg. per sq.cm.) to the square inch, were installed in the bottom of the tank for the purpose of agitating the solution. This was kept under agitation for approximately sixty hours, resulting in a solution of 86542.8 parts of salt to 1,000,000 parts of water. This solution was inserted into the penstock through four ½-in. (12.7-mm.) openings placed radially around the penstock, against an approximate head of 60 ft. (18.3 m.), by means of a 150-g.p.m. (567-l.), four-stage centrifugal pump driven by an induction motor.

The rate of flow of the solution into the penstock was kept constant as follows. A 3-in. (7.6-cm.) discharge pipe from the bottom of the tank, equipped with a 3-in. valve and a 1-in. (2.57-cm.) valve in parallel, was used to regulate the discharge from the tank, discharging into barrel *A*, in the bottom of which was installed a 1½-in. (3.8-cm.) nipple, forming an orifice for the discharge of the solution into barrel *B* below it, from which the solution was pumped. The valve in the discharge side of the pump was adjusted so that the solution was pumped from barrel *B* at such a rate as to keep the head constant in it, a constant head being maintained in barrel *A* by means of the valves.

The orifice was calibrated by diverting the solution from the pump into a barrel for a fixed period of time, which was noted by stop-watch, this quantity being weighed. The barrel for calibrating the orifice, together with a set of platform scales, was mounted on a platform over the tank for convenience, to permit emptying the solution into the tank after weighing and also to avoid wasting the solution.

The result of several of these calibrations gave a flow of 14.905 lb. (6.76 kg.) of solution per second.

The duration of tests for any fixed gate opening was approximately ten minutes. Referring to Fig. 1, it will be seen that very steady conditions were obtained within this period of time, and the period could have been shortened to five minutes with satisfactory results.

Insertion of the solution into the penstock was at a point approximately 800 ft. (245 m.) in lineal length of penstock above the waterwheels.

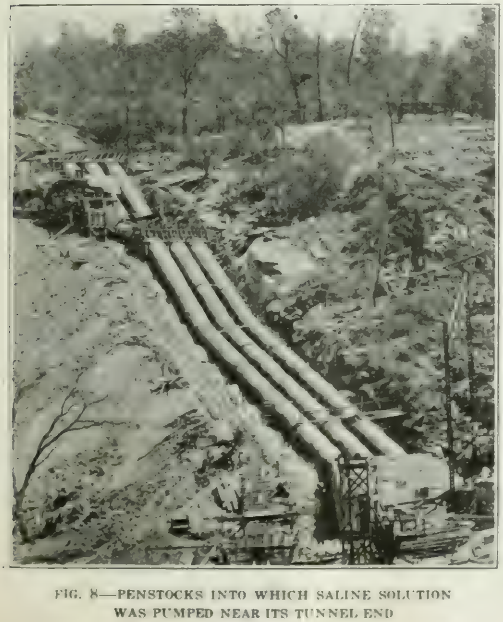


FIG. 8—PENSTOCKS INTO WHICH SALINE SOLUTION WAS PUMPED NEAR ITS TUNNEL END

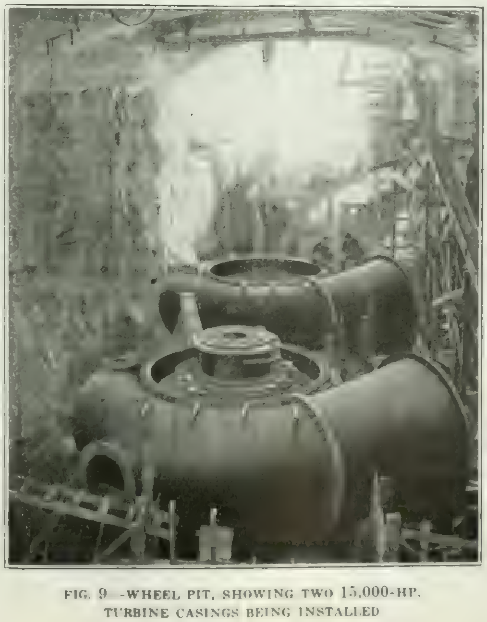


FIG. 9—WHEEL PIT, SHOWING TWO 15,000-HP. TURBINE CASINGS BEING INSTALLED

TABLE V—UNIT *B*, SUMMARY OF SWITCHBOARD READINGS

Gate Open	Kw.	Amp.	Volts	P. F.	Freq.	Exciter, Amp.	Exciter, Volts
0.4	5,650	545	108	92.7	60	200	157
0.6	9,200	830	108	99.5	60	206	162
0.8	11,650	1,070	107	99.7	60	224	135
1.0	13,400	1,225	108	100	60	240	185

TABLE VI—CHEMICAL DATA

Gate Open	Average Tail-water	Average Head-water	Salt Increase	Strong Salt	Dilution Ratio	Discharge, Sec.-Ft.
0.4	77.39	5.63	71.76	86,542.8	1,205.9	263.5
0.6	54.60	5.63	48.97	86,542.8	1,771.7	388.0
0.8	44.75	5.63	39.12	86,542.8	2,212.2	483.5
1.0	38.56	5.63	32.93	86,542.8	2,628.2	575.0

TABLE VII—TURBINE-HEAD DATA

Gate Open	Casing Inlet	Tail-water	Static Head	En-trance Head*	Dis-charge Head†	Net Effect. Head
0.4	969.55	636.09	333.46	1.067	0.075	333.45
0.6	967.75	636.35	331.40	2.31	0.163	333.55
0.8	962.75	636.7	326.05	3.59	0.253	329.39
1.0	959.75	637.1	322.65	5.09	0.366	327.37

* 31.8 sq.ft. † 120 sq.ft.

Samples of the solution and fresh water from the tunnel were also taken each period or for each fixed gate opening. The curves shown in Fig. 1 show an almost constant flow of water in the penstock for fixed gate opening when the flow is normal.

Elevations at the dam or lake were read on a graduated rod. Connecting the penstocks to the lake is a tunnel 16,943 ft. (5.162 m.) long, having an average area of 320 sq.ft. (30 sq.m.), driven through hard granite rock. About 100 ft. (30 m.) back from the penstock end of this tunnel is a surge tank about 90 ft. (27 m.) high, rising from the floor elevation of the tunnel and opening out at the side of the hill. A float was suspended in this surge tank and elevations were read against an established bench mark.

The diameter and area of the inlet section of the turbine were carefully measured, and at the same point three calibrated pressure gages were connected through three piezometer openings at different points around the circumference, the center line of these gages being at an elevation of 655.75 ft. (199.8 m.).

The turbines discharge into the river through straight steel-plate draft tubes and tunnels driven through the rock measuring approximately 10 ft. x 12 ft. (3 cm. x 3.7 cm.), close to the outlets of which stop log shafts are placed. A platform was constructed in *B* shaft for the observers taking tailwater elevations and the chemist in charge taking tailwater samples. A horizontal beam about 6 ft. (2 m.) above the water, having a bench mark, was used for checking the tailwater elevations, and a 1-in. (2.5-cm.) centrifugal pump connected with a manifold on the suction made up of eight pipes placed at different depths in the tailrace was used for obtaining tailwater samples.

TABLE VIII—SUMMARY OF DATA, UNIT *B*

15,000-hp., 315-ft. head, 360 r.p.m., 14,200 kva., 80 per cent power factor, 6,600 volts, 60 cycles, three-phase

Gate Open	Kw.	P.F.	Kva.	Gen. Eff.	Brake-hp.	Disch., Sec.-Ft.	Eff. Head	Turb. Eff.	Hp_1.	Q_1
0.4	5,680	93	6,110	95.8	7,950	263.7	334.4	79.4	1.3	14.4
0.6	9,295	99	9,380	97.2	12,800	388.5	333.5	87.3	2.10	21.3
0.8	11,860	99	11,985	97.62	16,280	463.5	329.4	90.1	2.72	26.6
1.0	13,610	99	13,750	97.74	18,680	575.0	327.4	87.4	3.15	31.8

TABLE IX—SUMMARY OF DATA, UNIT *A*

Gate Open	Kw.	P.F.	Kva.	Gen. Eff.	Brake-hp.	Disch., Sec.-Ft.	Eff Head	Turb. Eff.
0.84	12,400	98.5	12,600	97.6	17,000	505	320.5	90.0
0.5	7,730	92.0	8,400	96.7	10,700	333	334.0	85.0
0.35	4,690	80.0	5,850	94.75	6,640	228	334.5	77.0
0.2	2,500	52.0	4,800	89.5	3,750	180	334.5	55.0

For metering the output of the generator two calibrated wattmeters, connected to their individual current and potential transformers, were used. Readings were also taken from the regular switchboard instruments.

The fifteen observers at the various stations were connected with a common telephone line, used to start and stop the tests, which were each of approximately ten minutes' duration, and before the start of the test all watches were set to the same time. Stop-watches were used where necessary.

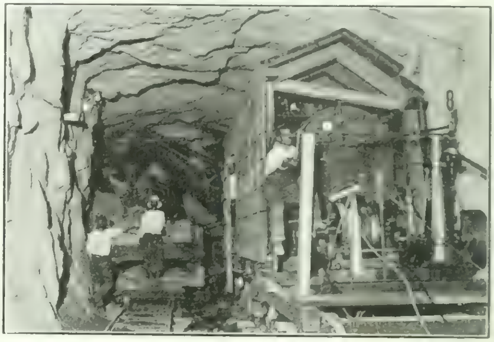


FIG. 10—DRIVING ONE OF THE TUNNELS CONNECTING DAM AND PENSTOCK (WHERE SOME LOSS OF HEAD OCCURS)

All tables and curves are compiled from a large number of simultaneous readings averaged and listed under their various headings.

The following formulas and relations were used in making the calculations:

$$\text{Kw.} = \frac{\text{total revenue} \times 3{,}600 \times 0.3 \times 240 \times 60}{\text{time in seconds} \times 1{,}000}$$

3,600 = seconds per hour.
0.3 = constant of meter.
240 = current transformer ratio.
60 = potential transformer ratio.

Chemical Data.—

Parts chlorine per 1,000,000 = c.c. of silver nitrate necessary to titrate 250-c.c. sample multiplied by 2.8144, the factor of normal 1/50 silver solution.

Salt increase = tailwater salt minus headwater salt.

$$\text{Ratio of dilution} = \frac{\text{strong salt}}{\text{tailwater minus headwater salt}}$$

Calibrated orifice discharge 14.905 lb. of salt solution per second.

Density of salt = 1.09248.

$$\text{Turbine discharge} = \frac{\text{ratio of dilution} \times 62.4 \times 1.09248}{14.905}$$

= cubic feet per second.

Turbine Head Data.—

Casing inlet equivalent elevation = pressure in pounds per inch times 2.31 (in feet) plus 655.75, the elevation of the center of the gages.

Static head = casing inlet minus tailwater elevation.

Entrance head = $V^2/2g$.

V = cu.ft. per second ÷ area of draft tube.
= $Q/120$.

Effective head = static head plus entrance head minus discharge head.

Summary of Data.—

Generator efficiency from curve showing shop test:

Brake-hp. $= \dfrac{\text{kw.}}{0.746 \times \text{generator efficiency}}$,

Turbine efficiency $= \dfrac{\text{brake-hp.}}{(Q \times H \times 62.4 \div 550)}$.

Hp., 1-ft. head $= \text{hp.} \div H\sqrt{H}$.

Q, 1-ft. head $= Q \div \sqrt{H}$.

Friction Loss in Penstock.—

Pressure drop = surge tank elevation minus casing inlet head.

Friction loss = pressure drop minus velocity head.

Velocity head = $V^2/2g$, where $V = Q/A$ and $A = 31.8$ sq.ft. area.

Average diameter of pipe = 7.56 ft. Area = 45 sq.ft.

Friction Loss in Tunnel.—

Tunnel length = 16,943 ft. (unlined) bored through granite, about 18 ft. square.

Average area = 320 sq.ft.

Tunnel loss = dam elevation minus surge-tank elevation.

Tunnel water = discharge of units A and B plus exciter A.

Velocity through tunnel = total water ÷ area.

Largest Generator Built

Goldenberg Plant in Germany Will Use 60,000-Kva., 7,000-Volt, 1,000-r.p.m. Generator Designed for 50 per Cent Overspeeding

A 60,000-KVA., 7,000-volt, three-phase generator, rated at 1,000 r.p.m. but designed to withstand 50 per cent increase in speed, has been completed by the Siemens-Schuckert Works, Germany, for the Goldenberg plant. The largest rating provided in any generator previously built by this company was 21,500 kva., so that this order represented a big jump beyond all experience. The ability to withstand such overspeeding was also a severe requirement owing to the utter lack of high-grade nickel steel at the time the unit was ordered.

A good idea of the gigantic dimensions and weights of this generator may be gained from the following data and the accompanying diagram showing a longitudinal section through the machine:

Shaft.—Weight 36,000 kg.; largest diameter, 1,100 mm.; diameter of hole (hollow shaft), 300 mm.; length of shaft over all, 8,700 mm.

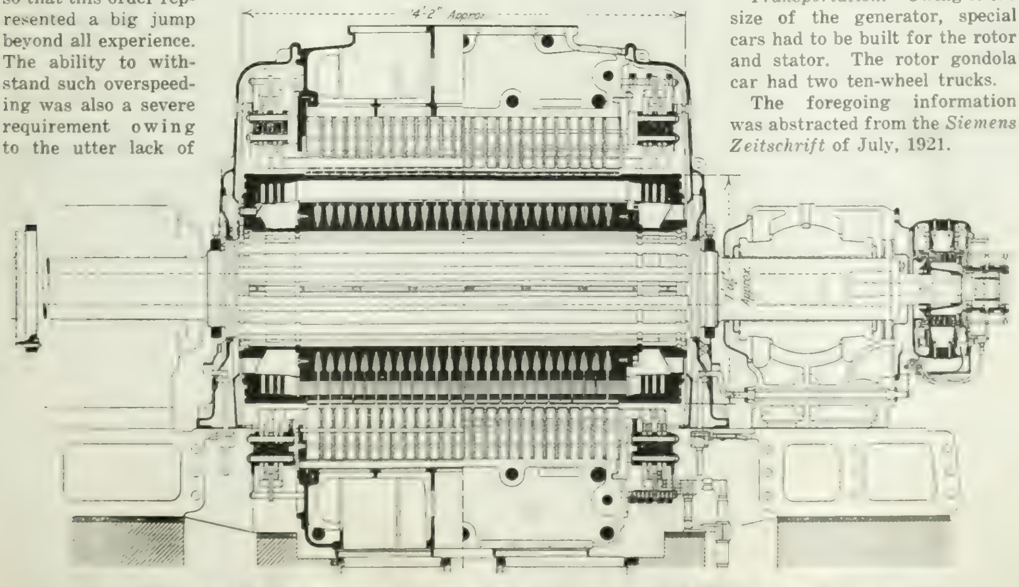
Rotor.—Built up of twenty-six steel disks of 120 mm. thickness each, shrunk upon the shaft; diameter of rotor, 2,300 mm.; weight, rough, 60,000 kg.; ready machined, drilled and slotted, 40,000 kg.

Rotor Winding.—Copper bars weighing 11,000 kg. were placed in forty-eight slots. The built-up and transposed copper bars are insulated with mica. The coil ends are protected against dislocation by steel caps shrunk upon them. Each of these two caps weighs 5,000 kg. Two steel collector rings, one on each side, are provided for 1,000 amp. exciting current at 220 volts. The weight of the complete rotor is 104,000 kg., or 52,000 kg. per bearing. The circumferential shaft speed within the bearings is 31.4 m. per second. In the testing department it took twenty-five minutes to accelerate the rotor to 1,000 r.p.m. using a driving motor of 800 kw. Running at full speed, the rotor represents an inertia of 614,000 hp.-sec.

Stator.—The laminations of the stator weigh 63,500 kg. and have an outside diameter of 3.5 m. A cast-iron shell of 45,000 kg. supports the lamination. To facilitate transportation the entire stator is made up of four parts, each quarter being shipped separately. The stator is cooled by forced air, requiring 45 cu.m. of air per second. Four hundred axial canals carry the cooling air through the stator. As the stator iron is 3 m. long, special care had to be taken to make the ventilation effective. The winding consists of 10,000 kg. of copper, bringing the complete weight of the stator to 145,000 kg.

Transportation.—Owing to the size of the generator, special cars had to be built for the rotor and stator. The rotor gondola car had two ten-wheel trucks.

The foregoing information was abstracted from the *Siemens Zeitschrift* of July, 1921.



THERE IS 23 TONS OF COPPER ON THE STATOR AND ROTOR OF THIS 60,000-KVA. GENERATOR

Electric Oven Reduces Cost of Baking Pencil Leads

Successful Application of Industrial Heating in New Direction—Cost Is 35 per Cent Under Cost with Gas Ovens

By Gordon Weaver
Industrial Engineer, Union Electric Light & Power Company, St. Louis, Mo.

BAKING pencil leads is a new, successful application of industrial electric heating which has been made in the factory of the Standard Pencil Company, recently completed at Brentwood in St. Louis County, Mo. Tests at this plant show that the cost of electric baking is 35 per cent less than that for baking with gas ovens, besides the fact that temperature control is easier. The factory has a 114-kw. electric oven installed for this purpose.

A complete charge in the oven consists of 1,350 lb. of leads, and with the present cycle of operation—*i.e.*, about every third night—it requires 2.437 kw.-hr. per 1,000 leads baked or 0.712 kw.-hr. per pound, which with the present cycle of operation means about 5.5 cents per 1,000 leads baked.

The energy cost is about 35 per cent less than the fuel cost of a gas-fired oven. The cost per 1,000 leads baked will decrease materially as the monthly production increases, as is shown in the curve, Fig. 1. The decrease will be due to increased load factor and also to the decrease in kilowatt-hours per 1,000 leads baked, owing to the fact that the more nearly the use of the oven is constant the less energy is required in heating up for the treatment of a charge.

This oven is the first one of its kind in the United States, and probably in the world, for this work. It is 12 ft. in length inside, 54 in. wide and 31¾ in. high in the center and 29½ in. at either side. The walls are 13½ in. thick, made up of 4½ in. of firebrick and 9 in. of insulating brick. There is a space of 12½ in. between the work—*i.e.*, the material to be baked—and both the front and rear wall, 15 in. on either side, and approximately 6 in. at the top and bottom.

The heating elements are General Electric nonoxidizing resistors of large cross-section formed into loops and supported on refractory bricks which are built into the oven walls. These bricks are of a material which has a high electrical resistance at high temperature. The total electric rating is 114 kw.

The temperatures are measured through the use of two thermocouples, one of which is placed near the resistor and the other on the surface of the charge. A recording instrument with a rotating switch which periodically connects first one and then the other thermocouple records the temperature of both. The record in Fig. 2 shows a series of oscillations from one thermocouple to the other, the top of the record showing the temperature of the resistor and the bottom the temperature of the charge.

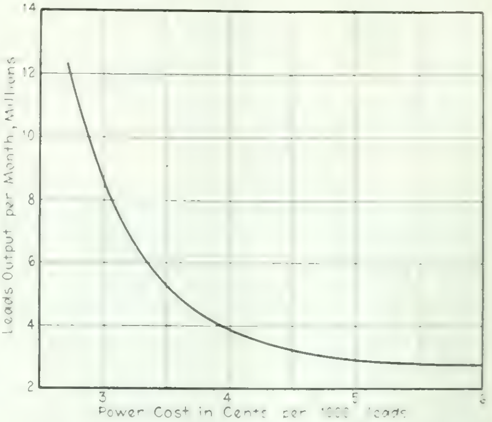


FIG. 1—INCREASING OUTPUT REDUCES COST OF BAKING PENCIL LEADS IN ELECTRIC FURNACE

The leads, after coming from the dry kilns, are placed in firebrick containers with outside dimensions of 24 in. x 18 in. x 8 in. Each container holds 26,000 leads. The oven will accommodate fifteen containers, or 405,000 leads. A single container filled with leads weighs 180 lb., the container and charge each weighing 90 lb. The containers filled with leads are placed in the oven with an especially constructed loading track.

When the oven is filled the door is closed and sealed and the current is turned on and left on until the temperature reaches 1,850 deg. Fahr., which requires eight hours and forty minutes under average conditions and the present cycle of operations. When the desired temperature is reached the current is cut off and the oven kept closed until it has cooled down to about 800 deg. Fahr., which takes about twelve hours; then the door is unsealed and opened and the charge removed. When the current is cut off and the cooling period begins, CO_2 gas is introduced into the oven at a pressure of 30 lb. to prevent the lead from oxidizing while cooling. The leads are then ready to be made into pencils. Electric service is supplied to this plant from the 13,200-volt lines of the Union Electric Light & Power Company through an outdoor substation of 225 kva. capacity, consisting of three 75-kva. General Electric Company transformers.

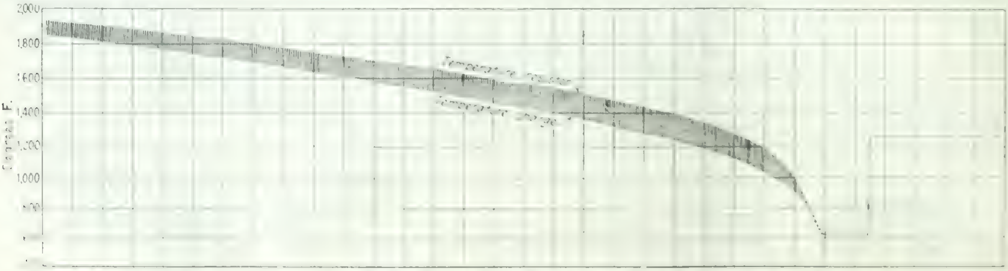


FIG. 2—TYPICAL TEMPERATURE RECORD OF RESISTOR-TYPE FURNACE FOR BAKING PENCIL LEADS

Economy of Substituting Copper for Iron Wire

Investigation of Losses in Iron and Steel Conductors to Determine Conditions Under Which It Is Economical to Adopt Copper—Copper Is Now at Lowest Price in Seven Years

By H. S. RUSH
Assistant Professor of Mechanical Engineering North Dakota Agricultural College

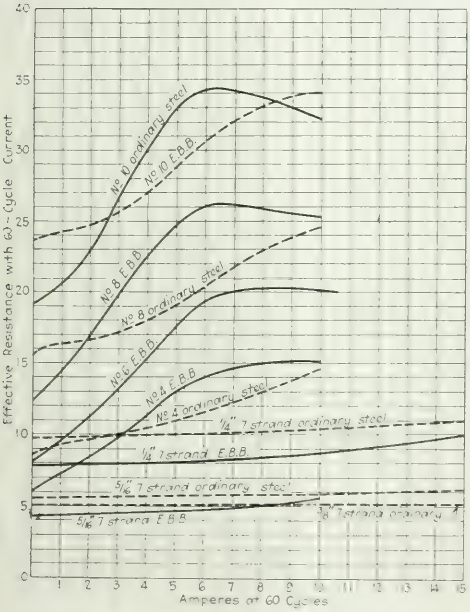


FIG. 1—EFFECTIVE RESISTANCE OF IRON AND STEEL CONDUCTORS WITH VARIOUS CURRENTS AT 60 CYCLES

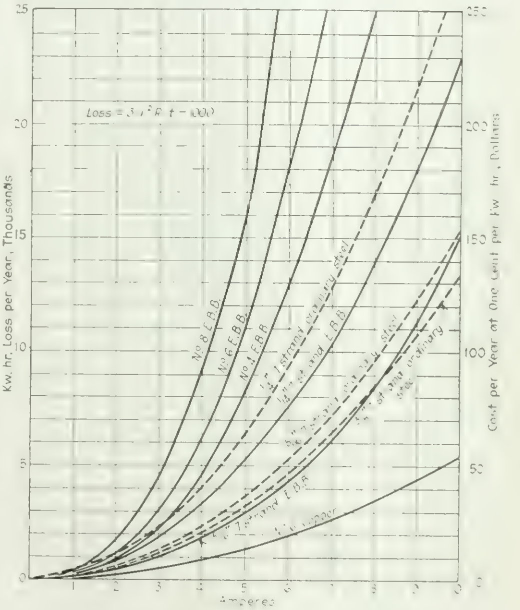


FIG. 2—ENERGY LOSS IN IRON AND STEEL CONDUCTORS AT VARIOUS CURRENTS (THREE WIRES)

OWING to the high cost of copper and aluminum during the war considerable use was made of iron and steel conductors of electricity. The information available concerning the properties of iron and steel when used as electrical conductors has been and still is rather meager. Such information as had been published can be taken only as an approximation for the reason that the various samples of apparently the same material differ considerably in their electrical properties. When used as conductors of alternating current, iron and steel have characteristics quite different from those of copper. Owing to the so-called skin effect, the effective resistance with alternating current may differ quite widely from the resistance when carrying direct current. It will be noted by reference to the typical curves shown in Fig. 1 that the effective resistance increases with increase in current up to a maximum value and then gradually decreases. In addition the frequency has a marked bearing upon the effective resistance. It will be further noted that the

TABLE I—DATA FACILITATING ECONOMIC COMPARISON OF IRON AND COPPER WIRE

	I Size of Steel Wire	II Original Cost per Mile	III Salvage per Mile	IV Investment to Amortize	V Replacement Cost	VI Total to Be Retired	VII* Annual Assessment	VIII† Fixed Charge for Copper	IX Total Annual Charge	X¶ Amperes for 24 Hours	XI¶ Amperes for 4 Hours	XII** Mile 33,000-Volt Line	XIII** Mile 66,000-Volt Line
B. W. G.	8 EBB	$36.00	$18.00	$18.00	$40.00	$58.00	$4.93	$23.40	$28.33	2.0	4.0		
	6 EBB	54.00	27.00	27.00	40.00	67.00	5.70	23.40	29.10	2.4	4.8	23	13
	4 EBB	73.50	36.50	37.00	45.00	82.00	6.97	23.40	30.37	2.8	5.6	26	14
Inches	¼ EBB	64.00	32.00	32.00	50.00	82.00	6.97	23.40	30.37	3.2	7.6	28	16
	5/16 EBB	110.00	55.00	55.00	50.00	105.00	8.93	23.40	32.33	5.0	10.0	41	21
	¼ Steel	63.00	32.00	31.00	50.00	81.00	6.49	23.40	29.89	2.8	6.6	25	14
	5/16 Steel	100.00	50.00	50.00	50.00	100.00	8.50	23.40	31.90	4.2	9.9	35	18
	⅜ Steel	141.00	70.00	71.00	50.00	121.00	10.29	23.40	33.69	4.7		38	20

* Necessary to retire column VI in twenty years with interest figured at 6 per cent.
† Figured at 10 per cent on $234 for new copper.
¶ Current which will produce loss at 2 cents per kilowatt-hour equal to saving in column IX produced by using copper.
** Length of line which at 2 cents per kilowatt-hour will give loss in mile of line next to station just equal to sum in column IX.

increase in resistance with increase in current can be pretty largely overcome by the use of stranded conductors. This fact has been pointed out by H. B. Dwight in a paper before the American Institute of Electrical Engineers, Vol. 35, page 1238.

It would seem that in striving to save in original cost of the line by the use of iron and steel wires sufficient account has not been taken of the energy losses which occur. The engineer accustomed to deal with the losses in copper conductors is apt to fail to realize the magnitude of the losses which are sustained in iron conductors. To begin with the direct-current resistance of iron is six to eight times that of copper of the same size and with alternating current this resistance, when a very few amperes are flowing, is practically doubled. To bring out the extent of the losses in a three-wire line in the course of a year the curves of Fig. 2 have been plotted between line amperes and kilowatt-hour loss per mile of line per year, and between line amperes and the cost of these losses at 1 cent per kilowatt-hour. The points on the curve were determined by the formula kilowatt-hours $= 3 \times I^2 \times R \times t \div 1{,}000$, where I is the line current, R is the resistance as determined from the curves of Fig. 1, t is the number of hours in one year and the factor 3 is introduced to give the losses in three wires. The cost of the losses at any other price per kilowatt-hour may be obtained by direct proportion.

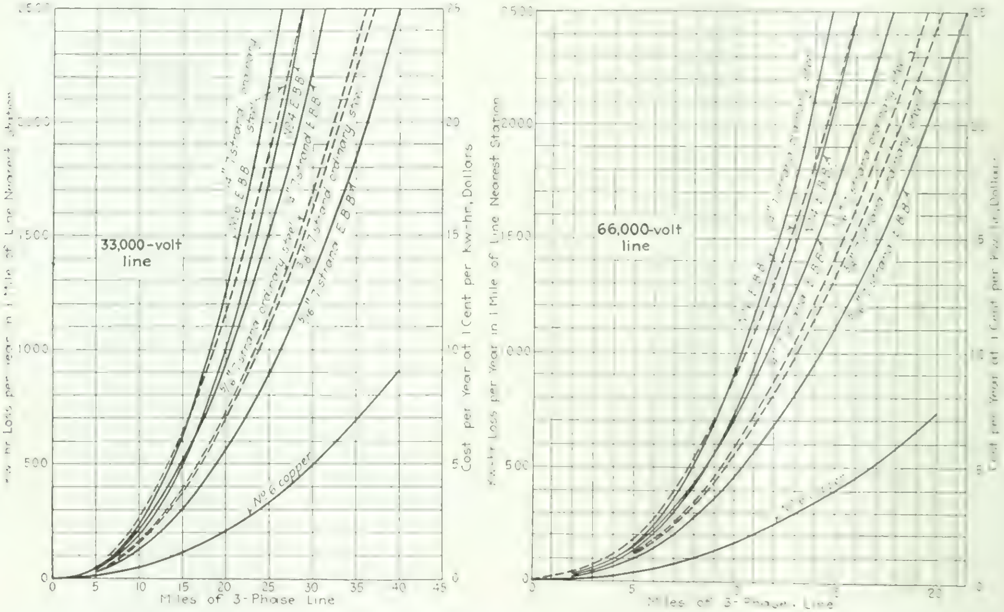
WHEN LOSSES IN IRON WIRE JUSTIFY CHANGES

To determine the conditions under which it will be economical to replace steel conductors with copper, or, in other words, to determine when the difference between the cost of the losses in steel conductors and in copper conductors is greater than the additional fixed charges after the change, some specific cases will be considered. Assume for the purpose of comparison that the same mechanical supports, such as poles, crossarms, etc., are used and that the amortization of the equipment removed and the net cost of the reconstruction is to be spread over a period of twenty years.

Considerations of mechanical strength will determine No. 6 B. & S. gage as the smallest copper wire which it is practical to use for transmission and distribution purposes. A three-phase line 1 mile in length will require 1,300 pounds of copper costing, at 18 cents per pound, \$234. Table I gives estimates covering a number of sizes of steel conductors compared with No. 6 B. & S. gage copper.

Due to its capacity, a transmission line operated at a high voltage carries a charging current twenty-four hours per day regardless of whether it transmits any load current or not. The curves in Figs. 3 and 4 have been plotted to show the losses due to charging current alone at 33,000 and 66,000 volts. Columns XII and XIII of Table I give the number of miles of 33,000 and 66,000 volt transmission line which will, at 2 cents per kilowatt-hour, give a loss in the mile of line nearest the station just equal to the sum given in column IX.

It is to be noted from Figs. 3 and 4 that after the first few miles the losses per mile increase very rapidly, therefore the changing to copper of any mile of line carrying the charging current of a greater number of miles of line than that shown in columns XII and XIII of Table I will under the conditions assumed be economical. The losses due to charging current also increase with voltage, therefore at higher voltages the change will be economical on shorter lengths of line. If the load conditions are such as to produce a line current greater than the charging current alone, the



FIGS. 3 AND 4 — LOSS IN IRON AND STEEL CONDUCTORS DUE TO CHARGING CURRENT FOR 33 AND 66 KV. LINES (ENERGY ASSUMED TO COST 1 CENT PER KILOWATT-HOUR)

change may also be economical with a shorter length of line than that shown. It would appear that there are a considerable number of lines now in operation for which it may be desirable to carry through a similar computation, using suitable local values for the various factors involved.

In making use of the curves for determining the difference in losses between steel and copper conductors, the work is facilitated if auxiliary scales are utilized as illustrated in Fig. 5. For a cost of energy other than 1 cent per kilowatt-hour and length of usage per day other than twenty-four hours the graduations on the auxiliary scales may be made to correspond to the assumed conditions. The annual charge given in column IX of Table I is laid off on the proper auxiliary scale. With the scale held horizontal, the zero is moved along the copper wire curve until the graduation indicating the annual charges coincides with the curve of the steel conductor. The corresponding amperes or miles of line (as the case may be) are then read off at the left of the scale.

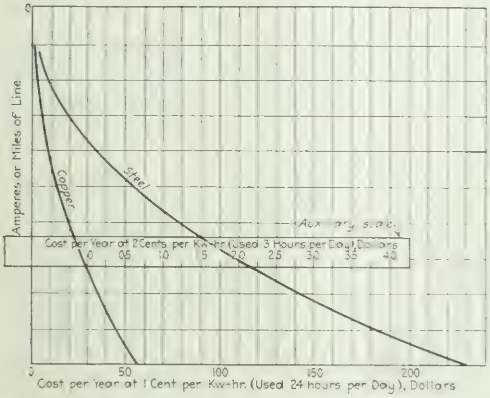


FIG. 5—AUXILIARY SCALE IS USEFUL WHEN COST OF ENERGY IS OTHER THAN 1 CENT PER KILOWATT-HOUR AND LENGTH OF USAGE IS OTHER THAN TWENTY-FOUR HOURS

Power from Mercury Vapor

THE mercury-vapor process of developing mechanical power which has been proposed and experimented with by W. L. R. Emmet, consulting engineer for the General Electric Company, for a number of years, has been advanced considerably of late, but a condition suitable to commercial applications has not yet been reached.

An application of this process on a large scale has been made in Schenectady and operated experimentally on many occasions, although it has not yet been brought to a condition where it is suitable for continuous operation.

This equipment was originally designed to give 1,500 kw. from the mercury turbine, but it has not been run above 1,050 kw. owing to certain limitations which have developed in the mercury boiler. Of the 1,050 kw. so delivered in these tests, about 850 kw. constitutes net gain as compared with a 200-lb. steam process operating with similar firing conditions. With such a performance of the mercury turbine and with the steam produced used as in the best power stations, this result is equivalent to about 11,300 B.t.u. from fuel per kilowatt-hour. Still, 18,000 B.t.u. per kilowatt-hour is considered extremely good in large existing steam stations. By using a pressure of 35 lb. gage in the mercury vapor, which seems to be possible, the efficiency could be considerably increased.

The possible rate of gain which may be accomplished by the proposed mercury-vapor process, as compared with steam plants, is naturally dependent upon the conditions and efficiency of the plant with which comparison is made. Compared with a steam-turbine generating plant using 200 lb., steam pressure, the mercury steam combination with 35 lb. gage pressure in mercury vapor should give about 52 per cent more output in electricity per pound of fuel. If in such a plant the boiler room is re-equipped with furnaces and mercury apparatus arranged to burn 18 per cent more fuel, the station capacity with the same steam turbines, condensers, auxiliaries, water circulation, etc., would be increased about 80 per cent. As compared with higher steam pressures the percentage of gain would naturally be less.

Illinois Commission Rules for Rural Service Consumers

Lines to Customers Must Be Operated and Maintained by Company Supplying Service—Rates Based on Service Plus Energy Charge

RULES that have recently been established by the Illinois Public Utilities Commission governing construction, ownership and maintenance of rural distribution systems and providing for rates to be charged for such service were outlined in part in the Aug. 27 issue of ELECTRICAL WORLD, page 411. In that article important features of the rules and points of difference between these rules and those established in other states were discussed. The specific rules for consumers who have been grouped into rural utilities or mutual companies were given in full. The rules governing service and rates to individual consumers are now given, thus completing the Illinois rules for service to rural consumers.

CLASS III.—THOSE CONSUMERS RECEIVING SERVICE AS INDIVIDUALS

1. *Ownership and Maintenance of Lines.*—In the case of consumers receiving service as individuals the arrangements as to the construction and ownership of the necessary lines, transformers, lightning arresters and other equipment must be such that the title to the said lines and equipment, when completed, will rest in the electric public utility and that the electric public utility shall be responsible for their maintenance, operation and replacement.

2. *Additional Consumers on Existing Lines.*—It must be agreed between the utility furnishing the service and the consumers along any proposed distribution line that additional consumers along the route of the said line or extensions thereof shall receive service if applying for the same upon a non-discriminatory basis. If unable to agree the parties may appeal to the commission, which will render a decision upon the merits of the case.

3. *Expense of Construction of Lines.*—The proposed distribution circuits for the serving of the consumers covered by this class may be constructed at the expense of either the electric utility or the prospective consumers, as the rules filed by the electric utility in compliance with this order shall provide.

4. *Lines Constructed at the Expense of the Utility.*—If the distribution lines required are to be constructed at the

expense of the utility furnishing the service, such utility shall first secure, in the manner provided by law, a certificate of convenience and necessity covering the construction and operation of the necessary lines, and the said construction must comply with the standards set forth in General Order No. 30, which provides standards for overhead electric construction.

5. *Lines Constructed at the Expense of the Consumer.*—In case the construction is to be at the expense of the consumers, the actual construction work may be done either by the prospective consumers themselves or by the utility at the expense of the consumers, as the consumers may elect. In any case the actual construction work must be done in accordance with the rules laid down in the commission's General Order No. 30, which provide standards for overhead electrical construction.

6. *Combining of Service.*—In case the individual consumer has on his own or adjoining premises owned by him, a number of buildings such as employees' houses, barns, etc., to which electric service is desired and the consumer desires to receive this service over one meter, pay one service charge, and assume the responsibility for payment of the entire bill, the utility shall so furnish the service, provided the consumer is willing, at his own expense, to provide all construction necessary to connect the various buildings and to bring the common service to the building most conveniently located to the company's lines where the common meter may be placed.

7. *Construction Work Done by Consumer.*—In case the construction is to be done by the prospective consumers, the utility which is to furnish the service, before assuming ownership of the lines constructed as set forth in Rule 1, shall secure, in the manner provided by law, a certificate of convenience and necessity authorizing the utility to take over and operate the said lines.

8. *Certificate of Convenience and Necessity.*—Before the certificate of convenience and necessity referred to in the foregoing rules is issued, the commission will require the filing of a plat showing the exact route of the lines and will require evidence that possible inductive interference with the lines of other wire using utilities has been considered and properly provided against, as set forth in Section II, Rules 204, 205 and 206 of General Order No. 30, as amended and adopted March 16, 1920. It is recommended that prospective consumers who expect to do their own construction work shall make all the arrangements necessary and secure a written contract for the service (if required) from the public utility which is to furnish the service before any construction work is done. Upon the signing of the contract for service between prospective consumers and a utility, the utility must immediately apply to the commission for the certificate of convenience and necessity provided for in these rules.

9. *Rates and Rules for Service to Be Filed.*—Before any electric public utility shall construct or extend distribution circuits into rural territory or connect its circuits to any distribution circuit for the purpose of serving individual consumers, such utility shall first file with the commission as part of its rate schedule for each community from which such service is furnished (or one schedule covering rural service to its entire territory in case the same rates and rules are to apply to the entire property), and in accordance with the provisions of General Order No. 28, a statement of the terms and conditions under which such service will be rendered and the rates which shall apply to the service after these terms and conditions have been fulfilled. This statement shall contain the following items:

(a) A description of the general type or types of lines to be constructed.

(b) A statement of the proportion of the cost of construction of said lines and other equipment which the utility will bear.

(c) An explanation of the basis upon which additional consumers may be served from existing lines or extensions thereof.

10. *Rates to Individual Rural Consumers.*—For the purpose of rendering bills for electric service furnished to individual consumers served under the provisions of the third section of this order, the utility shall file with the commission a statement of the fundamental charges as hereinafter contemplated upon which the type of rates shall be based. All rates for service to individual rural consumers shall consist of a service charge in addition to the regular urban rates provided for hereinafter.

11. *Service Charge.*—The amount of the service charge shall represent the excess cost to the utility of furnishing the rural consumer with the class of service which he demands over the cost to the utility of furnishing the same service to a like consumer in urban territory, including such items as are ordinarily represented by the minimum bill.

12. *Uniformity of Service Charge.*—The service charge to each consumer on the same line shall be identical except such portion of the service charge as may vary between individual consumers on account of the difference in size and cost of their transformer and meter installation. The service charge to consumers on different lines may vary as the expense to the utility of furnishing service over the different lines shall vary.

13. *Rate for Energy Used.*—The rate for the energy used by individual consumers shall be the same rate, including demand charges, if any, as charged to consumers demanding the same class of service in the municipality from which the service is furnished. The items ordinarily covered by the minimum bill in urban service are included in the service charge provided for in Rule II.

14. *Municipality from Which Service Is Furnished.*—In the case of lines extended from a municipality where service is furnished, into rural districts solely for the purpose of furnishing energy to rural consumers along the routes of said lines, the service shall be deemed to be furnished from the municipality from which said lines are extended. In case distribution lines are constructed from a transmission line extending between municipalities, for the sole purpose of furnishing electric service to rural consumers located along the route of such distribution line, the service shall be deemed to be furnished from the municipality located nearest to the junction of the main transmission line and the rural extension, as measured along the main transmission line. In case individual rural consumers are connected directly to a transmission line between municipalities, the service shall be deemed to be furnished from the municipality nearest the point at which the connection is made to the main transmission line for the consumer's service, as measured along the main transmission line.

15. *Meter Readings.*—The commission recommends that the rules provide for the reading of meters at not less than three-month intervals, but that provision be made for billing the service charge in monthly installments. This recommendation, however, shall not prevent utilities from securing readings of the meters of rural consumers at less intervals than three months if they so desire, or if special conditions surrounding the service make the same necessary.

16. *Type of Equipment on Rural Lines.*—It is strongly recommended that all utilities furnishing service to rural consumers should adopt as standard equipment for furnishing this service the most modern devices of this nature which can be secured. Devices should be used which have as the controlling factor of their design the possibility of the consumer taking care of ordinary interruptions of service, *i.e.*, such devices as are constructed to enable the consumer to safely remove and replace burned out fuses and other small operations of this nature. It is also recommended that the utilities should devote some time in instructing their rural consumers in the operations of removing and replacing fuses and locating all ordinary sources of trouble and interruption to the end that the service furnished these consumers may be of the most continuous and satisfactory character, and rendered with the least possible expense to the consumer for maintenance charges.

Saving Clause.—The adoption of these rules shall in no way prevent the commission from considering any case of a demand for service which may be brought to its attention upon its own merits, nor shall it in any way preclude the commission from altering, modifying or amending these rules from time to time as may be necessary or advisable.

Readers' Views and Comments

This is a readers' forum. Comments on questions before the electrical industry presenting economic, financial, engineering or commercial aspects and new or supplementary viewpoints on published articles are cordially invited

The Engineer Should Also Be an Economist

To the Editors of the ELECTRICAL WORLD:

Unquestionably much of the dissatisfaction prevalent among the various agricultural, commercial and industrial groups at the present time is due primarily to inadequate understanding of the fundamental principles of economics. The fact that economic laws constitute an acting force does not appear to be generally appreciated. This is especially noticeable among some of our political factions.

Every thinking man knows that Newton's lâw of gravitation acts with unfailing precision and that behind this law a force exists which tends to keep the universe in equilibrium. Furthermore, he either consciously or unconsciously acknowledges this fact, and, with comparatively few exceptions, he does not attempt to circumvent this fundamental law. On the other hand, this same individual is very apt to ignore what should be an apparent fact to him, *i.e.*, that in the realm of business economic laws are at work in much the same manner and tend to stabilize our social fabric. Before real prosperity can again commence it must be realized by all groups that these economic laws cannot be successfully interfered with.

It is said that before the great war, when referring to the then five great powers, the international politicians would sometimes jokingly make reference to what they chose to call the sixth great power, namely, the press. This is the great avenue of enlightenment, and every engineer should endeavor to make his influence felt in this direction for his own and the public welfare. We have emerged from an age of politics into a world of economics, and it is imperative that this fact be generally realized. Adam Smith performed just as great a service for business as Newton did for science, and, with modifications to suit present-day conditions, the precepts of the former should be made available, in popular form, to the average man.

It is an acknowledged fact that man's worst enemy since the dawn of civilization has been his ignorance of the things which he should know. It was the ignorance of the average man that made possible all the wrongs of history. Likewise it is knowledge that has advanced and will continue to advance the world.

An engineer exists principally to get things done in the most efficient way, but unless he thoroughly understands economics he cannot discharge his duties properly. The engineering profession stands in a unique position in regard to the dissemination of knowledge relative to economics, and the individuals of which it is composed can do much to bring about a better understanding of this most important subject. For this reason every engineer should consider it his duty and privilege to help enlighten his fellow-man along these lines.

No engineer believes in perpetual motion. The fact that something cannot be obtained from nothing is realized beyond doubt. Nevertheless, some of our fellow-men persist in apparently believing that a profit can be justly obtained without equal values being exchanged. Each individual in society should realize that, considered fundamentally, so-called profit is made in the creation of values and is realized in the exchange of values. As capital, management and labor are involved in the creation of values, the foregoing applies with equal force to each group within this category.

In our economic structure there are many groups contributing toward production of values, and services rendered are equivalent to values created. In this connection it should be borne in mind that transportation and advertising are most essential services and really comprise the keys to the continuation and extension of commerce and industry. Special attention should be paid to them by all groups just now and their importance acknowledged. There is nothing to gain and much to lose by emulating the ostrich. JOHN J. BROPHY,

Salem, Mass. Industrial-Electrical Engineer.

Utilities Can Profitably Familiarize Themselves with Radio Service Problems

To the Editors of the ELECTRICAL WORLD:

I have read with considerable interest the letter of C. H. Mueller on the subject of radio service problems in your Aug. 20 issue. There are one or two thoughts I should like to add to Mr. Mueller's comments.

I have had the unique experience of having been in turn a light-blinking amateur, a public service employee and a radio manufacturer. This experience has enabled me to understand the amateur radio problem a little more clearly than is usually possible. Somewhat more than a decade ago, when I was an offending light-blinking amateur, it was very difficult to get either co-operation or satisfaction from the electric light company serving me. I did not "blink" the lights and make sparks jump from the chandeliers in the entire neighborhood intentionally but because I knew of no way to prevent it. The light company took a hostile and even mysterious attitude. The result was that my first experience with utilities was one conducive to hostility. It was not until after I had had more than five years' service with utilities that I began to appreciate that at heart these organizations are really human organizations.

I believe that, in spite of the fact that in general he is a nuisance, the radio amateur should be handled with considerable care. Most radio amateurs are men with strong electrical tendencies. They are the type who advocate electrical cooking apparatus, motor-driven machinery and, in general, develop into consumers of a large amount of energy. The light-blinking, spark-jumping period is usually only a transient one, and if the light and power company and the amateur live through the period satisfactorily, the result is usually that the light and power company has obtained the good will of a large customer and one who champions electric service.

There is very little need of serious trouble due to sparks jumping. A set properly protected will care for this. The light-blinking problem today is not nearly so serious as it was a few years ago. Devices have been placed on the market which will absorb energy when the transmitting key is up. This means that during the transmitting period a nearly uniform load is thrown on the line.

It is my recommendation that every light and power company should have some one person in its organization who is familiar with radio work. Usually there is a lineman or office employee who is a radio enthusiast and at the same time can be trained to bring about cordial relations between the company and the radio amateur. I am firmly convinced that more than three-fourths of the radio problems can be solved by co-operation and a little instruction on the part of the light and power companies. The amateur question is, undoubtedly, a difficult one to handle, but the potential gain from handling it properly is sufficiently great to make its study worth while.

H. B. RICHMOND,
General Radio Company, Commercial Manager.
Cambridge, Mass.

Buying Used Equipment

To the Editors of the ELECTRICAL WORLD:

As a result of the war the purchase, installation and operation of so-called second-hand, or used, industrial and power equipment took place on an extensive scale. This development was characteristic of all sorts of mechanical and electrical industrial, manufacturing and power equipment—machine tools, boilers, turbines, electric motors and generators, pumps, general mill manufacturing equipment, and so forth. Other lines were, of course, affected, but I wish to call attention chiefly to the power equipment field in its relation to the purchase, application and operation of such equipment.

There are generally two principal objections to buying used equipment, the one positive, the other negative, the one real, the other imaginary.

The real and positive objection to the purchase and operation of used equipment is that it may have been installed and operated in locations which because of either atmospheric or water conditions have actually injured the apparatus. The buyer has no way of knowing that the coating of shiny paint that has been applied does not cover actual defects which will soon show up with usage and destroy the value of the equipment. Even equipment that has been in a dry place may be affected by subsequent installation by the used-equipment purchaser in a damp location. Bearings may be worn or the shaft of the rotary equipment may be sufficiently out of line to prevent precision in operation and later to cause serious trouble. The equipment may be obsolete and the procuring of repair parts may be difficult unless the manufacturer of the equipment is one of the old-established companies. If the equipment has been in a fire or if it has been badly damaged in an accident or by water it must be completely overhauled or even rebuilt, and missing, broken, or damaged parts must be replaced. In fact, there may be any number of possible defects in either design or construction that will render the equipment unsuitable or even useless to the buyer.

The integrity of the seller is the buyer's only protection because a detailed and discerning inspection is usually out of the question except in the case of the large industrial manufacturing concerns that maintain engineering departments composed of specialists.

The imaginary, or negative, objections are largely psychological. The prospective buyer may object to second-hand, or used, equipment, just as any buyer naturally prefers new to used equipment. He has more of a proprietary interest and claim in new machinery. Its history is an open book to him. He knows that it has come to him direct from the manufacturer and that he is its first "master." In case defects develop the buyer can resort to the manufacturer for redress and usually obtain satisfaction. If such defects appear in used equipment redress may sometimes not be so easily obtained.

The principal points favoring the purchase of used equipment are generally price and shipment. The price of used equipment is usually enough below the current market price for new equipment to overcome the psychological objections to the purchase. Shipment can usually be made without delay. After a disastrous fire, a crippling breakdown or other accident equipment is usually required as promptly as possible in order that the plant may resume operations at the earliest moment.

Used equipment generally comes on the market for one of the following two principal reasons involving non-usage: (1) Plant changes or enlargements, due to a change in production requirements or methods; (2) destructive or damaging fire or accident.

When buying used apparatus, especially if it is costly or to operate as an important cog in the manufacturing scheme, the prospective buyer should have it thoroughly inspected. If possible he should know where and how it has been used, whether in damp locations, as on a pump inside a mine, or in dusty places, as in a foundry, brick plant or cement mill. Was it used intermittently or continuously, and was it subjected to heavy and frequent shocks? Having a general history of the equipment the buyer will know where to look for weak spots, if any exist, and how to remedy them and to keep the equipment in first-class operating condition.

The war gave the used-equipment business a tremendous impetus, as has already been said, and, as is always the case under such circumstances, many scheming and unreliable and some actually dishonest men engaged in it, because it was for the moment profitable for all comers and promised quick and easy returns. Anthing, almost, could be sold at a profit. The buyer was neither very cautious nor very particular, and so long as he could quickly obtain equipment that seemed to fulfill his needs he was not disposed to quibble over the price. The buyer's necessity, and too often his indifference, was the dealer's opportunity, and he made the best of it while the opportunity lasted. Now all this is a thing of the past. Many of the paper, fly-by-night companies that sprang up in the emergency have disappeared. Older and reputable concerns still remain.

The present conditions in the used-equipment business, as a result of the war, have in a measure been a handicap for these older and reputable concerns in that to a certain extent confidence in the trade was and is impaired. These concerns are necessarily more reliable, trustworthy and honest—first, because they were not and are not transient and opportunist, but have "come to stay," and also because their traditions of right and fair dealing, which are always the first consideration to their clientele, have been built up from a long and successful past. Such concerns maintain competent sales and engineering forces and large, well-equipped storehouses and repair shops and are as careful in the repair, reconstruction and inspection of equipment before shipment as are the manufacturers of new apparatus. Their word is as good as their bond.

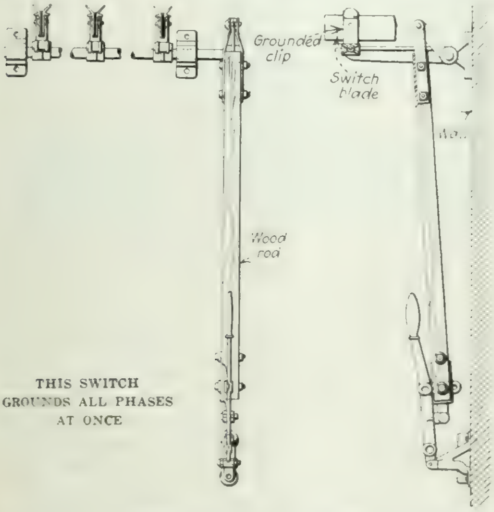
Pittsburgh, Pa. THOMAS ROBSON HAY.

Industrial and Station Practice

Installation, Operation and Maintenance of
Generating and Distribution Equipment and Economical Utilization of Electrical Energy
in Mills and Factories, Including Testing and Repair Methods

Three-Phase Grounding Switch Closed by One Movement

GROUNDING switches which are operated from the floor and which ground all three phases of a line at one time were installed on the 11,000-volt incoming lines in a recently constructed San Francisco substation. The lines enter to the blades of double-throw, three-phase disconnecting switches, the front clips of which lead to the oil switches. The back clips are left blank. In grounding a line the operator throws the three blades to the back position one at a time and then closes the ground switch, by one movement throwing the grounded clips against all three blades of the switch. By this means danger to the operator is eliminated. The switch is provided with a link so that it may be locked either open or closed.



THIS SWITCH GROUNDS ALL PHASES AT ONCE

FIELD EDITOR ELECTRICAL WORLD.

San Francisco, Cal.

Rules to Prevent Accident When Grounding Equipment

TO PROTECT men who are grounding circuits and equipment, a set of instructions on the right procedure for grounding is issued to the employees of the Pennsylvania Water & Power Company, Baltimore, Md. As these rules may be applied to advantage in other companies, they are published in the following paragraphs:

1. The following shall be the procedure for grounding a low-tension circuit or apparatus: (a) Be sure that the circuit is clear. (b) Test for potential with a test stick. (c) If the test indicates that the circuit is clear, apply the ground.

2. The grounding jumpers must first be connected to ground. Then apply the ground clamp to each of the three conductors of the circuit.

3. Never allow any part of the body to touch a conductor on which the ground has not yet been made. The fact that one conductor has been successfully grounded does not necessarily indicate that the other conductors are clear, and furthermore, the static effect of an ungrounded transmission line conductor caused by neighborhood live circuits is in some cases sufficient to cause death.

4. In grounding high-tension conductors, if within a station, the procedure shall be the same as explained for low-tension except that a switch stick will be used as a test stick. Where possible it is advisable to use a switch stick for applying the ground clamps.

Due to lighter type of construction of the high-tension buses, care must be taken to prevent damaging the thin copper tubing when attaching and removing ground clamps. On each of the sections of the bus special insulators have been installed at designated places to take up the strain when grounding and grounds should be applied at these points.

5. Operator's grounds must be applied by the operator personally or by such assistant operators as the chief operator may designate as competent for this work.

6. No ground shall be applied until all disconnector switching has been completed, until hold-off signs are in place, until grounding jumpers have been laid out in proper location and until the operator has inspected the work to make sure that the circuit is clear and ready for grounding. If the operator has done the disconnector switching, etc., he must be checked by the assistant operator before the grounds are applied.

7. The location of each ground placed or ordered on by the operator must be recorded on the mimic board by a ground tag.

8. As far as practicable no man shall work at a point where he is out of sight of the grounds which protect him. This means that when a man is working on a transformer or outside of the station or transmission lines, arc extinguishers, lightning arresters, reactors, etc., special grounds must be put on this equipment by the workman independent of the regular station grounds. As far as possible the placing of workmen's grounds must be supervised by the operator.

9. If it is necessary to cut a conductor, grounds must be placed on both sides of the work.

10. No man shall work on a transmission line more than 1 mile away from his ground connection.

11. In making high-tension ground connections outside on a transmission line, it is not possible to test with a switch stick. Instead a piece of 5-amp. fuse wire or a fine copper wire shall be attached to the

grounded steel work of the tower and the other end of this fuse wire shall be attached to a tool, such as a pair of pliers, and thrown across the conductor in such a way that should the conductor be alive, the fuse will blow and indicate the same. The man doing this must, of course, place himself in such a position that the possible arc and short circuit will not burn him. If this test shows the circuit not to be alive, grounding may proceed. Apply the ground immediately after testing and remove the test wire immediately after grounding. Each phase must be individually tested.

12. A workman's ground on a transmission line or in a station shall not be removed by any person except the one who made the ground or by his orders.

13. All three phases must be grounded, even though the work may be only on one phase.

14. An oil switch is not to be considered grounded until all six pots have been grounded.

15. In removing a ground the jumper should be disconnected first from the line conductors and last from the ground connection. No part of the body should be permitted to come in contact with the conductor after the ground has been removed.

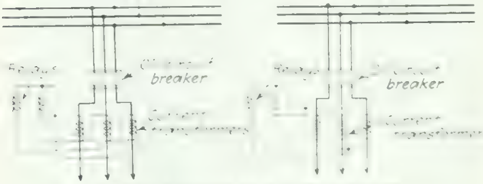
16. Grounding connections for high-tension circuits shall be, at Holtwood, at least No. 4 copper wire equivalent, and at Highlandtown, at least No. 1 copper equivalent.* For low-tension circuits it shall be at least No. 4/0 copper equivalent. Grounding jumpers shall be provided with clamps or terminals of corresponding carrying capacity.

17. All grounding jumpers are assigned to one of the operators for his daily inspection and he is responsible for their condition.

ALEX. BAUHAN,
Superintendent of Stations.
Pennsylvania Water & Power Company,
Baltimore, Md.

Advantage of Three Current Transformers for Relay Operation

REFERRING to the contribution by R. H. N. Lockyer in the July 2 issue of the ELECTRICAL WORLD, entitled "Advantage of Three Current Transformers for Relay Operation," it is quite interesting to note that this connection was proposed and discarded many years ago as it does not give adequate protection in the very case outlined. Consider the case where a double ground has occurred as described and then trace out the path of the secondary current. It must pass through one relay, but in order to complete the circuit it must pass through the secondary of one of the other current transformers. These two transformers are not overloaded, and consequently their secondaries offer such a high impedance to the current of the overloaded transformer that its secondary current is not sufficient to operate the relay. The same applies to any case where there is an overload in any one wire.



CORRECT METHODS OF APPLYING RELAYS

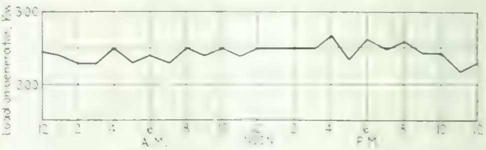
Although the general practice is to use three current transformers and three relays in systems of large magnitude, yet there are two connections of three transformers and two relays which give adequate protection from overloads under all possible conditions. They are the delta connection and the Z connection shown in the drawing. When used exclusively for protection (with no metering), it can be shown that the Z connection has several distinct advantages over the delta connection, and it is therefore widely used.

Both these connections are somewhat difficult to check in the finished installation. They are seldom used with power-directional relays owing to the difficulty of obtaining the proper phase relations with the potentials.

V. H. TODD.
Orange, N. J.

Test Results of Thirty-Day Run by Diesel Engines

A FUEL-OIL consumption of less than 0.09 gal. per kilowatt-hour was recorded at a recent thirty-day non-stop run of a 520-hp. Diesel engine at the Tucson Gas, Electric Light & Power Company, Tucson, Ariz.



DAILY LOAD CURVE OF DIESEL ENGINE IN THIRTY-DAY TEST

In the generating station of this company there are two 520-hp. Diesel engines directly connected to generators.

As Tucson has an altitude of 2,400 ft., the normal rating of the generator at this station is 498 hp., or 335 kw. In this run the average hourly load was 256 kw., the maximum was 330 kw. and the minimum 120 kw.

A typical twenty-four-hour load curve is shown in the accompanying illustration. The fuel was calol of 24 deg. Baumé. This oil cost at Tucson 6.8 cents per gal. From the tabulation it is seen that the fuel used per 100 kw.-hr. was 8.96 gal. This makes a total fuel cost of 0.609 cent per kilowatt-hour.

SUMMARY OF THIRTY-DAY NON-STOP RUN OF DIESEL ENGINE

Normal rating of engine at Tucson (2,400 ft. altitude), kw	335
Maximum load on engine, kw	330
Minimum load on engine, kw	120
Average hourly load, kw	[illegible]
Fuel oil used per 100 kw.-hr., gal	8.96
Kind of fuel	Calol 24 deg. Bé.
Lubricating oil for bearings and cylinders, gal. per day	[illegible]
Lubricating oil for air compressor, gal. per day	0.1
*Average gal. make-up engine cooling water per day	[illegible]
Average gal. make-up tower cooling water per day	[illegible]
Average temperature cylinder jacket cooling water, deg. F	In 83, out 120
Average temperature piston cooling water, deg. F	In 83, out 120
Average temperature exhaust-valve cooling water, deg. F	In 83, out 120
Average temperature exhaust header cooling water, deg. F	Out 140

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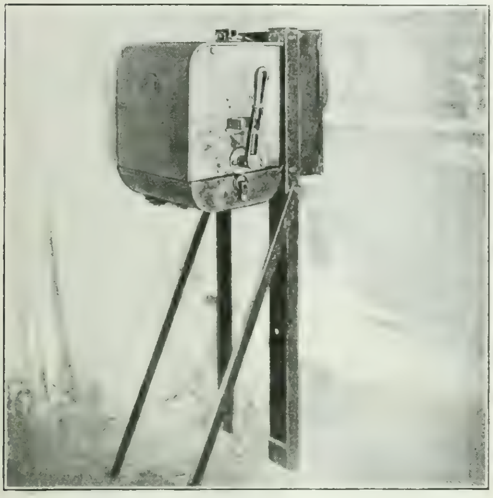
*Holtwood station is rated at [illegible] kva. and connected to a [illegible] kv. system. Highlandtown station is rated at 70,000 kva.

*Closed system for cooling water. [illegible]

Rugged Floor Mounting for Starter

A COMPACT but rugged floor mounting for motor starters shown in the accompanying photograph is used in the plant where the writer is employed. The supports consist of two pieces of 2-in. by 3-in. angle iron 5 ft. 3 in. long with ½-in. by 2-in. flat-iron braces run to floor.

The starter is mounted with the center of the operating handle about 4 ft. 6 in. from the floor at a convenient height for the operator. A safety switch is mounted on the rear of the angle iron for disconnecting the starter from the line when making repairs or inspections. The angle iron and braces are fastened to the floor by means of lag screws or bolts, through small pieces of angle iron bolted to the bottom of the angles and braces.



SAFETY SWITCH ON BACK OF AUTO STARTER ALLOWS DISCONNECTION FOR INSPECTION AND REPAIRS

F. W. McGRAW.
Swissvale, Pa.

Molten Cast Iron Held Without Change in Electric Furnace

A RECENT test conducted in a resistance-type electric furnace showed conclusively that it is possible to hold cast iron in a molten state for a long period of time without materially changing its analysis. The test further proved that it is economical to charge cast-iron turnings and borings and melt the same with a comparatively low power consumption. This test was run in a standard 105-kw. Baily electric furnace at the laboratory of the Electric Furnace Company, Salem, Ohio. The furnace was brought to temperature before charging, and approximately 1,500 lb. of pig iron was charged and melted in three hours, with a power consumption of 318 kw.-hr., or at the rate of 420 kw.-hr. per ton.

The metal was then held in a molten state in the furnace for more than twenty hours to determine what change in analysis would result. The analysis taken at the completion of the melting period was virtually identical with the analysis obtained at the end of the holding period. This test clearly showed that it is possible to melt and hold iron for a long period in a resistance type electric furnace without effecting material change.

At the expiration of this time 317 lb. of cast-iron borings was charged in the molten bath, and one hour later 325 lb. additional was charged. These borings were melted with a power consumption equivalent to 511 kw.-hr. per ton. By this second part of the test it was proved that a large quantity of borings and turnings may be melted economically in this equipment. The electric furnace as a straight melting unit of pig iron of heavy scrap cannot compete in cost with the cupola, except in small tonnages. However, the tests described indicate that great economies can be obtained by duplexing a resistance furnace of large hearth capacity with a cupola, melting the heavy scrap and pig iron in the cupola, discharging this molten metal into the electric holding furnace, where it may be refined if necessary, and melting borings and turnings in the electric holding furnace. The advantages of such a combination would be the ability to maintain a uniform pouring temperature so essential in small work, the continuous pouring that is made possible, and the fact that borings and turnings may be converted economically into good foundry iron.

F. T. COPE.
Electric Furnace Company, Chief Engineer.
Alliance, Ohio.

TESTS OF ELECTRIC FURNACE MELTING PIG IRON AND CAST-IRON BORINGS—CHEMICAL ANALYSIS

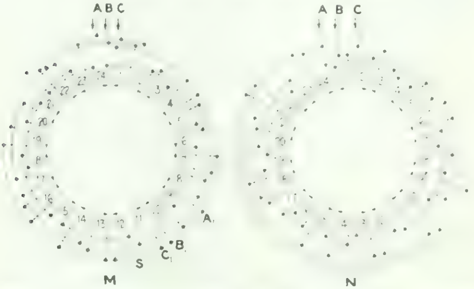
Kind of Material	Time	Sample Taken	Silicon	Sulphur	Comb. Carbon	Graphite	Phosphorus	Manganese	Kw.-Hr. Used
Charged 1,500 lb. pig iron	1.20 p.m.	Before melting	2.19	0.021	0.76	3.18	0.607	0.65	
	4.20	Melted	2.20	0.026	0.55	3.03	0.59	0.65	318
	7.30	Pouring temperature	2.18	0.026	0.55	3.07	0.60	0.65	335
	9.30 a.m.	After holding at pouring temperature for four hours	2.23	0.032	0.55	2.98	0.61	0.63	926
Charged 317 lb. cast-iron borings	9.45								22
	10.35	Borings melted	2.15	0.041	0.55	2.74	0.58	0.60	64
Charged 325 lb. cast-iron borings	10.45								28
	11.15		2.11	0.047	0.55	2.60	0.59	0.60	50
Kilowatt-hours used	To melt 1,500 lb. pig iron, 318; per ton to melt pig iron, 424; per ton to melt borings, 511								

Reconnecting Three-Phase, 220-Volt Motor for 440 Volts

IN RECONNECTING a 220-volt motor to operate on 440 volts, care must be taken to make the connection so that no coils are connected up with their polarity reversed. To illustrate, take the case shown at *A* which is the diagram of an eight-pole two-parallel Y-connected motor for 220-volt operation. If the line leads *A*, *B* and *C* are removed and connected to the leads from the coils 9, 10 and 11, as *A*, *B*, and *C* which are connected to the star point, the star connection being cut off at *S*, then the result will be a series-Y connection but half of the coils will have had their polarity reversed.

Two cases recently came to the writer's attention where this was done. Theoretically the resultant magnetic flux will be zero and there will be no torque produced. Actually, however, there is a very small resultant magnetic flux, the torque produced being insufficient to even start the motor free. However, it is noticeable. For instance, if the motor is turned by hand it will take longer to come to rest than with the line switch open. In the case of a slip-ring motor connected in this manner this can easily be seen by short circuiting the slip rings when the current taken by the stator with full voltage on it will be slightly more than with the rotor open circuited.

If now the connection is made at *B* then the result will be a series-Y connection, but in this case the polarity of all the coils have been kept the same and the result will be that the motor will operate satisfactorily on 440 volts. In this case the line leads *A*, *B* and *C* are left where they are and the star point to which the coils 12, 13 and 14 are connected is maintained. The star connection of the coils 9, 10 and 11 is broken and the coils are connected as follows: Coil 11 is connected to coil 23, coil 10 is connected to coil 22 and coil 9 is connected to coil 21.



CORRECT WAY TO RECONNECT 220-VOLT MOTOR FOR 440 VOLTS

There are other ways of obtaining this connection but the method outlined will be found the simplest. The chief point to observe in changing the connections of a motor to operate on a different voltage is not only to obtain the desired winding but to make sure that the polarity of the coils is not reversed.

EUSTACE C. SOARES,
Ophuls, Hill & McCreery, Inc., Electrical Engineer.
New York City.

Machine for Japanning Armature Disks

PAINTING armature disks with core-plate varnish is best accomplished by means of a japanning machine. The machine used in most cases consists of two printer's rolls, placed one above the other, the lower dipping into a trough-like pan containing the varnish. The lower roll transfers varnish to the upper and the disks are fed between the two rolls.

In the factory of a certain manufacturer, however, excellent results are being obtained by the use of bare steel rolls instead of those covered with printer's gum. The machine in use was made from an old tinner's roll, consisting of two steel rollers, 3½-in. in diameter and 18 in. wide, with adjustable spring tension on the upper rail. A slot ⅜ in. wide and 1 in. deep was cut near each end of each roller to keep the varnish from working over into the bearings. A galvanized-iron trough was easily attached to the frame work of the machine, so that the slots permitted the lower roller to dip into the varnish about an inch.

The steel rolls take up and transfer the varnish satisfactorily, and variation of the tension on the rollers controls the thickness of the coating applied.

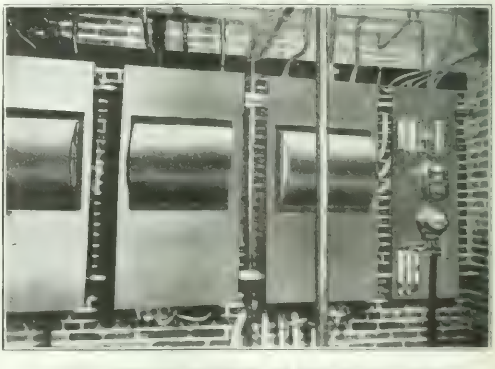
Honesdale, Pa. J. M. WALSH.

Factors in Design of Distribution Panels for Industrial Plants

IN THE modern industrial plants and mills the important criterion of success in electrical design is the continuity of operation of the units of the plant. Where twenty-four-hour operation is encountered safety is an equally important phase of electrical design. The installation should be safe for the workmen who repair the equipment, and the layout should be such that the electrical circuits are safe from damage from the contiguous apparatus employed in the process. For instance, where pipe lines are near, the circuits should be protected from leaky gaskets or broken pipes and where cranes are operating, the circuits should be protected from swinging loads and dangling chains.

In most industrial buildings the distribution panel for a unit building offers a fertile field for improved design and construction. Open switches mounted on a marble panel may yet be found in many plants. This is a decidedly inflexible unit, difficult to maintain without great labor and expense, unless installed in an exceptionally clean place. The switches and busbars, being exposed, are a hazard to the men working on the board and are liable to short circuits from foreign material striking the current-carrying parts.

In order to overcome some of the inherent defects of the open-panel construction, the writer has for some time inclosed all distribution points in a small room, using brick or metal lath-and-plaster walls with a roof of book tile supported on T angles. In order to secure a flexible installation to take care of the shifting of the manufacturing program, a pipe rack is installed with a bus along its top held by vertical bus supports. The power leads tap directly on this bus coming from the power house or the building transformers. The individual circuit switches are mounted on the framework, and leads tap from the bus to the top of the switch. Either 400-amp. or 600-amp. fused switches are used, these being of the safety type inclosed in a steel box and externally operated. This steel box gives protection to the repairmen and excludes dust and foreign material from the switch contacts. This type of switch in our plant has eliminated more than 75 per cent of the distribution circuit outages formerly experienced with the open panels even when they were inclosed in a room separate from the process buildings.



SAFETY SWITCHES MOUNTED ON PIPE MAKE A MORE FLEXIBLE AND SAFER SWITCHBOARD FOR INDUSTRIAL DISTRIBUTION

As the load increases a larger switch may be installed up to the 600-amp. limit. After that point an additional circuit is tapped on to the bus to take care of the additional load. For ordinary induction-motor groups' it has been found desirable to limit the size of circuits to 500,000 circ.mil. Above this size the conduits become very difficult to handle, and it is necessary to resort to multiple fuses, which should be avoided in all cases if reliable operation is to be maintained.

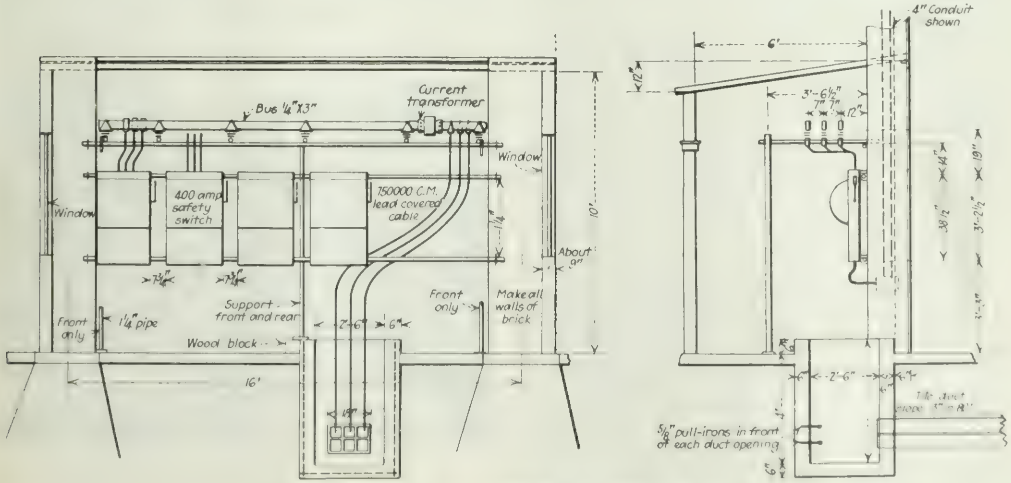
The conduits are run vertically in the rear of the switches and may run either to the roof for distribution or be placed underground.

This method of distribution lends itself readily to any system of metering. Should the building be one unit of the production scheme, bus transformers may be placed between the feeders and the bus feeding the individual switches. In several cases it is desirable to meter each outgoing circuit in a building, and either bus-type transformers are tapped on the leads entering the top of the switches or "multiple-turn" transformers are fastened to the pipe rack under the switch, from which the leads enter a conduit. A board is easily attached to the pipe frame to accommodate the watt-hour meters and their potential fuses. Provision is usually made on this board for the switch and meter of the building lighting circuit. The direct-current service with its meter may similarly be installed on a suitable panel when required.

The illustration shows a representative installation of this nature and indicates what may be accomplished with any distribution center. Each installation is usually different in some respect, but the principle of protecting the equipment from accidental injury and from deterioration may be applied to every requirement of distribution facilities.

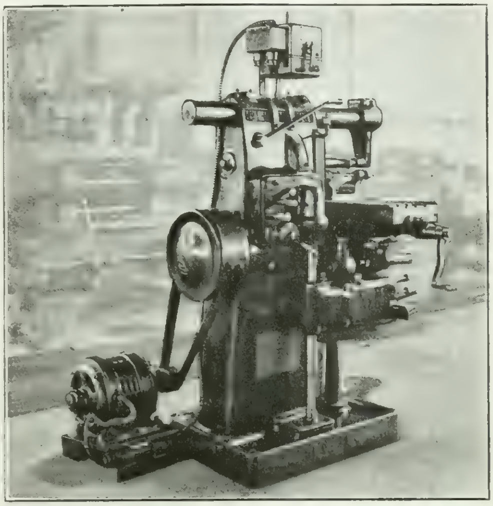
The example herewith given cost about $2,000 to install, which is four times the cost of the open-panel construction for three circuits. However, the added expense is more than justified by continuity of service, safety, flexibility and ease of metering.

J. E. Housley.
East St. Louis, Ill. Electrical Engineer.



DETAILS OF DISTRIBUTION CENTER FOR INDUSTRIAL PLANT

Motor for Individual Drive Mounted on Milling Machine



BELT TENSION MAINTAINED BY WEIGHT OF MOTOR MOUNTED ON SWINGING FRAME

A SOMEWHAT unusual individual drive of a Cincinnati milling machine is shown in the accompanying photograph taken in an industrial plant of Massachusetts. The motor is mounted on a swinging base carried on a bracket bolted to the tool base. The weight of the motor and bracket assist in maintaining belt tension and the drive is short and effective. In some quarters it has been criticized for lack of rigidity and mechanical symmetry, but so far as known has given good service. Also the motor takes little room and allows easy cleaning of the floor underneath.

Boston, Mass. Field Editor Electrical World.

Central Station Service

A Department Devoted to Commercial Policy
and Management Topics, Including Methods of Increasing the Use
of Electric Light, Power and Heat

Development of Southern California Edison's "Greater Service" Policy

THE Southern California Edison Company's "greater service department," which was recently organized and placed under the supervision of S. M. Kennedy, vice-president in charge of public relations, has now been functioning a little more than a year with highly satisfactory results. The department consists of twenty-four experienced men whose duty it is to call upon all of the company's customers and see to it that all complaints, real or imaginary, receive prompt and satisfactory attention. Briefly the work of the department is to (1) inquire if the service is satisfactory in every respect, referring not only to the physical service, but also to the consumer's relations with collectors, meter readers, clerks, etc.; (2) give consumers information regarding rates, company welfare work and development work under way and in prospect; (3) get the mental attitude of the consumers toward the company and its activities, and (4) explain the company's consumer stock-ownership plan.

The information which is gathered has been of much benefit to the company in establishing close relations with its customers. All complaints are investigated and settled to the satisfaction of the consumers. Those making no complaint have been influenced to become supporters of the company's activities. During a period of twelve and one-half months 12,702 consumers were interviewed. Of this number 12,140 upon first interview were found to be in accord with the company's policies, 512 consumers were indifferent, and only fifty consumers were found to be more or less antagonistic. The operation of the department of "greater service" is not in the nature of a campaign or temporary in its character. It is the intention of the Southern California Edison Company to make the department of "greater service" a permanent institution and as much a part of the organization as are the reading of meters and the collection of revenues.

Linotype Pots Offer Attractive Load

ONLY about 10 per cent of the linotype machines of the country use electricity under their melting pots, according to a statement of E. N. Lightfoot, engineering manager of the industrial heating department, Cutler-Hammer Manufacturing Company, New York, at a recent conference of electric heating experts in Boston, under the auspices of the Power Sales Bureau of the New England Division of the N. E. L. A. The average energy consumption of an electrically heated linotype pot when in service is about 700 watts, and the connected load per unit is about 1,500 watts. With an energy consumption of 7 kw.-hr. a day, or 2,100 kw.-hr. a year, a revenue of $63 is returned to the central-station company at a 3-cent rate. This rate will meet the competition of gas at $1 per 1,000 cu.ft., Mr. Lightfoot said. About 6,000 linotype pots are in service in the United States at present, some operating twenty-four hours a day. In practice the average energy consumption may range from 25 to 50 per cent of the connected capacity.

Electric Cooking School at Salt Lake

FEATURING the many uses of electricity in the household, and particularly the cooking and preparation of foods electrically, the annual cooking school conducted by the Salt Lake *Telegram* was held in the ballroom of the Hotel Utah, in Salt Lake City, during the week of August 1. This proved to be one of the most successful affairs of its kind that have yet been conducted in Salt Lake. Demonstrations and lectures in the art of cooking electrically were given daily by Miss Edith L. Clift. One of the features of the cooking school was a baking contest, in which hundreds of layer and loaf cakes, pies, loaves of bread and batches of doughnuts, made at home by hundreds of housewives, were entered and in which more than $1,500 prizes were given away. Prior to Miss Clift's lecture each day an interesting talk was given by E. T. Millham, field secretary of the Rocky Mountain Electrical Co-operative League, on the subjects of the convenience outlet and the electrical home. At the special invitation of Miss Clift, members of the executive committee of the Rocky Mountain Electrical Co-operative League were served with luncheon, electrically cooked, on Friday, Aug. 5.

While the cooking school was distinctly electrical, many merchants and manufactures of various products exhibited and demonstrated their goods. The Rocky Mountain Electrical Co-operative League was also represented by a very attractive booth. The school was exceptionally well attended, as may be judged from the accompanying illustration.

SHOWING EXCEPTIONAL ATTENDANCE AT SALT LAKE COOKING SCHOOL.

Direct and Indirect Lighting of Billboard Display

AN EFFECTIVE lighting installation calling attention to the attractions of a short trip by water from Bridgeport, Conn., is in service at a landing fronting the main lines of travel through that city. Fifty-watt gas-filled lamps mounted in metal reflectors near the top of and on both sides of the board provide excellent general illumination, eight lamps per side being used. An economical installation was insured by mounting each lamp at the end of a run of rigid conduit bent at the end to deliver light at the proper angle and attached at the central point to the top of the sign, where the leads to the lamps are brought in. The wiring is thus admirably protected against the weather.

EFFECTIVE LIGHTING OF BILLBOARD

On the side toward the city lighting is reinforced by about 240 50-watt lamps mounted within the display letters, bringing out the wording much more effectively than if indirect lighting alone were used. Much automobile patronage is attracted by this arrangement. Service is furnished by the United Illuminating Company.

An Electrical Test Prepared for Boy Scout Examiners

MERIT badges are awarded to members of the Boy Scouts of America who successfully pass examinations on the variety of subjects embraced in their courses of study. The set of questions concerning electricity which has been used in the past has not been well drawn up in the opinion of the many electrical men who act as merit-badge examiners in electricity for the scout bodies in their cities. To provide a better balanced and more adequate examination, R. S. Hale, superintendent special research department of the Edison Electric Illuminating Company of Boston, with the assistance of several of the Boston merit-badge examiners, has prepared a set of suggestions based upon the pamphlet of instructions sent out from the national headquarters of the Boy Scouts.

This new examination consists of six requirements under each of which is listed a set of theoretical questions and directions for a practical test. These six requirements are:

Requirement No. 1.—Ability to illustrate the experiment by which the laws of electrical attraction and repulsion are shown.

Requirement No. 2.—Understanding of the difference between a direct and an alternating current and the uses to which each is adapted. The boy should be able to give a method of determining which kind flows in a given circuit.

Requirement No. 3.—Ability to make a simple electromagnet.

Requirement No. 4.—An elementary knowledge of the construction of simple battery cells and of the working of electric bells and telephones.

Requirement No. 5.—Ability to replace fuses and to splice, solder and tape rubber-covered wires properly.

Requirement No. 6.—Demonstration of how to rescue a person in contact with a live electric wire, showing knowledge of the method of resuscitation of a person insensible from shock.

These suggestion sheets have been printed in quantity and will be supplied without charge to merit-badge examiners of any city on application to the National Headquarters, Boy Scouts of America.

From Here and There

Sioux Falls, S. D.—Negotiations are under way at present which will lead to the installation of electric service in sixty communities served by the Northern States Power Company in the vicinity of Sioux Falls. The total demand involved will nearly equal the present electric load served by the Sioux Falls company.

New York.—The first issue of $500,000 of the Adirondack Power & Light Corporation's 8 per cent preferred stock was oversubscribed in twenty-two working days. The 5,000 shares were offered exclusively to the company's present stockholders, customers and employees, and the oversubscription in so short a time was extremely gratifying to the company as a testimonial of the confidence and friendliness of its employees and the people it serves. Stock was sold in the following cities and towns served by the company: St. Johnsville, Amsterdam, Ballston, Schaghticoke, Saratoga, Schenectady, Glens Falls, Watervliet and Oneida.

Cleveland, Ohio. — In Ohio's two largest cities — Cleveland and Cincinnati—new electricity consumers are being added at the rate of more than 1,500 a month. Figures compiled by the Ohio Committee on Public Utility Information showing the number of new consumers added by central-station companies in the state during the last few years, and particularly the last six months, show an increasing demand for electric service. So many new customers are asking for service that many of the utilities are confronted with the problem of obtaining sufficient new capital to finance the necessary extensions of lines and betterments of plants. The number of new electric consumers added in nineteen of the larger cities during the first six months of this year are: Cleveland, 9,693; Cincinnati, 10,045; Toledo, 2,358; Columbus, 2,605; Dayton, 2,413; Youngstown, 2,753; Cambridge, 1,060; Akron, 850; Canton, 599; Middletown, 292; Lorain, 799; Steubenville, 676; Warren, 896; Newark, 929; Alliance, 363; East Liverpool, 279; Massillon, 365; Mansfield, 256; Fremont, 73.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
of the World

Generators, Motors and Transformers

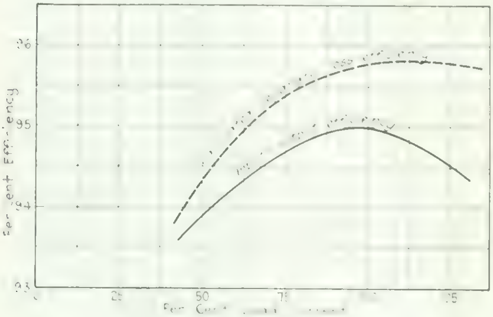
American Radiator Transformers.—A. PALME.—This short article gives an account of the development of the modern radiator-type transformer tank, having its origin in the desire to remove any upper output limit of self-cooled transformers. The most desirable properties of radiators are mentioned, and as examples of large types of self-cooled machines a machine for 25 cycles and 8,000 kva. with twenty-four radiators and a 60-cycle, three-phase, 10,000-kva. machine with eighteen radiators are described.—*Elektrotechnik und Maschinenbau*, July 3, 1921.

Zigzag Leakage.—LAURENCE H. A. PARR.—Mathematical calculation of the zigzag leakage in an induction motor.—London *Electrician*, July 15, 1921.

Generation, Transmission and Distribution

Induction Motor Core Losses.—P. L. ALGER and R. EKSERGIAN.—An analysis in which core losses are divided into six elements. Rational formulas are developed for the losses in the core back of the teeth which are found to give larger values than the more approximate formulas now in use. Charts give the correction factors to apply to the usual formulas for all ordinary conditions.—*Massachusetts Institute of Technology Publications, Serial No. 26.*

Stray Losses in 60-Cycle Synchronous-Booster Converters.—F. T. HAGUE.—The stray losses of a 6,000-amp., 60-cycle synchronous-booster converter were determined by taking the difference between the efficiency by the separate-loss method and the efficiency by laboratory input-output tests. The accompanying curve gives some idea of the stray losses as determined for this machine at 260 (normal) volts. The author discusses the accuracy of the efficiency determination.—*Electric Journal*, July, 1921.



STRAY LOSSES ARE THE DIFFERENCE BETWEEN THE UPPER AND LOWER CURVE

A Swiss-French 110,000-Volt Transmission System.—L. VELLARD.—A detailed description of the line construction and substation equipment of a three-phase transmission system 185 km. long, located partly in Switzerland and partly in France. About 40,000 hp. is generated at Goesgen, Switzerland, and of this 20,000 hp. is transmitted across the border into France, the line terminating at Pouxeux. All the poles are 19-m. steel towers carrying three 78-sq.mm. copper cables on eight-disk chains, with a 40-sq.mm. steel cable on top of the towers. All substation equipment with the exception of the electrolytic lightning arresters is installed under roofs. It is interesting to note that porcelain is used very sparingly, almost all the insulators for wall entrances, oil-switch leads, measuring transformers, line supports, etc., being made of paper ("bituba").—*L'Electricien*, July 15, 1921.

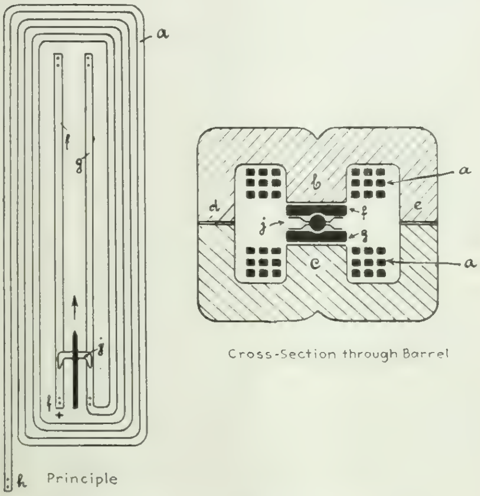
Low-Voltage Overhead Distribution.—BURKEWOOD WELBOURN.—An abstract of a paper presented before the British Institution of Civil Engineers.—London *Engineering*, July 8, 1921.

Traction

New Single-Phase Locomotives for the Gothard Railway.—L. PAHIN.—The Oerlikon Works began 1920 with the shipment of thirty-three 1-C + C-1 single-phase locomotives. They are designed for operation on single phase, 16⅔-cycle, 15,000-volt current. Two front and two rear motors, each of 550 hp., drive one jack shaft each, from which is operated a double-rod arrangement for three drivers fore and aft. The engines are built for 65 km. per hour on the level and 35 km. per hour on a grade of 26 mm. per meter. The normal drawbar pull is 13,100 kg. at a speed of 35 km. per hour. The article contains details and illustrations of the transformer, the oil switch, the transformer tap switch and the arrangement of the motors, as well as wiring diagrams.—*Industrie Electrique*, Aug. 10, 1921.

Electrophysics and Magnetism

Electric Cannon System.—FAUCHON-VILLEPLÉE.—A great variety of electric guns, based upon electromagnetic principles, ejecting a steel shell through one or more solenoids, have been built in accordance with theory, but none of them has ever achieved any actual or practical results. The French engineer Fauchon-Villeplée describes in this paper an entirely new system of electric propulsion of projectiles, suitable especially for stationary guns of very long range which outdo the war-famous German "Berthas." The basic principle of the new gun is the fact that a current-carrying, movable conductor will travel across a strong magnetic field. The author built during the war a model of such a gun, which shot a 50-gramme projectile at a muzzle velocity of 200 m., piercing easily a large hard-wood block. A long, narrow solenoid, wound with heavy copper conductors (*a*), extends the full length of what might be called the gun barrel. The magnetic flux is concentrated, guided and closed upon itself by an upper and a lower iron pole piece (*b* and *c*) and yokes on the sides (*d* and *e*), leaving in the middle a rather narrow air gap. This gap is lined with an upper and a lower copper bar (*f* and *g*), with a groove in their middle. The inner end of the long solenoid is connected to one of these copper bars. The other bar and the outer end of the solenoid represent the terminals of the gun (*f* and *h*). The projectile is a dart with two copper wings (*j*). It is obvious that if this dart is inserted into the groove, its two wings will make contact with the upper and lower copper bar and will close the circuit. The wings will represent a movable electric conductor within a strong magnetic field, and the result will be that the dart will be shot out from the solenoid, gliding between the copper bars. As the dart leaves the end of the long coil it will automatically open the circuit. Being used only for an extremely short fraction of a second, the winding may carry without any danger an enormous amount of current—100,000 amp. and more—which may be delivered from a flywheel dynamo or a storage battery. The author gives complete working drawing and photographs of the experimental gun, and also drawings for a long-range gun capable of hurling a 100-kg. projectile with a muzzle velocity of 1,600 m. per second. Including a suitable flywheel generator, the latter gun would not weigh more than the German "Bertha." The many advantages that such a gun would possess are recounted. —*Revue Générale de l'Electricité*, Aug. 6, 1921.



Principle

Cross-Section through Barrel

CONSTRUCTION AND OPERATING PRINCIPLE OF AN ELECTRIC CANNON

Installations, Systems and Appliances

Leader Cables in Navigation.—J. J. BENNETT.—An explanation of the principle of the leader cable used in harbors to guide ships to their port. Audible and visual signals are both considered, the arrangement of the apparatus on the ship is explained, and the method of utilizing the leader cable to reach port is described. So far, according to this report, the leader cable has been adopted in harbor approaches only, such as New York, Brest, Cherbourg and Portsmouth afford. Up to the present time no leader cable has been laid in a greater depth of water than 180 ft., and the longest cable in use runs a distance of 40 miles (64 km.).—London *Electrician*, August 12, 1921.

Automatic Substations Used in Coal Mining.—R. J. WENSLEY.—Some of the conditions which make it desirable to use automatic substations in coal mining are outlined, such as labor expense, interruptions in service, copper loss and machine insurance. Methods of insuring automatic operation are considered and factors are outlined which must be taken into account when outlining and designing mining automatic equipment. Automatic substations are not too expensive, the author contends. He says that a 200-kw. installation containing a 275-volt direct-current generator with manual switching would cost about $6,150 at the present time, whereas the same machine with the simpler type of automatic control would cost only approximately $8,350. If the difference of $2,200 is capitalized at 20 per cent for one year, it will give an annual charge of $440, which is far less than the wages of one man to operate such a plant one year.—*Transactions American Institute of Mining and Metallurgical Engineers*, September, 1921.

Units, Measurements and Instruments

Multiple Unit Shunts for the Measurement of Heavy Current.—M. B. FIELD.—Abstract of a test conducted at the Manchester College of Technology to determine the suitability and accuracy of multiple shunts. It is shown that with various arrangements the summation current remains substantially constant and equal to the addition of the individual currents in each sub-shunt. The article also treats of the effect of variation in current distribution in ordinary and multiple shunts, the three factors of importance being the constant or the shunt, its terminal resistance and the electrical symmetry.—London *Electrician*, August, 12, 1921.

Telegraphy, Telephony and Signals

Low-Frequency Voltage Factor for Oscillating Triode.—MARY TAYLOR.—Deals with the determination of the voltage factor of a thermionic tube—that is, the change in anode voltage required to maintain the anode current constant—when additional emf. is applied between the grid and the filament. When the tube was actually generating high-frequency oscillations, it was found that a voltage factor could be made greater or less than its value when the triode was not oscillating and in some cases could be made very great indeed. From the definition of the voltage factor it may be understood this can be increased either by increasing the mutual inductance or by decreasing the anode conductance.—London *Electrician*, August 12, 1921.

Home-Made Vacuum Tubes.—H. YAGI.—This is the report of tests of some home-made triode vacuum tubes, carried out in the Tohoku Imperial University about eighteen months ago. The static characteristics are first given, from which the operational constants such as "mutual conductance," "amplification constant," etc., are derived. After reviewing the behavior of the different types of tubes, some essential points are brought out about their design. How the mutual conductance varies with the filament heating is then experimentally studied. The "lumped characteristics" of two entirely different kinds of triodes are plotted, as suggested by Professor Eccles. Photographs of the triodes under test are reproduced.—*Journal Institute of Electrical Engineers of Japan*, July 10, 1921.

Books of Technical and Industrial Interest

The New Physics. By A. C. Crehore. San Francisco: Published by the *Journal of Electricity*.

This little book of less than a hundred pages discusses in easy style, free from mathematics, a number of the results of modern investigation in the field of subatomic physics. The author proposes a number of striking conclusions which are well worth considering. The volume divides itself roughly into two parts, the first concerning itself chiefly with the nature of specific inductive capacity, permeability and mass. Starting from Maxwell's well-known relation between the two former quantities and the velocity of light, and invoking the Lorenz formula for the mass of the electron, together with the Ryderg radiation constant, the remarkable conclusions are reached that specific inductive capacity, permeability and mass have the dimensions, the two former of the reciprocal of a velocity, and the last, mass, of a simple velocity. Much of the discussion is from the standpoint of physical dimensions, and the results mentioned lead to the elimination of mass as a fundamental unit, and to space and time as the only necessary ultimate components of all physical quantities. The second part is a review of the author's theory of gravitation, which supposes the attraction is due to the interaction between atoms of the electromagnetic forces due to the motions of electrons in their orbits in the atoms. Here, too, much of the discussion is from the standpoint of the physical dimensions of the various constants, using the conclusions of the first part, Planck's constant and other well-known properties of radiant energy. The validity claimed for the conclusions is based largely on the dimensional relations mentioned and on the agreement of values of the gravitational constant and of the charge and the mass of the electron as reached by experiment and by reasoning in the author's theory. Many of the premises and conclusions are open to criticism, but the subject matter and method of treatment will make their appeal to one wishing to keep in touch with the rapid progress of modern physical theory.

The Fundamental Basis of Dynamo-Electric Machine Design. By Tatsuo Tanaka. Tokyo, Japan: Maruzen Company, Ltd. 145 pages, illustrated.

Two design theorems are proposed, one fixing the ampere conductors and magnetic flux per pole, the other the armature dimensions. The opinions of several leading authorities are recited and an engineering criticism is made of them. A large mass of data taken from existing designs of the leading electrical manufacturers of the world is presented in support of the validity of the theorems. These data are plotted in comparative charts. In one case they are plotted against what the author asserts to be the usual design criterion, in the other against the proposed new criterion. Though it is not possible to agree completely with all that the author proposes, the book as a whole is an interesting, important and very comprehensive treatise on the subject of design of electrical machines. He has succeeded in developing a set of similar equations for the specific capacity of all classes of rotating electrical machines, in terms of the number of poles and the flux and ampere conductors per pole, and thus, to an extent not previously attained in electrical literature, has placed all of these machines on a comparative design basis. Moreover, he has worked out with a considerable degree of success what has many times been vainly sought, namely, a design coefficient which would remain practically constant through the whole range of size, speed, etc., from fan motors to the largest electric generators.

Die Asynchronen Wechselfeld Motoren. By Dr. Gustav Benischke. 114 pages, 89 illustrations. Berlin: Julius Springer.

The author introduces a new designation, "Wechselfeld" motoren, *i.e.*, "pulsating-field" motors. He does not call them alternating-current or single-phase motors because three-phase induction motors are also alternating-current motors and because a pulsating field may be obtained from both single-phase and three-phase current. It is the magnetic field, not the current, which signifies the type of motor. It has been customary to explain and to compute pulsating-field motors by dividing the field into two right-angle components, which caused complicated calculations and unintelligible diagrams. All the different types of motors described in this book, such as series and shunt motors, repulsion motors and plain induction motors, have been treated with their real, undivided fields. The book is of necessity of highly mathematical character and employs both the mathematical and graphic (vector-diagram) methods of solution. The author is a well-known professor of alternating-current theory at Charlottenburg. Present exorbitant book prices in Germany forced him to strip the book of all non-essential details and illustrations.

Die Wissenschaftlichen Grundlagen der Elektrotechnik. By Dr. Gustav Benischke. 640 pages, 602 illustrations. Berlin: Julius Springer.

This is the fifth edition of Dr. Benischke's book on the scientific principles of all branches of electricity. Among German electrical literature Benischke's book is no doubt a classic. It was, is and will be the primer for every German electrical student. From the simplest physical fundamentals to the most complex problems the reader is guided in an unmistakable and always strictly scientific way. The author is known for the independent views taken by him on many subjects, regardless of any existing, well-established conceptions. It is this independence and the clearness and simplicity of the language in his books that make them so attractive.

Das Radium und die Radioaktivität. By M. Centnerszwer. Volume 405 of the collection "Aus Natur und Geisteswelt." Leipzig and Berlin: B. G. Teubner. 118 pages, 33 illustrations.

This little book in its second edition is a valuable addition to a well-known and much-circulated collection of popular scientific works. In simple language it contains in four chapters the history of the discovery of radium and radioactivity by the Curies, explaining the position of the radioactive elements in the periodic system, the nature of the emanations, the different radioactive elements and the present use of radiology.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

Committee Representing Industries Takes Up Census of Manufactures

AT THE request of Secretary Hoover, representatives of industries gathered in Washington recently to discuss methods of bettering the next census of manufactures. At that meeting a committee was appointed to make specific recommendations. This committee has now suggested that no effort be made to collect statistics from establishments having an annual output of $5,000 or less. Heretofore the census has sought returns from every establishment having an annual output exceeding $500 in value. The committee discussed in detail the draft of the schedule proposed by Director Steuart of the Census Bureau for the 1921 census of manufactures. No public discussion of these schedules will be undertaken at this time.

Representatives of the industries who met with the Commerce Department officials emphasized the need of preventing duplication in government questionnaires and statistics. Another important point made at the conference was the need for greater safeguards to prevent the disclosure of individual returns.

George Otis Smith Sees Lack of Machine Power in England

LAST week saw the return of Dr. George Otis Smith, Director of the United States Geological Survey, from England, where he found evident a general desire in scientific and governmental circles to pool information with America and thus to co-operate in working out industrial and economic questions. "The marked difference between England and America in the use of electricity," said Dr. Smith, "cannot escape the notice of even the casual observer, but interviews with members of the government commissions studying this problem strengthen the opinion that industrial England suffers from a lack of machine power."

Indiana Commission Permits Use of Depreciation Reserve

THE Indiana Public Service Commission has authorized the Southern Indiana Power Company to use for current purposes money it had, by order of the commission, accumulated as a depreciation reserve. In October, 1920, the commission instructed the company to set aside annually 4 per cent of its total depreciable property, valued at $883,500, for a depreciation fund. When the commission issued the order it said that the rates fixed would yield the company 7 per cent on $1,165,837, the total valuation arrived at.

As a matter of fact, the commission now admits, the gross income for the period will amount to $41,793 less than estimated, and in consequence the commission has authorized the company to use $20,615 of its depreciation fund, accrued between Jan. 1 and July 31, for current uses and to put only 1 per cent instead of 4 per cent in its depreciation fund until 1923. No provision could be found in the order for the future reimbursement of the fund.

In another order the commission authorized the Interstate Public Service Company to sell $184,000 of 5 per cent first and refunding gold mortgage bonds, issue of 1913, at only 75 per cent of par. This will mean 25 per cent loss in discount if the company cannot obtain better bids.

Federal Recognition of Portland's Coming Exposition Extended

AMONG the bills signed by the President just before the Congressional recess was one authorizing the President to invite foreign nations to participate in the exposition to be held in Portland, Ore., in 1925 to celebrate the centennial of the invention of the electromagnet and to exemplify the development of hydroelectric energy. In order to handle the affairs of the exposition in a businesslike way, a corporation has been organized with a capital stock of $5,000,000. The directorate of the corporation is composed of thirty-three of the leading business men in the Northwest. Now that federal recognition has been obtained for the exposition, it is the intention to launch a nation-wide advertising campaign.

To Improve Electric Wiring Conditions in Michigan

A MOVEMENT has been started by the Michigan Electric Light Association to improve the wiring conditions in the state, particularly in the smaller towns and the rural sections. The committee on safe wiring indicated in a preliminary report at the recent convention at Ottawa Beach that the work had not proceeded far enough for definite recommendations and made the following observations:

"A survey of conditions in certain sections of the state clearly demonstrates the advisability of better wiring conditions, especially in the smaller towns. As an example of extreme conditions, your committee wishes to report that residences have been wired in certain localities with lamp cord fastened to the plaster after the room was prepared and service requested of the central-station company.

"The problem of proper inspection by disinterested parties has been very difficult to solve because this position has not been self-supporting in the smaller towns and cities. It is not the opinion of this committee that the utilities should make any electrical inspections on the customers' premises beyond the meter. This work should be taken care of by some one appointed by the city, state or insurance authorities.

"It is the plan of your committee to call a meeting of those interested, to determine, if possible, the best means to improve conditions throughout the state. The study of this situation seems to indicate that the cause of inferior wiring is undoubtedly the careless electricians who see only the possibility of getting the work on a price basis. It may be possible that state legislation would, in a measure, insure us good wiring conditions. This has been the practice in some of the states and has apparently gone a long way in preventing poor wiring.

"It is the belief of your committee that the various utilities should take up with their local fire authorities the matter of reporting losses by electrical fires in order that no reports may be forwarded to the state fire marshal advising of fires of electrical origin without the central-station company being permitted to investigate and determine if possible the truth of this report. It is the intention of this committee to take up this matter with the state fire marshal in order to have reports of fire losses due to electricity as authentic as possible."

Permits and Licenses Issued by Water Power Commission

A PRELIMINARY permit to extend for two years has been granted by the Federal Power Commission to the Kelly Mines Company of Seattle, Wash. Its project (No. 207) is on the Little Susitna River and Fishhook Creek, in the Knik Precinct of Alaska. It involves the construction of a diversion dam on Fishhook Creek and the erection of a power house. A second diversion dam is to be constructed on the Little Susitna along with a power house and a water conduit.

A license under the water-power act has been granted to James Hulme, W. E. McKinnen and Albert H. Piepenburg, representing an association of citizens of Pine Knot, Cal. (Project No. 227). The license covers a transmission line across public lands within the Angeles National Forest in San Bernardino County, Cal. The license was granted with the understanding that the construction of the transmission line must begin on or before Jan. 1, 1922, and be completed on or before Dec. 31, 1922.

Other licenses have been granted to Charles S. Benefiel of Paisley, Ore., covering a small project on the Chewaucan River in Lake County, Ore., and to the Alaskan-American Paper Corporation (Project No. 94) for a project at Orchard Lake, at the head of Shrimp Bay, Revillagigedo Island, Alaska, and on the lands of the United States within the Tongass National Forest.

An application for a license has been received from the Freshwater Lumber Company of Douglas, Alaska, covering the installation of a power plant on Chichagoff Island for operating a sawmill, and an application for a preliminary permit has been made by the Stene Consolidated Copper Company of Phoenix, Ariz., covering a dam and reservoir in the Bill Williams River, 30 miles from its mouth. A canal 35 miles long is planned as part of the development last named to conduct the water to a proposed power house at Planet, Ariz., where it will be used for irrigation and for the generation of power to be used by mining and public utility concerns.

The commission has rejected the application of Major R. L. Weeks covering the project at Duncan's Riffle, Ala., and has amended the license for this project granted to the Alabama Power Company so as to allow it to include lands near the dam site from which stone is to be taken for use in building the dam and power house.

Hydro-Electric Station of 30,000 Hp. Completed in Record Time

CONTINUING its water-power construction activities initiated immediately after the war, the Southern California Edison Company completed, on Aug. 12, in record time, its new 30,000-hp. Big Creek water-power station No. 8 on the San Joaquin River at its junction with Big Creek.

Although it would require, under normal working conditions, approximately one year to complete the construction of the power-house building and install the apparatus, this work has been accomplished on Power House No. 8 within a period of three and one-half months. Three shifts of men totaling 2,000 on the average, and at times reaching as many as 2,500, have been kept busy twenty-four hours a day on this job since ground was first broken at the power-house site early in May. The completion of the plant at this time removes all possibility of a power shortage this fall during the period when water-power plants without storage reservoirs are operating at reduced production due to low stream flow.

With the completion of the first unit of 30,000 hp. in this plant, the plant additions to the Southern California Edison system completed during the present year will total 92,000 hp. Other additions in the year were the Kern River No. 3 plant, rated at 40,000 hp., and the installation of an additional 22,000-hp. generator in Big Creek station No. 2.

This is the first plant in the world to be built for 220,000 volts operation, but for the present energy will be transmitted at 150,000 volts. Service from this station together with Big Creek No. 1 and No. 2, which have been in operation for several years, will be changed over to 220,000 volts when the capacity of the two transmission lines to Los Angeles is reached.

Maine Commission Sees Advantage in More Stock and Fewer Bonds

IN COMMENDING the local sale of stock by utilities the Maine Public Utilities Commission, in its sixth annual report, just issued, expressed the belief that in the case of very many companies it would be of greater advantage if there were more stock and fewer bonds or less floating indebtedness outstanding. The importance of high credit, public good will and an adequate return for service are also strongly emphasized.

A valuable feature of the report, in addition to the usual financial and operating data for 1919 and the reprints of decisions given, is an analysis by William M. Black, chief engineer of the commission, of the production, interchange, distribution of energy and load characteristics of 105 electric utilities of the state. These utilities generated 183,062,907 kw.-hr. by hydroelectric plants during 1919, representing 85.1 per cent of the total energy which they distributed. The interchange between utilities totaled 85,812,139 kw.-hr. and the total amount generated was 215,099,819 kw.-hr. The total number of lighting customers was 79,784 and of power customers, 4,433.

Los Angeles Will Accept Regulation on Colorado River Development

OFFICIALS of the city of Los Angeles and of its bureau of power and light have accepted the principles of regulation and taxation laid down by the State of Nevada on the service and properties in that state, provided that the city shall be permitted to develop power on the Colorado River at the Boulder Canyon dam site. In a statement to the ELECTRICAL WORLD Governor E. D. Boyle of Nevada said: "In a conference with Councilmen Wheeler and Fisher, Electrical Engineer Scattergood and City Engineer William Mulholland of Los Angeles the general problem of the Colorado River development was entered into, but no definite conclusions were reached. The Los Angeles officials expressed a willingness to allot 100,000 hp. to Nevada and to submit to taxation and to accept regulation of rates and service on power sold in Nevada. As their arrangements with the Reclamation Service are still tentative, it will require further conferences, which will include the Reclamation Service, to determine the attitude of the State of Nevada."

By vote of six to three the City Council of Los Angeles on Aug. 29 indorsed the plans of the city's Bureau of Power and Light to develop power on the Colorado River at the Boulder Canyon dam site. Prior to this time the plans had received no official indorsement, although various individual officials had been active in furthering the ambitions of the city to control the power situation. The action taken on Aug. 29 followed a heated debate in which a letter from Secretary of War Weeks was read declaring that action should be withheld until Congress shall have acted on the entire Colorado River development.

Judge Landis Hands Down Long-Expected Chicago Building Wage Decision

CARRYING a wage scale ranging from 47½ cents an hour to $1.25 an hour, the long-expected decision which, it is hoped, will start the needed revival of building construction in Chicago was handed down on Wednesday by Federal Judge Landis, who acted as arbitrator in the building trades controversy. This decision has been awaited with interest by building trades throughout the country and is expected to have a widespread effect not only in the Middle West but in other sections where the problem of reducing building-trades wages has not yet been solved. The market for electrical goods in the Middle West has waited, more or less, for this decision.

It is the hope of the building industry in Chicago that approximately $30,000,000 of construction work that has been awaiting the decision will be released and several thousand men now idle put at work. The carpenters, sheet-metal workers and plasterers are the only classes of workmen that were not included in the award, they having so far refused to participate in the proceedings or accept Judge Landis' decision.

The average drop in building costs is estimated by various authorities as between 20 and 25 per cent. The wages of electricians are fixed at $1.10. Bricklayers are to have $1.10; plumbers, 95 cents; hoisting engineers, 85 cents and $1.10; structural iron workers, $1.05; excavating labor, 47½ and 55 cents; cement laborers, 72½ cents; cement finishers, 85 cents; common laborers, 72½ cents; steamfitters, 95 cents. More than forty classes of building construction labor are included in the decision. In addition to those mentioned, stone carvers are to have $1.25; tile layers, $1.12½; stone cutters and mosaic and tile workers $1.02½; boiler makers, lathers, slate and tile roofers and tuck pointers, $1. All other hourly rates are under $1.

Engineers of America, Great Britain and France to Fraternize

SEVERAL hundred American engineers will gather with representatives of the principal engineering societies of Great Britain and France at a dinner to be given at the Engineers' Club in New York City on the evening of Oct. 10. It is expected that men prominent in the diplomacy and statecraft of Europe and the United States will also be present. Secretary of Commerce Hoover, Secretary of State Hughes and Lord Bryce are among those invited.

The event, while formally celebrating the homecoming of the distinguished American engineers who went abroad to confer the John Fritz medal upon Sir Robert Hadfield of London and Eugene Schneider of Paris, will mark the launching of a world movement of engineers to promote unity among the English-speaking and other peoples who were allied in the war and to establish international peace.

Ambrose Swasey and the other members of the John Fritz medal deputation will be guests of honor. British organizations whose representatives will be guests are the Institution of Electrical Engineers, the Institution of Civil Engineers, the Institution of Mechanical Engineers, the Institution of Mining Engineers, the Institution of Mining and Metallurgy, the Iron and Steel Institute, and the Royal Society of London. France will be represented by members of the Société des Ingénieurs Civils de France.

The appointment of the following committee of arrangements for the dinner has been announced: Calvin W. Rice, secretary of the American Society of Mechanical Engineers; Frederick F. Sharpless, secretary of the American Institute of Mining and Metallurgical Engineers; Elbert M. Chandler, secretary of the American Society of Civil Engineers; F. L. Hutchinson, secretary of the American Institute of Electrical Engineers, and Alfred D. Flinn, secretary of the United Engineering Society.

Tennessee Crossing Rules Follow Safety Code

VIRTUALLY no deviation was made from the National Electrical Safety Code, third edition, in the specifications for wire crossings over railroad tracks, adopted June 9 by the Tennessee Railroad and Public Utilities Commission. Considerable difference of opinion developed with reference to the minimum crossing height of lines 300 volts to ground to 15,000 volts. This is given in the Safety Code as not less than 28 ft. at 60 deg. Fahr. with no wind and for spans not exceeding 150 ft. The commission was inclined to require a 30-ft. minimum clearance under the most unfavorable conditions. It was finally agreed, however, by all interests to make this clause read "Supply line, 300 volts to ground to 15,000 volts, preferably 30 ft. and not less than 28 ft." This may be reduced to 25 ft., where lines are paralleled by trolley-track conductors on the same street or highway. The subject of inductive interference did not come up at this time.

These specifications were ordered approved after hearings in which the electric light and power, telephone and railroad interests participated. The rules became effective for all new construction and reconstruction upon signing of the order, and for existing structures not strictly in conformity with the specifications only where they are or become unsafe.

Public Relations to Be Emphasized at Empire State Meeting

PLANS for the annual convention of the Empire State Gas & Electric Association are almost complete. The convention will be held this year at Lake Placid Club, Oct. 6 and 7. In addition to the committee reports arrangements have been made for three addresses on public relations, by William A. Prendergast, chairman of the Public Service Commission, who has been asked to discuss the necessity for mutual confidence on the part of the public, the utilities and the commission and ways and means of promoting such confidence; H. M. Addinsell, chairman of the public utility securities committee of the Investment Bankers' Association of America, on "Public Relations as a Factor in the Value of Utility Securities," and Loyal S. Wright, on "Serving the Public."

Clause of Pennsylvania Utility Law Attacked as Unconstitutional

A FIGHT of customers of public utilities against the provisions of the Pennsylvania public service law which permit public service corporations to impose and collect increased rates for service thirty days after tariff schedules have been filed with the Public Service Commission has been carried to the United States courts. This provision is attacked as a violation of the Fourteenth Amendment of the United States Constitution, prohibiting the taking of property without due process of law, inasmuch as the consumer has no alternative except to pay the increased rates or be deprived of service, although there has been no determination by a competent tribunal of the reasonableness of the tolls, and the only recourse the consumer has, if it ultimately is decided that the rates are excessive, is to file a suit without any assurance that the excess will be returned.

In order to get a determination of this point the Coplay Cement Manufacturing Company has filed a bill in equity for an injunction to restrain the Pennsylvania Power & Light Company from discontinuing service should it refuse to pay the increased rates.

Pacific Coast Contractors Withdraw from National Association

AT THE annual convention of the California Association of Electrical Contractors and Dealers held Aug. 27 it was decided to withdraw from the National Association of Electrical Contractors and Dealers in order that the affairs of the California contractors and dealers might be conducted more in accord with the conditions existing in California. At the meeting an announcement was made that the Oregon association had taken similar action and that the Washington association, too, was contemplating acting likewise soon. The indications are that a Pacific Coast organization will be effected. Earl Brown was elected president to succeed Clyde Chamberlain.

Radio Consolidation Brings Important Patents Under One Control

FURTHER details of the merger of the International Radio Telegraph Company with the Radio Corporation of America, reported in last week's issue, have been given out by the Westinghouse Electric & Manufacturing Company, which controlled the Internationa company, in the following statement:

> The Radio Corporation of America has acquired from the International Radio Telegraph Company a group of patents relating to wireless telegraphy which the Radio Corporation found it necessary to make use of to enable it to give to the public proper and efficient service.
>
> Among its patents were the well-known Fessenden and Heterodyne patents, which have been sustained by the court. The Westinghouse Electric & Manufacturing Company, a large stockholder in the International company, had recently acquired an option to purchase the Armstrong and Pupin patents on what is known as the "feed-back circuit," which serves to intensify very weak signals, and these patents are of great importance in all systems of wireless telegraphy and telephony.
>
> The International company had not embarked upon commercial work to any very great extent and was confronted with important patents owned by the Radio Corporation, so that neither company was in position to give to the public satisfactory service without infringing upon the patents of the other. Under the circumstances, it was found essential that the right to use the several groups of patents should be acquired by one corporation. This led to the purchase by the Radio Corporation of the assets of the International Radio Telegraph Company, consisting principally of patent rights and a few coastal stations. At the same time the Radio Corporation purchased from the Westinghouse Electric & Manufacturing Company its rights with reference to the Armstrong and Pupin patent rights. The purchases were made with stock of the Radio Corporation.
>
> THREE SOURCES OF APPARATUS SUPPLY
>
> The General Electric Company, a large stockholder in the Radio Corporation, was manufacturing for the Radio Corporation, and the Westinghouse company was manufacturing for the International company. As a result of the new arrangement the Radio Corporation has available the facilities of both the General and Westinghouse companies, which enables the Radio Corporation, which is not itself an apparatus-manufacturing company, to have two sources of supply for wireless apparatus and at the same time to utilize the inventions of the several groups of patents, thereby giving to the public the best service possible without incurring the danger of interference by patent suits. In addition to this, another source of supply for certain lines of wireless apparatus is the Western Electric Company, which manufactures for the American Telephone & Telegraph Company, which is licensed under the entire group of patents for commercial wireless telephony, while the Radio Corporation receives rights under the wireless patents of the telephone company for its field.

A later statement from East Pittsburgh contains the following information:

> The Westinghouse Electric & Manufacturing Company announces that it has sold the assets of the International Radio Telegraph Company to the Radio Corporation of America, retaining certain patents and its rights in foreign fields. It has also obtained a substantial interest in the stock of the Radio Corporation of America and made commercial agreements with that company regarding the sale of radio devices which are manufactured by the Westinghouse Electric & Manufacturing Company and which it will continue to manufacture. It has also retained certain rights in the wireless field, among which is the broadcasting of information, an achievement well known to the public.

Iron and Steel Men Prepare for Coming Chicago Convention

WITH the Hotel La Salle, Chicago, as meeting place and exhibition hall, the Association of Iron and Steel Electrical Engineers will hold its fifteenth annual convention on Sept, 19 to 24, as previously announced. The program follows:

MONDAY, SEPT. 19

9:30 A.M.—Business session; election of officers.

2 P.M.—"Some Recent Developments in Induction Motor Starting," by M. Spencer; "The Electrical Engineer in the Steel Plant and Out," by F. B. Crosby.

TUESDAY, SEPT. 20

9:30 A.M.—"Electrification of Steel Plant Railroads," by R. B. Gerhardt; "Anti-Friction Bearings in Steel Mills," by A. M. MacCutcheon.

2 P.M.—Inspection trip.

WEDNESDAY, SEPT. 21

Fuel Economy Day, 9:30 A.M.-5 P.M.—"Fuel Requirements of Steel Mills," by F. E. Leahy; "The Control of Boiler Operation," by W. N. Flanagan; "General Use of Oxygen in the Steel Mill Industry," by E. A. W. Jeffries; "Waste-Heat Utilization for Steam Generation," by G. R. McDermott.

THURSDAY, SEPT. 22

9:30 A.M.—Report of electric furnace committee, by E. T. Moore; report of electrical development committee, by R. B. Gerhardt.

2 P.M.—Report of educational committee, by L. F. Galbraith; comments on safety committee work, by Walter Greenwood.

FRIDAY, SEPT. 23

9:30 A.M.—Standardization committee report, by W. T. Snyder; electric overhead traveling crane specifications, by F. W. Cramer; report of sub-committee on motors, by D. M. Petty; report of sub-committee on illumination, by H. L. Kirschberg.

2 P.M.—Inspection trip.

7 P.M.—Fifteenth annual banquet.

Government Engineers Recommended Interconnection of Muscle Shoals

IT WILL be recalled that during 1917-18 the general shortage of power throughout the country became so acute as to threaten the manufacture of articles essential to the prosecution of the war. A thorough investigation was therefore begun by the Power Section of the War Industries Board.

The creation of such a board was suggested by General Keller and authorized by the Secretary of War. Its working force consisted of officers of the Engineer Reserve Corps, who were selected because of their known qualifications as electrical engineers and were under the direction of Frederick Darlington. These officers performed the work of investigating power conditions throughout the country. Studies were made of the power situation in industrial centers, including the districts of Niagara Falls, Pittsburgh, New England, New Jersey, Philadelphia, Baltimore, the Pacific Coast and several localities in the Southern States. In view of the offer made for Muscle Shoals by Henry Ford, the report made on that power development by the army engineers is most enlightening.

The particular report dealing with the electric power problems in the Southern States was submitted by Capt. George K. Miltenberger, Capt. Lyle A. Whitsit and Capt. Robert W. Lamar, engineers, U. S. A. In addition, Major Malcolm MacLaren in his report said:

> It is especially desirable that consideration be given to the recommendation made in the report on the power situation in the Southern States that the provision that this power plant "shall be constructed and operated solelyby the government and not in conjunction with any other industry or enterprise carried on by private capital" be repealed, for apparently the very large amount of secondary power that may be generated at Muscle Shoals can be used economically only in connection with a large system affording great diversities as to natural and operating conditions. It seems particularly desirable that attention be given at the earliest possible moment to the adoption of legislation under which the Muscle Shoals power may take its appropriate place in the Southern power scheme.

RELATION TO SOUTHERN INDUSTRIES

The three army engineers other than Major MacLaren, in discussing Muscle Shoals, made the following recommendations for its utilization:

> This report on the power resources of the Southern States has been prepared to point out the most economic and reliable source of power that can be utilized for serving the industries of the South with a view to securing maximum economy in generation, and the resources in water and steam power thus far considered have excluded the Muscle Shoals project, by reason of the existing law prohibiting the use of this power for private purposes.
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> The procedure is illogical and unreasonable, because in order to provide cheap power it is necessary that the best sources of power be used, whether they are hydro-electric developments using the natural flow of the rivers, or whether they are hydro-electric powers with storage reservoirs that conserve the water during high-water stages for use during low-water stages, or whether they are sources of steam power; and further it is necessary to operate these powers jointly to obtain maximum economy, reliability and conservation of resources in fuel, labor and materials.
>
> The best economy and reliability cannot be secured by any one development, whether it is hydro power by flow of stream or by storage, or steam power, but will be obtained by a suitable combination of these different sources and by the interconnection of the systems supplied by them. Muscle Shoals has been selected by the government as a favorable location for the production of cheap power. The proposed design will furnish 100,000 kw. of prime power and 200,000 kw. of second-class power in an average year. The steam plant of 60,000 kw. which the government has installed at Muscle Shoals is capable of converting a portion of the second-class power to prime power. But this combination with a steam plant at Muscle Shoals, regardless of whatever economy may result, cannot be, broadly speaking, as favorable for all interests, either the government interests or private interests, as a combination of the Muscle Shoals steam and hydro powers with an interconnected group of public utility systems as described in this report. To segregate the Muscle Shoals power facilities from the other systems of the country is contrary to the policy recommended and strongly advocated, that is, of interconnecting all of the efficient going power systems and jointly operating them for maximum economy. The same principle which works for increased economy by interconnecting the public utility power systems of the Southern States applies to a further interconnection including the Muscle Shoals plants, and in the interest of cheap and reliable power the law should be changed and the interconnection and joint operation of all of the developed powers should be provided for.

OPPOSE INDEPENDENT UNIT AT MUSCLE SHOALS

Further on in the report the engineers give their opinion on Muscle Shoals operated as an independent unit. From the subjoined section of the report it is quite evident that the army engineers were not favorably disposed toward such a disposition of Muscle Shoals power:

> If interconnection between Muscle Shoals and the big public utility power companies of the Southern States is not planned for in the near future and eventually carried out under favorable conditions, the government development

at Muscle Shoals is liable to result, not in cheapening power for the industries of the South, but rather in increasing the cost. It is a matter of common knowledge that one of the large private interests acquired the water-power site at Muscle Shoals and spent a large sum of money in preparation for a hydro development similar to the one now being built by the government, with the intention of distributing this power to the industries of Alabama, which would logically later on, through interconnections, be extended to service in Georgia and Tennessee. The government has come into the situation and taken over this source of power and is building the plant, as provided by law, exclusively for government use, and if this is carried out, it will result in private industries being deprived of this natural resource, which, by reason of the government's own action in selecting this power for its use, may be regarded as a cheap source of power.

We have no figures as to what the government estimates the cost of Muscle Shoals power will be, either primary power or second-class power, since the undertaking at this place is for the joint purpose of improving navigation and for creating power, and we are not informed as to the proportionate charge that goes to these two purposes. It is, however, obvious that if a big power load is to be built up about Muscle Shoals, it must be done either by direct government operation or else the attraction in the way of low-priced power must be very marked to divert manufacturing from the present industrial centers and favorable locations for raw materials and transportation to the district adjacent to Muscle Shoals, which is sparsely developed industrially. If the inducement in the way of cheap power is sufficient to overcome the natural conditions as established by the superior industrial progress in other sections, the power at Muscle Shoals must be made available at a relatively low rate, which also, without the modification of the present law, would have to be wholly for government purposes.

It therefore appears that a broad and well-founded judgment would dictate that the Muscle Shoals development should be interconnected for exchange of power with the existing power systems of the Southern States, and that this interconnection and exchange should be arranged for without delay, so that future construction, both at Muscle Shoals and elsewhere, can be directed for the production of plants which will supplement one another for economy of construction and operation.

Indiana Cities Think Seven-Year Average Prices Too High in Valuation

OPPOSITION to the valuation basis proposed by the new Indiana Electric Corporation marked the opening of the Public Service Commission hearing on Aug. 26 on the corporation's petition to acquire seven Indiana utility companies and issue securities, as related in the ELECTRICAL WORLD for Aug. 20, page 384. The corporation's figures were based on the seven-year price average of 1914-1920, but counsel for cities participating in the hearing objected that the average was too high because of war prices. The commission ordered the corporation to make a valuation based on the ten-year price average, without committing itself to the average unit-price theory. Counsel for the corporation contended the reproduction-cost-new basis, but Commissioner Barnard, who presided, indicated that the commission was not bound to accept this theory.

Several valuations of the property were entered as evidence by engineers employed by the merger interests. William J. Hagenah, public utility valuation expert of Chicago, valued the physical property of the Merchants' Heat & Light Company at $11,420,000, which was computed on an average of a seven-year period. In addition to this, the company, he said, has invested $1,400,000 in improvements since 1917, which was not counted in the valuation. He testified that the present value of the Elkhart Gas and Fuel Company is $806,880. He valued the Valparaiso Light Company at $315,864.

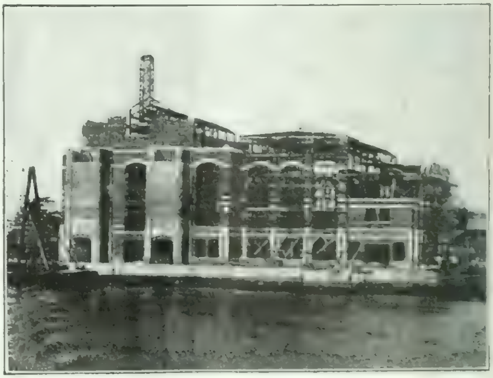
W. A. Vogelback of Chicago, consulting engineer, gave three valuations on the Indiana Railways & Light Company of Kokomo. One, based on the average of construction costs for five years from 1916 to 1921, was $5,161,486. A seven-year average on the property of the same company from 1914 to 1921 resulted in $4,702,670. When asked to submit a spot valuation he fixed $5,541,649, with a reduction of 15 per cent.

Mr. Spooner, the remaining engineer called by the petitioners, offered valuations on the Wabash Valley, Putnam and Cayuga Electric Companies and gave the total, obtained from an average of construction costs from 1914 to 1919, inclusive, as $1,323,000.

Permits Asked for Alaskan Power for Wood-Pulp Production

FRANK C. DOUGHERTY of San Francisco has applied to the Federal Power Commission for preliminary permits covering power developments in Alaska for use in manufacturing wood pulp. One project for a 6,000-hp. plant on the Prince of Wales Island involves the use of the waters of the Karta River at the head of Karta Bay, using Salmon and Little Salmon Lakes for storage. The other projects are for plants on Baranof Islands, one of 6,500 hp. at the Green Lake outlet at Silver Bay, another of like size at Warm Spring Bay on Baranof Lake, and the third of 7,000 hp. at the Second Lake outlet at the head of Cascade Bay.

New 100,000-Kw. Station of Bridgeport Company



A NEW tidewater steam station with an ultimate capacity of 100,000 kw. is rapidly taking shape at Bridgeport, Conn. Growth of load on the system of the United Electric Illuminating Company, coupled with limitations on further expansion at the Congress Street station, necessitated providing the nucleus of a new installation capable of meeting the demands of this important industrial territory for many years to come. At present the structure will house three 10,000-kw. units. It is at Steel Point, close to the load center of the company and within about a half-mile of the older station. Ample space for coal storage and handling is a feature of the new site. Westcott & Mapes, New Haven, are the designing and supervising engineers

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest

Bureau of Standards Issues Circular on Telephone Service.—Circular No. 112 of the Bureau of Standards, entitled "Telephone Service," has been issued and is ready for distribution. It covers telephone plant and its operation, traffic, grades of service, standards, public relations and commission regulation, with a statistical appendix.

Diesel-Electric Engines to Be Installed on New South California Ferryboat.—Announcement comes from Martinez, Cal., that a ferryboat to be built for the Rodeo-Vallejo Ferry Company, with a carrying capacity of 100 motor cars, will have three Diesel-electric engines, which will do away with upper deck works and stacks, thus adding to the area available for passengers and vehicles.

Seattle Firm Buys Wenatchee Plant.—The Wenatchee Valley Gas & Electric Company of Wenatchee, Wash., was sold at receivers' sale on Aug. 19 to the Washington Coast Utilities Company of Seattle for a reported consideration of $600,000. The company has been in receivers' hands since January, 1920. The property whose transfer has just been effected is estimated to be worth about $1,000,000. The Seattle firm was the only bidder.

Promoting the Use of Peat as Fuel.—A Swedish engineer has, according to United States Counsul-General Murphy, stationed at Stockholm, invented new machinery by which the conversion of peat into fuel is greatly facilitated. Reduced to powder or prepared in the form of briquettes, it is said to have been substituted for coal on locomotives with entire success. The Railway Board of Sweden has established one plant for preparing this bog fuel and is contemplating the construction of another one. The danger of the powdered peat exploding has, however, to be guarded against.

Electric Fire Apparatus Has Proved Its Reliability.—Electrically operated equipment for fire departments, though greatly outnumbered by gasoline engines and trucks, has thoroughly proved its dependability in ten different cities, according to the *Edison Monthly*. Eight machines installed in 1912 or earlier are still giving good service. In all sixty-five pieces of electrically propelled fire apparatus are now in use, of which Paterson, N. J., has twenty-one, Camden, N. J., twelve, Philadelphia eleven, Springfield, Mass., six, Grand Rapids, Mich., six, New Bedford, Mass., four, Akron, Ohio, two, and Brooklyn, N. Y.; Newark, N. J., and Baltimore one piece each. Springfield was the first city to install electrical fire-fighting machines, while Philadelphia claims the first "all-electric" fire house in America—one situated in Germantown, where there are long runs and many hills. The captain of this company is authority for the statement that the apparatus has never been out of service because of an electrical breakdown.

Geological Survey Completes Stream-Flow Stations on Duchesne River.—Working in co-operation with the Great Basin Power Company, officials of the United States Geological Survey have reported the completion of three additional stream-flow stations in the Uinta basin country in the State of Utah. The stations are situated on the headwaters of the Duchesne River, one on the west fork, another on Wolf Creek and a third near the Hades reservoir site on the north fork. The installation of the additional measuring stations by the Geological Survey results from the application of the power company to the Federal Power Commission for a right to develop water power at Hanna, Utah.

Supplying Power to Wellington, N. Z.—In connection with the many electrical developments in Australasia, the London *Engineer* reports progress on the important hydro-electric scheme undertaken to supply power to Wellington, New Zealand, to which reference was made in the Current News and Notes for May 21. The power from the source—the Mangahao—will be derived by damming two small rivers, about a mile apart, and connecting them by a tunnel 7 ft. in diameter cut through a hill. The water will then be carried by a second tunnel driven to the face of the hill and then carried by pipe lines to the power house 900 ft. below. Approximately 24,000 hp. will be generated, 12,000 hp. of which will be transmitted to Wellington.

Work of Michigan Committee on Public Utility Information.—In reporting to the recent convention of the Michigan Electric Light Association, Henry H. Tinkham, director of the Committee on Public Utility Information organized in that state, which began work on Jan. 1 last, said that the Michigan committee differed from those in Illinois, Ohio, Indiana and Wisconsin in that it does not issue regular bulletins. The publicity effort is in the line of direct appeal to the newspapers, and greater stress is laid upon building up the organization as an information bureau to serve as an agency through which the people and the utilities can be brought into closer touch. The newspaper mailing list includes about 140 dailies and weeklies, and 8,000 pieces of literature and newspaper articles have been sent out. Announcements, outlining the purposes and ideals of the utilities, were sent to municipal officers, newspapers, state officers, members of the Legislature, board of commerce, libraries, schools, colleges and other bodies.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

American Electrochemical Society.—Two papers announced by this society for its convention at Lake Placid, N. Y., Sept. 29-Oct. 1, are "A New Theory of the Corrosion of Iron," by J. Newton Friend, and "Researches on the Electrodeposition of Iron," by W. E. Hughes.

American Welding Society, Metropolitan Section.—This section will meet in the Engineering Societies Building, New York City, on Tuesday, Sept. 20, when a paper on "Practical Applications of the Electric Arc Welding Process" will be presented by E. Wanamaker, electrical engineer with the Chicago, Rock Island & Pacific Railroad.

A. I. E. E. to Meet with Marine Engineers.—The American Institute of Electrical Engineers will hold its three hundred and seventy-second meeting in the Engineering Societies Building, New York City, on Thursday, Nov. 17, in conjunction with the Society of Naval Architects and Marine Engineers. There will be an afternoon and an evening session. In the afternoon E. D. Dickinson, marine department of the General Electric Company, will give a paper on "Electric Auxiliaries" and W. E. Thau, commercial engineer of the Westinghouse Electric & Manufacturing Company, one on "Electric Propulsion." In the evening Prof. Alfred N. Goldsmith of the College of the City of New York will lecture on "World Communication."

Coming Meetings of Electrical and Other Technical Societies

N. E. L. A., Middle West Division and Nebraska Section—Omaha, Sept. 14 and 15. (For program see issue of Aug. 27, page 436.)

N. E. L. A., Great Lakes Division, and Indiana Electric Light Association—French Lick Springs, Sept. 21-23. (For program see "News of the Industry.")

Association of Iron and Steel Electrical Engineers—Chicago, Sept. 19-24. (For program see "News of the Industry.")

N. E. L. A., Rocky Mountain Division and Colorado Electric Light, Power and Railway Association—Glenwood Springs, Sept. 19-21

West Virginia-Kentucky Association of Mine, Mechanical and Electrical Engineers—Huntington, W. Va., Sept. 20-23.

Electrical Supply Jobbers' Association, Atlantic Division—Philadelphia, Sept. 22

Electrical Supply Jobbers' Association, Central Division — Chicago, Sept. 22 and 23.

Illuminating Engineering Society—Rochester, N. Y., Sept. 26-29. (For program see issue of Aug. 13, page 336).

American Electrochemical Society—Lake Placid Club, N. Y., Sept. 29-Oct. 1.

American Electric Railway Association—Atlantic City, N. J., Oct. 3-7

Empire State Gas and Electric Association—Lake Placid, N. Y., Oct. 6 and 7

N. E. L. A., Southeastern Section—Chattanooga, Tenn., Oct. 17-19

Recent Court Decisions

Findings of higher courts in local cases involving electric light, power and other public utility companies

Damages Sought Because of Injury to Customer from Exploding Lamp Bulb.—A verdict of $1,500 damages awarded to a customer of a central-station company whose eye was injured by the explosion of an electric lamp bulb she had brought to the company's store to exchange and which was knocked from the counter, according to her by the clerk but according to the defense by herself, was upset in the St. Louis Court of Appeals (Cook vs. Union Electric Light & Power Company) and the case remanded because the trial judge had predicated recovery on the doctrine of *res ipsa loquitur*, which the reviewing court held to have no pertinency in such a suit. (232 S. W. 248.)*

Occasional Licensed Diversion of Water Does Not Establish Easement.—In North Powder Milling & Mercantile Company vs. Pacific Fruit Express Company, the Supreme Court of Oregon found against the defendant's claim that occasional use by it of the surplus water leaving plaintiff's ditch by a spillway—the defendant company having in these cases, under a temporary license, obstructed the ditch below the spillway to divert more water—constituted an easement in the ditch or a right by adverse user. An injunction was therefore granted to the plaintiff company, which uses the water to generate electricity for its mill, forbidding the defendant to enter the ditch or tamper with the appliances even though the injury therefrom to the milling company had in only one instance been more than trivial. (198 Pac. 893.)

Liability for Death from Falling Wires of Bather Technically a Trespasser.—A boy bathing in the Harlem River while poised on a springboard anchored on property belonging to a railroad company was killed by a falling cross-arm to which high-tension wires were attached. The trial court dismissed the case (Hynes vs. New York Central Railroad Company) on the ground that as that portion of the springboard which rested on land was on the defendant's property the victim was a trespasser. By a vote of four to three the New York Court of Appeals reversed this finding and ordered a new trial, Justice Cardozo handing down an eloquent opinion in which he declared that a bather in a navigable stream was in the enjoyment of a public highway and entitled to reasonable protection against destruction by an abutting owner's electric wires and that he did not lose his title to protection by going upon a springboard affixed to the abutting property and extending beyond the property line over the public waters where there was no causal connection between his position on the board and his injury from the falling wires. (131 N. E. 898.)

Mortgage on Electric Plants Held to Cover Subsequently Erected Transmission Line Connecting Them.—Where a company owning independent electric generating and distributing plants in several small towns connects these plants by a high-tension transmission line with the object of producing economy and efficiency in operation, the Supreme Court of Nebraska declared, in John A. Roebling's Sons Company vs. Nebraska Electric Company, such transmission line, though extending over property not owned by the company and where it had only a license to go, constitutes an appurtenance to the existing plants and is subject to a mortgage given before the construction of the transmission line which was drawn to cover the plants and their appurtenances and which contained a clause covering additions, extensions and properties to be afterward constructed or acquired. Such a mortgage, it was affirmed, took precedence over a mechanic's lien filed by the firm furnishing the material for the line. (183 N. W. 546.)

Assumption of Risk Question of Fact, Not Law.—Although one who undertakes a hazardous employment assumes the risks ordinarily incident thereto and this modifies the master's obligation to provide the servant with a safe place to work, nevertheless if the danger of an electric shock to a lineman working on his employer's wires was one which the employer could have prevented by the exercise of ordinary care, it was not an assumed risk. So holding, the Georgia Court of Appeals, in Neary vs. Georgia Public Service Company, declared that the trial court erred in finding for the defendant on demurrer, and that the question of assumption of risk was one of fact that should have gone to the jury. In the case at issue a lineman had been killed while working on the company's lines because of contact with a heavily charged wire. It was alleged by the plaintiff that the man had not been informed that the wire was alive, that he was aware that it was the practice of the company to cut off the current when work on the lines was to be done, and that he had been ordered by his superior to do the work and told it was safe to perform it at that time. Although remanding the case for jury trial, the Court of Appeals asserted that if an electric service company could not cut off the current from wires on which work was being done without detriment to the entire service, it could not be called upon to do so. (107 S. E. 893.)

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities

Method of Measuring Statutory Distance Within Which Applicants Must Be Served.—The 100 ft. referred to in a statute requiring an electric light and power company to extend service to an applicant not more than 100 ft. from its nearest transmission line is to be measured, according to a decision of the New York Public Service Commission in a complaint against the receiver of the Richmond Light & Railroad Company, not in a direct line over private property of other persons, but along a course which the company has a right to follow.

Educational Building Upkeep a Proper Charge to Fixed Capital.—The former New York Public Service Commission for the Second District took issue with the contention of the city of Cohoes, in a rate-fixing case where the Cohoes Power & Light Corporation was the other party, that the equipment and maintenance of a so-called educational building, devoted to promoting the efficiency, welfare and *esprit de corps* of employees, should not be charged to the consumers, even indirectly. "The contrary seems to be a proper disposition of the matter," the commission said. "It is in a sense an addition to the compensation paid employees, and the part of plant maintenance for that purpose is a proper item of fixed capital."

Discriminatory Contract Set Aside Notwithstanding Large Expenditure of Customer to Comply with It.—A rate contract by which large consumers receive power at less than cost is unlawfully discriminatory, declared the Maine Public Utilities Commission in adjudicating a complaint against unremunerative rates made by the Lincoln County Power Company, and such a contract must be set aside notwithstanding that the consumer has incurred a large expense in electrifying its mill to comply with the conditions of the contract and that the surrender of a lawful existing contract was a part of the consideration therefor. The chairman of the commission filed a dissenting opinion, holding that the evidence in the case did not prove that the Lincoln County company and the commercial concern with which the contract had been made had either designedly or without full understanding entered into a contractual relation which was an undue burden upon the company or upon other customers, and that before invalidating the contract the existence of such a relation should be clearly shown.

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*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel—Responsibilities and Association Appointments of Men Engaged in Professional, Executive, Operating and Commercial Branches of the Industry

H. L. Sampson, formerly assistant to the power administrator of the Southern California Edison Company, has been promoted to the position of superintendent of station maintenance of that company and will have charge of all repairs and maintenance in its stations and substations. After graduation from the University of Michigan in 1907, Mr. Sampson became engineer-designer for the Board of Supervising Engineers, Chicago Traction. After leaving that position in 1910 he became chief electrician of the South Utah Mines & Smelters Company, remaining there until 1912, when he entered the employ of the Southern California Edison Company in the station maintenance department. He has been continuously employed by that company since that time and has held successive positions as assistant to the superintendent of the Los Angeles district and assistant to the power administrator.

H. L. SAMPSON

Fred R. Miller, vice-president of Roger Miller & Sons, general contractors, Toronto, has been appointed by the Ontario government a member of the Hydro-Electric Power Commission of Ontario in succession to I. B. Lucas.

George B. Cornell, Jr., has been appointed general superintendent of the Yonkers (N. Y.) Electric Light & Power Company. Mr. Cornell became associated with the New York Edison Company as a draftsman in 1907, and in the following year he was appointed chief clerk in the office of the manager of the Bronx district. In 1909 he was made assistant superintendent of the Yonkers Electric Light & Power Company and in 1910 superintendent.

C. A. Malone, formerly of the California-Oregon Power Company, has become assistant superintendent of the Hawaiian Electric Company, Honolulu.

W. F. Fox, Jr., formerly with the Oregon Power Company, has been appointed superintendent of the Nebraska Gas & Electric Company, Plattsmouth, Neb.

A. B. Coryell, who is at present superintendent of power for the Laurel Light & Railway Company, Laurel, Miss., has been appointed general superintendent of the Muskogee (Okla.) Electric Traction Company and the Shawnee & Tecumseh Traction Company, with headquarters at Muskogee. Mr. Coryell has a wide knowledge of the utility field, having had more than thirty years' experience in the construction and management of electric railway, light and power and gas properties. He expects to take up his new duties Sept. 15. His successor has not yet been appointed.

E. S. Jeffries, who has been appointed chairman of the iron and steel industrial committee of the A. I. E. E., is electrical engineer of the Steel Company of Canada, Hamilton, Ont., a post he has held since 1912. Previous to 1907, Mr. Jeffries was engaged in electrical work of various kinds. He was also connected at one time with the Marconi Wireless Telegraph Company. Mr. Jeffries is at the present time president of the Association of Iron and Steel Electrical Engineers. He was born at Alliance, Ohio, July 18, 1887, and was graduated from the Worcester Polytechnic Institute in 1912.

E. S. JEFFRIES

Raymond D. Sherman, until recently superintendent of the Connecticut River Power Company, has been appointed assistant electrical engineer of the Philadelphia Company, Pittsburgh. Mr. Sherman studied electrical engineering at Union University and received his degree in 1906. The following two years he spent in the testing department of the General Electric Company, specializing on steam turbines. During the period from 1908 to 1913 he held various positions, including that of chief operator, with the Schenectady Power Company at Schaghticoke, N. Y. In 1913 he was made electrical superintendent and while in that capacity designed and constructed street-lighting systems for several municipalities. He became superintendent of the Deerfield River Power Company, Readsboro, Vt., in 1918, and soon afterward was appointed to the same position with the Connecticut River Power Company, the largest subsidiary of the New England Power Company and the largest hydro-electric plant in New England, having a generating capacity of 40,000 hp.

R. D. SHERMAN

J. G. Phillips has resigned as general superintendent of the Mobile (Ala.) Light & Railroad Company.

L. C. Bewsey, electrical and mechanical engineer, has been appointed superintendent of the Michigan Railway Company's lines in Kalamazoo, Mich.

Ira W. Fisk has accepted the position of general manager of the Springfield (Ill.) Light & Power Company. Mr. Fisk was graduated from the University of Illinois in 1911, following which he was a member of the electrical engineering department of the University of Illinois for several years. He resigned from an assistant professorship to go to the Drexel Institute of Philadelphia as head of the department of mechanical engineering. Later he associated himself with a New York firm of consulting electrical engineers. During six years of this time he served as consulting electrical engineer for the company of which he is now general superintendent.

Farquson Johnson, who succeeded W. H. Morton on Sept. 1 as secretary-treasurer of the National Association of Electrical Contractors and Dealers, has been for the past two years a close associate of Mr. Morton at headquarters, during which time he has been editor of the association's journal, the *Electrical Contractor-Dealer*. Mr. Johnson has spent the greater part of his commercial life in the printing and publishing business. He founded and for three years edited and published *Ad Sense* at Chicago. He then came to New York to join the Syndicate Publishing Company's organization, of which he became a director and manager of publicity and an executive in the sales department. Later he was assistant editor of *Advertising and Selling*. During the war he was employment director of a government explosives plant, and in 1919, as has just been stated, he became connected with the N. A. E. C. and D. as editor of the *Electrical Contractor-Dealer*.

F. JOHNSON

Charles B. Hodgson, assistant treasurer of the Beverly (Mass.) Gas & Electric Company, has been elected treasurer of that company, succeeding Charles R. Prichard.

Richard Franchot Paige has been appointed secretary-treasurer of the Society for Electrical Development, to fill the vacancy created by the resignation from that office of James Smieton, Jr.

James Cranston, Northwest district manager for the General Electric Company, with headquarters at Portland, Ore., has been made chairman of the electrical committee for the Atlantic-Pacific Highways Exposition, to be held in Portland in 1925.

Harry S. Williams, who was formerly connected with railroad electrification and who on the adoption of electric power by the West Shore Railroad between Utica and Syracuse, N. Y., was made electrical engineer of that property, has returned to the electric railway field as superintendent of equipment of the Detroit municipal street railway system.

R. F. Gooding, formerly associated with Tucker & Laxton of Charlotte, N. C., has recently accepted the position of chief engineer of Winthrop College, Rock Hill, S. C.

F. D. Mahoney, commercial manager of the Alabama Power Company, has been elected president of the Alabama Light and Traction Association.

Theodore Burger, formerly with the Western Electric Company of San Francisco and later with the Baker-Joslyn Company in Los Angeles, has joined the staff of the Society for Electrical Development in New York City.

Parker M. Robinson has been transferred from the East Pittsburgh to the Los Angeles office of the Westinghouse Electric & Manufacturing Company, where he will be steam-power-plant equipment specialist, his territory including the Southwestern States and the northern part of Mexico.

William B. Cooley has been made general sales manager of the Re-Pel-Arc Furnace Company, Indianapolis, Ind., following the purchase by that organization of the interests of the Industrial Electric Furnace Company, Chicago. Mr. Cooley had served as general sales manager of the latter concern. He was graduated from Purdue University, School of Electrical Engineering, in 1917. He was an officer in the First Aero Squadron, A.E.F., and was shot down from a height of 6,000 ft.

W. E. Freeman has been appointed acting dean of the University of Kentucky, Lexington, Ky., to serve during the absence of Dean F. Paul Anderson, to whom a year's leave of absence has been granted. Dean Anderson will direct the work of the research laboratory of the American Society of Heating and Ventilating Engineers in the Bureau of Mines, Pittsburgh, Pa. During the past year Mr. Freeman has been supervisor of commercial training with the Westinghouse Electric & Manufacturing Company at East Pittsburgh. From 1911 to 1920 he was head of the department of electrical engineering at the University of Kentucky, and from 1904 to 1911 he was in the telephone engineering department of the Western Electric Company at Chicago and New York.

Al. Dusseau, who has been appointed manager of the Electrical Supply Company of Toledo, is returning to the scene of his earlier business career. For the last six or seven years Mr. Dusseau has been connected with the Commercial Electrical Supply Company of Detroit, where for the greater part of the time he was the company's purchasing agent. Prior to that he was engaged in the electrical contracting business. He is well known both among electrical supply manufacturers and among the contractors and dealers.

AL. DUSSEAU

Obituary

Llewllyn Owen, for the past twenty years in the employ of the Central Illinois Light Company and its predecessors at Peoria, Ill., died on Aug. 21 after an illness of only a few hours. For eight years Mr. Owen had been the electrical department superintendent. He was widely known among the men of the industry in Illinois and the other Middle Western States.

William W. Lighthipe, since 1905 an expert engineer with the Otis Elevator Company and recently manager of the special sales division of that company, died in Brooklyn, N. Y., on Aug. 7. He was born in Vincentown, N. J., in 1876 and was graduated from Columbia University in 1898. He began his work with the Sprague Elevator Company in the latter year, becoming its general superintendent two years later. From 1901 till 1905 he was with the Marine Engine & Machine Company of New York. Mr. Lighthipe was an associate member of the A. I. E. E. and also belonged to the American Society of Mechanical Engineers.

Epes Randolph, formerly vice-president and general manager of the Los Angeles Railway and the Pacific Electric Railway, who was instrumental in building and operating 700 miles of electric lines in Los Angeles and its vicinity and who was widely known as a pioneer railroad man in the Southwest, is dead.

Frank J. Kastner, only recently appointed manager of the Omaha supply house of the Western Electric Company, died suddenly of heart disease in that city on Aug. 24. Mr. Kastner entered the employ of the Western Electric Company in Chicago as a stenographer in 1899. He was later put in the stockroom as a selector and was advanced from that post to buyer for the telephone department. In 1914 he was made assistant stores manager and held this position until his appointment to the Omaha house.

Trade and Market Conditions

Business Reviews, Together with Market Letters from Important Trade Centers, on the Supply, Demand and Prevailing Prices of Electrical Apparatus and Supplies

Increased Buying and Production of Electrical Sheets

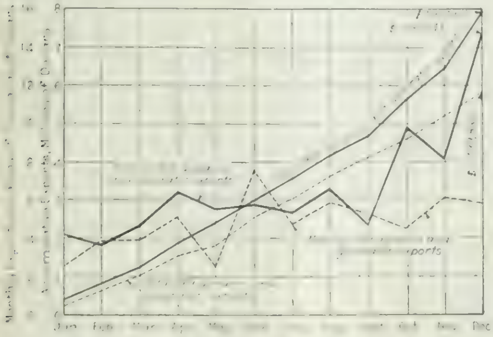
ALTHOUGH all producers of electrical sheet steel do not hold to the same opinion concerning the present market for that material, still from certain quarters it is learned that since Aug. 1 there have been better orders placed for sheets. It is felt in this branch of the semi-finished material market that a returning buying movement is about due to break. Buying this spring and summer has been on such a low scale that stocks of sheets held in electrical apparatus manufacturers' hands probably are at a low level and need replenishing.

Prices of electrical sheets have declined at least twice this year and are now on a basis which is about 40 per cent lower than the prices of May, 1920. The base price of black sheets at Pittsburgh is 2.75 cents at this time, while one year ago the base price was 7.50 cents. The labor factor in the treating process to get electrical sheets has, however, not decreased in any such proportion. Manufacturing costs are said to be at bottom under present conditions of labor, raw material and freight.

Mill capacity has been increased in some instances during the last three weeks, and certain mills have been reported running to capacity over periods of a week or so on electrical sheets.

Generator Exports for 1920 Stand Third in List

WHEN the year 1920 came to a close the exports of dynamos and generators from the United States amounted in value to $7,937,935, as against $5,799,885 for the calendar year 1919. This gain of more than $2,000,000 represents an increase in exports of approximately 37 per cent for 1920 over 1919. The only single items in the list of 1920 exports which exceeded in value those of dynamos and generators were the items of motors and insulated wire and cable. In 1919 exports of batteries just exceeded those of dynamos and generators.



EXPORTS DURING LAST THREE MONTHS OF 1920 SHOW CONSPICUOUS INCREASE

An analysis of these markets yields some interesting results. Japan took the greatest amount, in value $1,402,984, while British India and China were very close together, with $798,142 and $713,532 respectively. From the attached list of twenty-three countries, each of which imported dynamos and generators from the United States in excess of $50,000, Hong Kong is the only other Asiatic community shown. The sum total of these exports taken by Asiatic countries amounts to more than $3,000,000, or 38 per cent of the total exports of dynamos and generators in 1920.

European countries imported only about half of this amount, or 20 per cent, the total figures amounting to $1,577,000. This total, however, was divided up between seven different countries. Canada and Cuba both stood high in the list of North American countries and with Mexico imported a total of $1,530,000 worth of dynamos and generators, 19 per cent of the total exports from the United States.

DYNAMO AND GENERATOR EXPORTS IN 1920

Japan	$1,402,984	Philippine Islands	$138,601
British India	798,142	Hong Kong	104,279
China	713,532	Colombia	86,440
Canada	684,584	Dutch East Indies	83,370
Cuba	637,365	Belgium	72,771
France	614,967	Argentina	70,866
Chile	314,804	British South Africa	70,470
Spain	282,344	Uruguay	69,531
Italy	244,539	Sweden	51,280
Mexico	208,514	Sixty other countries importing dynamos or generators	617,778
Brazil	192,613		
Australia	166,897		
Norway	161,476		
England	149,788	Total	$7,937,935

Five of the South American countries took a total of $734,000 in this material, 9 per cent of the total, and the islands southeast of Asia took in $389,000 worth, or 5 per cent of the total.

The sixty other countries importing dynamos and generators but in amounts less than $50,000 each make up a grand total of $617,778, or an average of a little better than $10,000 each.

These figures were compiled by the ELECTRICAL WORLD from data obtained from the Bureau of Foreign and Domestic Commerce.

Pacific Coast Business Indicates Improvement in Early Fall

ALL OF the indications point toward a very satisfactory jobbing business on the Pacific Coast in the fall. Although jobbers and contractors are almost unanimous in agreeing that present and prospective business will not equal that of the past two or three years of exceptional activity, even the most conservative ones are convinced that the business in the fall months will approximate at least 90 per cent of what could be called "normal."

In the Pacific Northwest the electrical trade depends upon the resumption of activity in the lumber, mining and agricultural interests. Following national prosperity the lumber industry will regain its former position only as building throughout the country is resumed. A number of the lumber companies are considering the electrification of their properties in order to reduce the cost of production. Actual work, however, is not anticipated until the market for lumber returns. Among the mining interests in the Northwest, together with those in the Intermountain States, gradual lowering of labor costs will doubtless facilitate the resumption of mining activities. In general the agricultural situation in the Pacific Northwest is satisfactory. Large shipments of grain are being made, and the banks are having much of their farm paper taken up. In fact, the banks in the Pacific Northwest are at the present time holding up large amounts of capital. Bank credits are being extended very grudgingly, apparently to the detriment of industries in that section.

Electrical sales in the Northwest are considerably below those of last year, although it is reported that the number of orders is greater than twelve months ago. The average value of each order is, however, slightly increasing, and if the rate of increase is maintained it is confidently expected that the business of the fall will equal 75 per cent of last year during the same period.

In California as a whole the power companies are making noteworthy additions to their generating capacity but do not seem to be pushing the sale of power with the vigor of former years. This is being felt by the jobbers. The power companies in San Francisco are making an intensive drive on the sale of large energy consuming devices such as ranges and water heaters. The interest created in these campaigns will be felt only after a considerable period, but general stimulation in the sales of household devices will doubtless follow. In southern California industrial and residential building continues. Industrial expansion is proceeding rapidly and a good market for electrical material is found in this quarter.

A decrease in electrical apparatus and supplies for oil companies has been noticed because of the decreased activity in the Southern California oil fields resulting from a materially lessened consumption of oil. The motion picture industry of Los Angeles has become almost stationary. Unless the tremendous payroll and program of expansion of this industry are soon resumed, southern California will feel the effects seriously.

As about one-fifth of the electrical business in California is in the agricultural districts, the situation in these quarters has a material bearing on the market for electrical supplies and apparatus. The expected increase in the electrical load in the agricultural districts was not reached this spring, and it is thought that the coming winter and spring will see more than the usual activity along these lines.

New Tax Law Would Exempt Foreign Trade Income

A FEATURE of the revised tax bill which passed the House of Representatives on Aug. 20 and which, it is expected, will be brought before the Senate after the end of its recess on Sept. 21, will react to the benefit of Americans engaged in business in foreign countries. United States citizens and domestic corporations under the present law are taxed on their entire net income from whatever source derived, and this, of course, includes income from foreign business. The new bill would tax American business concerns or individuals only on such part of their income as is derived from domestic business when 80 per cent or more of their income is derived from sources without the United States and 50 per cent or more of their income is derived from the active conduct of a business without the United States.

Foreign states have been and still are exempt from taxes on their own foreign business, and if this provision is incorporated in the new law it will relieve American concerns from some of the expense of doing business and enable them better to compete in foreign fields. Several American manufacturers of electrical materials have extensive foreign holdings.

German Manufacturers Again Cultivating American Market

"MADE-IN-GERMANY" goods are again making their appearance on the American markets. Nor has the electrical market been missed, although for the most part German-made articles found there are small products that do not involve intricate production methods. In engineering machinery the Germans have found themselves unable to accommodate all the markets that they have been cultivating. On the other hand, they continue to seek business.

Already there is in the field a publication printed in English, which is designed purely to create a market in English-speaking countries for German engineering machinery. Among the products advertised in a single issue can be found electric furnaces, storage batteries, Diesel engines, boilers, economizers, insulated wire and cable, electrical equipment of all kinds, elevators, hoists, electrical steel, electrical conduit and schedule material, rotary converters, wire rope, steam equipment and accessories, transformers, meters and time switches.

Current Copper Consumption at Rate of 62 per Cent of 1920

ALTHOUGH consumption of copper is gradually increasing, it is still far below the consumption of last year. Even with electrolytic copper quoted at 12 cents for spot shipment, delivered—and a month or so ago it was quoted at a fraction under 12 cents—this low figure in itself has not been sufficient to start any heavy buying movement. The last time the metal touched 12 cents was in 1914.

The *Boston News Bureau* has published a table on copper consumption in the various industries, taking the consumption figures in pounds for 1920 and estimating those for 1921, following their present rate:

	1921	1920
Electrical manufacturers	260,000,000	340,000,000
Telephones and telegraphs	85,000,000	100,000,000
Wire not included elsewhere	110,000,000	190,000,000
Automotive industries	54,000,000	99,300 000
Railway locomotives and cars	14,000,000	17,600,000
Shipbuilding	24,000,000	71,500,000
Buildings	40,000,000	53,400,000
Ammunition	14,000,000	23,400,000
Bearing metal for steam railways.	40,000,000	45,000,000
Other uses	100,000,000	197,200,000
Exports of copper manufactures	64,000,000	164,000,000
Total	805 000 000	1 301 400 000

Metal Market Situation

COPPER has strengthened in tone considerably during the last few days and is commanding a firmer price. Electrolytic may be purchased from certain producers at 12 cents, delivered, for spot and September but the ruling price is nearer 12.12½ cents per pound, delivered; October is holding about 12.25 cents. Under the feeling that a generally higher price will soon be ruling for the metal there seems to be no great desire among producers or the outside sellers to force sales at these prices and the outside price appears to be a fraction higher than shown above.

Buying has held up pretty well and there is a better feeling in the trade that the low valley of sales has been reached and passed and that business is on the up-grade again. Foreign shipments are holding up well, sales to Germany being particularly prominent. Electrolytic copper, f.a.s., is being held at a fraction better than 12 cents in New York. Standard copper in London presents still a firmer tone than it did a week ago, standing at £68 17s. 6d.

Official lead price on Sept. 2 was advanced 10 points to 4.50 cents, New York, and demand is good.

NEW YORK METAL MARKET PRICES

	Aug. 30, 1921	Sept. 6, 1921
Copper	£ s d	£ s d
London, standard spot	67 12 6	68 17 6
	Cents per Pound	Cents per Pound
Prime Lake	12 25	12 00
Electrolytic	12 00	12 12½
Casting	11 50	11 62½
Wire base	13 25 13 50	13 50
Lead, Am. S. & R. Co. price	4 40	4 50
Antimony	4 50	4 45
Nickel, ingot	41.00	41.00
Sheet zinc, f. o. b. smelter	10 00	10.00
Zinc, spot	4 62½	4 70
Tin	26 87½	27 25
Aluminum, 98 to 99 per cent	24 50	24 50

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	9 50—10 00	9 50—10 00
Brass, heavy	4 50— 4 75	4 50— 4 75
Brass, light	3 75— 4 00	3 75— 4 00
Lead, heavy	3 25— 3 37½	3 25— 3 37½
Zinc, old scrap	2 00— 2 25	2 00— 2.25

THE WEEK
IN TRADE

Prices When Quoted Are Those Prevailing at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

THE underlying tone in the market this week is better than it has been, and in the New York territory the reports show a little better buying movement. In the Southeast the short cotton crop is causing higher prices, and this is leading to the expectation of more money to go into circulation. Here wire, vacuum cleaners, fixtures and cross-arms are moving well. Coal mining is increasing in the Intermountain region, and in St. Louis territory wheat movement for July far outstripped that of July, 1920. Meters are showing greater activity there.

New England shows better trade in lighting fixtures and a better tone in the general equipment market. Special prices are attracting trade in the Chicago market, and lower prices are ruling on washing machines. Collections are improving there and in Boston. The West Coast is pushing range and water-heater sales. Lower prices are reported on certain schedule materials, the reduction being about 22 per cent.

NEW YORK

A much better tone to business was reported by the jobbers this week. The optimistic feeling is not based on a prospective improvement but on an actual increase in the amount of stock moved. One jobber stated that the quantity of business transacted during the past week was fully 10 per cent greater than at any time during the summer, and there is no indication that the present activity is only a spasmodic flurry. Furthermore, the movement has not been confined to any one class of material. Heating appliances are moving better and the demand for washing machines and vacuum cleaners has improved. Wiring material, conduit, armored conductor, rubber-covered wire and so forth are moving steadily, although orders are for moderate-size quantities.

A drop in prices amounting to about 22 per cent on some schedule material became effective on Sept. 1. Although the new prices do not affect the entire list, many of the principal items, such as sockets, rosettes, push-button and snap switches, receptacles, switch plates and entrance switches, are included. The new discount on this material is about 40 per cent off list in standard packages as compared with 23 to 25 per cent formerly quoted.

The renewed activity in heating devices has brought about a temporary shortage of some devices. There is a scarcity of flatirons, and it was stated that orders totaling 16,000 in New York City alone remain unfilled. Jobbers' stocks are not large, and manufacturers have advised early placing of orders to prevent a shortage later on.

Little change was reported in collections, some jobbers stating that they are slow and others that they are "only fair."

Conduit.—There has been virtually no change in the quotations on conduit during the past week. The following prices were quoted: For ½-in. black pipe in 2,500-ft. lots, $54 to $55; ¾-in., $70 to $73, and 1-in., $106 to $108. Galvanized pipe in the same sizes was quoted as follows: $60 to $63, $78 to $82 and $116.96 to $118.65. Demand is fairly steady and orders are for moderate size quantities. Stocks are fair to good considering demand but would be quickly exhausted if contractors' requirements increased only moderately.

Flexible Armored Conductor.—This material is moving steadily but without any increased demand. Prices remain unchanged. No. 14, two-wire, single-strip was quoted at $45 to $47 per 1,000 ft. in 1,000 ft. lots. Stocks are ample to meet demand.

Rubber-Covered Wire.—Demand continues to be light but consistent, most buying being of a hand to mouth nature. No. 14 rubber-covered in lots of 5,000 ft. is quoted at $6.25 to $6.50 per 1,000 ft.

Loom.—Recent changes have lowered the price of this material. The $\frac{7}{32}$-in. size is quoted this week at $17 to $18 and the ¼-in. size at $19.50. Demand is light and stocks are kept low.

Lamp Cord.—Stocks are good but demand is light. No. 18 cotton twisted was quoted at $12.50 per 1,000 ft., and No. 18 parallel at $16.85 per 1,000 ft.

Schedule Material.—A revision of discounts effective Sept. 1 has lowered the prices of some material 20 to 22 per cent. The principal items affected are key, keyless and pull-chain sockets, push-button and snap switches, switch plates, receptacles, rosettes, entrance switches, plug cutouts and fuse plugs. The new discount in standard package lots is 40 per cent as compared with 23 to 25 per cent formerly.

Outlet Boxes.—Additional discount was announced this week on outlet boxes. The new discount on black boxes in standard package lots is 60 per cent against 55 per cent formerly and on galvanized boxes 55 per cent as against 50 per cent.

Heating Appliances.—The looked-for activity in heating devices has made its appearance and jobbers report that grills, percolators, curling irons and other appliances are moving. The previously reported shortage of flatirons continues and jobbers state that there is a scarcity of some other appliances. Stocks are only fair and manufacturers' stocks are said to be only moderate.

CHICAGO

There has been more improvement in the frame of mind of local jobbers and manufacturers during the past week than there has been in actual business conditions. Some betterment is looked for in September as the fall buying season commences, and the general feeling is that the worst is past and that a gradual improvement will take place from now on. Stocks of most items are very large, but with inventories reduced this condition is no longer a source of much worry though movement in every line is still slow. Retailers report that the public is still shopping and that special prices attract trade while regular lines move stiffly. The Commonwealth Edison Company shows large iron sales in the last three months, due to sales campaigns, but other appliances are quiet.

Seemingly as an appreciation of this attitude of the public, substantial decreases on washing machines and ironers are beginning to make their appearance. Two makes of washing machines which until recently had been retailing around $140 are now selling around $110. Slightly better business followed preliminary cuts around the first of July, and it is hoped that the present large decreases will awaken a corresponding demand. The drop on one make of ironer has totaled $50 in the last sixty days, bringing the retail price down to $175.

Collections have improved, one jobber reporting them around fifty days while he is receiving 25 per cent of the amount due on account on each first of the month. Other jobbers, while not as fortunate, report conditions bettering. Chicago accounts appear to be settled more promptly than those out of town because construction is opening up more in Chicago than in smaller towns and cities.

Flexible Armored Conductor.—Sales have been slightly lower than they were in July, but the recent total of building permits has made the market firmer and prices have not changed. Stocks are uniformly large. No. 14 is quoted at $47 per 1,000 ft. for the two-wire single-strip.

Farm-Light Plants. — Jobbers report improvement in sales during the last thirty days, though business is still far from normal. Several dealers interviewed were optimistic concerning prospects for sales during the fall on account of the better liquidation of farm products in the last two months. Although the farmers in this territory have lost money on the 1920 crops which came into the market this summer, nevertheless they have more cash than they had in the last year.

Locust Pins.—Movement has been very slow, though inquiries have picked up recently. Not a great deal of business is expected this fall, however, as utilities are not doing much beyond maintenance work. Prices are fairly steady, the 1½ x 9-in. pin selling for $39 per 1,000.

Wire.—Quotations are back to the 15-cent base, but there is little activity. A few small orders for magnet wire have reached jobbers. Sales of both weatherproof and rubber-covered wire are small.

Lamps.—Business has not started to pick up yet on the approach of the longer hours of darkness. Lamps for residence use are doing better than those of large wattage for industrial purposes. Dealers are ordering very little, apparently being completely stocked.

BOSTON

Trade held up unexpectedly well last week in view of the closing vacation season. Price movements in wiring materials were sharp in some cases, and a better tone to the general equipment market was evident. Collections are still well maintained and stocks are weekly becoming better liquidated. Some complaint was heard at the week end that recent price drops in schedule material narrowed the jobber's profits materially. Increased activity in the fixture field presages a wholesome fall trade, it is believed. It will be a great surprise if the volume of business handled by distributers does not grow substantially through the rest of the year. Labor conditions continue easier with the exception of the Providence (R. I.) section, where reports of unwillingness to accept an 85-cent-per-hour rate for wiremen are current. New building enterprises have not yet hit their stride in New England, but the textile industries appear to be gaining generally in orders. The outputs of at least two large central-station systems are reported to be within a few per cent of the corresponding figures of this time last year, and some plants are handling a perceptibly increased business.

Wire.—Little change in prices is noted, but on good-sized orders quotations are open. Stocks are in easy volume for business expansion. No. 14 rubber-covered sells at $6.25 per 1,000 ft. in 5,000-ft. lots. Weatherproof base is about 14½ cents, with moderate sales.

Motors.—The market is spotty, inquiries showing some improvement and sales, too, in some agencies. Prices are firm. Little business of old-time dimensions is going upon the books and such trade as is obtained is of a very diversified character.

Fixtures.—Leading houses report a healthier tone to the fixture market running back three to four weeks. Stocks are in shape to meet active fall trade in most cases. Prices are sharply competitive on bids for building jobs.

Fans.—Another retail spurt was experienced at the week end owing to hot weather. Little life in fans is now evident in jobbers' places, however.

Flexible Armored Conductor.—Sales are proceeding on a conservative basis with satisfactory stocks and some price fluctuations where orders appear larger in prospect than hitherto. In 1,000-ft. lots No. 14 single-strip commands $50 per 1,000 ft.

Schedule Material.—Pull sockets underwent a sharp drop last week, representative lines selling at 40 cents each in less-than-carton lots, 35 cents in cartons and 31½ cents each in case lots. Leading receptacles are quoted 16 and 22 cents in case lots. Fuse plugs also weakened in price last week.

Tape.—With moderate demand prices reflect weakness. A representative tape sells at 50 cents per pound on less than 25-lb. lots, 40 cents on 50-lb. to 100-lb. orders, and at open prices on 100 lb. or over. Small wiring jobs are causing some movement at present.

Bushings and Lock Nuts.—Prices are unsteady, though the demand is light. On orders of $10 to $50 list the discounts on ½-in., ¾-in. and 1-in. sizes is now 70 per cent, all other sizes moving at 60 per cent off.

Tubes.—Light demand is reported with prices quiet. The 3-in. by 5/16-in. size is moving at $4.60 per 1,000 in barrel lots. "Nail-it" knobs are selling at $13.10 per 1,000 in barrel lots.

ATLANTA

The most notable event of months past is the sudden increase in the price of spot cotton, the local market reaching the new high mark of 16¼ cents, an increase equal to approximately $30 a bale over the quotation of a month ago. It is freely predicted that with the present market trend the price will reach 20 cents within the next thirty days. This sudden increase in price is traceable to the government's cotton-condition report of 7,037,000 bales, which is only 49.3 per cent of the normal yield. Cotton cloth has risen sharply in sympathy, and virtually all the textile mills in the Southeast are back on full-time operation. This condition has been even further bettered by the settlement of the cotton-mill operatives' strike in the Carolinas. The cotton handlers in New Orleans, however, went out on strike last week, and this will tend seriously to embarrass the New Orleans market unless their differences are quickly settled. The improvement in the cotton situation is strongly reflected in the wonderful betterment of the business morale of the entire section, most of the pessimism so noticeable during the last few months having been swept aside.

Building in all of the larger Southern cities is on the increase, Nashville reporting the greatest value of permits for August on record, while neighboring cities show heavy increases over the past four years. As yet the improvement has hardly had time to be reflected in the jobbing and contracting business, but wideawake firms are preparing to take the necessary steps to meet the demand for building material that is sure to result from the construction of homes and commercial buildings, and they are also beginning to place orders for fall and winter requirements. Heating devices are showing some activity for the first time in several months.

Vacuum Cleaners.—An increased activity is in evidence, and jobbers have been able to reduce their stocks to a fair volume. Little or no recent change in price is to be noted, and the demand is expected to continue strong during the fall.

Washing Machines.—This line continues dormant despite recent price reduction of approximately 10 per cent. Jobbers' stocks are heavy.

Cross-Arms.—Standard fir arms are moving rapidly and local stocks are less than for several months past; in fact, some firms are ordering heavily to replenish depleted stocks. No recent price changes are reported.

Flexible Armored Conductor.—The local market is badly upset by some heavy price cuts, with the result that quotations are ranging from $55 to $60 per 1,000 ft. The volume of sales is fairly satisfactory, but most of the business is going to the so-called "outside firms." Local stocks are in good shape.

Fuses.—Industrial plants are making many inquiries for quotations on the renewable type, and indications are that the movement of this type will be satisfactory within the next ten days. As usual, plug fuses continue steady in demand.

Fixtures.—Both the residential and commercial markets are experiencing a considerable boom, but no particular type or style seems to hold any marked preference, purchases ranging from the cheap to the expensive. This is the natural aftermath to the heavy building activity noted this summer.

Heating Devices.—Jobbers report inquiries and orders considerably improved in both hollow ware and irons. Air heaters, however, continue very dull.

Wire.—Brisk sales of wire are reported for the past week, particularly in No. 12 and No. 14 rubber-covered. Weatherproof is also showing improvement in the sizes of No. 6 and No. 12.

ST. LOUIS

That business has now a better tone is the general comment, although the volume and nature of business show no appreciable change when compared with the last few months. Buying continues on a necessity basis, the number of orders being large though the average size is considerably smaller than in past seasons. According to a report of the Federal Reserve Bank of St. Louis, there was a decrease of 26 per cent in employment between July 1, 1920, and July 1, 1921, in the St. Louis district. An encouraging development has been the heavy movement of farm products to the market. This is especially true of wheat receipts of which at St. Louis in July totaled 9,767,576 bushels, an increase of 5,496,000 bushels over the corresponding month in 1920. The proceeds thus obtained will have a direct effect upon the purchasing power of this district, which in turn is expected to have its effect in liquidation of indebtedness with the banks and merchants. The universal report now is that settlements on current purchases are prompt, but there is backwardness in liquidating extended accounts. The latter situation, however, shows some improvement.

In the electrical industry the week shows no marked developments. Materials for residential work continue fairly well in demand. The erection by the government of a hangar in Belleville, Ill., is increasing interest in industrial materials. Some building has been started by industrial concerns, but most of them are postponing building until costs are lowered.

Wire.—Quotations of $6.10 per 1,000 ft. continue for No. 14 rubber-covered in 10,000-ft. lots. For 5,000 ft. lots the price is $6.40. Weatherproof this week is being sold at a base of 15 cents per pound and bare wire at a base of 15½ cents. Except for No. 14 rubber-covered, movement is comparatively slow. Stocks are reported to be improved.

Non-Metallic Flexible Conduit.—The $\frac{7}{32}$-in. size loom is being quoted at $18.50 per 1,000 ft. in 1,000-ft. lots. Only a fair amount of business is being done and jobbers have their stocks well in hand.

Porcelain.—Some improvement in demand is reported by a number of jobbers and stocks have as a rule been fairly well reduced. The following representative prices are obtaining: "Nail-it" knobs, glazed, $17 per 1,000 in barrel lots, and unglazed, $16.49; 2½-in. tubes, $4.72 per 1,000 in barrel lots; two-wire cleats, $12 per 1,000 in barrel lots.

Dry Cells.—A number of companies report somewhat better business, but the demand has been good for some time. The regular cell is priced at 31 cents and the igniter at 32 cents, both in barrel lots. Stocks have been maintained at normal value.

Tape.—Varying prices are found, ranging for the rubber from 36 to 40 cents per pound and for the friction from 38 to 40 cents per pound, both in 100-pound lots. Stocks are being maintained on a low basis and movement is reported to be attractively good.

Vacuum Cleaners.—The demand is showing some improvement. One jobber has stimulated sales by special efforts, and another has instituted a special reduced price campaign, reducing the retail price from $55 to $36 and offering liberal time payments.

Meters.—A steady demand, materially better than a few months ago, is reported. The call is almost entirely for the residential lighting type. Larger sales in Missouri and Illinois are now reported.

SAN FRANCISCO

Following the building trades settlement, incorporating the American plan of open shop, there is a strong note of optimism for the future, and next spring should see a great amount of construction under way. The value of the building permits issued in the three principal California cities during the month of August is as follows: San Francisco, $1,216,937; Oakland, $1,852,609; Los Angeles, $7,015,861. The value for the corresponding month of 1920 was: San Francisco, $1,517,916; Oakland, $672,074; Los Angeles, $6,870,312.

Ranges.—The principal topic of discussion at the last state contractors' meeting was the best method of marketing electric ranges and water heaters. With all the new power now or shortly available this is an important question. There are two suggested methods, one of which has already been made effective by the Great Western Power Company. The latter method is for the power company to bear the burden of the missionary work and the actual selling, giving an approximate commission of 10 per cent to the electrical dealer who furnishes the lead. The devices are to be sold at cost prices. The other method, which is sponsored by the Pacific Gas & Electric Company, is that the dealer should be encouraged to handle the sale throughout with a commission of approximately 28 per cent on a cash sale.

SEATTLE

It is difficult to point specifically to any pronounced improvement in local business conditions over a few weeks ago, yet it is apparent that at present a far more optimistic state of mind prevails than formerly. The basic industries of western Washington which constitute the business barometer have shown improvements during recent weeks. Lumber shipments have been picking up. This is particularly true of Japanese shipments, which for the first six months of 1921 show an increase of about 31 per cent over the corresponding period of a year ago. The port of Seattle reports a gain in both foreign and domestic commerce in July of about 12 per cent over June, according to figures recently given out. Washington's coal-mining industry is again beginning to produce, and Washington coal is appearing on the local markets in quantity for the first time since last March. The small fruit season, now about over, has been good. The potato crop is about ready and is also good.

Building operations in Seattle continue to go forward in considerable volume. More than 1,100 permits were issued in Seattle during August, with a total valuation of $1,340,430. The total number of permits as well as their valuation exceeded the figures for the same month a year ago. In August, 1920, permits numbered 904 and total valuation was about $1,072,000. In the electrical business jobbers report a fair demand in most lines. Among the lines showing greatest activity are lighting plants and pumping equipment for farm use. These have picked up considerably during the last few weeks, and it is expected that September will see further gain.

SALT LAKE CITY—DENVER

A feature of the past week is the resumption on a larger scale of coal mining in all of the coal fields of the Intermountain region. This puts thousands of men back on the payrolls, and the effect is sure to be felt in the way of a better market for various necessities. While farmers have little cash on hand after meeting payments on their notes and other liabilities, yet they are showing a marked disposition to meet their needs of long standing. Electrical appliances are slightly more in demand than they were a month ago with every indication of a still better market after the lapse of a few more weeks. The railroad shops are employing more men, while the lumber industry is quieter, owing to an overstock in most lines. Small building projects are continuing at a good rate with several big construction jobs now in sight. The Utah Steel Corporation has decided on an extension of its plant that will involve an outlay of $3,000,000.

Air Heaters.—The sudden advent of cool evenings has created a flurry in the air-heater market. Dealers are beginning to make inquiry and jobbers are well prepared to meet all orders.

Flatirons.—The advertising of materially reduced prices on all weights of flatirons has had a good effect, and buying has been resumed.

Ranges.—The central-station companies are encouraging the installation of ranges as a means of finding an adequate outlet for surplus power occasioned by the shutdown of the copper plants. After checking the sales for the summer they report a considerable increase in the use of electric ranges.

Manufacturers' Activities

Devoted to the Business Side of Manufacturing, Distribution and Sales, News from Jobbers and Foreign Fields and a Record of New Devices and Trade Literature

Fall Meeting for Radio Section Set for Sept. 22

The fall meeting of the Radio Apparatus Section of the Associated Manufacturers of Electrical Supplies will be held in the association rooms at 30 East Forty-second Street, New York City, on Sept. 22. Cost accounting is one of the main questions which will be discussed as it is felt in this new industry that this is one of the most important factors of production that can be well studied.

Royal Cleaners Being Made in Canada

Manufacture of Royal electric cleaners is being undertaken by the Continental Electric Company, Ltd., Toronto, Canada. This company is a corporation operating under a Dominion charter and entirely separate from the P. A. Geier Company, Cleveland, but it has a contract with the P. A. Geier Company giving it the exclusive manufacturing and selling rights for Royal products throughout the Dominion of Canada. Under the terms of the contract the Continental company is required to adhere to the engineering policies and standards of manufacture prescribed by the P. A. Geier Company, so that the products of the two companies will at all times be identical, according to advices from the latter company.

The Royal products will be manufactured in a newly equipped plant at 507-511 King Street East, Toronto, and advertising and selling will be handled entirely by the Continental company.

Attachments Sell Well in Apex Vacuum Cleaner Contest

In the Apex vacuum cleaner sales contest just completed by the Apex Electrical Distributing Company, Cleveland, a high record was made in the ratio of attachment sales to cleaner sales. About ten salesmen sold 100 per cent attachments, but their sales were under fifteen cleaners each and so did not figure in the prizes. Two contestants who sold about seventy cleaners each during the contest made a figure of 98 per cent attachment sales. Five other salesmen made 97 per cent attachment sales, and fifteen more made over 90 per cent attachment sales.

The contest was conducted among more than a hundred of the company's "livest" dealers in the smaller communities throughout the country. These dealers had agreed to use ten inches per week of local newspaper advertising space, to which the Apex company was adding fifteen inches of copy on its cleaners, and the salesmen of these dealers competed for the prizes based on the highest number of points, cleaners and attachments each being of the same value in points, and with a special prize for high ratio of attachments.

Further Announcements of A. M. E. S. Section Chairmen

Announcement of further new officers of several sections of the Associated Manufacturers of Electrical Supplies is made as follows: Knife-Switch Section, J. H. Trumbull, Trumbull Electric Manufacturing Company, chairman, and T. A. McDowell, Westinghouse Electric and Manufacturing Company, secretary; Panelboard and Switchboard Section, C. E. Wilson, Sprague Electric Works, chairman, and F. T. Wheeler, Trumbull Electric Manufacturing Company, secretary; Attachment Plug Section, A. H. Fleet, Cutler-Hammer Manufacturing Company, chairman, and F. T. Wheeler secretary; Lamp Receptacle and Socket Section, H. R. Sargent, General Electric Company, chairman, and H. J. Morey, Pass & Seymour, secretary.

Fixture Business Shows Decided Spurt, Says Boston Jobber

A gratifying increase in fixture sales within the past week has been noted by M. W. Vye, vice-president McKenney & Waterbury Company, Inc., Boston. Mr. Vye informed the ELECTRICAL WORLD that three good-sized jobs have been secured for public building lighting within the last few days and that inquiries are much more active. Business is now running at least 50 per cent above that of a fortnight ago as a result of vigorous sales effort. Customers appear more satisfied with existing prices than for some time. Competition is alert and the outlook seems good for a fairly busy fall trade.

New Engineering and Construction Firm in New York

Edmund L. Barto and Harry J. Phillips have formed the Barto-Phillips Company, engineers and builders, with offices at 280 Madison Avenue, New York City, to engage in the engineering design, construction and exportation of all classes of industrial buildings, including powerhouse and equipment requirements. Mr. Barto was formerly sales engineer and Mr. Phillips chief engineer of the New York office of the Austin Company

Cooper Hewitt's Fire Does Not Interrupt Shipments

While the Cooper Hewitt Electric Company, Hoboken, N. J., lost its storage warehouse at Adams and Ninth Streets by fire on Aug. 30, advices from the factory state that there will be no interruption or material delay in meeting the demand for the standard products of the company. The warehouse was used for the storage of both raw materials and the finished auxiliary parts for the Cooper Hewitt lamp outfits, including industrial lighting, motion picture and photographic, but no manufacturing was carried on in that building.

The manufacturing plant at Eighth and Grand Streets was in no way affected by the fire except for the slight delay which will be occasioned in getting in raw materials. Stocks of these materials have been located at the different mills and are already coming in. Stocks of finished lamp tubes running from 10,000 to 12,000 are all in the manufacturing plant, and supply of the daily demand for renewal tubes and spare parts has had no interruption at all, shipments going on as usual.

Hungerford Brass & Copper Takes Over Swoyer Company

The U. T. Hungerford Brass & Copper Company, Hungerford Building, Lafayette, White and Franklin Streets, New York City, has purchased the merchandise stock of the A. P. Swoyer Company, 17 North Seventh Street, Philadelphia, and has leased the premises formerly occupied by the Swoyer company at that location, of which possession was taken Sept. 1. The U. T. Hungerford Brass & Copper Company proposes to carry a full line of brass, copper, tobin bronze, nickel silver and monel-metal products in sheets, rods, tubes, wire, etc., at its Philadelphia branch.

Inquiries More Significant Says Scovill Superintendent

Although too great optimism concerning the early return of normal business conditions is unwarranted, a better tone in the market has begun to be reflected from inquiries for brass products, according to a recent interview given by John H. Goss, general superintendent of the Scovill Manufacturing Company, Waterbury, Conn.

The company has not as yet increased its working schedule over that in effect during the past two months and is now running at about 40 per cent of its 1914 plant capacity. "It would be foolish for us to encourage local workers," said Mr. Goss, "by an optimism which is at present unwarranted by actual conditions. There is no doubt that Waterbury faces a hard winter while the industrial world is attempting to get back on its feet. Experts believe that it will be a full year before things are back to their normal level, and there are pessimists who insist that it will take even a greater time.

"The situation is not without its brighter side, however," continued Mr. Goss. "We have noticed a return of buying confidence which is expressed in a more sincere purpose in inquiries on prices. People are evidently buying more than they did two months ago. Manufacturers in general are trying to uphold the present wage scale and would like to see wages at a higher rather than a lower level. Here at the plant, for instance, we are paying 35 cents an hour for common labor, although contractors can get plenty at 30 cents an hour. We realize that we are supplying men in most cases with only three and a half days' work and that the extra dollar and a half means a great deal to them when they are getting only $10.50 a week. If we had plenty of work to give the men, we could cut down to 30 cents and the men would get a wage of about $17 a week. If there were greater production, it might mean a reduction of 5 cents an hour for labor; but the laborer would be glad of it and willing to work at a reduced rate if he could make a good week's pay. At present, as in practically all industries, we are quoting prices which represent less than the actual cost of production. We are glad to do it to keep our men working and aid in the return to a normal level.

"In general, I think that the fall will see an improvement in local conditions, but the improvement will not be such as to warrant any undue optimism. It will not be such as to warrant the spending of a single dollar foolishly while the city is passing through a period of such depression."

American Bosch Making Storage-Battery Ignition System

The American Bosch Magneto Corporation, Springfield, Mass., is now producing a battery ignition system for automotive engines. The company has been working for some time on the development of this system, and while production was only recently started, contracts have already been closed with large users of battery ignition equipment.

The company expects to produce these units in great numbers and already is engaged in their production on a fairly large scale. It does not, however, expect to acquire additional manufacturing space, at least for the present.

New Company Will Manufacture Wire and Cable

The Cleveland Wire & Cable Company, Cleveland, which was incorporated in February, 1921, with a capital stock of $100,000, is manufacturing slow-burning and weatherproof wire and cable. Its plant is on Collamer Avenue and Nickel Plate Railroad, with direct railroad connection into its factory. The officers are: W. H. Staring, president; P. C. Clark, vice-president; D. J. Hard, secretary, and E. H. Smith, treasurer.

Wagner's Sales About 50 per Cent of Normal

The Wagner Electric Manufacturing Company, St. Louis, reports that its sales are about 50 per cent of normal and that its plant is producing at the rate of 35 per cent of its normal capacity. Business is being obtained equally in all of its lines, consisting principally of motors, generators, transformers and automobile equipment. Satisfactory progress is being made in the reduction of merchandise and other obligations. W. A. Layman, the president, in an interview with a representative of the Electrical World said that merchandise obligations had been reduced since the first of the year by 85 per cent and that a reduction of 30 per cent in all obligations had been effected. The inventory carry-over, he asserts, has been reduced by about 25 per cent. Further improvement is expected as general business increases in activity. "From the increase in inquiries we are receiving," Mr. Layman says, "it would appear that business men are getting ready for better business."

Texas Jobber Reports Mexican Demand for Lighting Fixtures

The National Council of Lighting Fixture Manufacturers in its recent bulletin reproduces a letter from a hardware company in Laredo, Tex., to this effect: "Our salesmen in Mexico report a brisk demand for electric lighting fixtures, including chandeliers, wall brackets, boudoir lamps, table lamps, floor lamps, etc., of the popular selling quality. We therefore beg to ask that you [the National Electric Light Association, to which the letter is addressed] advise the various fixture manufacturers associated with you to send us three sets of catalogs, together with their best jobbers' prices."

During the year 1920 exports from the United States to Mexico amounted in value to over $4,000,000.

Stickers Used to Better the Credits of Contractors and Dealers

In an endeavor to improve the credit rating of the electrical contractors and dealers, the National Association of Electrical Contractors and Dealers, 15 West Thirty-seventh street, New York City, is urging other branches of the trade to lend their influence in impressing on the contractors and dealers the benefits that will accrue to them through the employment of the standard accounting system approved by that association.

The association has printed stickers calling attention to the standard accounting system approved by the N. A. of E. C. and D. and indorsed by the National Electrical Credit Association, stating that "Your credit standing will be improved and you will know why you are not making sufficient net profit if you install the standard accounting system. Write us for details." A supply of these stickers was sent to the divisions of the National Electrical Credit Association about a month or six weeks ago, and some were also sent individually to the electrical supply jobbers. To date probably fifty replies have been received from jobbers asking for further information, and replies are coming in daily. So far as can be learned the Steel City Electric Company, Pittsburgh, is the only electrical manufacturer sending out these stickers to its trade, and these are addressed to the credit managers' attention in a letter suggesting co-operation in introducing the system and by attaching the stickers to monthly statements, aiding contractor and dealer customers who are "slow pay."

Great Activities Planned for Davis-Made Products

The Davis Sewing Machine Company, Dayton, Ohio, is entering the arena of big business this fall on a greater scale than ever before in the company's fifty-nine years of existence. Davis-made products—the Blue Bird electric clothes washer, the Davis sewing machine, the Blue Bird sewing machine and other specialities—are to be merchandised in an even more aggressive manner than in the past, it is announced, and plans are rapidly nearing completion for these activities. The factories at Dayton are expected to operate at capacity. There are sixty buildings in all, which afford 700,000 sq.ft. of floor space.

Co-operation with the dealer who sells Davis-made products is one of the outstanding features of the company's plans for coming activities.

The American Steel & Wire Company, 208 South LaSalle Street, Chicago, has announced the appointment of H. S. Durant, sales agent, and M. W. Floto, assistant sales agent, at its Detroit office, to succeed M. Whaling and T. J. Usher, Jr., resigned.

The Universal Electric Stage Lighting Company, manufacturer of Kliegl stage-lighting equipment, is now established in its new premises at 321 West Fiftieth Street, New York City.

The Triumph Electric Company, Cincinnati, manufacturer of the "Triumph" polyphase induction and direct-current motors, has moved its Philadelphia office to 709 Arch Street, where it has more spacious quarters to enable it to take care of its increasing business in that section. This territory is in charge of Arthur H. Allen, district manager.

J. E. Slimp, who for many years was connected with the sales staff of the Ohio Brass Company, Mansfield, Ohio, and recently manager of sales of the E. T. Chapin Company, Spokane., Wash., with office in Chicago, has resigned and is taking an extended vacation.

The Hygrade Lamp Company, Salem, Mass., announces that it has made arrangements with the Mills & Lupton Supply Company, Chattanooga, Tenn., to distribute its products in that territory.

Foreign Trade Notes

FRENCH ELECTRIC COMPANIES CONSOLIDATE.—A company has been formed in Paris, France, with a capital stock of 1,000,000,000 francs, under the name of the Groupement des Compagnies d'Energie Electrique et d'Eclairage du Nord et de l'Est, for the purpose of obtaining financial assistance for its members, based on the guaranty of annuities due by the French government to these companies to rebuild the factories which were damaged during the war.

PROPOSED HYDRO-ELECTRIC DEVELOPMENT IN ARGENTINA.—A French engineering company has solicited a concession from the Republics of Argentina and Uruguay for the construction of a hydro-electric plant at the falls of the Uruguay River, which separates Uruguay from Argentina. The proposed plant would furnish electricity to all the territory within a radius of 375 miles of Salto Grande and would include the principle cities and about three-quarters of the population of Argentina.

THE WESTINGHOUSE ELECTRIC INTERNATIONAL COMPANY, East Pittsburgh, Pa., has opened an office in Shanghai, to take care of its increasing business in China. This office will eventually have several branches throughout the country in order to handle inquiries and negotiations for electrical equipment. J. D. Birrell, who has long been engaged in business in the Far East, is manager of the new office.

ELECTRICAL INDUSTRY IN GERMANY.—Owing to an increased demand for small motors for agricultural machines needed for the coming harvest, says the *Transatlantic Trade,* the electro-technic industry in Germany improved during June. The demand for larger motors, generators and transformers has greatly fallen off. The situation in the iron and steel industries continues to be slack on account of world market conditions.

PRODUCTION OF ELECTRICAL EQUIPMENT IN POLAND.—In spite of the difficulties in obtaining metals and other materials necessary for the electrical industry in Poland, according to *Electrical Industries,* various enterprising capitalists have started plants for the manufacture of necessary articles. Local factories are now able to supply insulated wire of small diameter, switches, safety appliances, insulating tubes with accessories, electrotechnical porcelain, electric lamps, etc., all of which are of good quality, and, although the output does not cover local requirements, the industry is developing satisfactorily. Owing to the depreciation of the Polish mark there is no competition in this class of goods at the present moment, but there is no doubt that as soon as the exchange improves the Germans will throw on the Polish market their products, of which they hold large stocks, and which were imported in large quantities before the war.

EXTENSION TO ELECTRIC RAILWAYS IN JAPAN.—The Bankai Electric Railway Company is considering extending its railway from the present terminus at Hirano, branch line, to the town of Kashiwara, Minamikwachigun, a distance of about 4 miles, for which permission has been secured. The Railway Department, according to the *Tokyo Asahi,* has decided to submit to the next session of the Imperial Diet a bill for the electrification of the Tokaido railway between Tokyo and Kobe and of the Central Eastern line between Tokyo and Kofu.

EXTENSION TO ELECTRIC RAILWAY IN AUCKLAND, NEW ZEALAND.—The City Council of Auckland, New Zealand, has decided to authorize an extension to the tramway system along a suburban road in Auckland, to include seven new cars, to cost about £82,900.

PRODUCTION OF ELECTRICAL EQUIPMENT IN AUSTRALIA.—With the growing interest in the use of electrical equipment and appliances in Australia, involving many new schemes for utilizing hydro-electric power in place of coal for motive power and railway uses, new plants for the manufacture of electrical goods, according to a report from Vice-Consul Ray Fox from Melbourne, are being erected. It appears that all materials entering into such equipment are available as Australian products, and inasmuch as it is doubtful whether the recently established companies could compete with the larger American firms, it is the opinion of the Vice-Consul that an opportunity exists for the establishment of a branch American company in Australia. He also states that the Victorian Railway Commission, which operates the government-owned railroads of the state, is gradually electrifying the railway system of Melbourne and surrounding suburbs, the entire system being scheduled for completion by 1923 and calling for large orders of electrical equipment.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

A mercantile firm in Mesopotamia (No. 35,401) desires to purchase electrical fittings such as fans, meters, lamps, wire and telephone apparatus.

A commercial agent in Italy (No. 35,403) desires to secure an exclusive agency for the sale in Sicily of electrical supplies and materials of all kinds, including motors.

INDUSTRIAL EXTENSIONS IN CHINA.—New flour mills are projected in China, according to advices from the Guaranty Trust Company, New York City, and the development of cotton and flour mills reacts favorably upon the markets for electrical and steam power machinery. A large number of the treaty ports are provided with electric light and power plants, and the market for such plants is developing rapidly in the interior.

ELECTRIC LAMPS FOR TRAINS IN SOUTH AFRICA.—The administration of South African Railways and Harbors will receive tenders until Nov. 7 for incandescent lamps for train lighting (tungsten filament, 24 volts, 8 cp. to 10 cp.); engine headlight lamps (150 watts, 32 volts, gas-filled, ½-watt type, with concentrated filament); incandescent lamp (tungsten filament), and incandescent lamps (carbon filament). Delivery is to be made from stocks held by the contractors in South Africa as required during the year ending Dec. 31, 1922. Tenders should be addressed to Secretary, Tender Board, South African Railway Headquarters Office Johannesburg. Particulars may be obtained at the Department of Overseas Trade, 35 Old Queen Street, Westminster, S. W. 1., London, England.

New Apparatus and Publications

SAFETY STARTING SWITCHES.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., is manufacturing a switch with quick-make and quick-break action, known as type WK-55 for both alternating-current and direct-current motors.

ELECTRIC TOUCH CONTROL.—Electric touch control for the Ediphone (dictating machine) is the latest development announced from the laboratories of Thomas A. Edison, Inc., Orange, N. J.

LIGHTING FIXTURES.—"Brascolite for Banks and Office Buildings" is the title of a pamphlet issued by the Luminous Unit Company, division of the St. Louis Brass Manufacturing Company, St. Louis, covering its different types of fixtures for illumination of banks and office building.

REPAIR KIT.—The Electric Motor Manufacture Company, Ludington, Mich., has put on the market a power repair kit which is equipped with a lathe, a chuck for drilling, a grinding wheel and a buffing wheel.

INDUCTION FURNACE.—"Heat by the Fireless Method" is the title of a bulletin issued by the Ajax Electhrothermic Corporation, 636 East State Street, Trenton, N. J., describing the Ajax-Northrup high-frequency induction furnace.

RESISTOR ARC WELDER.—The General Electric Company, Schenectady, N. Y., is distributing a four-page pamphlet covering its type AW resistor arc welder.

CHANDELIERS AND LIGHTING FIXTURES.—The St. Louis Brass Manufacturing Company, Jefferson and Washington Avenues, St. Louis, is distributing a catalog covering its "Stuart line" of chandeliers and lighting fixtures.

SWITCHES AND ACCESSORIES.—The Hart & Hegeman Manufacturing Company, Hartford, Conn., has issued catalog H, covering its "H & H" barrier 600-volt switches and all types of switches and accessories.

ELECTRIC FLUID ROASTING AND HEATING SYSTEMS.—The Daniel M. Luehrs Company, industrial engineer, 2,015 East Sixty-fifth Street, Cleveland, is distributing two circulars, one covering the "Luehrs" system of liquid heat transmission and the other the "Luehrs" electrically heated oil roasting system.

ELECTRIC HAND IRON.—The Pittsburgh Gage & Supply Company, P. O. Box, 1236, Pittsburgh, has brought out a new "[illegible]" hand iron.

LAMP HANGERS.—The F. W. Wakefield Brass Company, Vermilion, Ohio, has designed an improved line of "Red Spot" hangers for commercial lighting units, both ceiling and [illegible] types.

SAFETY LIMIT SWITCH.—A new crane safety limit switch, known as type LC, has been put on the market by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

SURGE ARRESTERS.—The Electro Service Company, Marietta, Ga., is distributing a four-page pamphlet illustrating the "Bennett" surge arresters.

SMALL MOTOR STARTER.—A new type of motor starter, the WK-30, has been developed by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., for starting small alternating-current motors by connecting them directly to the line.

UTILITY TRANSFORMER.—The Standard Transformer Company, Warren, Ohio, is distributing a small leaflet describing its general utility transformer recently brought out.

ELECTRIC GRINDER AND BUFFER.—The Louisville Electric Manufacturing Company, Louisville, Ky., has placed on the market a new electric grinder and buffer.

New Incorporations

THE FREEDOM DISTRICT ELECTRIC LIGHT COMPANY, Sykesville, Md., has been incorporated by John T. Scott, Charles C. Williams and Charles W. Melville, Sykesville, to construct and operate an electric light and power system.

THE CAPE BATTERY COMPANY, Barnstable, Mass., has been incorporated with a capital stock of $10,000 by Roy F. Gammon, William S. Boice and Raymond L. Rich to manufacture and deal in electrical specialties.

THE ELECTRIC THERMO COMPANY, New York City, has been incorporated by W. L. Strauss, C. C. Trautmann and C. A. Oberwager 233 Broadway. The company is capitalized at [illegible] and proposes to manufacture electrically operated washing machines.

HICKEY FIRE & BURGLAR WIRE COMPANY, Wilmington, Del., has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $250,000 to manufacture wire and other electrical products. T. L. Croteau, M. A. Bruce and C. H. Maxwell are local incorporators.

THE VITALIS PRODUCTS, INC., Wilmington, Del., has filed articles of incorporation under the laws of the State of Delaware. The company is capitalized at $13,000,000 and proposes to manufacture electric storage batteries and accessories. T. L. Croteau, M. A. Bruce and C. H. Maxwell are local incorporators.

THE HICKORY POWER COMPANY, Hickory, N. C., has been incorporated with [illegible] to construct and operate an electric light and power plant. The incorporators are B. M. Smith, L. F. Abernathy and J. A. Moratz.

THE [illegible] BRASS & BRONZE WORKS, [illegible] has been incorporated by [illegible] Shapiro and Henry P. Mertel, 700 Madison Street. The company is capitalized at [illegible] and proposes to manufacture electric fixtures and other brass and bronze products.

THE TOUSEK ENGINEERING CORPORATION, Newark, N. J., has been incorporated by [illegible] and Edward E. Tousek, [illegible] Avenue, Newark. The company is capitalized at $100,000 and proposes to manufacture electrical devices and equipment.

THE WICKEY BATTERY COMPANY, East Chicago, Ind., has been incorporated by E. W. and W. G. Wickey, J. E. Francis, D. L. White and H. E. [illegible]. The company is capitalized at [illegible] and proposes to manufacture [illegible] batteries.

Record of Electrical Patents

Notes on United States Patents

(Issued Aug. 9, 1921)

1,387,280. TELEPHONE SYSTEM; Alben E. Lundell, New York, N. Y. App. filed Dec. 30, 1916. Purpose to obviate necessity of operator's written memorandum.

1,387,282. TELEPHONE SYSTEM; James L. McQuarrie, Montclair, N. J. App. filed Dec. 28, 1918. Relates to automatic telephone switches.

1,387,284. TELEPHONE SYSTEM; Harry W. McDougal, East Orange, N. J. App. filed July 31, 1919. Relates to systems in which the signals for a plurality of trunk lines extending between widely separated stations are controlled over a single signaling path common to such trunk lines.

1,387,285. APPARATUS FOR DRIVING MAGNETOS IN CONNECTION WITH INTERNAL-COMBUSTION ENGINES; Auguste Maire, Argenteuil, France. App. filed Sept. 25, 1917. Intended to avoid stoppage of engine due to damage of one of the parts of the ignition apparatus.

1,387,334. CABLE SPLICE; Charles Vignos, Canton, Ohio. App. filed Feb. 3, 1920. Joining and reinforcing spliced cable ends.

1,387,350. SAFETY DEVICE FOR STORAGE BATTERIES; Rufus N. Chamberlain, Chicago, Ill. App. filed Feb. 24, 1919. Relates to large units which are employed for lighting trains or similar installations.

1,387,353. MACHINE-SWITCHING TELEPHONE SYSTEM; Henry P. Clausen, Mount Vernon, N. Y. App. filed Nov. 26, 1917. Relates to means for controlling the release of the switches.

1,387,354. TELEPHONE-EXCHANGE SYSTEM; Henry P. Clausen, Mount Vernon, N. Y. App. filed June 5, 1919. Has particular reference to a selectively operable switch.

1,387,367. TELEPHONE SYSTEM; William L. Dodge and Hugh D. MacPherson, Maplewood, N. J. App. filed Aug. 7, 1919. Relates to systems in which the signals for a plurality of trunk lines extending between widely separated stations are controlled to such trunk lines.

1,387,386. TELEPHONE SYSTEM; C. L. Goodrum, New York, N. Y. App. filed July 26, 1917. Relates to the trunking arrangements employed in such systems.

1,387,389. APPARATUS FOR THE HIGH-VOLTAGE WINDINGS OF ELECTRICAL MACHINES; Fritz Haberli and Johann Kubler, Switzerland. App. filed July 30, 1920. To prevent the occurrence of discharges and the consequent risk of destroying the insulation of the coils.

1,387,394. ELECTRIC ETCHING INSTRUMENT; Edward F. Hankin, Philadelphia, Pa. App. filed Aug. 23, 1920. To provide an improved instrument which can be used in the manner of a pencil.

1,387,397. STORAGE-BATTERY GRID; Walter E. Holland and James M. Skinner, Philadelphia, Pa. App. filed Oct. 29, 1918. Grid or frame for storage-battery plates.

1,387,399. SIGNALING DEVICE; Richard M. Hopkins, New York, N. Y. App. filed Jan. 27, 1917. Makes prominent a distinctive signal transmitted over a circuit normally occupied with signals of another class.

1,387,425. ELECTROLYTIC PROCESS AND APPARATUS; Matthew M. Merritt, South Middleton, Mass. App. filed Oct. 13, 1919. Improvements in electrolytic processes and apparatus.

1,387,426. METHOD OF SOLDERING ALUMINUM; Matthew M. Merritt, South Middleton, Mass. App. filed Oct. 13, 1919. Provides a simple, inexpensive and satisfactory method.

1,387,433. SYSTEM OF CONNECTIONS; Hermann Sundhaussen, Essen, Germany. App. filed Sept. 3, 1920. Intended to regulate the strength of a current in the divisions of a two-part divided current circuit.

(Issued Aug. 16, 1921.)

1,387,458. WINDING STRUCTURE FOR MULTISPEED INDUCTION MOTORS; Harold L. Barnholdt, Pittsburgh, , Pa. App. filed May 2, 1917. To provide a multispeed induction motor of compact, symmetrical and inexpensive construction.

1,387,466. SYSTEM OF CONTROL; Andrew H. Candee, Pittsburgh Pa. App. filed Oct. 30, 1918. For the control of storage-battery locomotives and the like.

1,387,469. MEANS FOR SUPPRESSING HARMONICS; Lewis W. Chubb, Edgewood Park, Pa. App. filed Feb. 13, 1917. Relates to alternating-current distributing systems.

1,387,470. ARRANGEMENT OF CONNECTIONS FOR DYNAMO-ELECTRIC MACHINES; Joel R. Cook, Wilkinsburg, Pa. A novel arrangement of the conducting leads between the field magnet and armature windings.

1,387,471. ELECTROLYTE; John Coulson, Wilkinsburg, Pa. App. filed Feb. 19, 1917. Capable of acting upon film-forming metals, such as aluminum, magnesium and the like.

1,387,487. ELECTRIC ARC WELDING SYSTEM; Klaus L. Hansen, Wilkinsburg, Pa. App. filed Sept. 3, 1919. Relates to generators of the constant-current type which may be employed in direct-current welding systems.

1,387,492. RESISTOR; Harvey H. Johnston, Edgewood, Pa. App. filed Jan. 8, 1919. Relates to registers employed on railway vehicles.

1,387,496. SPEED CONTROL FOR INDUCTION MOTORS; Benjamin G. Lamme, Pittsburgh, Pa. App. filed Oct. 21 1916. Substantially free from surging and allied harmful phenomena.

1,387,498. CONTROL SYSTEM AND APPARATUS; Harry A. Lewis, Norristown, Pa. App. filed May 23, 1919. Electromagnet actuated by the energization of coils within predetermined limits only.

1,387,503. SYSTEM OF CONTROL; Paul L. Mardis, Swissvale, Pa. App. filed Oct. 17, 1918. Railway-motor control.

1,387,509. LIQUID RHEOSTAT; Stanley G. Nottage, Murraysville, Pa. App. filed Dec. 13, 1919. For governing polyphase electric railway motors or the like.

1,387,514. LIFT INDICATOR FOR FLYING MACHINES; Anita S. Reynolds, Greenwich, Conn. App. filed March 14, 1917. Aviator will be informed as to sustaining force acting on aërofoils.

1,387,521. RADIANT HEATER FOR ELECTRIC RANGES; Frank Thorton, Jr., Mansfield, Ohio. App. filed Nov. 20, 1919. Heating elements have a relatively small heat-storage capacity.

1,387,522. AUTOMOBILE-ENGINE HEATER; Frank Thorton, Jr., Mansfield, Ohio. App. filed Dec. 10, 1919. Small portable electric air heaters.

1,387,524. INSULATOR TROLLEY-CONDUCTOR CLAMP; Nils J. A. Wahlberg, Pittsburgh, Pa. App. filed Sept. 13, 1919. Clamps used in conjunction with suspension insulators.

1,387,548. ELECTRICAL CONNECTOR DEVICE; Harold K. Lowry, Chicago, Ill. App. filed Oct. 3, 1918. Devices for placing in electrical communication a track rail and a source of current supplied carried by a conductor.

1,387,555. AEROPLANE SPEED INDICATOR; Arthur F. Poole, Kenilworth, Ill. App. filed July 8, 1918. Gives a simultaneous indication of the speed and the direction of the aëroplane.

1,387,595. CONTROL SYSTEM; Ray E. De Camp, Wilkinsburg, Pa. App. filed Nov. 6, 1919. For stabilizing the positions of the movable members of switches for controlling circuits embodied therein

1,387,607. THERAPEUTIC APPARATUS; William Meyer, Chicago, Ill. App. filed June 24, 1920. High-tension electrode for administering electrical treatments to internal organs.

1,387,642. RECORDING APPARATUS; Gibson L. Douglass, Duluth, Minn. App. filed Aug. 5, 1918. For making records to identify vehicles such as railway cars.

1,387,668. CALL-METERING SYSTEM; Frank M. Slough, Rochester, N. Y. App. filed Sept. 26, 1918. Connection cannot be registered more than once.

1,387,669. TELEPHONE SYSTEM; Frank M. Slough, Elyria, Ohio. App. filed July 20, 1914. Improvements in testing systems

1,387,670. BREAD TOASTER; Charles P. Strite, Minneapolis, Minn. App. filed May 29, 1919. To toast bread for different length of time according to the degree of crispness desired

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

BARRE, VT.—The power plant of the Wetmore & Morse Granite Company, between Graniteville and Websterville, was recently destroyed by fire, causing a loss of about $75,000

PEPPERELL, MASS.—Application has been made to the Department of Public Utilities by the Nissitissit Electric Light & Power Company for authority to issue $25,000 in capital stock. The company has taken over the electric light plant formerly owned by the Middlesex Engineering Company, which supplies electricity to the residents of Pepperell.

WESTFIELD, MASS.—Work has been started by the municipal light department on the erection of an electric transmission line to Mundale. When this line is completed the street-lighting system in upper Franklin street will be installed.

WORCESTER, MASS.—Plans have been completed by the Worcester Electric Company for a three-story machine shop, to cost about $35,000

STAFFORD SPRINGS, CONN.—Benedict Schwanda & Sons, who are operating the pearl-button plant in the Old Hope Mill, have purchased the Garland mill property in Staffordville. The new owners, it is said, will erect a power plant to supply electricity to operate the button factory. The water power available is estimated at about 100 hp

Middle Atlantic States

BATAVIA, N. Y.—The Public Service Commission has granted the Genesee Light & Power Company permission to extend its transmission and distributing lines to furnish electricity in Attica and Stafford. Franchises granted by local authorities have been approved.

CANANDAIGUA, N. Y.—The Council has authorized the Department of Public Works to negotiate with the Rochester Gas & Electric Corporation for the installation of a new lighting system in the business section of Main Street.

CORINTH, N. Y.—The Corinth Electric Light and Power Company has been granted permission by the Public Service Commission to build an addition to its power plant and to make a number of extensions in its distributing system.

HANNAWA FALLS, N. Y.—The Hannawa Falls Water Power Company has filed notice of increase in capital stock from $300,000 to $1,000,000.

MASSENA, N. Y.—The Massena Electric Light & Power Company has filed notice of increase in capital stock from $50,000 to $150,000

NEW YORK, N. Y.—The Lackawanna Railroad Company, 90 West Street, New York City, it is reported, has rejected all bids submitted fór equipping a portion of its system in the anthracite coal district of Pennsylvania for electrical operation. New bids, it is understood, will be asked at a later date. Gibbs & Hill, Pennsylvania Terminal Building, New York City, are consulting engineers.

OGDENSBURG, N. Y.—The Ogdensburg Power & Light Company has filed notice of increase of capital stock from $100,000 to $150,000

POTSDAM, N. Y.—The Potsdam Electric Light & Power Company has filed notice of increase in capital stock from $25,000 to $75,000

NEW BRUNSWICK, N. J.—Preliminary work has started on the installation of conduits on Albany Street for the proposed ornamental lighting system on that thoroughfare.

NEW GALILEE, PA.—The Borough Council is negotiating with the Harmony Electric Company for the purpose of securing electric service in New Galilee.

Harry Etheridge is superintendent of the Harmony Company.

SHAMOKIN, PA.—Plans have been announced by the Pennsylvania Power & Light Company for improvements to its plant in the entire Shamokin district, covering the next six months. Contract has been let for a new substation at Frackville to relieve the Mount Carmel station, and it will be twice as large. A 66,000-volt transmission line will be erected from the Hauto plant to Frackville and on to Shamokin. The entire wiring system in the Shamokin district will be changed to handle the higher voltage. The company, it is understood, contemplates crossing the Susquehanna River with its lines and furnishing service in the portion of the state west of the Susquehanna River.

UNIONTOWN, PA.—Work will soon begin on the construction of a power house in connection with a mechanical laundry at the Uniontown Hospital, to cost about $10,000.

MORGANTOWN, W. VA.—The installation of new electrical and mechanical equipment, to cost about $35,000, at its local property is under consideration by the Hess Coal & Coke Company.

LYNCHBURG, VA.—The City Council has appointed a committee, composed of Mayor Harper, Councilman Ernest Williams and City Manager E. A. Beck, to negotiate for additional power and riparian rights in connection with the proposed municipal hydro-electric plant. Three sets of plans for a power house are under consideration by the City Council, the cost ranging from $100,000 to $362,000. It is proposed to have the plant ready for use by the close of the present lighting contract at the end of 1922. Lamar Lyndon, 21 Park Row, New York City, is consulting engineer.

YORKTOWN, VA.—Plans have been completed by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for the construction of a power house at the local works of the Government.

North Central States

RAVENA, MICH.—The Ravena-Conklin Electric Light & Power Company, it is reported, is asking for bids for the construction of a hydro-electric power plant in Ravena, to cost about $85,000. Holland, Akerman & Holland, 106 Liberty Avenue, Ann Arbor, are engineers.

TRAVERSE CITY, MICH.—Work will soon begin on the construction of the proposed new municipal hydro-electric generating plant on the Boardman River, to cost about $250,000.

UNION CITY, MICH.—Plans and estimates have been prepared by Holland, Akerman & Holland, 106 L'berty Avenue, Ann Arbor, engineers, for the construction of a municipal hydro-electric power plant. The cost is estimated at about $150,000. John L. Moore is village president.

DAMASCUS, OHIO.—Investigations are being made by the Bogwell Electric Company, Youngstown, with a view of furnishing electricity for lamps and motors in Damascus.

BLUE DIAMOND, KY.—The Blue Diamond Coal Company is considering enlarging its local power plant and installing new equipment.

HAZARD, KY.—The Kentucky & West Virginia Power Company contemplates the erection of electric transmission lines into the Hazard and Elkhorn coal fields. It also plans to connect with the electric plant at Spriggs, W. Va

PIKEVILLE, KY.—Plans are under consideration by the Pike Light & Power Company for extensions and improvements to its plant this fall

WHITESBURG, KY.—The Whitesburg Light & Power Company is planning extensions and improvemnts to its electric plant, including the installation of new equipment. L. F. Daniel is manager.

EVANSVILLE, IND.—The Public Utilities Company, it is reported, contemplates extensions and improvements to its system. F. J. Haas is vice-president and general manager

CARROLLTON, ILL.—Preliminary plans are under way by the City Council for establishing a municipal electric light plant, to cost about $90,000.

MARSHALL, ILL.—The Council has engaged an engineer to prepare a preliminary estimate of the cost of a new municipal electric light plant upon which to base a bond issue. He will also make an inventory of the local electric plant, owned by G. C. Hallauer, to determine whether it would be advisable to take over that plant or to build a new one.

DULUTH, MINN.—The City Commissioners are considering the installation of ornamental lamps on Grand Avenue from Fifty-ninth Avenue west to Central Avenue, on Central Avenue from Grand Avenue to Roosevelt Street, and on Ramsey Street from Fifty-fourth Avenue to Grand Avenue. P. G. Phillips is commissioner.

PILOT GROVE, IOWA.—A company has recently been organized for the purpose of furnishing electricity to farmers between West Point, Pilot Grove and St. Paul. Energy to operate the proposed system will be obtained from St. Paul. The company is capitalized at $12,000. John Hellman, Pilot Grove, is treasurer.

KANSAS CITY, MO.—The Board of Public Works has granted the Kansas City Power & Light Company permission to erect overhead wires from its plant in the East Bottoms to its distributing station on Southwest Boulevard.

CASSELTON, N. D.—The General Utilities Corporation is planning to erect a high-tension transmission line from Fargo to Casselton.

FAULKTON, S. D.—An election will soon be held to submit to the voters the proposal to issue bonds to purchase the local electric light plant, to be owned and operated by the municipality.

BEATRICE, NEB.—An election will soon be called to vote on the proposal to grant a twenty-five-year franchise to the Gage County Gas & Electric Company.

WEST POINT, NEB.—Extensions and improvements will be made to the electric light system, to cost about $58,000. Bids for the work have been received. Koening & Hollister, Bankers' Life Building, Lincoln, are engineers. S. Lindale is city clerk.

DEXTER, KAN.—Bonds to the amount of $26,000 have been voted for the installation of a municipal electric lighting system. Electricity for operating the proposed system will be obtained from the municipal electric plant at Winfield.

Southern States

HICKORY, N. C.—The Granite Falls Manufacturing Company contemplates the construction of a hydro-electric plant on Wilson Creek, near Lenoir, to supply electricity to its cotton mills in that territory. The cost is estimated at about $250,000.

RALEIGH, N. C.—The North State Power Company, recently incorporated with a capital stock of $250,000, will take over the property and holdings of the Cumberland Light & Power Company, recently placed in the hands of a receiver. The new company proposes to furnish electricity in Cumberland, Bladen, Robeson, Hoke, Harnett, Sampson, Johnston, Wayne, Wilson, Lee, Moore, Wake and other counties.

WAUCHULA, FLA.—The Hardee County Power & Ice Company, recently organized with a capital stock of $200,000, is contemplating the construction of an electric power plant. J. G. Fancy, Fort Meade, Fla., is president.

WEBSTER, FLA.—Plans have been approved by the Town Council for the erection of a transmission line to Bushnell, where connection will be made with a transmission system for electric service in Webster. A local distributing system will also be built.

HARTSELLS, ALA.—A company is being organized by Ernest Lynn and associates for the purpose of constructing a hydro-electric power plant in this section. The cost of the initial installation is estimated at about $100,000

BASTROP, LA.—An election will soon be held to vote on the proposal to issue $35,000 in bonds for the installation of a municipal electric light plant.

NEW ORLEANS, LA.—Application has been made to the Commission Council by Harry K. Johnson for a franchise to supply electricity for lamps and motors in New Orleans.

NEW ORLEANS, LA.—Extensions and improvements to cost about $545,500 are under consideration by the New Orleans Railway & Light Company. The work will include additional transmission lines, to cost $129,000; rotary magazine station, $40,000; switchboard $56,000; six 1,000-kw transformers, $60,000, etc.

HEALDON, OKLA.—Work will soon begin on the construction of a municipal electric light plant, for which bonds were issued some time ago.

DALLAS, TEX.—Plans are under way by the Dallas Railway Company for extension of its interurban railway system from Dallas to Terrell, Tex., a distance of about [illegible] miles. The cost, including [illegible] generating stations, rails, line equipment, etc., is estimated at about $1,800,000.

DICKINSON, TEX.—The Dickinson Electric Company, recently organized for the purpose of supplying electricity in Dickinson, is planning to secure electricity from the Galveston & Houston Electric Company to operate the proposed system. Dr. W. H. Lukens of Dickinson is president of the local company.

Pacific and Mountain States

SALEM, ORE.—The Oregon Pulp & Paper Company has decided to build a dam across Mill Creek between Mill and Church Streets, construct a power house and erect transmission lines to the main paper plant. The cost is estimated at about $100,000. The new plant will supply auxiliary power.

BOISE, IDAHO.—Application has been filed with the State Department of Reclamation by Rupert Winters, Featherville, for permission to construct a dam on the south fork of the Boise River in Camas County, to cost about $75,000. The proposed dam will be 40 ft. high, 200 ft. at the top of the dam and 50 ft. at the bottom. About 1,000 hp. will be developed. The power will be utilized to generate electricity for mining purposes.

LOS ANGELES, CAL.—The Los Angeles Gas & Electric Company is considering an expansion and improvement program in connection with its electric generating plants and system to cover a term of years and to cost, including equipment and machinery, about $5,850,000.

LOS ANGELES, CAL.—The Board of County Supervisors has authorized the installation of an ornamental lighting system in the Crescent Heights lighting district. Concrete lamp posts will be used.

MERCED, CAL.—The San Joaquin Light & Power Company, Fresno, has entered into a contract with the Merced Irrigation District for electricity to be generated at the proposed plant of the district at Exchequer, Mariposa County, 25 miles north of Merced. The Merced Irrigation District plans the development of power in connection with its irrigation system.

REDLANDS, CAL.—Negotiations have been completed whereby the power line of the Nevada-California Power Company extending from its Mill Creek generating station in Mono County, Cal., to Hawthorne, Nev., a distance of 52 miles, has been purchased by Mineral County, Nev. Provision was made for the purchase some time ago, when Mineral County voted to issue $150,000 in bonds to acquire the transmission line and extend it to the Somon and Candelaria mining districts.

VENTURA, CAL.—Plans are under consideration by the Southern California Edison Company, Los Angeles, for extensive improvements in Ventura County within the next twelve months, including the erection of a substation at Adobe Hill in the Ojai. The cost of the entire work is estimated at about $250,000.

Canada

CALGARY, ALTA.—A permit has been granted for the construction of a power plant at the Institute of Technology, to cost about $40,000. McDonald Brothers are contractors.

HALIFAX, N. S.—The City Council has decided to take over the power developed at St. Margaret's Bay by the Nova Scotia Hydro-Electric Commission. The question of distribution has not been decided upon as yet

HALIFAX, N. S.—Contract has been awarded by the Nova Scotia Hydro-Electric Commission for the construction of the dam at Big Indian Lake to the Bedford Construction Company, Ltd., at $65,931.

MONTREAL, QUE.—Contract has been awarded by the Administrative Commission to the Atlas Construction Company for the erection of the proposed new electrically operated pumping station at Point St. Charles, at $498,800.

Electrical World

New York, Saturday, September 17, 1921

Saturation—in Other Industries and in Our Own

MOST of the great industries that sell direct to the home are engaged in providing almost entirely for replacement. They face a condition quite different from that encountered by the electrical industry. And when you come to think of it, the comparison is interesting.

The clothing business, for example, is one of the great basic trades. Its sales are tremendous in volume and value, yet everybody already has clothes. The furniture business is gigantic in its proportions, yet every existing home already has its beds, tables and chairs. The sales of cutlery, kitchenware, china, bedding and rugs are enormous, yet every home is already equipped. More sewing machines are made and sold today than ever before, though it was estimated forty years ago that every household was supplied. Everywhere it is the same. They sell to apparently saturated markets and still their business grows.

With us in the electrical industry, however, an entirely different situation exists. In the first place, out of the twenty-two million households in the land, we have not yet begun to reach some fourteen million, because their houses are not wired. The great business of selling electric service to the home, therefore, has so far been restricted to the eight million other families who use electric light. And out of them we know how few there are as yet who have even begun to realize what comforts and economies are offered today and to take advantage of them. We are selling to a market that is both unsaturated and unawakened. We have built up our industry to its present growing size by the hasty and partial cultivation of a mere fragment of our field.

So at present we sell this commodity of ours, which ultimately will be in universal use, to less than one-third of the people. On top of that, only a mere fraction of those who do use electricity today are using it in more than a most meager way. The great majority apply the service only to providing light. Some day they will be cooking with it, sweeping with it, washing and ironing with it, heating their homes with it and doing with it most of their work of housekeeping. But millions of these homes have not even begun to *think* about any of these things as yet.

There is no such word as saturation for us. When every factory and every store uses electricity for power and heat and light, when every household makes the most of it, then only will the electrical industry get into its stride. Our chief concern today must be to awake the sleeping millions of people who are still unconscious of the full meaning of electric service.

James Burke

An inventor, electrical engineer and executive, who through creative genius, perseverance and leadership is widely recognized as a talented contributor of engineering fundamentals essential to the development of the electrical industry from its beginning.

TO THE [illegible] that inventors and other geniuses are poor business men the career of [illegible] fifteen [illegible] electrical [illegible] in this country and abroad, prior to [illegible] in [illegible] the [illegible] inventive ability received international recognition. The patents granted to him for the design of a generator winding by which three-wire service was made possible from a single machine and his "universal" motor that operates on both direct-current and alternating-current circuits have had far-reaching effects on the expansion of electric service. Both inventions were original in their conception and stand today as the highest types of design in their respective applications. They have also been widely adopted by prominent manufacturers under licensee arrangements. The Crocker-Wheeler Company for years has built the Burke type of three-wire generator, and it is found today in many office buildings, hotels and industrial plants. The "universal" motor has been the foundation for the wide use of portable electric tools, vacuum cleaners, electric fans and other motor-operated labor-saving devices for the home. Such is Mr. Burke's inventive genius.

His position at the head of a progres[illegible] past seventeen years and the influence he has wielded in the affairs of the electrical industry during that time, particularly in the promoting of the principles and ideals of the Electric Power Club and matters of electric standardization here and abroad, have won for him the same high standing as an executive that he has always enjoyed as an electrical engineer.

Mr. Burke was born in England April 7, 1873, and obtained his technical training under the handicap of self-instruction gained mainly by night study after working hours. The proficiency he thus acquired and his fondness for electrical experimenting obtained for him a position in the Edison Machine Works at Schenectady when he came to this country at the age of sixteen. With that company and the General Electric Company, which later absorbed it, he spent six years, going through one department after another, until he had [illegible] the process of manufacturing that he was appointed to the company's staff of designing electrical engineers. In December, 1894, Mr. Burke resigned from the partnership of Herrick & Burke, [illegible] in New York [illegible] Electric Company in Berlin, Germany. The success of this work caused him to give up his consulting practice in 1898 to go to Berlin in charge of the manufacturing and engineering operations of the Bergmann Electric Company, with [illegible] to the United States and established the Burke Electric Company—in July, 1904. [illegible] ing in the manufacturing industry both [illegible] Mr. Burke converted the activities [illegible] Institute of Electrical Engineers, a mem[illegible] A. I. E. E. and also of the United States [illegible] technical Commission. In May, 1919, he [illegible]

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Political Versus Consumer Ownership

A HAPPY antithetical phrase and one giving food for much thought and discussion is "political versus consumer ownership." It presents the real crux of municipal and governmental ownership agitations. In California particularly this phrase finds a ready application and a very direct bearing; for in that state a proposal that the state own, construct and operate electrical generating, transmission and distribution systems has recently been made. Fortunately for the general progress and prosperity of California, the electric utilities there have well-launched and successful policies of selling their securities directly to their consumers. This has been done on a very extensive scale both as regards the total value of the securities sold and the number of individual subscribers. The result is that those utilities are rapidly reaching the point where it can be said that the citizens of California already own their utilities. This robs the municipal-ownership partisans of their one talking point, that of ownership of public necessities by the public. A change to municipal possession would be one to "political ownership." The conclusion from the success of the companies' policy is obviously that the voters do not want such ownership; they prefer to own these valuable properties themselves rather than make them the appendages of politics.

Meaning of Arbitrator's Decision in Chicago Building Trades Controversy

IT IS hardly conceivable that the decision in the Chicago building trades controversy can start a big building boom at this time of the year, particularly under the country-wide conditions that exist. Its importance and the reason for the widespread effect that it will have on the building industry, and indirectly on nearly every other industry, are due to the crystallization of public sentiment that it will bring. All through the investigations the pot and kettle called each other black until the bewildered public, though convinced that neither was of alabaster, found it impossible to tell which had the darker hue. Judge Landis has pointed in a very definite way to certain practices that are vicious, and in some cases where the guilty have refused to reform he has not hesitated to name them and describe their practices. Middle Western people who know the judge have confidence in his honesty and fair-mindedness, particularly because of the fear he inspires among the criminal element. While they may not always agree with him, they know he has the courage of his convictions and is not swayed by prejudice. His findings will be accepted generally as a measuring stick by which to judge the whole situation. It will be difficult for any one to oppose his findings, particularly as the men most anxious to oppose them will be those tainted in the public mind by questionable if not actually criminal practices. It will be hard, also, for those who have held aloof in the proceedings to stand against the public sentiment that will rally in support of the decision, since they also have been under the suspicion of wanting to maintain the very practices that the arbiter has ruled against.

While the wage scales established are important, they are, after all, a minor factor because with changing conditions it is hardly likely that they will be of long standing. With public backing the effort to eliminate the questionable practices in the building trades that have existed in Chicago as well as in numerous other sections of the country will have a wide effect, not only on the building trades, but also on every line of industrial endeavor. It will make for a higher moral plane in all business activities.

Hydro-Electric Development of the Colorado River

THE hydro-electric development of the Colorado River has given rise to much controversy. Uncontrolled, the river is a peril to lives and property in the Imperial Valley in California and the low-lying adjacent lands in the United States and Mexico which are below sea level. Completely controlled, the Colorado River can be used to irrigate about two million acres of land and make available approximately 5,000,000 potential horsepower. Any development of the river, however, must be made first with a view to flood control; second, to serve irrigation requirements, and, third, for power purposes. To meet the first two requirements a huge storage reservoir to hold the total normal flow of the river for from two to three years would have to be erected. A dam 500 feet high thrown across the Colorado at Glen Canyon, "at the top of the hill," would provide a uniform stream flow throughout the year that would be available for whatever power plants may be built between Glen Canyon and sea level, besides yielding ample water to irrigate all irrigable land. A second possible reservoir site is at Boulder Canyon near the "foot of the hill." There a dam 600 feet high would form a storage lake ample for complete regulation. Either dam would solve the flood control and irrigation problem completely, but that at the Boulder Canyon would not provide regulation for power purposes except for plants built below that site, nor would it permit of a comprehensive development of the river as a whole.

Obviously, it would not be economical to build two huge dams each 500 feet to 600 feet high if one will do. The question is of such vital importance because of the immense irrigation and power possibilities involved that nothing short of a comprehensive plan for the best final development of the river should be adopted. The Federal Power Commission now has the matter under advisement and can be counted on to conserve the interests of the country as a whole, and particularly the interests of the states of Arizona, Nevada and California, in working out a plan to which every licensee on the river must conform.

Model State and National Conventions

THE convention of the Pennsylvania Electric Association held last week differed from the convention of the Association of Edison Illuminating Companies held this week in that at the former those in attendance comprised superintendents, operators and heads of departments who have their hands on the throttle and are actively engaged in every-day operating problems. The Edison conventions, on the other hand, are attended chiefly by the executives of the largest urban companies in the country. Naturally the conventions differ widely in the character and scope of the papers presented, since one is held by a state and the other by a national body. However, each is typical and forms an excellent pattern for convention work. The intimate contact and exchange of experiences between operators is one of the chief assets of the Pennsylvania convention and emphasizes the desirability of strong state associations as a foundation for the electric light and power industry. The greater and broader problems naturally fall to the national body, made up as it were of men who are post-graduates in the business and are therefore equipped to handle these problems in a large way. This makes for thoroughness and order and enables the industry to move forward rapidly, confident in the mastery of its affairs arising from the accumulated experience, counsel and skill of all its members, as exemplified in state conventions, with the national body eventually acting as a clearing house for the benefit of all.

Are the Users of Trucks Getting Full Benefit from Them?

LACK of specific cost information on the performance of industrial trucks, even in installations handling large tonnages, is rather startling to the investigator. In too many instances the only information available concerns the general groups of wages, cost of repairs and battery maintenance and cost of energy to charge the batteries. The only comparative information is that the total cost is less than the cost of the older methods and to that extent there is a saving of money. The cost of operation on a weight-distance basis is a missing figure in most cases because no reliable figures on the tonnage and the distance traveled are available and there is little attempt being made by the user to make them available.

The modern factory devoted to quantity production is keenly interested in eliminating unnecessary movements of material, and it has come to be a common saying that the raw materials go in at one end and the finished product is loaded onto the cars at the other. Great pains are taken to see that the material is always kept moving in the same direction and that no unnecessary distance is traveled. These results are accomplished after careful studies in which not only the financial but also all physical factors are carefully ascertained and the physical factors reduced to a financial form of statement. The maximum benefit of truck service in any plant can be obtained only after all the data necessary to an analysis of what is being done are gathered and the lessons taught by the analysis put into practice. A unit weight carried over a unit of distance costs money, and unless figures are available showing the weights carried and the distance traveled it is impossible to determine whether the weight-distance factor has been reduced to the lowest practicable limit.

The argument that it is impossible to change factory arrangements on the saving that might possibly be shown is weak since because of the changing conditions in factory processes the active factory is forced from time to time to remodel its arrangements. Accurate information on the handling costs of materials and completed products is necessary if these changes are to be intelligently planned.

A New Electron Tube—the Magnetron

THE most conspicuous and probably the most important new electrical device of the past decade is the hot-cathode vacuum tube. Its astonishingly rapid application in the radio telephone and telegraph fields is well known. Recognized first as an interesting but unimportant phenomenon in the incandescent lamp, the electric discharge from hot bodies was neglected through a number of years until the remarkable properties of electrons, uncovered by the physicists, drew attention to the possibilities of useful application. Then followed rapidly the development of rectifying valves, detectors, X-ray tubes, amplifiers and oscillating generators, resulting in a period of unprecedented expansion and development in the fields mentioned. And the end is not yet.

Now comes the announcement of another addition to this already indispensable tube family, namely, the "magnetron." This was the subject of a lecture by A. W. Hull at the annual meeting of the American Institute of Electrical Engineers, and the first printed description appears in the September number of the *Journal* of the Institute. The tube has the usual hot cathode and plate anode and in its conductivity obeys the well-known laws involving the plate potential and filament temperature. The salient feature lies in the control of the current through the tube by a magnetic field. The tube is cylindrical in shape, and filament and plate must be symmetrical about the axis of the cylinder. The controlling magnetic field is furnished by an external coil with axis coincident with the axis of the cylindrical tube. Up to a critical value of the current in this external magnetizing coil the tube has full conductivity, but beyond this critical value it ceases completely. It is at once obvious that in this way all of the normal phenomena of the three-electrode tube can be accomplished in the magnetron by means of current in an external coil rather than by means of current in a grid inside the tube. The separation of the control and tube circuits will be seen as an important feature.

The explanation of the operation of this tube lies in the deflection of the path of a moving electron when passing in a magnetic field. Above a certain strength of field, electrons leaving the central filament are turned back without reaching the outer plate electrode. This deflection of electrons in a magnetic field is an old phenomenon which has been identified with the entire development of our knowledge of the property and behavior of electrons. It was used by J. J. Thompson in the original studies of the values of the charge and mass of the electron, and by Becquerel in studying the velocity of the ions emitted by radium. It is also an essential part of the principle of the cathode-ray oscillograph. A moving charge is the equivalent of an electric current and consequently suffers mechanical force and change of direction when moving in a magnetic field.

Perhaps the most striking feature of the paper mentioned is the concluding paragraph containing predictions of the author as to the future possibilities of tubes of this type. In his mind they will soon be used as rectifiers for series arc lighting and for replacing synchronous converters in substations, and, looking still further, he finds them on electric locomotives, permitting the use of direct-current motors and finally direct-current transmission lines fed through transformers and vacuum-tube rectifiers. It is to be hoped that he speaks with the voice of authority and of knowledge of facts already accomplished but still unannounced. It will indeed be a continuation of the remarkable achievements of the early years of these phenomenal little tubes if the predictions mentioned are only partly realized.

Insulator Development on a Rational Basis

IN THE operation of extra-high-voltage lines the flashing over of the insulator strings is one of the most serious troubles that are encountered. Lines as low as 60,000 volts are subject to such disturbances, but in these cases the flashovers are due in the main to high-voltage transients of a value greater than the rupturing voltage of the normal gaps between the conductors and ground. In the higher voltages—namely, 150,000 volts and more—the flashovers are due to more complex causes as outlined in the paper in this issue by Harris J. Ryan, H. H. Henline and F. F. Evenson. Only within very recent years has the subject of insulation of these lines been approached on a rational basis. The mere piling up of more and more insulators in the hope of so increasing the air gap that neither the line voltage nor the transients usually encountered could jump over the gap has proved inadequate for voltages of this range. The studies reported in the paper just referred to were not undertaken to prevent the occurrence of flashes over the insulators but to restrict them and, when they do occur, direct their course so that the arcs will not shatter the porcelain.

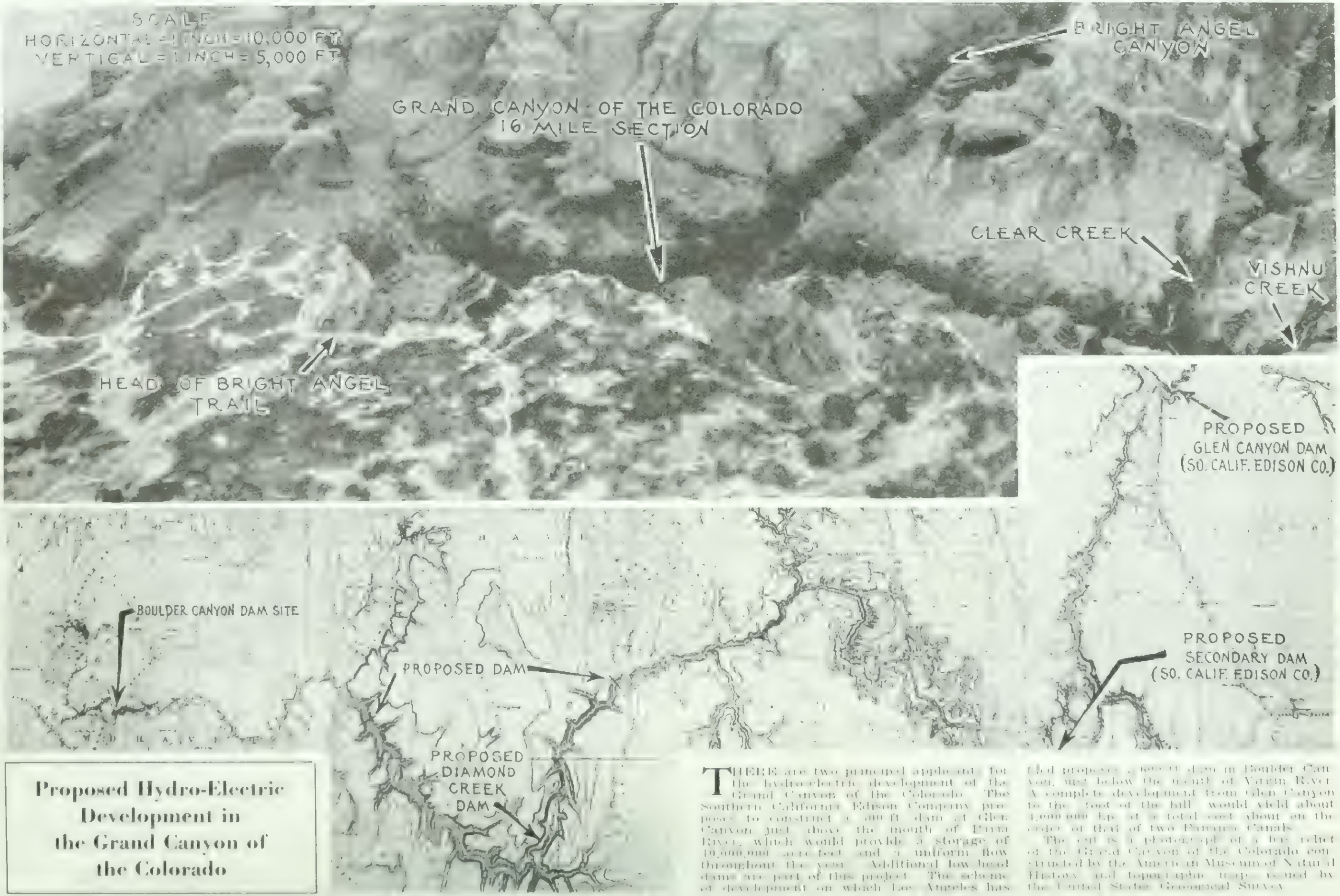
Even now these and other similar studies have had practical application. The recently completed 165,000-volt line of the Great Western Power Company, which stretches across California, is equipped with shields placed between the line conductors and the lower units of the insulator strings. The shields so distribute the unit duty on the strings that the line-end units are at less stress than is usually encountered in lines of lower voltage. Although this line has not been operated long enough to get conclusive proof of the effectiveness of these shields in preventing and directing flashovers, yet the tests indicate that the line should be little endangered by this form of trouble. A further application of the theories so far developed is to be made soon on the 220,000-volt lines of other California companies.

How Shall the Student Engineer Be Taught?

WHAT training shall the engineer receive in his college or university course? The tendency in the past has been toward ultra-specialization in the purely mathematical, scientific and technical phases of the course in which the particular student is interested. This tendency has produced some engineers to whom the fact that certain things are justified from an engineering viewpoint is sufficient to justify their application in any and all situations without the consideration of any other factors. The result has been the erection of many structures that are perfect from a purely theoretical engineering viewpoint but a reproach to the engineering profession from other viewpoints. Engineering is fundamentally a means or method through which it is possible to accomplish certain results. The results must be justified by the benefits that accrue to the community. These benefits may be and usually are measured in financial terms, though there are matters concerning public welfare and health in which the question of direct profit or loss is a minor or non-existent consideration.

The engineer must therefore be capable of deciding whether the course he recommends is justified not only from an engineering viewpoint but also from a broader viewpoint that is primarily economic. The effort of the engineering schools should be directed more and more to giving the young engineer an education well balanced between engineering fundamentals and the economic considerations that govern the world in which he must work. Some clear-thinking engineers are even raising the question whether an engineering course should not begin with a year or preferably two years of a collegiate business course framed so that the student's mind would be actually taken entirely away from engineering subjects and concentrated on preparation for a business career. Economics, political economy, English and studies dealing with the every-day problems in the business world would predominate, and, in preparation for the engineering studies to come later, intensive study in mathematics would be carried on. The last years of the course would then be devoted to intensive work on engineering subjects with their relation to the business studies of the earlier years constantly emphasized. Through the entire course the largest possible amount of practical work during the school term and the summer season should be undertaken in order to teach the student the practical application of the principles he is learning and above all give him the attitude of mind with which he must face the problems of his business career. The whole effort would be directed toward impressing the student with the idea that technical theory is an important guide, but cannot be made the supreme arbiter inasmuch as no one theory can comprehend all the factors on which a single decision must be based.

The problem is essentially one of sending out students who can approach their work with an attitude of mind related to that of the seasoned executive. While it is not possible in a school course to give the student what the business man has learned only in a long period of years, it is possible to send him into the business world with an attitude that will not have to be overcome and the individual's whole habit of thought reversed as the result of hard knocks and bitter experience in the post-collegiate environment.


SCALE
HORIZONTAL = 1 INCH = 10,000 FT.
VERTICAL = 1 INCH = 5,000 FT.
GRAND CANYON OF THE COLORADO
16 MILE SECTION
BRIGHT ANGEL CANYON
CLEAR CREEK
VISHNU CREEK
HEAD OF BRIGHT ANGEL TRAIL
PROPOSED GLEN CANYON DAM (SO. CALIF. EDISON CO.)
PROPOSED SECONDARY DAM (SO. CALIF. EDISON CO.)
BOULDER CANYON DAM SITE
PROPOSED DAM
PROPOSED DIAMOND CREEK DAM

Proposed Hydro-Electric Development in the Grand Canyon of the Colorado

THERE are two principal applicants for the hydro-electric development of the Grand Canyon of the Colorado. The Southern California Edison Company proposes to construct a 300-ft. dam at Glen Canyon just above the mouth of Paria River, which would provide a storage of 10,000,000 acre-feet and a uniform flow throughout the year. Additional low head dams are part of this project. The scheme of development on which Los Angeles has filed proposes a 600-ft. dam in Boulder Canyon, just below the mouth of Virgin River. A complete development from Glen Canyon to the foot of the hill would yield about 1,000,000 hp. at a total cost about on the order of that of two Panama Canals.

The cut is a photograph of a bas-relief of the Grand Canyon of the Colorado constructed by the American Museum of Natural History and topographic maps issued by the United States Geological Survey.

Capital Needs and Sources of Availability Should Be Predetermined

Failure to Estimate Them in Advance May Embarrass Companies at Critical Periods—Higher Business Efficiency Can Be Assured by Maintaining Simple Budget System—Application of Such a Plan to Public Utilities Considered

By R. S. SEESE
Electrical Engineer, Chicago, Ill.

ALTHOUGH it would be thought suicidal for the head of any enterprise not to make in advance some provision for financing its operations, it is surprising how many organizations do not employ a really systematic plan for predetermining the amount of capital that will be needed, where such capital will be procured and how and when it will be expended. The lack of ready cash often prevents the purchase of badly needed equipment or of materials at large-quantity prices, thus forcing the operation of the business at a lowered efficiency. On the other hand, the purchase of such things at haphazard, without careful provision for payment, frequently causes an embarrassing situation requiring drastic action at a sacrifice to some phase of the business.

Nor is this lack of advance preparation in financing common to the smaller companies alone. Commercial history cites numerous cases in which companies doing millions of dollars' worth of business annually, at rates carrying a satisfactory profit, became seriously embarrassed and not infrequently went into receivership because they were unable to obtain money at the moment it was needed. Even in normal times, seasonal fluctuations in the demand for various commodities cause a wide variation in the amount of capital required to operate a business. In times like the present, when there is added the uncertainty of obtaining any outside capital at all, the necessity for careful planning far ahead is increased manyfold.

Financial experts tell us that most business failures are due primarily to lack of adequate working capital. This dictum might be amended by saying that the lack of capital occurred at the time when it was most needed. In other words, the average working capital carried by the company was sufficient, but the operators failed to provide a maximum of capital when the expenditures reached a peak.

Some companies carry an excess of working capital in order to "play safe," but this is as great an error as carrying too little. Public utilities, fortunately, may carry their working capital at a minimum, because their receipts and expenditures can be accurately calculated in advance and their business is not ordinarily subject to the rapid fluctuations that occur, say, in manufacturing or jobbing.

A public utility may depend on its monthly receipts to pay current operating expenses, but should establish a reserve for the periodic payment of interest and other fixed charges and of seasonal repairs and maintenance work. An advance estimate for a utility company, setting forth expected receipts and expenditures over a long period, can be accurately made, even including expenditures for new construction, no matter whether the construction expense is to be paid out of new capital procured by the sale of securities or partly out of current earnings. Such an advance estimate, or budget, if calculated by small increments of time over a considerable period, is an invaluable aid in financing.

The budget must not be confused with an operating statement nor with an advance operating statement, because it has no direct connection with "sales" and "expenses." If properly constructed, the budget shows how much money will be spent for all purposes during the period and indicates the source of this money; that is, whether it is obtained from earnings or from outside the business. As the amount of cash available at certain times of the year may be insufficient to meet the expenditures at those times, the budget indicates when money must be borrowed and the times when it will be most convenient to repay it.

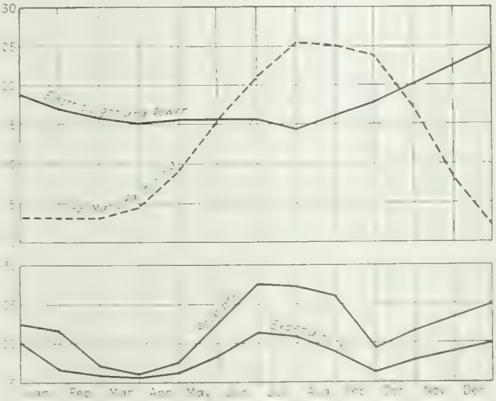
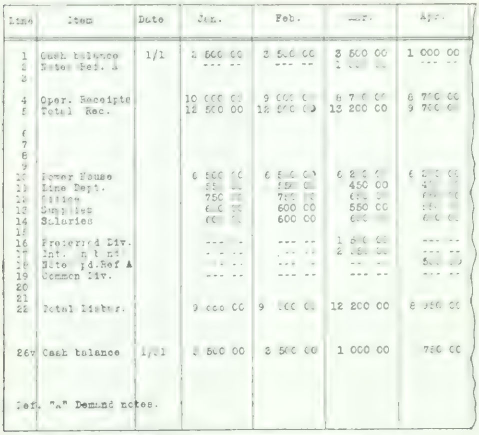


FIG. 1—RECEIPTS AND EXPENDITURES OF ICE-ELECTRIC PROPERTY PLOTTED TO SHOW METHOD OF ANALYZING FINANCIAL NEEDS

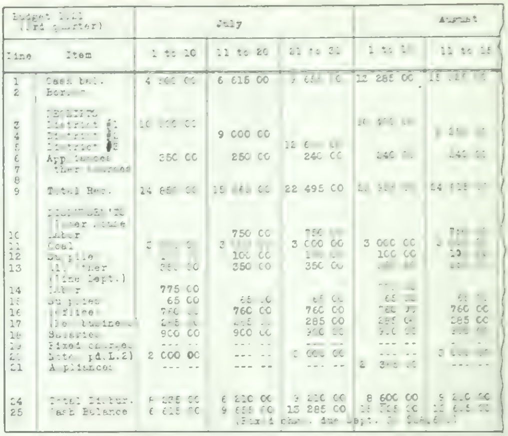
Probably the most popular form of budget covers operations by the month for the period of one year. Fig. 2 shows a simple form of such a budget. Assuming that dividends, accrued interest and so forth for the preceding year are paid, the cash balance for the beginning of the current year is relatively small. The receipts from all sources and the expenditures necessary for the conduct of the business are carefully estimated. Setting these down by the month, the cash balance for each month is then rapidly calculated, thus determining the times, if any, when it will be necessary to obtain outside capital to carry out the year's program. If, after this schedule is completed, it is apparent that



Line	Item	Date	Jan.	Feb.	[illegible]	Apr.
1	Cash balance	1/1	2 500 00	3 500 00	3 500 00	1 000 00
2	Notes Ref. A		--- --	--- --	1 [illegible]	--- --
3						
4	Oper. Receipts		10 000 00	9 000 [illegible]	8 7[illegible] 00	8 7[illegible]0 00
5	Total Rec.		12 500 00	12 500 00	13 200 00	9 7[illegible]
6						
7						
8						
9						
10	Power House		6 500 00	6 5[illegible]	6 2[illegible]	6 [illegible]
11	Line Dept.		[illegible]	[illegible]	450 00	[illegible]
12	Office		750 [illegible]	7[illegible]	[illegible]	[illegible]
13	Supplies		[illegible]	600 00	550 00	[illegible]
14	Salaries		[illegible]	600 00	[illegible]	[illegible]
15						
16	Preferred Div.		--- --	--- --	1 [illegible]	--- --
17	Int. [illegible]		[illegible]	[illegible]	2 [illegible]	--- --
18	Note pd. Ref A		[illegible]	[illegible]	--- --	5[illegible]
19	Common Div.		--- --	--- --	--- --	--- --
20						
21						
22	Total Disbur.		9 000 00	9 [illegible]00 00	12 200 00	8 [illegible]50 00
26	Cash balance	1/31	[illegible] 500 00	3 500 00	1 000 00	750 00

Ref. "A" Demand notes.

FIG. 2—A TYPICAL BUDGET FORM



Budget 1921 (3rd quarter)		July			August	
Line	Item	1 to 10	11 to 20	21 to 31	1 to 10	11 to 15
1	Cash bal.	4 [illegible]	6 615 00	[illegible]	13 285 00	15 [illegible]
2	Bor[illegible]					
	RECEIPTS					
3	District #1	10 [illegible]			[illegible]	
4	District #2		9 000 00			[illegible]
5	District #3			12 [illegible]		
6	Appliances	350 00	250 00	240 00	[illegible]	[illegible]
7	Other sources					
8						
9	Total Rec.	14 [illegible]	15 [illegible]	22 495 00	[illegible]	24 [illegible]
	DISBURSEMENTS (Power House)					
10	Labor		750 00	750 [illegible]		[illegible]
11	Coal	[illegible]	3 [illegible]	3 000 00	3 000 00	[illegible]
12	Supplies	[illegible]	100 00	[illegible]	100 00	[illegible]
13	All other	[illegible]	350 00	350 00	[illegible]	[illegible]
	(Line Dept.)					
14	Labor	775 00			[illegible]	
15	Supplies	65 00	[illegible]	[illegible]	65 [illegible]	[illegible]
16	Office	760 [illegible]	760 00	760 00	[illegible]	760 00
17	[illegible] business	[illegible]	[illegible]	285 00	[illegible]	285 00
18	Salaries	900 00	900 00	[illegible]	[illegible]	[illegible]
19	Fixed charges	--- --	--- --	[illegible]	--- --	[illegible]
20	Notes pd. L.2)	2 000 00	--- --	[illegible]	--- --	[illegible]
21	Appliances	--- --	--- --	--- --	2 [illegible]	--- --
24	Total Disbur.	[illegible]	6 210 00	[illegible]	8 600 00	[illegible]
25	Cash Balance	6 615 00	9 [illegible]	13 285 00	[illegible]	[illegible]

([illegible])

FIG. 3—BUDGET FOR EACH TEN DAYS

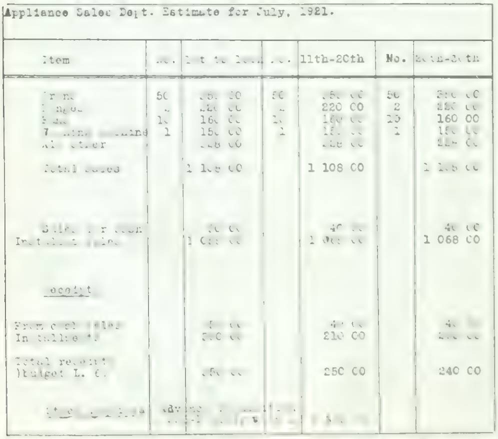
there will be a deficit of ready cash at some time during the year, it is often possible to shift certain proposed expenditures or to defer them until the budget indicates sufficient cash on hand to meet them.

Another form, in which the calculations are made for ten-day periods ending on the tenth, twentieth and thirtieth of each month, is shown in Fig. 3. The company using this form has three distribution properties from which receipts come in at different times of the month. Wages and salaries are paid on the fifteenth and thirtieth. Coal and supply invoices are paid on the tenth, twentieth and thirtieth, thus taking advantage of cash discounts and at the same time concentrating the work in three ten-day sections.

SIMPLEST FORM THE BEST

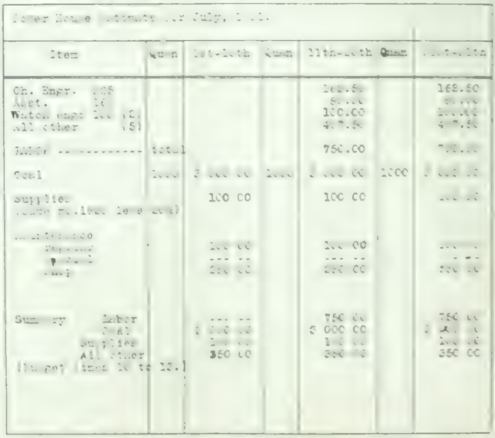
A budget must not be too complicated, if it is to be serviceable. No operating official can foresee exactly the conditions which will affect the purchase of materials, the price of labor or any other factor in the operation of the company's business for a whole year. Twelve months is a short time when calculating the earning capacity of a property, but it is a whole lifetime when considering what may happen to machinery and equipment, or what difficulties may arise with labor or the public which will boost operating costs or cut down revenue. It is therefore unnecessary to subdivide the various items of the budget sheet minutely, although this may be done on separate sheets when making up the budget, and indeed is quite necessary when computing any item whose amount is in doubt or which is subject to undue variation. As an example of this subdivision of budget sheet items, consider line 6 of Fig. 3, showing the estimated receipts from the sale of electric appliances. Fig. 4 shows the sub-estimate sheet made up by the department manager, in which he gives his calculations of expected receipts from this source and indicates the time and amount of expenditures necessary to keep up his stock. The total receipts for each month or part of month are then set down on the budget sheet, and the purchasing department is enabled to determine the best time for purchasing the appliances, thus giving the information for line 14 of the budget.

In the same manner the estimate (Fig. 5) of power-house expense is condensed and entered on the



Appliance Sales Dept. Estimate for July, 1921.

Item	[illegible]	[illegible]	[illegible]	11th-20th	No.	[illegible]
Irons	50	[illegible]	50	[illegible]	50	[illegible]
Ranges	[illegible]	[illegible]	[illegible]	220 00	2	[illegible]
Fans	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	160 00
Washing machines	1	[illegible]	1	[illegible]	1	[illegible]
All other		[illegible]		[illegible]		[illegible]
Total sales		1 [illegible]		1 108 00		[illegible]
Sales for cash		[illegible]		[illegible]		40 00
Installment sales		1 [illegible]		1 [illegible]		1 068 00
Receipts						
From cash sales		[illegible]		[illegible]		[illegible]
In tallies [illegible]		[illegible]		210 00		[illegible]
Total receipts (Budget L. 6.)		[illegible]		250 00		240 00
[illegible]	[illegible]					



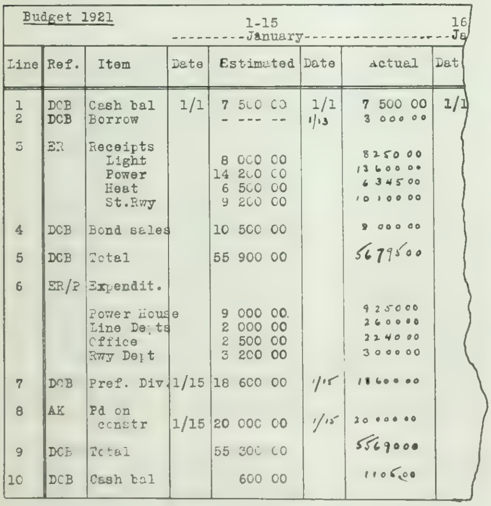
Power House Estimate for July, 1921.

Item	Quan	[illegible]	Quan	11th-[illegible]	Quan	[illegible]
Ch. Engr. [illegible]				[illegible]		162.50
Asst. [illegible]				[illegible]		[illegible]
Watch engr [illegible] (2)				100.00		[illegible]
All other (5)				[illegible]		[illegible]
Labor ———— total				750.00		[illegible]
Coal	[illegible]	3 [illegible]	[illegible]	[illegible]	1000	[illegible]
Supplies ([illegible])		100 00		100 00		[illegible]
[illegible]						
[illegible]		[illegible]		[illegible] 00		[illegible]
[illegible]		--- --		--- --		[illegible]
[illegible]		[illegible]		[illegible]		[illegible]
Summary Labor		--- --		750 [illegible]		750 [illegible]
Coal		[illegible]		3 000 00		[illegible]
Supplies		[illegible]		[illegible]		[illegible]
All other		350 00		[illegible]		350 00
(Budget lines 10 to 13.)						

FIGS. 4 AND 5—DEPARTMENTAL SUB-ESTIMATES

budget sheet, lines 9 to 13. All of this departmental data must, however, be thoroughly "boiled down" in order that it may be of real value to the financial officer.

It is important to repeat that the budget is concerned with receipts and disbursements and not with sales and expenses. To any one not used to looking at the matter in this way the following examples will be of assistance: The appliance sales department, we will say, puts on a fan campaign in May and June, allowing the company's patrons to purchase fans on the installment plan. Therefore, while the sales during these two months are very heavy, the receipts derived from the first and second installments are comparatively light. Again, the company agrees to install a suburban line and transformer station to serve a group of farmers. The cost of this extension is to be paid originally by these new customers, but it is agreed that a certain amount shall be deducted monthly from the light and power bills of these customers until the company shall finally have absorbed the cost of this extension. If the transaction is a large one, the receipts from this extension will be small for a long time, yet the "sales" each month may be most gratifying. If the financial head of the company makes the mistake, as he sometimes does, of confusing "sales" with the actual inflow of good hard cash with which he must pay bills, his calculations will frequently go badly astray.



Budget 1921				1-15 January			16 Ja
Line	Ref.	Item	Date	Estimated	Date	Actual	Dat
1	DCB	Cash bal	1/1	7 500 00	1/1	7 500 00	1/1
2	DCB	Borrow		- --- --	1/13	3 000 00	
3	ER	Receipts					
		Light		8 000 00		8250 00	
		Power		14 200 00		13600 00	
		Heat		6 500 00		6345 00	
		St.Rwy		9 200 00		10100 00	
4	DCB	Bond sales		10 500 00		9000 00	
5	DCB	Total		55 900 00		56795 00	
6	ER/P	Expendit.					
		Power House		9 000 00		9250 00	
		Line Depts		2 000 00		2600 00	
		Office		2 500 00		2240 00	
		Rwy Dept		3 200 00		3000 00	
7	DCB	Pref. Div.	1/15	18 600 00	1/15	18600 00	
8	AK	Pd on constr	1/15	20 000 00	1/15	20000 00	
9	DCB	Total		55 300 00		55690 00	
10	DCB	Cash bal		600 00		1105 00	

FIG. 6—SPECIAL BUDGET FORM

Contingencies will, of course, arise which were impossible to foresee. An attempt to take into account everything that might happen in the course of a year in a busy utility property would so complicate the budget sheet that it would be worse than useless. A "contingency allowance" may, however, be carried on the sheet, its amount based on the experience of former years, although the amount set aside for contingencies is preferably distributed over the items which are known to be susceptible to greatest variation. The budget is bound to be more or less in error in any case and will be revised from time to time, but to sum up the experience of a successful telephone executive, whose suggestions form the basis of this article, it is much better to spend a great deal of time formulating a budget and miss one's calculations than never to have attempted a budget at all.

FORM OF BUDGETS

Ruled sheets for budget work ordinarily carry no wording, as the form will require changing from time to time, and suitable wording can be readily inserted on the few copies that are required. The unworded forms can also be used in making up the departmental subestimates. If some extraordinary occurrence should sensibly change conditions during the progress of the period, a supplementary or revised budget is made, either by interlining with red ink on the original sheet or by typing a new sheet outright. It is convenient to have the entire year's estimate on one sheet, but as this is cumbersome, especially where ten-day intervals are calculated, three to six months to the sheet is the rule, and such sheets will fit an ordinary typewriter.

The writer recently saw an interesting variation of the budget form in which fifteen-day intervals were calculated and parallel columns provided in which the actual results were set down beside the anticipated ones (Fig. 6). It is usually sufficient, however, and productive of best results to make these notations in pencil or red ink on the regular budget form.

It is obviously impossible to go into great detail in this article regarding all of the various items which help to make a serviceable budget sheet. As in accounting, no two systems are exactly alike, and the purpose of these suggestions is merely to give an idea of the principle of the budget. Various modifications will occur to the user of the budget which will help him in his own particular application of the principle. No matter what form is used, the budget sheet may be considered to have performed its function if it indicates the time and amount of the major items of expenditure, if it provides sufficient cash to meet these expenditures, and if it points out the reasons for any material differences from the advance estimate.

Hydro-Electric Energy as Byproduct from Boston Water Supply

NEARLY 16,000,000 kw.-hr. was delivered in 1920 to the interconnected systems of the Edison Electric Illuminating Company of Boston and the New England Power Company by the Wachusett and Sudbury hydro-electric plants of the Metropolitan District Commission as a byproduct of the Boston water supply. The Wachusett station, situated at Clinton, Mass., receives water from the Wachusett reservoir under a head of 96 ft. and after passing it through four 1,000-kva. waterwheels discharges it into a tunnel feeding the metropolitan area. Similarly, the Sudbury station, operating under a head of 65 ft., with a plant rating of 1,450 kva. in vertical units, discharges water into the Boston supply. The latter plant was formerly a gatehouse. Last year the Wachusett station delivered 7,474,485 kw.-hr. to the two companies at 5.3 mills per kilowatt-hour, and from Sudbury the Edison company took 6,382,831 kw.-hr. at 6.25 mills. The Boston Edison-New England Power 66,000-volt tie line enables the plants to be interconnected when desirable and has resulted in a much larger sale of energy to these utilities than would otherwise have taken place. In eight years $500,000 worth of byproduct energy has been sold from the Boston water supply to these utilities and for pumping.

Leland Stanford Tests Indicate Nature of Breakdown

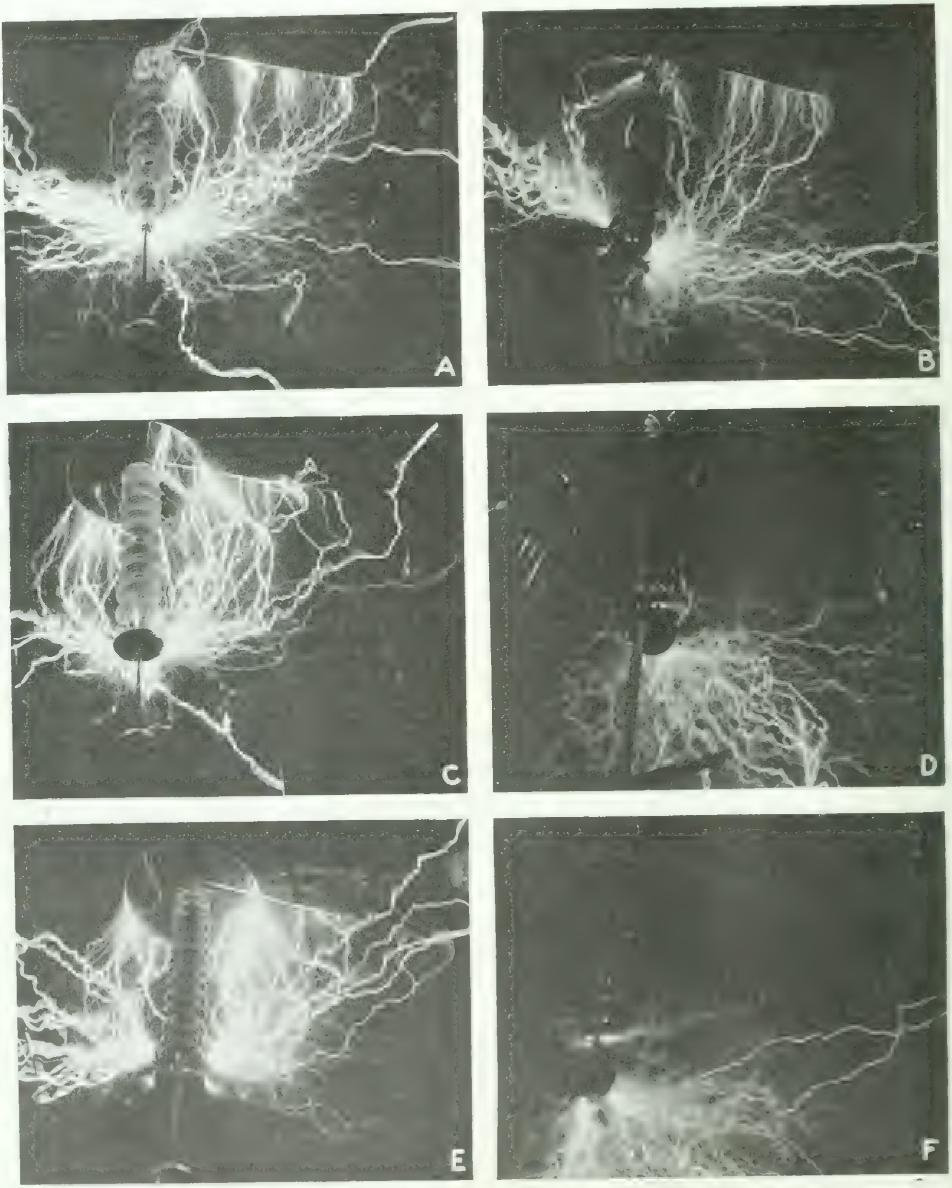


FIG. 1—JUST A FEW OF THE PHENOMENA OBSERVED IN FLASHOVERS

A—Wet ten-unit string cascading as well as arcing, with two three- and four-unit strings.

B—Tests in the presence of rain showed three cascades occurring along with thirteen flashes and nineteen flashovers.

C—Thirty-one wave fronts produced one [illegible] cascade, five flashes and twenty-five flashovers. One flash to the upper right was more than double the length of the string.

D—Use of a plate at the [illegible] caused [illegible] to be deflected downward or outward.

E—Same as D but without rain. [illegible] resulted in this case, there were four flashes and twenty-one flashovers.

F—Same as D with the [illegible] which does not materially affect the result.

Flashover of Insulators for 220-Kv. Lines*

Flashover Characteristics of Suspension Insulators, Including V-Strings and Composite Strings with Shielding Devices—Investigations Indicate that Flashing May Be Controlled to Cause Minimum Destruction of Insulators

By Prof. H. J. RYAN, H. H. HENLINE and F. F. EVENSON
Stanford University, Palo Alto, Cal.

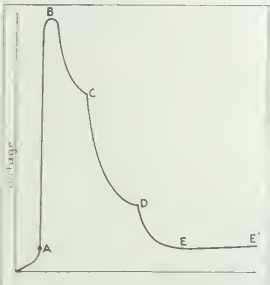
THREE sorts of electrical failures may occur in high-voltage transmission-line insulators: First, failure by puncture of the porcelain; second, failure by excessive conduction over the surface of the porcelain due to conducting material thereon, and third, failure of the atmosphere immediately adjacent to the insulator. The first type of failure has been largely eliminated by design and care in manufacture, and the second type partly by design but chiefly by better maintenance. The third type is complex, having many factors which may be grouped as follows: (1) The physical condition of the air and the presence of ions; (2) the form of the electric field in the air; (3) the magnitude and time variation of the voltage causing failure.

The first group involves the conductivity of gases.† This paper appertains particularly to the latter two divisions, and many flashovers of long insulators were made to determine the fundamentals and the relation of structural features to flashovers.

The study indicates that transient radio-frequency high-voltage discharges follow the direction of the field in which they are developed and that they can be controlled by proper attention to the forms of electrodes and the fields resulting. In the case of 60-cycle streamers a strong auxiliary field is formed, and great care must be exercised to prevent such arcs from breaking into the insulator string. Inspection of the 150-kv. Big Creek lines shows that arcs followed the initial electric fields quite generally. The simplest flashovers, those over various kinds of units in strings of two, were all by cascading, notwithstanding the fact that such strings have the best distribution of voltage. These flashovers were produced by both 60-cycle and high-frequency voltages. In all the other tests given here the latter was used, being produced by an oscillator operating at 55,000 cycles. Flashover of a string with ten units is shown in Fig. 1A. The string was set up with the high-voltage conductor connected axially and without arcing horns or shields, thus producing the highest ratio of maximum to average unit duty. Cascading is a small factor in this long string and is not due to irregular distribution of the string.

Succeeding tests were made on a ten-unit string having a 12-in. (30.4-cm.) shield at the conductor end and a 36-in. (90-cm.) shield at the tower end, shown in Fig. 1C; a fourteen-unit string with a line clamp and arcing horn at the conductor end and the 36-in. (90-cm.) shield at the tower end, shown in Fig. 1E without rain and Fig. 1B with rain; a fourteen-unit string having a 10-in. (25-cm.) sphere at the line end and no shield at the upper end, shown in Fig. 1D without rain and Fig. 1F with rain.

From this series it was found that transient radio-frequency oscillating high-voltage discharges follow the direction of the field in which they are developed and that they can be directed as desired by proper attention to the forms of the electrodes and of the field resulting. The insulators and shields shown in Fig. 5A were given thirty-two wave-train discharges, as shown in Fig. 5B, which produced two cascades of the three tower-end units on each string of the two; two 84-in. (213-cm.) discharges to the wall; three 49-in. (130-cm.) discharges horizontally to the tower, and twenty-three discharges 51 in. (135-cm.) vertically to the tower and clear of the insulators. These and other discharges are analyzed below.



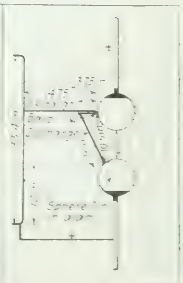


FIG. 2—PROGRESS OF CONDUCTION THROUGH A GAS. FIG. 3—OPTIONAL PATHS TAKEN BY DISCHARGES DEPEND UPON SHAPE AND DIRECTION OF INITIAL AND AUXILIARY FIELDS

FUNDAMENTALS CONTROLLING HIGH-VOLTAGE FLASHOVERS

When an electric field is set up in the air at sea level at common temperatures the air is overstressed if the gradient exceeds 76,000 volts, maximum, per inch (30,000 volts per cm.); the atoms are mutilated and therefore ionized. This is the start of a breakdown which develops into a flashover.

Insulation is either the absence of ions or it is a solid barrier to the passage of ions. Gases cannot act as barriers to stop the migration of ions formed and driven by an electric field. The insulating character of the air is therefore a negative quality; it is the absence of ions. Without ions there can be no conduction regardless of the voltage and of the field formed by the voltage. The continuity of discharges produced through a gas column is shown in Fig. 2.‡ The curve *OABC-*

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*Condensed from a paper delivered before the San Francisco Section of the American Institute of Electrical Engineers.

†Conduction of Electricity Through Gases, by J. J. Thomson; Electricity in Gases, by J. S. Townsend; [illegible], by H. J. van der Bijl.

‡[illegible] *Metallurgical and Chemical Engineering*, [illegible]

DEE', with co-ordinates *E* and *I*, expresses the continuous voltage-current relation in conduction through a gas from the saturation current at *A* to the arc at *E*. In this chart ever-changing scales are used for the values of *E* and *I*. The smallest currents are in fractions of microamperes and the corresponding voltages in kilovolts. Larger currents are plotted in values increasing to amperes and the voltages in kilovolts and volts.

GROWTH OF CURRENT THROUGH GASES

When voltage is applied to the gas between parallel plates and increased in value from zero an extremely small current is set up owing to the mobilization of antecedent ions which are the result of some obscure cause. At a few hundred volts more or less all free ions are being gathered in to form the current stream and the point *A* is reached. This ionic stream is called the saturation current. It cannot be increased by considerable increase in voltage.

By greatly increasing the voltage the current increases to the point B. Then a glow discharge appears, accompanied by a sharp decrease in voltage with increase in current. This is caused by the establishment of a sufficiently strong field in the gas adjacent to the electrodes to cause copious ionization by collision. Should the voltage remain constant, the current-voltage relation will be unstable and the glow discharge will quickly grow and culminate in general ionization and flashover. If the current is increased but controlled by lowering the voltage so as to maintain a stable relation, the point *C* is reached, whereat a third source of ionization appears. This is due to a radiation of negative thermions from the heated cathode. A further increase in current and drop in voltage then occurs, forming the half-arc. On continuation the point *D* is quickly reached, where the anode boils and gives off the greatest number of ions encountered in conduction through a gas. After passing through *D* the relation stabilizes and small increases in voltage correspond to large increases in current. The four distinct forms of discharge are summarized in Table I.

TABLE I—DISCHARGE THROUGH GASES IN RELATION TO THE SOURCE OF IONS

Source of Ionization	Type of Discharge
I. Antecedent	Saturation currents
II. Collision	Glow discharge
III. Cathode radiation	Half arc (Poulsen arc converter)
IV. Anode vaporization	Full or power arc

Little is known about the time element in Fig. 2, although it is of the highest importance, and nothing is known of the time required to develop a discharge through the saturation-current and glow-discharge states in advance of flashover. The form of the field is another of the important factors in the production of flashovers as it determines where the glow discharge first appears. This is the chief source of ions that develop flashovers, and it also has much to do with the route of the flashovers.

The nature of the field form and time element of 60-cycle discharges has been demonstrated with the apparatus shown in Fig. 3. The approximate form of the field is shown in light lines. Without the metal plate 205,000 volts was required for a discharge across the gap. At slightly below 143,000 volts and with the plate connected to the lower sphere discharges resulted due to ionization from the short, blunt barb of small wire mounted on the upper sphere as shown. The shortest distance from the barb to the lower sphere was 10.5 in. (26.6 cm.) and to the plate 14.75 in. (36.5 cm.). At 143,000 volts discharges went as freely to the plates as to the sphere. Without the plate there was no brush discharge formed at the barb even at 205,000 volts—the voltage required to discharge between the spheres by the shortest route. When the plate was slightly more remote all the discharges took place between the barb and the lower sphere, and when slightly less remote, from the barb to the plate.

A flashover occurs when a streamer is built from the glow discharge to the opposite electrode. The field drives the ions of one sign forward and of the other backward. Therefore the direction of the impelling field is the chief factor governing the route taken by the discharge. The direction and amount of this field is the sum of the initial and auxiliary fields. The field between the electrodes prior to the glow discharge is the initial field, that subsequently built up from the streamer to the opposite electrode being the auxiliary field. The direction of the ion propulsion at the streamer head is coincident with the direction of the combined fields.

In the analysis of the flashover results it must be noted that, given a source of ions, 10,000 volts per inch at 60 cycles is required to maintain the streamer which is the initial stage of a flashover. The discharges from the barb to the plate were by the shortest route, having a length of 14.75 in. (36.5 cm.), while those from the barb to the sphere did not traverse the shortest route of 10.5 in. (26.6 cm.) but covered two sides of a triangle having a combined length of 14.75 in. (36.5 cm.). Both these discharges conform to the 10,000-volts-per-inch rule.

The relative positions of the initial and auxiliary fields and the time element in the development of the glow and streamer discharges are the responsible factors in the selection of the paths. In the case of the discharge from the barb to the plate the directions of the two fields are coincident throughout and the discharge develops in the direction of the initial field. In the discharge to the sphere the two fields differ in direction by more than 90 deg. The glow discharge and streamer growth at the barb start suddenly near the 60-cycle wave crest that has already established a strong initial field, and there exists no auxiliary field. The initial field drives the first crop of ions forward in its own direction toward the plate. By the time a streamer grows 3 in. (7.5 cm.) toward the plate the auxiliary field has formed from this streamer toward the sphere in sufficient strength to divert some or all of the ions toward the sphere. The race is then on, and the streamer that reaches its goal first develops the flashover.

Radio-frequency, flashover-producing streamers develop no strong auxiliary fields. The result is that this class of flashovers conform largely to the directions of the initial fields in which they originate. Sphere-gap flashovers produced with undamped 70,000-cycle voltages are shown in Fig. 4A. Barbs were mounted on each of the spheres as shown. Similar discharges were produced (Fig. 4C) without barbs by touching the sphere at the top with a hard-rubber rod. Because of the higher specific inductive capacitance of the rod the air between it and the sphere was overstressed. A glow discharge developed followed by a flashover to the top of the other sphere. Thus high-frequency discharges depart little from the route of the tubes of force in the field in which they originate.

Other things being equal, the voltage consumed through the 60-cycle streamers is low and that through the radio-frequency streamers high. The result is that the potential of the head of a 60-cycle streamer will be higher than the potential in the adjacent region of the electric field, and a strong auxiliary field is formed and terminated upon the streamer head. The potential of the head of a radio-frequency streamer will be correspondingly nearer to the potential in the adjacent field and the resulting auxiliary field at the head of the streamer will be correspondingly weak. It is for these reasons, generally speaking, that low-frequency discharges develop along the shortest routes between electrodes of the conductor or condenser circuits and the high-frequency discharges develop more often through the far longer routes of the tubes of force in which they have had their start.

The long suspension-insulator flashovers produced by the oscillator in Fig. 5C established the fundamental that a discharge thus produced is also confined approximately to the route of the tube of force in which it obtains its start. Small vertical cylindrical shields were mounted on either side of the insulator string and capped with pin-type insulators. The start of discharges into the tubes of force that extend upward near the insulator was thus prevented at the voltage that started the discharges through the tubes of force that lead downward and terminate on the top of the cross-arm immediately below.

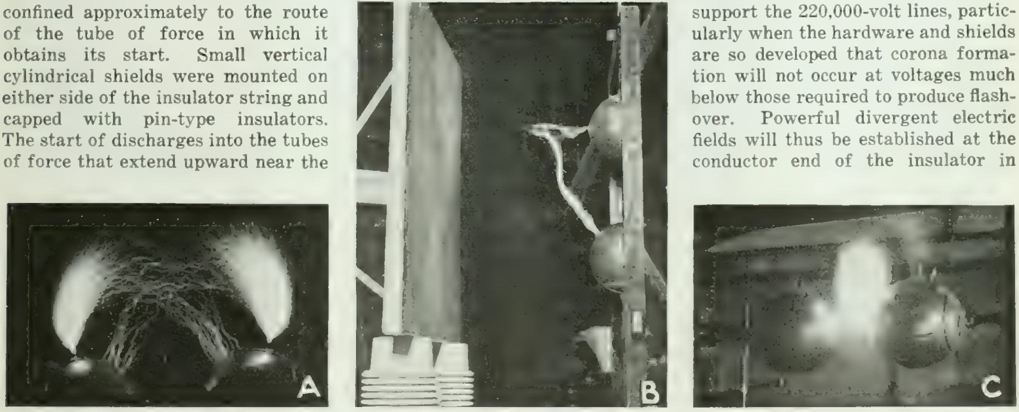


FIG. 4—HIGH-FREQUENCY DISCHARGES COMMONLY FOLLOW INITIAL FIELDS

A—Discharges between barbs mounted on spheres indicate the form of the field of force and show the effect of initial fields on the paths of discharges.

B—Remarkable photograph showing how a 60-cycle discharge started by the initial field is diverted downward upon the lower sphere by the auxiliary field.

C—Two stages of discharge—streamer discharges above and arc below.

The preceding set-up was modified by replacing the small vertical cylindrical shield on the side of the insulator away from the tower with one of the same length but larger diameter and by omitting the pin-type insulator cap, with the result shown in Fig. 5D. Streamers were built up upward across the insulator end to the tower cross-arm, thus producing heavy cascades and flashovers.

A study of the flashovers of the V-strings in Fig. 5B throws light on the nature of the time element as a fundamental in discharge phenomena. This photograph reveals the fact that during the interval in which the isolated streamer grew to a length of 84 in. (213 cm.) the associated streamers, planted thickly around the 1-in. (2.5-cm.) conductor, grew to a corresponding length of only about 5 in. (12.5 cm.). In another set of flashovers studied but not photographed the formation of isolated streamers was prevented by shields and a dead-end sphere. It was then observed that some of the associated streamers about the line conductor outran the others and developed lengths exceeding 3 ft. (1 m.) during the time in which the rest did not grow beyond 5 in. or 6 in. (12 or 15 cm.)

ARCS ON BIG CREEK LINES FOLLOWED INITIAL ELECTRIC FIELD

The 150,000-volt Big Creek lines of the Southern California Edison Company which were inspected with reference to flashovers are suspended from insulator strings which are neither long nor short (nine units in suspension and eleven in dead-ends). The marks that had been left on insulator hardware, line conductors, towers and ground conductor where flashovers had occurred indicated clearly that the flashovers struck clear of the insulators in most cases. The routes along which they developed were largely determined by the initial field and to a small extent only, if at all, by the secondary field. This promises well for the success of the longer strings that will be used to support the 220,000-volt lines, particularly when the hardware and shields are so developed that corona formation will not occur at voltages much below those required to produce flashover. Powerful divergent electric fields will thus be established at the conductor end of the insulator in advance of streamer formation. At the start streamers will, therefore, be driven outward and well away from the properly shielded or graded insulators by the initial field when produced by overvoltages of the transient radio-frequency type. The same flashover-direction control will hold for overvoltages of the sustained 60-cycle form when sufficient care has been taken to determine outward in lieu of inward directions of the auxiliary fields accompanying 60-cycle streamers.

During a storm in which lightning struck in the vicinity of a transmission line near one of the power houses an overvoltage transient was thrown onto the line that passed the electrolytic lightning arrester having a 13-in. (33-cm.) horn gap, entered the station and discharged over, but free of, a bushing, 48 in. (120 cm.) to ground. This is strong evidence that the lightning stroke set up an oscillating transient in the line that produced an association of slow-growing glow and streamer discharges at the gap of the arrester and a rapid 48-in. (120-cm.) flashover, race-winning, isolated streamer at the bushing within the power house.

Direction of Flashovers May Be Controlled

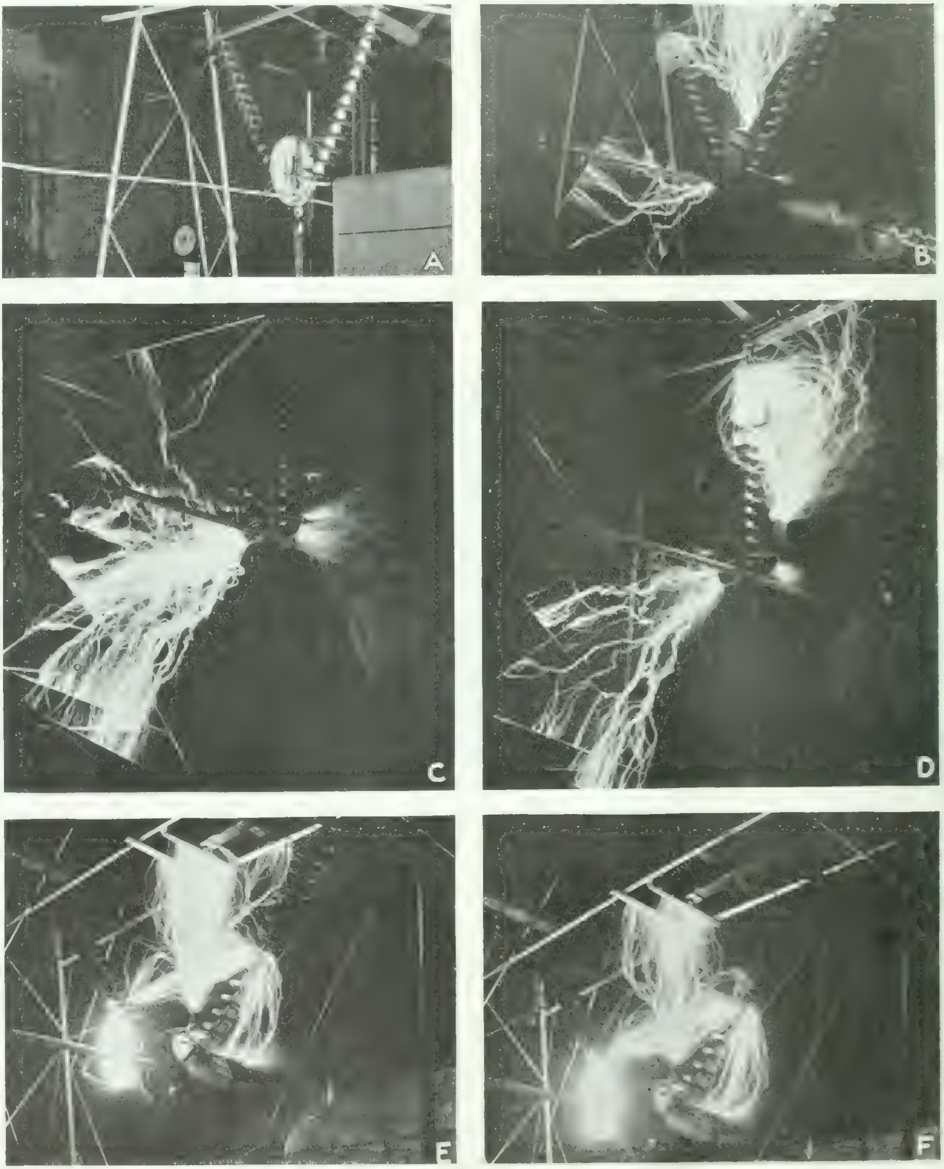


FIG. 5—SHAPE OF ELECTRICAL FIELD SURROUNDING INSULATORS DETERMINES DIRECTION OF FLASHOVERS

A and B—This arrangement of insulators has been proposed for one of the first lines that will operate at 220,000 volts. This is a V-string with thirteen units in each section, having a larger metal disk between the sections and a smaller shield at the bottom of each section.

C—Proper design of shields in this case causes the discharge to be deflected to the tower and away from the insulators. Small vertical shields are mounted on either side of the insulator string and these are equipped with pin-type insulators.

D—Slight change in arrangement [illegible] causes [illegible] cascading over the upper units of the string of suspension insulators. In this case one of the pin-type insulators has been removed and a blunt pin substituted.

E and F—This is another type of design that has been suggested for the 220,000-volt lines. The similarity of discharges indicates that one arrangement will always give practically the same flashover. In this set-up there are fourteen disks in each leg and a [illegible] ring at the bottom of each insulator section.

A space factor of some sort exists which cannot be defined as yet, but it should be noted that Figs. 5C and 5D, which are of two successive tests on the same set-up, are astonishingly alike and that it is difficult to distinguish one from the other. The counts made by witnesses of the number of discharges that occurred over corresponding routes are summarized in Table II. While there were but thirty wave trains, these, being heavy, all parted, each taking successively several different routes.

TABLE II—ROUTES TAKEN BY FLASHOVERS IN FIGS. 5C AND 5D

Location of Flashover	Path Length, In.	No. of Discharges Fig. 5C	No. of Discharges Fig. 5D
Right outside ring to insulator top	36	11	12
Right inside ball to insulator top	35	25	25
Left inside ball to insulator top	38	18	18
Left outside ring to insulator top	35	30	30
Center ball to cross-arm	38	26	17
Total	..	110	102
Groups of wave trains			30

The close agreement between the two sets seems to indicate that the discharge along one route cleans up the ions there so completely that the discharges immediately following can be more readily established by other routes less recently used, thus accounting for the wide adoption of routes and the virtual repetition of discharge groups when the numbers of discharges in each group amount to thirty or more.

CONCLUSIONS

From the foregoing tests the following conclusions have been reached:

1. The classical studies of Steinmetz and Hayden and of Peek in regard to the time factor in electrical discharges should be greatly extended so that the results will be directly applicable to insulator flashovers.
2. The strength and direction of the aggregate electric field during the production of a flashover are the chief factors in determining the route of such flashover.
3. In many forms of applied overvoltage and of electric fields thereby established time is more important than space in the determination of the route that will be taken by the flashover.
4. Where flashovers are developed in quick succession (one per second) there exists a space condition that is a factor in the control of the flashover route.
5. The value of the average voltage gradient (kilovolts per centimeter or inch) required to produce flashovers in air at sea level and ordinary temperatures varies between wide limits: 1,000 to 14,000 volts per centimeter (2,500 to 35,000 volts per inch).

Adoption of Metric System Again Up at Washington

A SUB-COMMITTEE of the Senate committee on manufactures has been designated to conduct hearings on a bill by Senator Ladd of North Dakota providing for the compulsory adoption after ten years of the metric system of weights and measures. Senator McNary of Oregon will act as chairman of the subcommittee. The other members are Senator Weller of Maryland and Senator Jones of New Mexico. It is the intention to have limited hearings shortly after the congressional recess so that the proponents and opponents of the legislation may be heard and a stenographic record of the hearings circulated. Further hearings are planned for the December session.

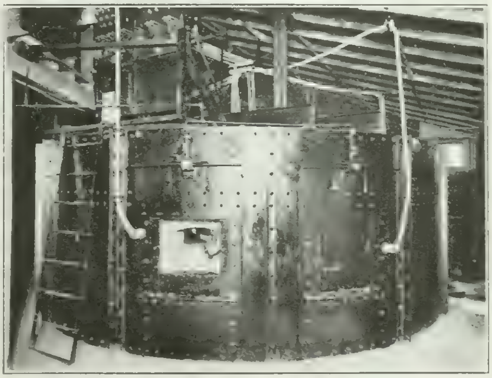
Rotary Electric Furnace Shows Marked Advantages

Nash Motors Company Will Install Another—Displaces Oil-Fired Furnace for Continuous Heat Treating, Annealing and Carbonizing

BY ALAN D. DAUCH
Engineer with George J. Hagan Company, Pittsburgh

TO PERMIT continuous heat treating, annealing and carbonizing the Nash Motors Company, Kenosha, Wis., recently placed in operation a rotary electric furnace which is of unusual design and which has many advantages over the oil-fired furnace that has been displaced. The results obtained in the past few months' operation have been so satisfactory that the company has arranged to install another furnace similar to it.

The fact that the equipment had to be designed so as to be able to heat-treat automobile parts varying in size and characteristics from a small spring clip to a large front axle made the problem of design unusually complex. A rotary furnace with a moving hearth in the form of a continuous annular ring was finally selected as being best suited for all purposes. Accordingly, this furnace was laid out so as to have the following physical dimensions: Over-all outside diameter, 19 ft. (5.7 m.); over-all outside height, 7 ft. (2.1 m.); outside diameter of rotating hearth, 15 ft. (4.5 m.); inside diameter of rotating hearth, 5 ft. (1.5 m.); width of hearth, 5 ft. (1.5 m.); height of heating chamber, 2 ft. (0.6 m.). The furnace walls are of standard construction, bonded throughout with "Adamant" cement and incased by sheet steel reinforced with structural beams. The hearth rotates on a series of roller bearings—twenty in number—placed at regular intervals about the circumference of the table. Roller bearings on the inner wall of the furnace prevent side play of the hearth. The clearance space between the hearth and the furnace is closed by means of sand seals to reduce infiltration of air.



CHARGING AND DISCHARGING DOORS IN FOREGROUND; CONTROL EQUIPMENT ABOVE

The furnace is provided with two adjacent doors, pneumatically operated, one for charging and one for discharging. A baffle wall extends across the heating chamber between the two doors to prevent the heated pieces being chilled when cold material is charged. The hearth is driven by an electric motor through gear reduction machinery so as to give six speeds of rotation varying from one complete revolution in thirty minutes to one revolution in seventy-five minutes.

HEATING ELEMENTS DISTRIBUTED TO GIVE TWO ZONES

The electric heating equipment consists of two sets of nickel-chromium ribbon-heating elements mounted on the inner and outer walls of the furnace. The first section or heating zone extends approximately two-thirds the distance around, starting at the charging door, and has a connected load of 210 kw. The soaking zone or soaking section has a connected load of 60 kw. installed for the purpose of supplying the radiation losses in this part of the furnace and giving enough additional heat to bring all of the charge to a uniform temperature. The main or heating zone is run at a temperature of 1,580 deg. Fahr. and the finishing or soaking zone at 1,525 deg. Fahr. The heating elements in each zone are separately connected to a General Electric control board. The temperature of each section is automatically controlled and recorded by means of a two-point Leeds & Northrup potentiometer. The temperature of each zone can be automatically maintained at any value between 200 deg. Fahr. and 1,800 deg. Fahr. The total connected load of 270 kw. is connected to 440-volt, three-phase, 60-cycle power service, and 110-volt, single-phase, 60-cycle power service is used for control purposes.

Under actual operating conditions 11.75 lb. (5.2 kg.) of steel has been heated to 1,525 deg. Fahr. and soaked at the same temperature per kilowatt-hour consumed. This is at the rate of 170 kw.-hr. per ton. The charge per hour consists of approximately 3,000 lb. (907 kg.) of various automobile parts such as spring clips, steering knuckles, connecting rods and front axles. The weights of the different parts vary from 3 lb. (1.3 kg.) each to 180 lb. (81.6 kg.) each. The time during which the pieces are in the furnace naturally depends on the cross-section and weight of the particular part. This feature of time in the furnace is very aptly taken care of by the different speeds at which the hearth may be revolved.

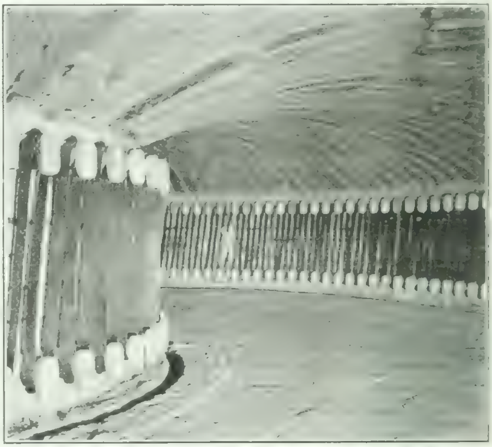
OPERATING CYCLE OF FURNACES AND COMPARISON WITH OIL-FIRED UNITS

After the furnace operator has removed the final charge of material to be hardened and the main line switch is opened, a charge of grey-iron castings and steel forgings is placed in the furnace over night for annealing purposes. The only heat employed to anneal these parts is the heat drawn from the furnace walls. The temperature of the charge and the furnace in the morning averages about 1,000 deg. Fahr. The annealing material is then removed and the furnace is again utilized for hardening operations. Approximately forty minutes is required to bring the furnace temperature from 1,000 deg. Fahr. to 1,525 deg. Fahr. This furnace is also to be used for carbonizing cam shafts. It is planned to charge a total of 18,000 lb. (8,165 kg.) of carbonizing boxes, packing and material in the furnace at one time.

Some of the advantages of this furnace over the box-type oil-fired furnaces displaced follow: Owing to the uniform rate of heat absorption, distortion on long parts (axles) has been entirely eliminated. In the fuel furnaces, regardless of the fineness of control, there was no assurance that all of the parts in the furnace had reached the proper temperature or had not been overheated. In this electric furnace the work is charged at one place and travels for a predetermined time around the circumference of the furnace before it can be withdrawn. The temperature, heating time and rate of heating are under absolute control and are duplicated with mechanical precision day after day.

Scaling has been virtually eliminated in the electric furnace. The material annealed in the rotary electric furnace now requires only a "flash pickle." This operation formerly required three to four hours of time.

Since the electric furnace has been used the scleroscope hardness test on all parts has been increased from two to five points. Furthermore, the quality of the material by individual test has proved to be more uniform in strength and other physical properties. The item of labor for handling the same number of parts has been reduced from six to three men, and up to the present no material handled in this furnace has been rejected because of faulty heat treatment.


SPEED OF ROTATION OF ANNULAR HEARTH CAN BE REGULATED FOR PRODUCTS OF DIFFERENT SIZE

The most important advantage observed by the metallurgical men who have charge of this equipment is that they have been able to reduce heat treatment to a mechanical operation. The furnace operator is supplied with a heat-treating ticket on which are written the number of pieces, drawing number, speed of rotation of furnace hearth and temperature. It is then an assured fact that the particular product will receive the specified treatment regardless of any of the usual conditions affecting a heat-treating operation. Furthermore, working conditions have been vastly improved by the design of the furnace with the resultant increase in productive effort on the part of the furnace attendants.

From the electrical superintendent's viewpoint this electric furnace possesses other advantages worthy of consideration. For instance, owing to the unity power factor and high load factor this equipment has materially benefited power-factor and load-factor conditions throughout the entire plant.

The furnace was designed and installed by the George J. Hagan Company, furnace and combustion engineers.

Making Better Engineers of College Men

Power to Think Is More Important than Mind Filled with Facts — Sound Basis in Fundamentals Necessary—Attitude of Service and Co-operation Most Desirable Characteristic of Young Engineer

MANY constructive suggestions for improving the fitness of graduates of engineering schools were given by prominent electrical engineers in answer to a letter sent out recently by the educational committee of the American Institute of Electrical Engineers. Among these suggestions two stand prominent. The first is that the college should teach thoroughly a few fundamentals rather than impart a large store of facts and should drill the student in analyzing any problem and solving it by applying these fundamentals. The second is that the graduate should cultivate above other things the attitude of service and co-operation.

It was asserted in nearly all the answers that development of the power to think is more important than the accumulation of information no matter how great the amount. The whole field of engineering and of commerce and business demands analytical ability of the highest order. Therefore the capability to analyze an unknown problem, first recognizing all the elements present, and then to progress step by step in considering each factor and its bearing on the objective sought, is a prime requirement for personal success in engineering and industry.

FUNDAMENTALS MUST BE MASTERED

Although it is advocated that the students shall be grounded in fundamental theory, it is not the desire to make them theorists. As one engineer expressed it, "Ground them thoroughly in the fundamentals of physics and mathematics, both to be taught by engineers and not by physicists and mathematicians." Another letter brought out the point that there is need for more professors who are practical engineers, who have rubbed shoulders with the world and who are capable of doing the jobs they are trying to teach students to perform.

It is of the utmost importance that there be a certain amount of business and legal training in the engineering curriculum. The students should be taught banking, the laws pertaining to contracts, accounting and many aspects of business of which the average college-trained engineer knows little or nothing. In every profession it is the all-around men who are at the top, the men who are interested in and know other specialties besides their own. Anything which contributes to the development and accentuation of personality through discipline and culture will eventually be more valuable than that which contributes to the equipment of the specialist. A better knowledge of English is desirable in order that the engineer may express himself clearly and definitely and put forward in a concise manner the reasoning which he has in mind.

The old type of manual training in colleges is considered to be to some extent a waste of time. In place of this it is thought better to have the student do one year's work in some manufacturing establishment or in some branch of practical engineering work allied with the course which he is taking.

Service, in the highest sense of the word, was thought by virtually all who answered the letter to be the basic philosophy that should be impressed on the student to serve as a guide in future work. After selecting the work which he will follow, the student should put forth untiring effort in preparation to become a master of it, with the predominating thought always in mind to give the best service in his ability. Such a resolution to give service implies cheerfulness in co-operation, self-helpfulness, determination and consideration for others. This attitude outranks ability in every normal competition. There may be instances in which ability alone might win, but never in the team work which is necessary to modern industry and society. The engineer must learn to build up and construct, helping others rather than criticising and tearing down, and to get his reward from the co-operative efforts of others and the confidence they place in him. The supreme importance of applying plain common sense in all problems should be constantly kept in mind. This common sense should be applied in all affairs of life, and the student should learn the value of mixing with his fellows and taking a lively interest and active part in all of the affairs of citizenship.

The engineer should never cease to be a student. The time for absorbing knowledge does not end when the college course is completed, but extends throughout life.

Health is obviously essential to success, and the importance of conserving the physical powers should be emphasized.

Interesting quotations taken from the replies are made in the following paragraphs, the name of the writer preceding each quotation:

B. G. LAMME: "In the first place, I find that the vast majority of technical graduates from our schools have no real grasp of fundamental principles. These principles may have been taught to them, but have gone over their heads, or they have not realized that these were fundamental. The principal reason for this lack of realization, I think, lies in the fact that the students are not trained in the use of such principles. Possibly many of them would not have the grasp even if they were trained in the use of fundamentals, but the general indications that I have found are that they have never been drilled in the use of the fundamental principles. I can cite several instances in my own experience which may serve to illustrate the point I have in mind.

ONE MAN WHO USED THE FUNDAMENTALS TO ADVANTAGE

"In my own work in college, where I took up a course in mechanical engineering, the professor at the head of the department, S. W. Robinson, had a tremendous reputation among the boys as a man who knew practically everything. In other words, the general feeling was that he was a 'wizard' in engineering matters. Naturally, hearing such things, I at first held the same opinion. However, as I got to know him better—and eventually I was very close to him in engineering matters—I acquired an entirely new opinion of him. To my surprise, I found that there were a vast number of subjects about which he apparently knew little or nothing, but, nevertheless, on such subjects he could reach conclusions quickly and reliably. For example, in endeavoring to find the source of this ability, and also how he got at things, I devised from time to time a number of special problems, which I sprang on him on suitable occasions, usually in private. On such problems I had done considerable work and had encountered some difficulty, which was the occasion for presenting the matter to him. I found that in virtually all cases when I first presented such a problem to him he knew practically no more about the subject than I did, or even possibly less, but that almost invariably, after a little study, he could solve the difficulty for me and explain it to me clearly. In getting at how he did it I came to the realization that he simply relied upon a few fundamental principles and that he brought these to bear directly on the solution of the problems I put up to him. In many cases I had also gone over these same fundamental principles, but had no realization to what extent they could serve as tools for handling difficult work. Gradually, in watching Professor Robinson's work, I came to the knowledge that his real strength did not come from any broad general fund of information, but rather from the fact that he had apparently a limited amount of information of a sort from which he could construct almost anything he wanted. This gave me an entirely new idea of the meaning of education. With him it was a case of having a few general-purpose tools, which he could use in all manner of ways to construct a desired result; whereas, compared with him, many so-called educated men had a vast collection of tools practically none of which they knew how to use.

"A very broad-spread idea, which should be combated, is that the boy takes a college course for the purpose of collecting information. This idea is not only a mistake but is a very harmful mistake. A boy goes to college for the purpose of learning to use his head, not merely to fill it. Much of the college training today is in the nature of a filler, and much of the filler is worthless in the way of future advantage. If the boy is to be an engineer, presumably he will want to lead in something and his future work may consist largely of things which do not yet exist. Much that he acquires at school is simply the story of what is already done; that is, it covers what is already a story of the past. The value of this past work lies mostly in the principles upon which it is based, and these principles are very liable to be carried into the future. Therefore, if the college boy can be trained to set aside the vast mass of facts and results of the past and simply recognize a few fundamentals upon which these are based, he will be fairly well equipped for his future work."

Future of Different Lines Should Be Explained

Carl Hering: "During the year preceding that in which the student must select his particular branch of engineering he ought to attend a course of lectures describing what each of the different branches of engineering comprises; that is, what kind of work he would have to do, what studies he would have to take up, what the probable field for employment is, what the possible field of development is, etc. This should embrace not only the few general branches of engineering, like electrical, mechanical, civil, mining, chemistry, architecture, etc., but should also include the subdivisions; in electrical engineering, for instance, such subdivisions as the generation and distribution of power, design and construction of machinery, telegraphy and telephony, furnaces, electrochemistry, teaching, salesmanship, administration, etc. At the end of such a course the student is better able to make a correct choice, and his teacher is better able to advise him and to sort out the wheat from the chaff. A student will always do best in that branch in which he is most interested, but he often fails to make the correct choice because at the time of making it he has too little knowledge of the kind of work and study required in the various branches."

More Practical Professors Are Needed

H. C. Heaton: "First, there is a need for more professors who are practical engineers, who have got out and rubbed shoulders with the world and who are capable of doing the job they are trying to teach their students to perform.

"Second, in order to secure practical teachers it will be necessary to compete from a monetary standpoint with the industries, and this means that we have to pay attractive salaries in the teaching profession.

"Third, there should be the closest co-operation between industry and the institutions of learning, and if necessary, industry should assist in liberally endowing them in order to make the fullest use of their facilities for research work and the development of new fields of progress. This alliance of science and industry brought Germany to the very pinnacle of commercial success just prior to the war.

"Fourth, no engineering course should be considered complete without requiring the student to do one year's work in some manufacturing establishment or in some branch of practical engineering work allied with his own course.

"It is of the utmost importance to include a limited amount of business training and legal training in the engineering curriculum. Engineers as a class are deficient in knowledge of these subjects.

"Above all, college spirit should tend toward democracy and not to exclusiveness. More than one college graduate has prejudiced employers toward his kind by consciously or unconsciously cultivating a slight air of exclusiveness."

Gano Dunn: "Ground students thoroughly in the English language, a lack of command of which in writing and speaking is the greatest single defect in the college training of most engineers. It is not enough for an engineer to be skilled; he must make his skill prevail, and the power and culture that come from familiarity with English are tremendous forces in the success of an engineer."

E. H. Bangs: "If some one thing is needed now to help students, it would seem to be that they should know more of the truth about themselves, particularly as to their location in the picture and as to its perspective. It is very doubtful if they generally appreciate that life is a continuous educational process and that nothing definitely separates the particular part of life that they spend in college from what went before or what is to follow. It is simply a period when it is easiest to learn certain kinds of things, and coming as it does when students have little earning power, it is a very convenient time to allow them to concentrate on the accumulation of knowledge, in much the same way that kindergartens are found to be convenient for younger students. That part of their education which they use in their profession could perhaps be obtained elsewhere and at some other period, but not so easily and not so efficiently, and that is the impelling motive for colleges. That part of a student's education which is received in college is terminated by economic reasons and not by the capacity of the student to learn or of the college to teach."

RALPH D. MERSHON: "Emphasize reliability. This includes probity, of course. But it also includes accuracy and initiative."

L. T. MERWIN: "At the risk of the accusation of being a gross utilitarian, I would state that the criterion of all engineering work in the industrial world today is 'Will it pay?' This measuring rule is a flexible one and may involve a prophetic insight of the future economic conditions; it may further involve an idealistic conception of the value of beauty of form and arrangement; or again it may be a discernment of the value of social and welfare relations in the economic life of the community. In the last analysis, however, engineering work must pay or it is futile."

S. D. SPRONG: "Greater emphasis should be placed on what may be called the economics of engineering. That is, generally speaking, engineering is only a means to an end and not the end in itself, which usually has a place in the economic structure of the locality or corporate system. Its value will be measured by how efficiently it articulates with the remainder of the project and its all-around economy as a part of the whole."

Reservoir Will Control the Flow of the Chippewa River

SEVERAL interesting features are included in the license granted recently by the Federal Power Commission to the Wisconsin-Minnesota Light & Power Company for a storage reservoir (Project No. 108) on the Chippewa River. The reservoir will have a capacity of approximately 257,000 acre-feet and a water surface of 26 square miles. The water level will be raised 35 ft. at the dam.

The proposed method of operating the reservoir is to close the gates and store water during the high-water period from March to July. About 140 sec.-ft. will be released during the medium low-water period from August to November, and the remainder, about 230,000 acre-feet, will be released so as to maintain a steady flow during the months of December, January, February and March. In this way the reservoir will control virtually the entire flow of the stream. There will be added over 800 second-feet to the flow of the river during the winter months and about 140 second-feet during the medium low-water period.

There are three developed sites below the dam with an aggregate installed capacity of 53,200 kw., one of which is the Wissota plant. There are also eight undeveloped sites with an aggregate head of 247 ft., two of which are owned by the company. All of these plants will be benefited by the proposed storage reservoir. Under the method of regulation as described, the total output of the three developed sites will be increased 8 to 12 per cent. The amount of continuous power available will, however, be increased about 70 per cent.

Readers' Views and Comments

This is a readers' forum. Comments on questions before the electrical industry presenting economic, financial, engineering or commercial aspects and new or supplementary viewpoints on published articles are cordially invited

Experiences with Ungrounded Secondaries

To the Editors of the ELECTRICAL WORLD:

The writer believes that it would be of great benefit to municipalities to ascertain the risk to life and danger of fire that result from the failure of central-station companies to ground the secondaries of their transformers. It would be worth while to get an expression of opinion from those experienced in the field on a matter of such vital interest, especially when the points suggested below are considered.

In one case with which the writer is familiar the central-station company gives a straight two-wire, single-phase, 60-cycle, 110-volt service from a 2,300-volt distribution network, no three-wire, 220-volt service being given. The secondary is not grounded in any manner whatever. The core of each transformer is, however, grounded, the idea being that in event of surge from lightning in the primary circuit it will flash over to the core first, as the insulation between the core and the primary in the transformer is made much weaker than between the primary and the secondary. This theory does not seem correct in view of the fact that during thunderstorms chandeliers have repeatedly "cracked" and shot out fire caused by strokes of lightning, to say nothing of the fire danger arising from the severe strain on insulation behind the walls and floors of the dwelling.

In addition to this, repeated shocks have occurred when turning on lamps where the floor was damp and the fiber insulation of the socket was moist, as in cellars, garages, etc. On investigating a small blue spark was found to jump about $\frac{1}{64}$ in. from either side of the line to ground, showing there was static leakage through the transformer and also revealing the fact that all the wiring was under a strain of about 2,300 volts to ground, a potential much higher than the insulation was designed to withstand. There is little doubt that this is detrimental to the rubber insulation of wires installed in conduit where it is grounded. If it is not grounded, the conduit will become more or less charged above earth potential.

The writer knows of one particular case where the insulation on a small $\frac{1}{4}$-hp. motor directly connected to a water pump was broken down by this strain of 2,300 volts, the frame of the motor being grounded through the water pipes running to the pump. In the event of lightning striking a primary circuit it is needless to say that the strain of 2,300 volts to ground is greatly exceeded and there is a danger of breakdown altogether, which would allow the primary current to flow directly into the secondary.

The writer believes that the only safe and humane course is for central-station companies to ground their secondaries, even if it will cost them something; then all this excess voltage will be drained off to ground. This subject has been up numerous times for discussion. Is it not time that real laws were made and enforced? Prevention is safer than damage suits. Advice as to how to proceed to get the central-station companies to eliminate this life and fire hazard would be appreciated. It would seem that the state inspector ought to have power.

V. Des Roches,
Electrical Engineer.

Matthews Engineering Company,
Sandusky, Ohio.

The Doctor Must Go to the Patient

To the Editors of the Electrical World:

During the war public utilities were forced by necessity to incur greatly increased costs not only for labor but in capital expenditure. These capital charges cannot be made to vanish at one stroke of a pen or one flourish of a magic wand. It is evident from a commercial standpoint that the central-station industry is now suffering from a muscle-bound sales effort. For this there are two reasons: First, during the war and for a short time afterward the service was not sold but demanded; second, when deflation came its reflection on the central-station industry, with its idle equipment upon which charges must be met, was marked.

The average manager is prone to read monthly reports and balance sheets and then to lie awake at night figuring what can be done to meet the steadily growing red figures or the disappearing black ink. He awakens some morning just after the first of the month feeling that he must do something and proceeds to the office to cut down the commercial force. Next he starts to cut minor employees, with a resultant small decrease in the payroll. Then he waits for business to come back. Right here commences the real story. In the first place, business does not come back of its own accord. It is true that certain economic conditions influence its course, but none the less we must get out and bring it back. One would not expect a sick man to run to the hospital.

The problem faced by central-station commercial men is how to bring business back. First, put the commercial men to work. Make sure that the right men are on the job and receive the sympathy and encouragement that a human being needs. Commercial men need this more than any one else in the organization because when a customer has a real or imaginary grievance, and even if he indulges in abuse, the commercial man must maintain his balance and be tactful. He must stand under fire and turn a "knocker" into a "booster." It is his personality and tact that turn a liability into an asset. The banker may say that you cannot capitalize on assets of that kind, and they do not make a direct showing on the balance sheet; but the experienced manager knows the value of such an asset when he goes to the city council or utility commission with a case for decision. Actual instances could be cited where such a public policy has worked wonders in some important case.

Just putting commercial men in the field and giving them encouragement and sympathy will not, however, accomplish the desired result alone; it only helps. The commercial man must be an engineer with tact who can see a proposition through the eyes of a business man and place himself in the position of the buyer and the seller. The central-station commercial man is often too much inclined to give his prospective customer a long letter or report full of details. Although this is desirable for office records and sometimes influences the customer, it will be found far more desirable to present figures as briefly as possible since a business man thinks in abstract figures. The representative of the central-station company is not only selling a service but he is selling a gilt-edge security with a larger financial return than his customer can obtain in any other way and is placing the equity in the customer's own hands.

To illustrate, suppose you have a prospective customer whose operating expense with his own plant is $50,000 a year, and your estimate of operating expense on electric drive with purchased energy is $45,000, making a difference in favor of electric drive and purchased energy of $5,000 per year. The cost of equipment with electric motors and other apparatus to use electric power would be $20,000, and the customer maintains that the cost of electrification is too great. You are asking this man to spend $20,000 to make a saving of $5,000 a year, or a reduction of his operating expenses of only 10 per cent.

Now, suppose you went to this same man and told him you could sell him a security that would return 25 per cent on his investment, and that in addition you would place in his hands under his own control tangible property amounting in value to the full amount of the investment you were offering. What would happen? He would either think you were crazy or he would lock the door and open the safe.

But as a matter of fact the central-station company's representative is not only selling a service but is also selling a security with a large return on the investment and with no chance of losing the equity. Where can one find such an investment elsewhere?

Selling electric service is a man-sized job, yet any one with adequate knowledge and experience can bring the sick Mr. Business back to health by giving him the greatest of all tonics, a larger return upon his investment. But the doctor must go to the patient.

Worcester, Mass. W. J. Kyle.

Electrification of French Industries

To the Editors of the Electrical World:

French electrical works are now busy with orders booked that compare favorably with those of the previous year. This satisfactory situation is partly due to the electrification of many enterprises in continuation of the movement started during the war on account of the perplexing fuel problem. These works are now being completed, but chiefly in the reconstruction of the devastated industries in northern France, which will be electrified on a scale hitherto quite unknown.

Steam-operated central stations are being erected in the neighborhood of the coal mines and thus guarantee the most economical generation of electrical energy possible in these districts. Numerous new installations are responsible for a steadily increasing demand.

Keeping pace with this electrical development, imports are considerable, and Switzerland especially is profiting by this situation, supplying much of the material required, particularly dynamo-electric machines and transformers.

It may be mentioned, too, that the Belgian electrical industry is working under very favorable conditions at present, employing on an average nearly one-third more workmen than in 1913. Henry L. Geissel.

Beaurivage, Thoune, Switzerland.

Industrial and Station Practice

Installation, Operation and Maintenance of
Generating and Distribution Equipment and Economical Utilization of Electrical Energy
in Mills and Factories, Including Testing and Repair Methods

Effect of Temperature on High-Voltage Underground Cables

A RECENT study of high-tension cables seems to point out clearly that high temperatures cause failures, but that the cables fail more frequently while cooling than they do at the highest temperature of the day. In this study a record was kept of the total number of short circuits, cable failures and interruptions on the 13,000-volt electric system in Baltimore for the years 1914 to 1920, both inclusive. An interruption was recorded whenever service was cut off from a customer owing to a short circuit on the 13,000-volt system. It was noted that the frequency of short circuits varied for different months of the year, being greatest during the summer months. In order to show just what influence the different seasons of the year have all of these failures were combined in one curve (Fig. 1).

It will be seen that the line showing the number of cable failures has the same general shape as the one showing the mean average temperature, except during November and December, this being the season of peak load, which causes extra heating in the cables and partially offsets the cooling effect of the atmosphere.

The study having shown that a large percentage of cable failures are due to the effect of temperature, an endeavor was made to determine in what way this effect takes place. For several years it has been realized that the dielectric loss of high-voltage paper insulated cables increased with the temperature, and in most cables manufactured more than five years ago the dielectric loss increased so rapidly that in many cases the effect became cumulative and the temperature increased much more than in proportion to the load, many failures resulting. However, cables that are manufactured today are comparatively free from this trouble owing to the lower dielectric loss at the higher temperatures resulting from the use of better insulating materials. Moreover, on plotting the curve in Fig. 2 showing the number of failures that occurred during the summer at each hour of the day, it was noted that the failures did not always occur during the heavy-load period when the cables were hottest, but on the contrary, the failures more often occurred during the light-load period. Not only does the maximum number of failures occur during the period of light load, but the tendency is for them to occur when the load is decreasing and the cables are cooling off. Of course, the temperature of the duct line does not drop as soon as the load decreases on the cable, but the temperature of the copper starts to drop as soon as the load starts to drop.

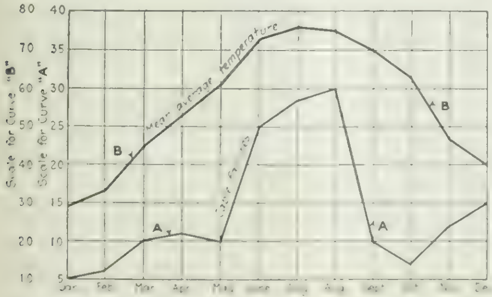


FIG. 1—NUMBER OF CABLE FAILURES IS HIGHEST DURING HOT WEATHER

The conclusion drawn is that the change in temperature causes expansion and contraction of the conductors and insulation, which sets up a movement in the cable and causes the failures. This theory is strengthened by the fact that most of the failures occurred in manholes and exposed sections of the cables, usually at bends. It is quite evident that most of these failures were due to the effects of temperature and, since the temperature in the manholes is usually lower than that in the ducts, temperature has some other effect tending to cause failures other than that of increasing the dielectric loss. The conductors, on account of their spiral form, would tend to open up as they expand and draw together as they contract, which effect would be to exaggerate at bends, and very probably many cable failures have been due to this cause.

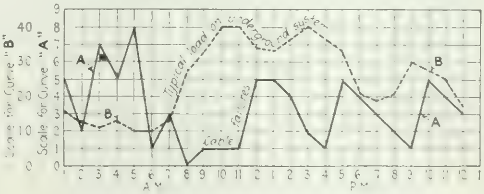


FIG. 2—GREATEST NUMBER OF FAILURES OCCURS AS CABLE IS COOLING FROM HIGH TEMPERATURE

R. H. LANG,
Chief Operator.

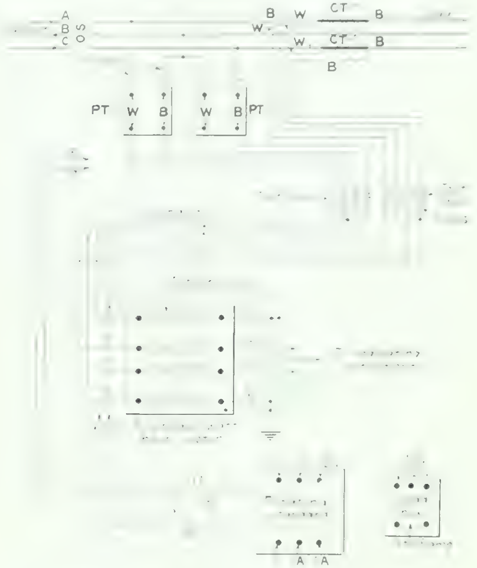
Consolidated Gas, Electric Light & Power Company,
Baltimore, Md.

Installation Test on Watt-Hour Meters

A SIMPLE and reliable method of making installation tests on watt-hour meters is used by the writer. This method checks the connections of instrument transformers and meter, the accuracy of meter and the power-factor condition of the circuit. Only a rotating standard and a load box are required for the test. The line on which the meter is installed must be carrying a load. To help in the explanation of the method the accompanying drawing has been made. It shows the correct connection of a watt-hour meter and potential and current transformers. It shows also the rotating standard with leads numbered. Use the 1-amp. coil of the rotating standard whenever possible and the 220-volt coil for checking voltage on potential transformers for the first time.

1. The first step is to note that the meter is running.

2. Is meter connected to the right potential trans-



CONNECTIONS FOR CHECKING INSTALLATION OF WATT-HOUR METER

formers? Open the potential test links 1, 2, 3 and 4. If the rotation stops, these are the correct transformers.

3. Is the meter connected to the right current transformers? Short-circuit the upper studs of the current links 5, 6, 7 and 8. Open the links. If the rotation stops, these are the right current transformers.

4. Is each element of meter operating? Open test link 1 and note direction of rotation. Close link 1 and open link 4; also note direction of rotation.

5. Are current transformers correctly connected on 2,400-volt side? The leads with polarity marks should be connected to the incoming side of the bus or line.

6. Are potential transformers correctly connected on 2,400-volt side? Check polarity marks and see that same relative connection is made on the 110-volt side.

7. Are potential transformers giving 110 volts, three-phase, or 110/220 volts, single-phase? Connect leads 19 and 20 to studs of link 10 and open 10. Touch leads 17 and 18 to 1 and 2, to 3 and 4 and 1 and 4. If single-phase 110/220 volt, speed in first two cases will be one-half speed in last case.

8. Are leads from potential transformers connected to corresponding leads on meter? Connect curent coil (leads 19 and 20) of rotating standard to top and bottom stud of link 10. To test potential wire 9 connect potential lead of standard 17 to link 9 and lead 18 to link 1. No rotation shows that the wire connects from 1 to 9, which is correct. Similarly touch 17 to 2 and 3, and 18 to 13 and 16. No rotation indicates correct connection. Again, connect 17 to 4 and 18 to 12. No rotation indicates correct connection.

9. Are proper leads run from the current transformers to the meter current coils? If no indicating instruments are in the current circuit (links 13, 14, 15 and 16 are connected together and grounded), the secondary side of the load box (with primary open) should be connected to links 14 and 15. Place potential leads 17 and 18 across potential links 1 and 2. Touch lead 17 to link 5 and lead 18 to link 10. No rotation indicates that this current wire is correct. Likewise touch 17 to 6 or 8 and touch 18 to ground. No rotation indicates correct connection. Then touch 17 to 7 and 18 to 11. No rotation means correct connection.

10. To determine if a current lead is grounded. First, to test the lead which runs from 5 to 10, short-circuit top studs of links 5 and 6. Open links 5 and 10. Connect 19 and 20 across link 11 and open this link. Touch lead 17 to 1 and touch 18 to open link 10 at wire coming from 5 (not at meter). No rotation indicates no ground. Likewise the other lead from 8 to 11 may be tested.

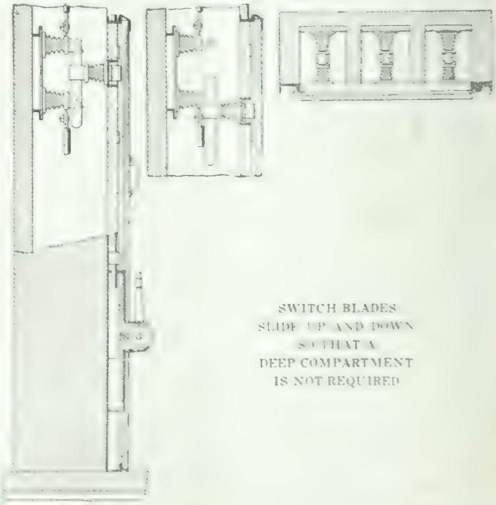
11. Make calibration test in usual way. Meter should be tested from test links and not at meter studs. Each element is tested separately and finally in series. The load impressed on each element is 100 per cent, 50 per cent and 5 per cent. Never remove meter covers except to make calibration correction.

The tests described can be simplified greatly and extended to indicating instruments, etc. The tester should be given a chart showing results to be expected from various connections of meters and transformers.

Texas Power & Light Company, A. R. Happoldt.
Dallas, Tex.

Disconnecting Switch Operated in Shallow Compartment

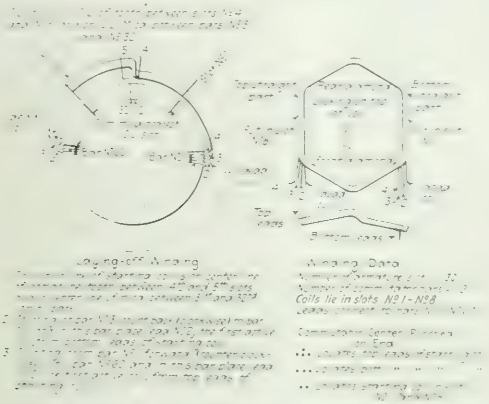
A disconnecting switch which may be installed and operated in a very shallow switch compartment has recently been developed. In this switch the disconnecting blades are mounted on a frame which is set in a vertical direction to make or break the circuit. Operation of the switch is accomplished by means of a handle geared to a rack which carries the frame holding the movable contacts. A patent has been issued on this switch.



SWITCH BLADES SLIDE UP AND DOWN SO THAT A DEEP COMPARTMENT IS NOT REQUIRED

Diagram to Simplify Connecting Commutator of Series Motor

In winding a direct-current motor it is very important that the connections are correctly made from the windings to the commutator. A diagram for showing just how to make these connections should be drawn up beforehand to avoid mistakes. The accompanying illustration shows such a diagram made for a series motor. In order to fill in the diagram, if the windings are not too badly damaged, it is the common practice of the winder to note the throw of the leads from coil to commutator bar while stripping the windings, and in this way get the desired information. This method cannot be entirely relied upon as there is a possible chance that the winding was connected wrong when it was originally wound, either in the repair shop or the factory. The only safe way is to get this winding information from the maker of the motor.



WINDING DIAGRAM AND INFORMATION FOR A SERIES-TYPE MOTOR

The diagram as illustrated has been worked out to show each detailed step and to give all necessary information in such a form as to be readily understood, so that the average winder can intelligently use it in winding an armature and feel sure that the work is being done correctly. The final form of this diagram herein was the result of a careful study of a number of criticisms on previous diagrams and was adopted only after being modified and changed in line with numerous suggestions made by practical men familiar with this line of work.

In rewinding motors and filling out these diagrams the following points should be kept in mind: Series motors are usually laid out for a wave or two-circuit type of winding. They may be wound with either a right-hand or left-hand coil. A right-hand coil is one where the leads come out from the right side of the coil when holding the coil with the portion to be placed in the bottom of slot toward the holder and with the air-gap side of the coil uppermost. A left-hand coil is one where the leads come out of the left side of the coil when holding the coil with the air-gap side of the coil uppermost. Armatures of the two-circuit type may be wound either progressive or retrogressive. A progressive wave or two-circuit winding is one in which the throw of the coil lead is one-half a commutator bar greater than half way around the commutator. A retrogressive wave or two-circuit winding is one in which the throw of the coil lead is one-half a bar less than half way around the commutator. For example, with 135 commutator bars, a progressive winding has a lead throw of $(135 + 1) \div 2 = 68$ bars or 1 and 69. A retrogressive winding has a lead throw of $(135 - 1) \div 2 = 67$ bars or 1 and 68. The wave or two-circuit windings always require an odd number of commutator bars. When an even number of coils per slot are used there will always be an idle or dead lead. When an odd number of coils per slot are used and there are an even number of slots on the armature there will always be an idle or dead lead. When an odd number of coils per slot are used and there are an odd number of slots on the armature there will never be an idle or dead coil.

The alignment of the armature slots or teeth with respect to the commutator mica or bar is as follows: (1) With the coil throw even and the lead throw even, the center line of the tooth will line up with the center line of the mica; (2) with the coil throw odd and the lead throw odd, the center line of the slot will line up with the center line of the bar; (3) with the coil throw even and the lead throw odd, the center line of the tooth will line up with the center line of the bar; (4) with the coil throw odd and the lead throw even, the center line of the slot will line up with the center line of the mica.

John S. Dean,
Motor Engineering Department.
Westinghouse Electric & Manufacturing Company,
East Pittsburgh, Pa.

System for Inspecting Motors and Equipment

In order that inspectors of motor equipment in industrial plants may not neglect any details, it is well to issue or post directions which may serve as a reminder. The directions may be worked up in the form of instruction sheets or as a blueprint, a copy being given to each inspector.

Not only is it a good idea to be sure the inspectors are uniformly instructed as to what troubles to look for and their possible remedies, but it is also a good practice to alternate the inspectors weekly. This arrangement gives them a change of work and also allows each man the chance of discovering some possible trouble overlooked by the last inspector. The element of competition which enters through this method is helpful in insuring efficient and thorough work.

It has also been found advisable to use a trouble card containing information on the following points: motor, location, pulley, belt, base bolts, oil gages, commutator, brushes, springs, leads, temperature, line, relays, switch, and starter contacts. Space for "remarks," for the inspector's signature and for the date is provided. The inspector enters the nature of the trouble, and when it has been attended to the card is signed by the mechanic doing the work.

Another check on inspection which has been found helpful is to have tacked up near each motor a printed card with a small blank space for every day in the next three or six months. The inspector when he inspects the motor or other apparatus marks in the date on the proper square. This method gives a check on the time the inspection was made when compared with the report turned in to the electrical or other department.

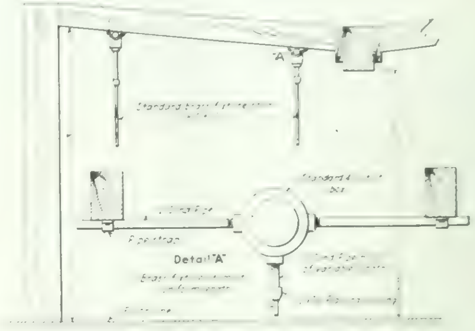
One plant also requires the superintendent to make a very thorough inquiry into the cause of every motor shutdown. If the shutdown could have been avoided, or if the blame falls on the electrical department, the result is in the nature of a warning. Efficiency in inspection work simply means that the inspectors must pay careful attention to their work and see that repairs are reported promptly. There is a tendency to neglect motors that are difficult to get at, such as those suspended from a ceiling or installed in dark places. These motors are particularly the ones which should not be neglected, and a good inspector will make every effort to do thorough work, regardless of the location of the equipment. If the inspection work is done properly, there should be very few shutdowns of motors. In one large plant operating in New York State and using 125 motors, rated at from 1 hp. to 50 hp., there has been only one actual shutdown during working hours in a year's time. That particular case was due to dust in a woodshop motor getting into a bearing and stopping the oil ring and so overheating the sleeve. In almost every plant inspection will be found to pay both by the reduction of motor shutdowns during working hours and by the reduction of motor upkeep costs due to trouble with bearings. It also means a reduction of rotor and starter repairs. H. S. Rich.

East Berlin, Conn.

Symmetrical and Economical Factory Lighting Installation

TO PROVIDE uniform lighting in one of the sections of the Graton & Knight factory constructed during the war, and to avoid undue expense in overhead fittings, the symmetrical layout shown in the accompanying photograph was adopted. Lamps are spaced 10 ft. apart longitudinally and 8 ft. apart laterally, 100-watt gas-filled incandescents of the bowl-enamel type being installed in Holophane reflector-refractors at a height of 9 ft. 6 in. above the floor. For the horizontal runs No. 14 rubber-covered wire is used, No. 16 rubber-covered wire making the drop to each unit. One-half-inch horizontal rigid conduit is employed, and the spacing adopted between lamps enabled this pipe to be installed with very little cutting on the job. On a working plane 30 in. above the floor measurements show an intensity of illumination of 5.5 ft.-candles. A mill-white paint on ceiling, walls and piping adds greatly to the efficiency of illumination.

GAS-FILLED 100-WATT LAMPS SPACED 8 FT. X 10 FT., 9½ FT. ABOVE FLOOR, GIVE 5.5 FT.-CANDLES ON WORKING PLANE



METHOD OF HANGING LAMPS AT UNIFORM HEIGHT

A feature of this installation is the means employed in mounting the fixtures so as to bring the lamps into the same plane 9 ft. 6 in. over the floor. The location in the top story of this mill-type factory building presented a problem of fixture suspension from a beamed ceiling with a variation in elevation of about 2 ft. from walls to the center of the building, where the roof drains are. The method shown in the sketch was adopted and proved entirely satisfactory and economical in construction.

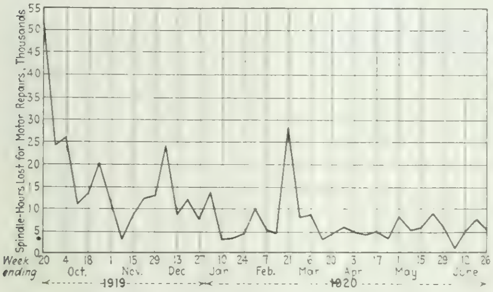
A. H. Magnuson,
Electrical Engineer.
Graton & Knight Manufacturing Company,
Worcester, Mass.

Regular Motor Inspection Cuts Lost Machine-Hours 80 per Cent

CONCRETE proof of the value of systematic motor inspection is evident in the records of the Acme Wire Company, New Haven, Conn. Before regular inspection was started, in September, 1919, the average spindle-hours lost on account of motor repairs in a section of the factory amounted to 5,250 per week. About 100 direct-current motors, rated at ¼ hp., operating at 240 volts and running 1,700 r.p.m. in continuous day and night service, were involved. These motors were individually connected to machines, and for two years motors had been repaired after trouble developed, only superficial inspection being given during operation. In view of the foregoing lost time it was decided to adopt a regular inspection program planned to forestall motor failures as far as possible. The scheme was immediately effective, and as a result the lost spindle-hours due to motor troubles have been reduced 80 per cent.

Over the week-end of Sept. 20, 1919, about 25 per cent of the motors were taken out, overhauled and restored to service. In one week the lost time fell to 2,400 spindle-hours. Twenty-five per cent more were overhauled during the next week-end. The accompanying chart shows a general decrease in spindle-hours lost through the remainder of 1919 and to the spring of 1920, when a range of weekly losses running well below 750 spindle-hours was attained. The trend of the curve argues well for preventive systematic inspection.

The plan is to subject each motor to the maintenance inspection every six months. To that end motors are inspected at the rate of four a week, so that the entire lot is rotated every twenty-five weeks. The program followed is to take the motors apart, wash the field coils with gasoline, note if leads are chafed and wash with gasoline, shellac the outside of the field coils to keep oil out of the windings, examine bearings and look for stuck rings, micrometer worn shafts, wash armatures with gasoline followed by shellacking, turn down commutator bars and undercut the mica, clean commutators, test resistance between segments and test for incipient grounds between segments, winding and frame.



SYSTEMATIZED INSPECTION AND OVERHAULING REDUCED LOST SPINDLE-HOURS FROM 5,250 TO BELOW 750 PER WEEK

Once a week, or after running for 120 hours, all motors in service are examined at close range for oiling conditions and overheating. The system of "anticipatory" maintenance described above is carried out under the direction of Mario Bozzi, electrician of the Acme Wire Company.

Boston, Mass. FIELD EDITOR ELECTRICAL WORLD.

Satisfactory Way to Pour Bearings and Lead Grout Under Bedplates

CONSIDERABLE trouble is sometimes experienced in pouring bearings and in pouring lead grout or mat under bedplates that are supported on steel foundations. The trouble seems to be in getting the proper kind of substance to seal the joints. In a good many instances a mixture of fireclay and water is used, but when the metal comes in contact with the damp clay steam forms and causes air holes or blowouts. Mixing asbestos and oil together to about the same pliability as putty makes an excellent sealing compound which does not give this trouble.

In pouring lead grout under bedplates where the bedplate is of considerable length and the I-beams supporting the plate are from 6 in. to 8 in. in width and the mat is to be from ½ in. to ¾ in. thick, it is best to divide or partition off about every two feet. By sealing all joints of the wooden forms around the bedplate with the compound of asbestos and oil and having the lead hot enough to char a wooden stick and pouring as fast as possible very good results will be accomplished. The same idea applies to bearings or any similar part where good results are desired.

R. L. JOHNSON,
Erecting Engineer.
Westinghouse Electric & Manufacturing Company,
Detroit, Mich.

Adapting Alternating-Current Heater to Direct-Current Operation

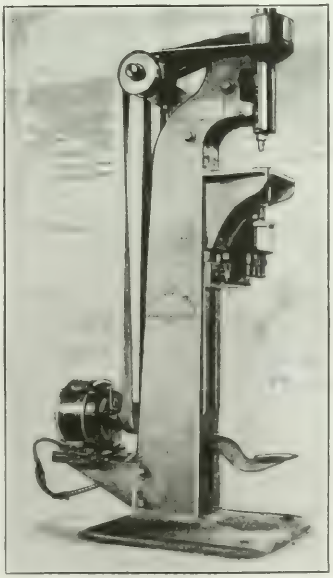
SOME trouble was experienced with the thermostat of a hot-water heater after changing over from alternating to direct current in a Pennsylvania factory. The heater, a 1,500-watt three-heat device of the immersion type, for use in an ordinary range boiler, was installed to supply hot water for the office service rooms. A thermostat in connection with the heater coils controls the water temperature by cutting the coils in or out of circuit as required.

When the distribution system, including the heater, was changed to direct current, trouble was experienced at the thermostat contacts. Severe arcing occurred at these points when a coil was switched on or off, and it became evident that the operation of the heater would not be satisfactory.

To remedy the trouble, a standard 1-mfd. telephone condenser, costing less than a dollar, was connected across each contact. The operation of the thermostatic switch was then excellent. The three condensers were placed in a small treated-wood box, completely inclosed and mounted on the wall near the heater, so as to be connected easily in the circuit. The installation is neat and serviceable and the cost was comparatively small.

Honesdale, Pa. J. W. WALSH.

Compact Motor Mounting for a Rivet-Spinning Machine



NEAT MOUNTING OF A MOTOR FOR MACHINE FORMERLY IN GROUP DRIVE

A BRACKET mounting of simple but effective design is shown in the accompanying illustration where a ½-hp. Westinghouse motor running at 1,725 r.p.m. drives a Grant rivet-spinning machine in a Massachusetts industrial plant. The bracket in this case was formed of two plates of triangular shape 6 in. high and 2⅝ in. thick attached to the machine pedestal by ½-in. bolts. This bracket keeps the motor off the floor, thus preventing it from accumulating dirt and also allowing cleaning underneath. The long vertical drive gives very satisfactory service. The starting switch is mounted on the frame of the machine at a convenient height near the operator's right hand.

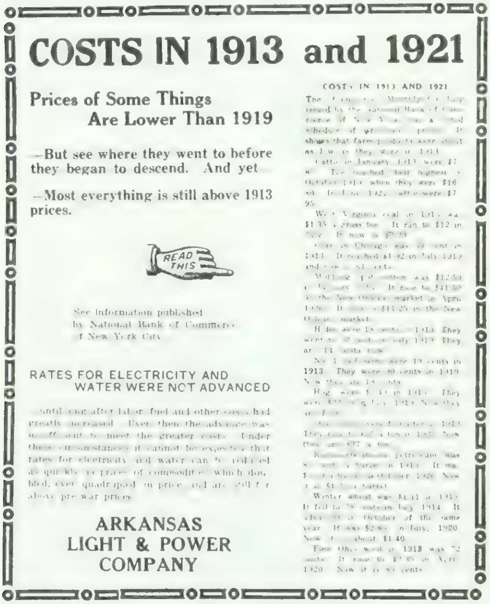
Boston, Mass. FIELD EDITOR ELECTRICAL WORLD.

Central Station Service

A Department Devoted to Commercial Policy
and Management Topics, Including Methods of Increasing the Use
of Electric Light, Power and Heat

War Prices of Commodities Compared with Utility Rates

TO SHOW that the utility companies did not benefit from high prices or war rates, the Arkansas Light & Power Company of Pine Bluff, Ark., recently published the accompanying advertisement in several cities where it operates. It points out that while many commodities increased in price from 100 to 300 per cent above pre-war levels, utility rates in many instances did not advance sufficiently even to meet the greater operating costs.



COSTS IN 1913 and 1921

**Prices of Some Things
Are Lower Than 1919**

—But see where they went to before they began to descend. And yet

—Most everything is still above 1913 prices.

See information published
by National Bank of Commerce
of New York City

RATES FOR ELECTRICITY AND
WATER WERE NOT ADVANCED

**ARKANSAS
LIGHT & POWER
COMPANY**

COSTS IN 1913 AND 1921

PUBLICITY SHOWING THAT UTILITY RATES HAVE NOT BEEN WAR-INFLATED

Central Maine Adopts New Plan for Employee Stock Selling

THE Central Maine Power Company has adopted a new plan for employee stock selling which will do away with the former short-period contests and place this work on a par with other phases of the company's business. Under the new arrangement the sale of stock by employees will become a steady, year-around performance, with a closing date every six months. District and department quotas will be figured on a weekly basis, and all districts and departments will be urged to sell their quota each week. The quotas assigned will be definite and carry definite responsibilities to each department and division head. Higher commissions have also been established as follows: For the first ten shares sold, $1 per share; for the next ten, $1.25 per share; for the next ten, $1.50 a share; for the next ten, $1.75 per share, and for all above forty shares, $2 per share. A so-called supercommission of 25 cents per share will also be added on all shares sold above the quota of any district. These extra commissions are established in lieu of the many weekly prizes previously offered but now discontinued. Five prizes, however, will still be awarded for various district, departmental and individual championships. A total quota of 3,000 shares sold by employees has been established for the period ending Jan. 21, 1922.

Power Factor in Electric Power Rates

By H. W. Meyer

Northern States Power Company, [illegible]

THE power factor of the energy taken by a power consumer should in some way be a factor in the rate which a consumer pays for energy taken from the lines of a public service company. Where the power factor is less than unity there is an increase in the capacity of transformers, lines, cables, substations and generating capacity required. Copper losses are increased and voltage regulation is made more difficult. If hydraulic plants are operated on the system, there is a direct loss in the kilowatt-hours which may be generated due to the limitation of the output of the generators because of heating. Such a loss, of course, exists only when there is ample water for operating at full load and where the hydro-electric plant capacity is not sufficient to carry the entire load.

It has been proposed to install watt-hour meters so connected as to read the reactive component of the kilowatt-ampere-hours and from this reading and the reading of the ordinary watt-hour meter calculate a power factor which forms the basis of a penalty or a factor to be applied to the power rate.

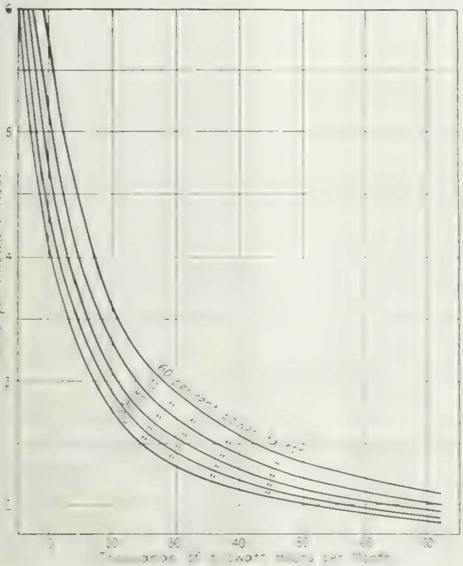
Some Methods Undesirable

This scheme will, of course, give the consumer with a low power factor an incentive to increase that power factor, but it has certain objections. The power factor which is calculated by this method is not an average power factor, as has been stated. This is true for the reason that the reactive component increases very rapidly as the power factor becomes low. Two consumers may therefore, if the reactive component meter is used, have the same number of kilowatt-hours during a month and the same number of reactive kilowatt-ampere-hours and yet have widely different characteristic loads, one of which may be desirable from the point of view of the central-station company and the other undesirable because of poor power factor at the time of maximum demand.

This method of penalizing for low power factors has the further objection that it involves a formula which is not generally understood by the consumers and is subject to errors in calculation. Any rate in which a penalty is provided based on the per cent power factor is objectionable and to be avoided if possible.

For these reasons a different method of taking into account a consumer's power factor is here proposed which consists of measuring the maximum kilovolt-ampere demand made by the consumer and using this demand in a demand-energy rate in place of the maximum kilowatt demand.

Such a rate is logical inasmuch as the consumer is required to pay fixed charges on the equipment which he makes necessary, plus an energy charge to cover the operating costs in producing the kilowatt-hours consumed.



RATES PER KILOWATT-HOUR BASED ON DEMAND ENERGY SCHEDULE FOR LOAD OF 100 KW. AT VARIOUS POWER FACTORS

The objection may be raised that certain consumers will have high power factors over their maximum loads and may have low power factors at light loads. This is, of course, true of certain power consumers using induction motors which are only lightly loaded at times and fully loaded at other times; but the objection is not serious since the most vital factor from the central station company's point of view is the maximum kilovolt-ampere demand, especially if this occurs on the system peak.

A rate of this kind involves no objectionable changes in existing demand-energy rates and at the same time offers an incentive to the consumer to increase his power factor.

The accompanying curves show the rate per kilowatt-hour for consumers having a 100-kw. energy demand and various kilowatt-hour consumptions per month with different power factors. These curves are based on a demand-energy rate of $30 per kilovolt-ampere of maximum demand per year plus 1.5 cents per kilowatt-hour. The 100 per cent power-factor curve is, of course, the same as the rate which would be charged if the demand charge were based on kilowatts of maximum demand instead of kilovolt-amperes.

In order to apply such a rate at this time, it would be necessary to install a recording ammeter and a recording voltmeter to determine the maximum kilovolt-amperes for the month, as there is as yet no instrument which will measure directly the kilovolt-amperes in a circuit. Such an instrument can no doubt be devised and would be highly desirable in connection with a rate of the kind which is proposed.

From Here and There

Boston, Mass.—An innovation in the good work of the Edison employees' loyalty committee of the Edison Electric Illuminating Company was a series of five-minute talks to employees during business hours. The talks were arranged in all locations where there were ten to twelve employees, and a definite schedule was announced. Thirty five-minute talks on "Good-Will" and "Loyalty" were given recently in four days. The speakers were James White, chairman of the Edison employees' loyalty committeee, and Harry A. Townes of the employment bureau.

Ogden, Utah.—Employees of the Utah Power & Light Company who have occasion to visit homes in connection with their work have been equipped with badges, which carry the company name, number assigned to the employee, and the department to which the employee belongs. This action has been taken to safeguard Ogden residents against possible theft by persons who have resorted to the strategy of saying that they were light or gas meter inspectors. Residents of the city have been warned by the company to allow no person to enter their homes to read light or gas meters unless he can show one of these badges. Employees of the Salt Lake office of the company have been similarly equipped for some time.

New York.—The Cities Service Company presents the interesting fact of an expanding list of stockholders despite the depressed condition of the general securities market. As of Aug. 15, when the books closed for the dividends payable Sept. 1, there were 60,426 holders of record of the Cities Service Company stocks, comparing with 57,492 stockholders of record of May 15, the date of closing books for the June 1 dividend. On Aug. 15 there were 8,327 holders of the company's common stock, 22,535 holders of its bankers' shares, 24,680 holders of preferred stock and 4,884 holders of preference B stock, these figures comparing with 7,935 holders of common stock, 20,299 holders of bankers' shares, 24,507 holders of preferred stock and 4,753 holders of preference B stock on May 15, the increase in the total number of stockholders from May 15 to Aug. 15 being 2,935. These figures do not include any of the holders of debentures or of securities of subsidiary companies, and should these be included the total number of holders of securities of Cities Service Company and subsidiaries would be in excess of 100,000.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
of the World

Generation, Transmission and Distribution

Induction and Self-Inductance of a Straight Transmission Line with Earth Return and the Potential Difference on the Earth Surface.—With the assumptions that the earth has a uniform specific resistance and that the stream lines of current of commercial frequencies in it may be taken approximately as those determined with resistance only taken into account, it is shown that the emf. induced by a varying current in a straight transmission line with earth return, in a conductor 1 cm. long parallel to the line at a point p distant y_0 cm. from the line, may be expressed by

$$-\left(\log \frac{y_0}{\sqrt{x^2+y_0^2}-x} + \log \frac{y_0}{\sqrt{z^2+y^2}-z}\right)\frac{di}{dt},$$

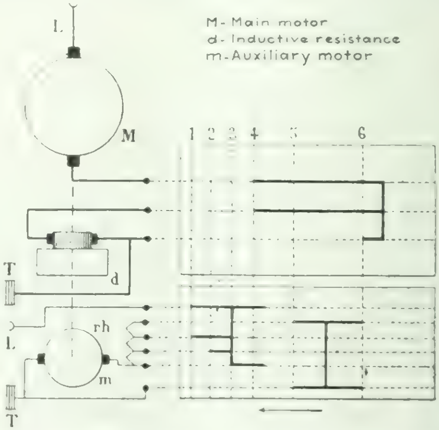
x and z being the distances from the two ends of the line to the foot of the perpendicular from p to the line. x or z is to be taken negative when p is outside the line in either direction. Integrating this, the total emf. induced in a parallel line is obtained. As a result of application of the formula, the self-inductance of a single-conductor straight transmission line with earth return is shown to be

$$L = 2D\left(\log \frac{2D}{r} - \frac{3}{4}\right)$$

where D is the length of the line and r is the radius of the conductor. Lastly, the potential difference on earth surface is expressed in terms of the electrostatic capacities of the electrodes.—*Journal Institute of Electrical Engineers of Japan,* July 10, 1921.

Traction

Inductive Starter for Direct-Current Railway Motors.—A. GIVELET.—The use of ohmic resistance during the starting period of direct-current railway motors is, as is generally known, a great waste. Millions of kilowatt-hours are wasted annually in the resistance starters of all direct-current motor-driven vehicles. The author has developed a radically new method for starting direct-current motors which is both very simple and very effective and does away entirely with wasteful ohmic resistance. The principle of the new method may be explained thus: Suppose an annular "Gramme" armature with a commutator and two brushes arranged at opposite sides. To close the magnetic circuit two poles embrace the armature and are connected by the customary yoke of laminated iron. Standing still, this arrangement will give virtually zero resistance to any current passing through it. If, however, this armature is revolved at the time the direct current passes through it, the resistance will increase proportionally with the speed until a point is reached where further speeding up results in no higher resistance. The induction and the speed vary, therefore, in inverse proportion, so that their product stays constant and equal to the line voltage. ($e = iLw$, $w = 2\pi n$). From this it is apparent that such an apparatus may be used advantageously instead of ohmic resistance for the starting of any direct-current motor. For practical use a drum armature inclosing two windings is used, every turn of one winding being connected to the even commutator bars and every turn of the second winding being connected to the odd bars. A pair of high-resistance brushes somewhat wider than one commutator bar connect the lines to the armature. Surrounding the armature is a laminated stator carrying no windings. This apparatus is driven by a small auxiliary motor, requiring only such an amount of power as to overcome friction. The first two notches on the controller start the small motor. When this small motor has attained full speed and therefore offers the greatest degree of resistance against any passing direct current, the small motor is taken off the line and the main motor is laid directly on the line, with the spinning armature of the induction resistance in series. As this armature slows down its resistance becomes less and less, which in turn causes the main motor to start up to speed. By the time the armature stands still the main motor is up to full speed and the starting armature may be short-circuited. If necessary, the auxiliary motor may be slowed down in less time by short-circuting its terminals across a resistor (see diagram of circuits). If, as is the case with most motor cars, two main motors are used in series-parallel arrangement, one small auxiliary motor may drive two inductive-resistance armatures. In this case the small motor is started up and slowed down twice, first for starting the



MOTOR AND CONTROL CIRCUITS FOR AUTOMATIC INDUCTION STARTER FOR DIRECT-CURRENT MOTOR group of two main motors in series and a second time to put them on the line in parallel. The inventor claims: (1) The auxiliary motor may run very much faster than the main motor—for example, at 3,000 r.p.m. as against 600 r.p.m.—and as the armature windings of the inductive resistor carry current only for a very brief period, a very high current and iron density may be used. In no case should the volume of the inductance be more than one-eighth to one-sixth of the volume of the armature of the main motor. (2) It requires a very small driving energy. (3) The method always permits uniform and automatic starting. (4) The starting is stepless and therefore smooth. (5) Cable connections between the controller and the motor or motors are very much simplified.—*Revue Générale de l'Electricité*, July 23, 1921.

Installations, Systems and Appliances

Electrical Cleaning of Blast-Furnace Gases.—N. H. GELLERT.—In showing why present methods fall short of the desired results the author points out how the electrical screen does its duty. The method employed is that developed by Dr. F. G. Cottrell several years ago. The problem in electrical precipitation, the author maintains, is to regulate the vertical and horizontal forces sufficiently to form a resultant which will precipitate the particle of dust on the side of the pipe. The vertical force can be regulated by the cross-sectional area of the pipe. It has been erroneously assumed that the bigger the pipe and the greater the voltage that may be impressed, the stronger the force that may be secured to act horizontally. This is not true because the force varies inversely as the square of the distance between the object to be precipitated and the electrode, so that even with higher voltage the impressed force on the particles may be less than with lower voltage. Features of some of the equipment used for the electric precipitation are described. At Sheridan and Dunbar the results obtained with electric precipitation are very satisfactory, the precipitator collecting approximately 5,000 lb. of dust per day, from the output of a 250-ton furnace. With the plant operating on pig iron instead of ferromanganese, the indications were that the precipitator could clean ordinary gases to less than 0.1 grain.—*Iron Age*, Aug. 11, 1921.

Electrophysics and Magnetism

The Laws of Absorption of X-Rays.—F. K. RICHTMYER.—In these experiments homogeneous radiation was insured by using a Bragg spectrometer, and the effects of secondary radiation were avoided by placing the absorbing material between the two slits which limited the beam. By taking these and other precautions a precision of 0.5 per cent was obtained. It is pointed out that the linear relation established by Hull and Rice between the mass-absorption coefficient and the wave length holds accurately for silver, aluminum, copper, molybdenum, lead and water until as the wave length is increased the characteristic K limit is approached. The linear relation also holds above the K limit, but the mass-scattering coefficient is about the same. The atomic absorption coefficient for wave lengths below K is a linear function of N^4, where N is the atomic number. The general law of X-ray absorption is therefore $\mu_a = kN^4\lambda^3 + \sigma_a$, where k is a universal constant equal to 2.29×10^{-27} below the K limit and to 0.33×10^{-27} above that limit.—*Physical Review*, July, 1921.

Thermal, Electrical and Magnetic Properties of Alloys.—ALPHEUS W. SMITH.—The author considers about thirty alloys and shows the variations in freezing point, thermo-electromotive force, electrical conductivity, magnetic susceptibility and other values with change in percentage of constituents. In the discussion of the results, principal attention is paid to the change of thermo-electromotive force with temperature, the theories of resistance and thermo-electromotive forces, and resistance and hardness.—*Journal Franklin Institute*, August, 1921.

Electrochemistry and Batteries

Effect of Temperature and Humidity on the Capacity of Inert Cells.—C. LAWTON.—From tests carried out in Calcutta, India, the author concludes that both the temperature and humidity affect the capacity of inert cells. —*Post Office Electrical Engineers' Journal*, July, 1921.

Units, Measurements and Instruments

Harmonic Analysis by Selected Ordinates.—ALBERT E. CLAYTON.—The accuracy of the original Perry method and some of its simplifications is investigated. It is shown that such methods are theoretically exact, provided that the number of ordinates chosen per half period is greater than the order of the highest harmonic present. The third part of the paper gives a brief review of three other methods of practical analysis of wave forms, namely, Wedmore's, Fischer-Hinnen's and Thompson's, and Russell's method of applying Weddle's rule to the determination of the values of the various Fourier integrals.—*Journal Institution Electrical Engineers* (London), Vol. 59, No. 301.

Telegraphy, Telephony and Signals

Digest of United States Patents Relating to Radio. —JOHN B. BRADY.—This section makes available in convenient form for research engineers and others interested brief information on radio patents which are issued each week by the Patent Office.—*Proceedings Institute Radio Engineers*, August, 1921.

Imperial Wireless Station at Leafield, Oxfordshire.—E. H. SHAUGHNESSY.—Description of the 500-kw. installation, using Elwell arc machines. For signaling, a spacing wave is used; that is, during the spaces between the Morse signals energy continues to be radiated, but at a wave length differing from that used for the marks. The change of wave length is effected by varying the inductance of the keying inductance.—*Post Office Electrical Engineers' Journal*, July, 1921.

Miscellaneous

Curves That Show Comparisons of Electric Machines. —J. BLONSTEIN.—The use of cross-section paper ruled horizontally and vertically on a logarithmic scale may be useful in the comparison of different sizes of electric machines by plotting such data as are contained in the catalogs of manufacturers. When the weights and prices of the machines are plotted on the diagram as functions of the output, it is possible to see at a glance any irregularities of the design series. This method also permits of fairly safe interpolation and extrapolation of new sizes. Among the advantages in using logarithmic scales instead of rectilinear scales the author mentions the shorter length of the first-mentioned scale and the fact that the weights will give a straight line if expressed as a function of the output.—*Revue Générale de l'Electricité*, July 16, 1921.

Scientific and Industrial Research

(Printed in the Third Issue of Each Month)

A Department Devoted to Reports of Investigations Contemplated or Completed, Research Facilities Available, and Suggestions for Co-operative Work.

Conducted by PROF. VLADIMIR KARAPETOFF
Cornell University, Ithaca, N. Y.

Research in Progress and Completed

[illegible] serve, details thereof will be presented in other parts of this paper. Contemplated research or that which appears to have limited appeal will be only briefly reported in this section, but [illegible] institution named in the report. Readers are referred to the department "Digest of Electrical Literature" for investigations reported in other journals. The news and engineering sections should also be followed for research reported before technical societies.]

INSULATION, LEAKAGE IN.

An experimental investigation is being made of the losses in various types of insulation under alternating potentials. An electrostatic wattmeter is used for potentials up to 25,000 volts. —*J. B. Whitehead, Johns Hopkins University, Baltimore, Md.*

VIBRATIONS OF MACHINERY, MEASUREMENT OF.

A "vibrascope" has been devised to indicate the amplitude of the vibrations of machinery in operation. The frame of the instrument is attached to the machine under test, and the amplitude of vibration may then be read on the instrument [illegible] —*Prime Movers Committee, N. E. L. A.*

ELECTROSTATIC MEASUREMENTS, COMPENSATION SCHEME FOR.

In the measurement of an ionic saturation current in a gas it is customary to connect one plate of the ionization chamber to one pole of a high-potential battery, the other plate being connected to one quadrant of an electrometer whose other quadrant, together with the remaining pole of the battery, is connected to the electrometer case. If under these conditions the electrometer is to be free from fluctuations resulting from the inductive action of the high-potential plate, a very high battery constancy is essential. The difficulties arising from fluctuations in the battery potential may be eliminated by the following simple device: A high-potential battery is connected to the ends of a high resistance. The high potential plate of the ionization chamber, the electrometer needle, electrometer case and the outer member of an auxiliary condenser are connected respectively to different points along the resistance. Thus the ionization chamber potential and the needle potential are provided from the same battery. It is readily possible so to adjust the conditions that there will be no inductive deflection of the needle on throwing on the entire battery.—*W. F. G. Swann, Minneapolis, Minn.*

GROUND DETECTORS.

Some experiments are under way to develop a detector for 2,200-volt service which will have the necessary sensitiveness and yet avoid the defects of the present types. A three-phase differential relay has been made for connection direct to the secondaries of a potential transformer. Tests have proved that this relay is just as sensitive as one in the primary ground. Experiments have also been made with what might be called a "three-phase, differential, hot-wire ammeter" to replace the indicating lamps. Although these experiments have not been carried very far as yet, it is believed this device can be brought to such a point that its combination with the differential relay will make a ground detector which will be both safe and re[illegible] —*Accident Prevention Committee, N. E. L. A.*

IMPEDANCE MEASUREMENTS WITH HUND'S DIFFERENTIAL TRANSFORMER.

Hund's method (ELECTRICAL WORLD, Vol. [illegible], page [illegible]) was successfully applied to the measurement of the effective resistance and inductance of telephone lines and induction coils at frequencies of $2\pi f = 10{,}000$. A common duplex telephone coil was used as a differential [illegible] connected to a telephone receiver. The unknown resistance and inductance were balanced [illegible] standard values until the noise in the receiver disappeared. With this method a simple supervision of long-distance telephone circuits is possible, using the traffic current itself for measurements.—*Bela Gati, Budapest, Hungary.*

CONVERTER, ROTARY, SINGLE-PHASE.

In an ideal single-phase converter, disregarding the moment of inertia of the armature, the instantaneous power on the alternating-current side and on the direct-current side must be equal to each other. But the alternating-current power is fluctuating, so that the direct-current power and the speed of the machine must also fluctuate within wide limits. In a real machine these theoretical relations are essentially modified and the direct-current power flow is made more uniform owing to the inertia of the revolving part, magnetic energy stored in [illegible] the machine. [illegible] single-phase rotary converter, running it both from the direct-current and from the alternating-current side, and the records substantiate the above mentioned theoretical conclusions; namely, that the direct-current power and amperage are fluctuating and that the machine cannot be made to run without appreciable [illegible] New York City.

[illegible]

Considerable difficulty has been experienced with the manu[illegible] therefore built for annealing and slowly cooling glass disks. The temperature of a 22-in. disk was kept constant for eleven [illegible] deg. Fahr. per hour. The rate of cooling was controlled by automatic electric devices and continued for five weeks. Power interruptions lasting a few minutes occurred several times but caused no mishap. With this electric furnace it is expected that disks up to 40 in. in diameter can be successfully made.— [illegible]

PAPER, PHYSICAL AND CHEMICAL TESTING OF.

A large number of tests have been made in a special room [illegible] cent relative humidity. Methods have been developed for determining the percentage of ash and the amount of sizing, also qualitative and quantitative tests for rosin in paper and for the various kinds of loading materials. — *Bureau of Standards, Washington, D. C.*

[The results of this research may be of interest to electrical [illegible]]

Suggestions for Research

FUEL, LOW-GRADE, ADAPTATION OF STOKERS TO.

It would be of great general interest if qualified persons of experience would publish results of investigation made to determine how existing stokers can be made to burn low-grade fuels without clinker trouble, high maintenance expense, loss [illegible]

EXPLOSIONS ON SHORT CIRCUIT.

The committee urgently recommends that more study be given to the design and installation of current-limiting reactances, circuit breakers, instrument transformers and protective devices, and also that ample clearances be allowed not only in new installations, but also on older installations before interconnection with systems of large capacity is made.—*Accident Prevention Committee, N. E. L. A.*

POWER PLANTS, STEAM, EXTRA-HIGH-PRESSURE.

In order to test the possibilities of steam-power units of extra high pressure at the least possible cost, a small high-pressure turbine should be installed in an existing power station which would reduce high-pressure steam to the ordinary pressure used in the plant and discharge it into the plant mains. Such an installation could be fed from a small high-pressure steam generator at low cost, and its performance record would give some idea of the advisability of spending money and effort in the further development of high-pressure units.—*Prime Movers Committee, N. E. L. A.*

ACOUSTIC SHOCK PREVENTION.

One of the troubles resulting from inductive interference at times of certain faults on parallel power lines is the acoustic shock which is sometimes given to the telephone operator on account of the snapping of the diaphragms of the receiver. The present telephone protector gap consists of a pair of carbon blocks separated by a mica spacer with a hole or slot in it. This gap is connected between the telephone line and the ground, and in case of high induced voltage it breaks over and relieves the strain on the telephone apparatus. Acoustic shock is liable to occur when this gap breaks down on account of the flow of current from the side of the line which does not ground through the receiver to the side which is grounded by the gap. It has been proposed that gaps be made so that they will insure that both sides of the circuit are grounded at precisely the same instant, and further investigation is desired in this direction, and also by means of an air column between the diaphragm and the operator's ear.—*Inductive Interference Committee, N. E. L. A.*

VACUUM-TUBE APPLICATIONS.

The perfection of [illegible] electrostatic voltmeters, and for use with oscillographs for recording without disturbance of circuit.—*F. S. Dellenbaugh, Jr., Massachusetts Institute of Technology, Cambridge, Mass.*

GROUND DETECTORS.

It has been found that [illegible] from high-voltage wires becoming grounded or crossed with other wires under conditions which cause no disturbance on the circuit and which may thus remain undiscovered for some time. Several cases have occurred which resulted in loss of life or in personal property damage which could have been avoided if [illegible] ground detector. A [illegible] very high-resistance grounds and would sound an alarm as soon as such a ground occurred is very essential to safe operation. The static ground indicator is not sensitive enough and has no alarm feature. There seemed to be no other available, so the detector was developed [illegible] report. This detector has several defects and its further development [illegible] *N. E. L. A.*

[illegible]

[illegible]

PETERSEN EARTH COIL FOR POWER CIRCUITS.

This device has been described in the foreign technical press [illegible] arcing grounds and limits the flow of [illegible] relatively small quantity. A careful detailed investigation of this method is desired.—*Inductive Interference Committee of the N. E. L. A.*

News of the Industry

Chronicle of Important Events and General Activities in the
Technical, Commercial and Manufacturing Fields With Announcements and
Reports of Association Meetings and Conventions

New York Utilities May Issue No-Par-Value Stock

ATTENTION of all dealers in and holders of public utility securities is called by H. M. Addinsell, chairman of the public service securities committee of the Investment Bankers' Association of America, in an interim report, to the recent amendment to New York State "no-par-value" law extending the privilege of issuing stock of no par value to public utility corporations. After quoting S. Z. Mitchell, president Electric Bond & Share Company, and O. B. Wilcox, past-chairman of the committee, favoring no par value for public utility stocks, the report says:

"The first state actually to embody this idea in a law was New York, which passed the act authorizing the organization of corporations having shares without par value in 1912. Since any new legislative ideas taken up by the conservative Empire State always attract much attention throughout the country, the following years saw many other states adopt similar measures. During the various protracted discussions relative to this subject the idea had been expanded and developed to such a degree that the New York law of 1912 had become somewhat obsolete, and this new amendment was needed to bring it up to date.

Irrigationists Win in Deschutes River Conflict

THAT no license be issued for water-power development on either the Upper or the Lower Deschutes River in Oregon which is not in harmony with the maximum development of irrigation is the recommendation of the board of engineers that investigated the use of this river and its tributaries as the result of a conflict between irrigation and power interests. Three filings were made for power on the river—one by the Columbia Valley Power Company for 78,000 hp. and two by H. S. McGowan totaling 131,000 hp.

Considerable interest has attached to this investigation because it is the first case of conflict between power and irrigation to be decided by the Federal Power Commission. There are other conflicts of somewhat similar nature as yet undecided, the most important of which relates to the Colorado River development.

The board of engineers was composed of D. C. Henney, consulting engineer of the Reclamation Service (chairman); Col. J. B. Cavanaugh, Corps of Engineers, U. S. Army, the division engineer for the Northwest district, and Fred Henshaw, the Geological Survey's district engineer for the Northwest. The report, which was made to the Federal Power Commission, is voluminous, covering more than 300 typewritten pages. A number of recommendations are made, among which are the following:

That storage rights in the Upper Deschutes be held for irrigation and domestic use.

That storage rights in the Upper Crooked River be withdrawn for best future use, it being the present opinion that use for power with incidental use for irrigation will prove most beneficial.

That, because of absence of any large market for Deschutes power and of doubt that any of the large powers in the lower river can be developed profitably within the time contemplated by law after application for preliminary permit, all such applications at this time be considered as covering necessary investigations only and be handled by the commission so that ultimate development may not be hindered when conditions under such development are economically practicable.

That no license be issued for power on either the upper or the lower river which is not in harmony with the maximum development of irrigation.

That no license be issued for any project in the lower river which is not in harmony with the general scheme for the development of water power outlined in Water Supply Paper 344 of the Geological Survey unless conclusive showing of an improvement upon this general scheme is made.

If all the Upper Deschutes be given over to irrigation, about 555,000 hp. can be developed in the lower river without storage at Post, of which 362,000 hp. is likely to be obtainable, the report states, at reasonable cost. Post storage will add 26,000 hp. On the Metolius River it is estimated that 63,000 hp. of the 88,000 hp. possible can be developed at reasonable cost.

Stability of Utilities Emphasized at New England Convention

HEALTHY growth of the central-station industry coupled with improved technique in electrical practice and increased cordiality in public relations, as well as in relations between companies and between industries, were dwelt upon at the thirteenth annual convention of the New England Geographic Division of the National Electric Light Association, held at the Hotel Griswold, New London, Conn., Sept. 7-9. In his opening address President Bowen Tufts emphasized the stability of the utility industry and urged more frequent divisional meetings and intensive economic activities by committees.

M. H. Aylesworth, executive manager N. E. L. A., commended the progress of the inductive interference and public policy work of the national body, and Frank W. Smith, first vice-president, greeted the convention in the absence of President M. R. Bump. Vincent Goldthwaite, Boston, described the work of the purchasing agents' committee, which has already saved the divisional subscribers considerable money through comparisons of fuel and supply prices. A fine lecture and demonstration of the prone-pressure method of resuscitation by Dr. E. W. Bullock of the New England Telephone & Telegraph Company closed the opening session.

An Accounting Section headquarters, with exhibits and crowded informal sessions daily, in addition to the regular session, was a new departure of the convention. A budget system for construction expenditures was recommended by the sub-committee on accounting for construction work. An exhaustive report upon purchasing and storerooom accounting was presented by W. F. Stevens, Boston, indicating lines of improved practice, and in a long discussion methods of minimizing investment and views of handling depreciation received attention.

The admirable results of customer ownership were set forth by P. H. Whiting, Central Maine Power Company, and by Mr. Aylesworth at a public relations session Wednesday evening. Among the other speakers were Joseph B. Groce, newly appointed director of the New England Bureau of Public Service Information, and George C. Gardner, vice-president Union Trust Company, Providence, R. I.

Commercial problems provided a full program on Thursday. William C. L. Eglin, chief engineer Philadelphia Electric Company, addressed the convention upon "Power-Factor Correction," emphasizing the need of planning for the future in developing distributing systems along unified lines. The speaker said that it is hoped to standardize static-condenser sectional construction for application to individual induction motors through the co-operation of the association and the manufacturers. It was the general opinion in the discussion that the customer should finance improvements that offer him a chance to realize a lower rate.

POWER-FACTOR RATES FAVORED

J. E. Gray, for the rate committee, reported in favor of power-factor clauses in rate schedules—effective at present only in the case of the larger power consumers and upon the service-charge portion of the rate.

F. A. Gallagher, Jr., Providence, R. I., presented the report of the lighting committee. Julius Daniels, Boston, spoke of the widespread interest in the Bureau for Better Illumination exhibit now maintained in that city. Increased sales of lighting equipment have already resulted. A long and enthusiastic discussion of electric range problems, with an address by P. L. Miles, Edison Electric Appliance Company, Chicago, and a demonstration by Frank J. Allen, Westinghouse Electric & Manufacturing Company, Boston, were features of the afternoon session. L. D. Gibbs, chairman electrical page committee, outlined recent efforts of the Boston Edison company to come into closer relations with contractor-dealers.

A comprehensive technical program under L. L. Elden, chairman, covering inductive interference, safety rules, electrical apparatus, plant and equipment developments, was carried through on Friday. Extracts from these papers and reports will be presented in later issues. A feature of the day was an illustrated talk by Prof. W. L. Robb, Rensselaer Polytechnic Institute, Troy, N. Y., upon "Power Development Possibilities in Connecticut." In these sessions gratifying harmony was apparent between central-station company, telephone and telegraph representatives working upon the problems of inductive interference. Revision of certain safety rules of the Bureau of Standards was advocated, and great interest was shown in the development of automatic hydro-electric plants and substations. Radiotelephone communication between central stations and line crews was declared practicable, and the possibility of operating turbo-generators with less cooling was emphasized. Advanced practice in underground distribution, including the more accurate location of faults in fresh-water cables, was also discussed.

The following officers were elected: President, Charles L. Edgar, Boston; vice-president, E. H. Barrows, Providence; secretary, Miss O. A. Bursiel, Boston; treasurer, C. R. Hayes, Boston. The executive committee members will be E. M. Graham, Bangor, Me.; F. A. Belden, Portsmouth, N. H.; D. W. Jardine, Burlington, Vt.; T. C. Fales, Boston; E. L. Milliken, Pawtucket, R. I.; Samuel Ferguson, Hartford, Conn.; A. B. Reynders, Springfield, Mass.; R. H. Rice, Lynn, Mass.; F. S. Price, George B. Quinby and Bowen Tufts, Boston.

National Safety Council Expects Large Attendance

MEN and women interested in the promotion of safety are expected to attend to the number of three or four thousand the tenth annual congress of the National Safety Council, to be held in the Massachusetts State House, Boston, on Sept. 26 to Sept. 30. As has been the custom at past safety congresses, the delegates from the various industries will meet in separate sectional meetings with others of their group to discuss the special problems of their own industries. In addition there will be general meetings in which the representatives of all industries will join. Herman Spoehrer, secretary-treasurer of the Union Electric Light & Power Company, St. Louis, will present the report of the committee on public utilities at the meeting of the public safety section, and at the meeting of the public utilities section addresses will be made as follows:

"The Necessity of the Support of Executives in Accident Prevention Work," by Charles B. Scott, general manager Bureau of Safety, Chicago (discussion by H. C. Lucas, treasurer Philadelphia Electric Company, and R. E. McDougall, manager New York & Harlem Railroad Company.)

"Hazards in Hydro-Electric Plants," by Alexander E. Bauhan, superintendent of stations Pennsylvania Water & Power Company, Baltimore (discussion by W. H. Mulligan, Hydro-Electric Power Commission of Ontario, and John Morse, general superintendent Shawinigan Water & Power Company, Montreal.)

"Risks in Handling and Storing Coal, Oil and By-products," by C. E. Paige, manager Worcester (Mass.) Gas Light Company (discussion by A. O. Mitchell, Northern Indiana Gas & Electric Company, Hammond. Ind., and James B. Douglas, United Gas Improvement Company, Philadelphia.)

"Care in the Construction and Maintenance of Overhead Lines," by A. B. Gates, superintendent of overhead lines Commonwealth Edison Company, Chicago (discussion by H. J. Burton, Consumers' Power Company, Jackson, Mich., and Charles Durfee, Rochester (N. Y.) Gas & Electric Corporation.)

"The Use of Protective Devices," by Wills Maclachlan, consulting engineer, Toronto (discussion by E. R. Dobbin, Empire Gas & Electric Company, Geneva, N. Y., and George R. Rinke, Utilities Mutual Insurance Company, New York City.)

A "get-together luncheon" of the public utilities section will be held on Tuesday, Sept. 27, at 1 o'clock at the Boston City Club. C. L. Edgar, president Edison Electric Illuminating Company, Boston; Milan R. Bump, president National Electric Light Association; William McClellan, president American Institute of Electrical Engineers, and Joseph B. McCall, president Philadelphia Electric Company, Philadelphia, will speak.

At a joint meeting of manufacturing sections "Better Industrial Lighting" will be the topic—"Why?" being answered by R. W. Shenton, National Lamp Works, Cleveland, and "How?" by A. S. Turner, Edison Lamp Works, Harrison, N. J.

Southeastern Drought Situation Relieved by Rains

A SUBSTANTIAL rainfall during last Saturday and Sunday helped materially to relieve the drought situation in the Southeast. The unprecedented water shortage has necessitated in one instance curtailment of electric power supply. The smallest rainfall in years has resulted in the drying up of many of the smaller streams and reservoirs and materially reducing the height of water in many of the more important ones. All the hydro-electric companies throughout the Southeastern States have drawn heavily on their water reserves, and several companies have found it necessary to start up steam reserve plants.

Among the companies affected are the Carolina Power & Light Company and its subsidiaries. They found it necessary to suspend service to cotton mills from Thursday until the end of last week. Service was restored on Monday and had not been curtailed again when this was written. The large reservoir created by the Blewett Falls dam of the Yadkin River Power Company, a subsidiary, continues to give normal service, except for the temporary suspension to the cotton mills. The restrictions make it impossible to operate the Raleigh steam plant, which would otherwise give relief.

The Southern Power Company found itself well protected during the drought by the new Bridgewater storage reservoir. This was drawn down around 7 ft. or 8 ft. At the offices of the company in New York it was stated that there had been no curtailment whatever of service. It had, however, been necessary to start up the steam plants again at Greenville, Greensboro, Eno and Mount Holly, as many as three having been in operation at one time during the past two or three weeks. Recent rains, however, it was said, have relieved the situation.

A wire from the Georgia Railway & Power Company states that this company is not curtailing service nor are there any prospects of its having to do so. The company has in storage water representing 45,000,000 kw.-hr. and as yet has not considered it necessary to start steam plants.

Transmission Line Characteristics at 1,000,000 Volts Ascertained

TESTS were conducted at the high-voltage laboratory of the General Electric Company's Pittsfield works this week using voltages up to and above 1,000,000 to determine whether the corona and spark-over characteristics at these enormous voltages follow the laws which have been established for voltages below 250 kv. As a result of these tests, which were made at 60 cycles, engineers of the General Electric Company have concluded that it will be feasible to adopt considerably higher voltages for transmission than are now commercially employed. With the transmitting range permitted by 1,000,000 volts—namely, about 1,000 miles—it should be practicable to supply vast districts with power from the original source of energy such as waterfall, coal mine or oil well.

Among those principally responsible for these tests were C. C. Chesney, general manager of the Pittsfield works; F. W. Peek, Jr., G. Faccioli and W. S. Moody. In response to a request regarding the significance of these tests Mr. Peek replied as follows:

"For some time engineers have been able to predict with certainty the corona and spark-over characteristics of high-voltage transmission. These predictions were based on laws of corona established by careful tests made up to about 250 kv. and on spark-over curves established on needle and sphere gaps and line insulators at somewhat more than double this voltage. Commercial apparatus has already been built for 220-kv. operation.

"It was of great present theoretical and probably future practical interest to determine experimentally if there was a discontinuity in the established laws and curves at a million volts or over. Although no deviation was expected, we could not be certain until actual tests were made. We might, for instance, speculate that because of the great length of lightning sparks the air must be relatively weaker at the very high voltages.

"Tests up to about 1,100 kv. were made on the various elements entering a transmission line as follows: (a) The spark-over curve between points showed no discontinuity. The spark-over at 1,000 kv. was found to be about 105 in. (b) The spark-over curve between 75-cm. spheres showed no great deviation from calculated values. (c) Tests were made on strings of line insulators and the spark-over voltages were as expected; for instance, a string of eighteen standard suspension insulators arced over at about 900 kv., while a string of twenty-two insulators did not arc over at more than 1,000 kv. (d) Visual corona tests were made on 3½-in.-diameter brass-tube lines operating single-phase. The corona starting voltage (about 900 kv.) checked with the calculated value."

Great Need for Capital and Other Topics Discussed by Edison Companies

PROBLEMS facing the electric light and power industry were frankly discussed at the fortieth convention of the Association of Edison Illuminating Companies, held on Tuesday, Wednesday and Thursday of this week at Spring Lake, N. J. Mr. Edison himself was in attendance, and as an evidence of his inventive genius Dr. Clayton H. Sharp traced the significance of the "Edison effect" to the art of wireless communication and showed that long before Marconi had sent radio messages Edison had conceived the idea of signaling between ships and had actually taken out patents on a wireless system of communication. Unfortunately Edison was deterred from pursuing his investigations further, and it was left to others like Professor Fleming and Dr. De Forest to apply Edison's discovery to the art of wireless telegraphy and telephony.

In his presidential address Walter Johnson visualized the work before the industry. He saw wonderful opportunities ahead because the world looks to electricity for big things, and yet, alluring and real as is the vision, public support is necessary to bring it to fruition. Mr. Johnson said that it is no longer necessary to demonstrate the advantages of electricity. These are now accepted as fact and the experimental stage is past. In the present day money many times in excess of the invested capital is needed to finance new work, and he admonished his hearers to impress upon the public that investment in public utility securities, both senior and junior, is safe, wise and profitable.

The most interesting and valuable of all the committee reports read before the Edison association is that of the lamp committee, presented now for many years by John W. Lieb. The report this year emphasized the fact that if the continued progress and expansion of the industry were to be assured, it was as necessary now as ever to give careful attention to standards of illumination and the provision of proper lamps. The past few years have amply demonstrated that the lighting load is a valuable stabilizer of station output and that it is the least affected by industrial depression and untoward business conditions. Mr. Lieb said it was gratifying to note, notwithstanding present business conditions, that there was no lull in research and investigations making for continued improvement in incandescent lamps.

On Wednesday evening Samuel Insull delivered a notable and intimate address on the development of the central station industry. Lucien H. Tyng, representing the Investment Bankers' Association of America, also addressed the association on that evening on some problems concerned with electric light and power company financing.

The committee on standards, of which W. C. L. Eglin is chairman, reported briefly on the status of the National Electrical Safety Code and the action of the American Engineering Standards Committee relating thereto. Improvements in meter supply were noted by P. H. Bartlett, chairman of the committee on metering and service methods, who also reported on late developments in demand and ampere-hour meters. A plea was made for liberal standardization of service and meter cabinets by both manufacturers and power companies, and gratification was expressed over the progress already made in standardizing service entrance cut-outs up to 100 amp. rating. L. L. Elden, reporting for the committee on electricity distribution and use, presented for consideration a series of subjects having an economic bearing on the electric light and power business. These subjects included interconnection, automatic substations, sectionalizing bus reactors, wireless installations, standard lamp voltages, wiring costs, temperature limits for insulation, cable specifications and terminals at substations.

COMMERCIAL SURVEY MADE

All of Wednesday morning was given to a consideration of merchandising and commercial topics. Three papers were presented—one a survey of residential installations made by a sub-committee of the lamp committee headed by Clarence Law, the second a study of residence kilowatt-hours with reference to relative consumption by appliances and lamps, by C. J. Russell and T. W. Berger, and the third a paper on the economics of electrical merchandising, by George P. Baldwin. The survey made by Messrs. Russell and Berger in Philadelphia, although it covered only one month's use of lamps and appliances, is undoubtedly one of the most important studies of residential circuits made in recent years. It indicated that by means of greater appliance loads residential business may be made more attractive to the electric light and power companies of the country and by that means the saturation of the dollar invested may be more nearly accomplished.

Papers dealing with the engineering features of central-station work were presented on Thursday. These included reports of committees on steam turbines and generators, power factor and fuel. Prof. J. P Jackson delivered a very timely address on the interrelation of power systems.

Plan Merger of Doherty Properties in Toledo

STEPS are being taken to effect the consolidation of the Toledo (Ohio) Railways & Light Company and the Acme Power Company, both controlled by Henry L. Doherty & Company. A special stockholders' meeting of the Toledo Railways & Light Company is called for Oct. 10 to vote on a change of name, an increase of capital from $15,000,000 to $25,000,000 and the proposed merger with the Acme Power Company. Since the Toledo Railways & Light Company's street-railway properties in Toledo were transferred early this year to the Community Traction Company, a municipal project, the company has proposed to change its name to the Toledo Edison Company and effect the merger with the Acme Power Company. Details of the financial plan of the new company have not yet been announced, but it is understood that a complete financial reorganization will be made.

Little Damage to San Antonio Utilities In Flood of Sept. 10

DAMAGE to the property of the San Antonio (Tex.) Public Service Company as a result of the flood on Saturday, Sept. 10, was slight. At the New York office of the American Light & Traction Company, which controls the electric light and power, street railway and gas utilities in San Antonio, it was stated that there was little or no physical damage to any of the company's property. Only one of the company's plants, a comparatively small one, known as Station B, was reached by flood water, and while detailed reports had not yet been received as to the extent of the damage, it was not believed that the total cost of clearing away débris and making necessary repairs would exceed $20,000.

Electric service was interrupted shortly after the flood started about 1 o'clock Saturday morning, but was restored at 8 o'clock in the evening of the same day. Traction service was resumed on Sunday morning. The gas service was affected the least.

Massachusetts Utilities Again Seek Premium Capitalization

TO BROADEN the market for gas and electric securities in Massachusetts, the capitalization of premiums was urged before the Department of Public Utilities at Boston Sept. 13, at a hearing given by the commission in response to a resolve of the last Legislature. E. W. Burdett, for the fifty-three utilities composing the Massachusetts Gas and Electric Association and including leading companies in the state, addressed the board. Four recommendations for legislation were presented by Mr. Burdett to the commission, which is investigating the general problem of utility capitalization with instructions to report its findings and suggestions to the incoming Legislature next January. The recommendations were these: (1) That the department may approve the issue of stock below par in cases of necessity; (2) that the commission establish the issue prices of bonds and their rate of interest; (3) that the cash and share capital of companies be equalized under supervision of the commission; (4) that the commission may authorize the issue of capital stock without par value.

Colorado River Dam Is Federal Project, Secretary Fall Says

SECRETARY FALL of the Department of the Interior is in favor of the construction of the Boulder Canyon dam on the Colorado River by the federal government, according to advices just received in California from A. P. Davis, chief of the United States Reclamation Service. This significant declaration is the first authentic disclosure of the attitude of the Secretary, who must pass on the project both as Secretary of the Interior and as a member of the Federal Power Commission. According to Mr. Davis, the Secretary believes that no dam should be built on the Colorado River by any authority except the United States, the enterprise being altogether too large, too important and involving too many interstate and international problems to permit of its being undertaken by any other than the federal government. The communication from Mr. Davis further says: "The Secretary thinks it is not desirable to permit any of the interests to contribute to the investigations, but in view of the urgency of the matter has consented that all municipalities may be invited to do so for the present in order to keep the work going and forestall delay." The Secretary has instructed Mr. Davis to prepare estimates in the amount of $100,000 to further investigate the Boulder Canyon project. Contributions to this fund are to be solicited from the interested municipalities with the explicit agreement that such contributions do not involve any moral or legal advantage concerning the allocation of benefits from the completed project.

Arrangements Made for 168,000-Hp. Plant to Feed Into Winnipeg

ARRANGEMENTS have been completed for the financing of a ten-million-dollar power development project at Great Falls on the Winnipeg River in Manitoba, Canada. A. W. McLimont, vice-president of the Winnipeg Electric Railway, has recently returned from a trip to Montreal, where he was in consultation with the firm of Nesbitt, Thomson & Company, who will finance the undertaking. When completed the plant will have a capacity of 168,000 hp. Work has begun and about 200 men are now employed. This force will later be increased to between 1,500 and 2,500 men, and the whole plant, it is expected, will be finished in 1927.

The undertaking will be carried out under the charter of the Manitoba Power Company, Ltd., which company is taking over the assets of the Winnipeg River Power Company. Sir Augustus Nantan of Winnipeg, who is also a director of the Winnipeg Electric Railway, will be president and A. W. McLimont will be vice-president of the Manitoba Power Company.

Public Relations the Keynote of Pennsylvania Electric Association Convention

THE fourteenth annual convention of the Pennsylvania Electric Association was held at Bedford Springs, Pa., on Thursday, Friday and Saturday of last week. Chief interest in the program was centered in a public policy meeting on the evening of Sept. 8, at which President M. R. Bump of the National Electric Light Association; A. W. Thompson, president of the Duquesne Light Company of Pittsburgh, and W. D. B. Ainey, chairman of the Public Service Commission of the Commonwealth of Pennsylvania, spoke.

LARGE AND ENTHUSIASTIC ATTENDANCE AT BEDFORD SPRINGS CONVENTION

Papers were presented during the convention as follows: "Superpower Survey as It May Affect Pennsylvania," by Harold Goodwin, Jr.; "The Uses and Value of Classified Cost-of-Service Data as Supplementary Evidence in Certain Types of Rate Cases," by Charles E. Cooke, Jr.; "Closer Co-operation with Our Customers," by W. H. Wade; "Electric Service for Rural Customers," by C. W. Drake; "Inductive Interference," by A. E. Silver; "Light and Power Company Hazards as Viewed by the Department," by Clifford Connelly, and "Accident Prevention Among Electric Utilities," by Paul R. Kuhn. In addition there were reports from the following committees: Rates, F. S. Smith chairman; Commercial Section relations, G. M. Gadsby chairman; Technical Section, Henry Müller chairman; safety and welfare, J. H. Shearer chairman; Accounting Section, H. R. Kern chairman; purchasing and storeroom accounting, J. F. Torrence chairman; customers' records and billing methods, John F. Ford chairman; credits and collections, C. F. Kalp chairman.

In his presidential address Henry Harris of Wilmerding reviewed briefly the accomplishments of the year and laid stress on what was yet to be done, especially in the way of service, financing and winning public good will. Much that he said was re-echoed in fuller detail at the public policy meeting. Mr. Bump was certain that the securities of electric public utilities will remain attractive for many years to come. He outlined the plans of the N. E. L. A., calling attention to the Customer Ownership Service Bureau recently established at headquarters in New York, to the general good-will program, and to the relationship established with the telephone companies for amicably settling inductive-interference troubles.

Service was the keynote of A. W. Thompson's address. While probably not more than 5 per cent of the customers indulge in adverse criticism of the service, yet Mr. Thompson said, success or failure is measured by the manner in which these complaints are handled. Mr. Thompson also called attention to the service necessary to the employee to make him contented and happy and the service to the investor whereby additional capital may be attracted to securities of the local companies.

Commissioner Ainey expressed his confidence in the ability of the electrical industry to solve the problems before it. He declared it to be one of the most essential parts of the fabric of human civilization and progress and said that such associations as the Pennsylvania Electric Association and the National Electric Light Association are of untold assistance to the regulatory authorities because through them the commissions receive the composite thought and practices of the utilities and are able to adjudicate matters for the good of the individual, the community and the nation.

Mr. Goodwin in his paper dealt with some of the commercial and engineering aspects of the Superpower Survey recently made in the Northeastern section of the United States, the final report on which is soon to be distributed. The executive, legal and financial phases were not touched on. Standard distribution voltages for the Superpower Zone were recommended as follows: 2,300 volts, 23,000 volts and 66,000 volts. Particular emphasis was laid on the virtues of 66,000 volts as against higher voltages, and use of this voltage with pin-type insulators was advocated.

At the closing session of Saturday A. S. Cantlin of Allentown was elected president, H. H. Ganser of Norristown was elected first vice-president and E. H. Davis of Williamsport second vice-president. J. H. Shearer of Altoona was elected treasurer.

First Application from New England for Preliminary Hydro Permit

THE meeting of the Federal Power Commission which was scheduled for Sept. 12 was postponed owing to the fact that the Secretary of War was called out of the city. The meeting will be held immediately on his return. At that meeting the commission will pass upon the request of the Connecticut River Power Company for a preliminary permit covering the project at Enfield Rapids on the Connecticut River, where it is intended to develop 32,000 installed horsepower. This will be the first preliminary permit to be granted in New England since the enactment of the water-power act. It is expected that the commission will reject the application of A. P. Connor of Springfield, Mass., which covers the same site. The commission at its next meeting will also pass upon an application by George C. Hazlett of Cordoba, Alaska, for a preliminary permit covering a project at the outlet of Silver Lake in Alaska in which 5,000 hp. is involved.

Application has been made to the commission by the Uinta Power & Light Company for a preliminary permit covering a Utah project, in which some 6,000 hp. is involved, and by the Darwin Silver Company of California for a license covering a transmission line from one of the power plants serving the city of Los Angeles to a near-by mine.

Salesmanship and Customer Ownership to Be Discussed at French Lick Springs

THE program of the Great Lakes Geographic Division, N. E. L. A., and Indiana Electric Light Association convention at the French Lick Springs Hotel, French Lick Springs, Ind., Sept. 21-24, will include addresses by President Bump and Executive Manager Aylesworth of the National Electric Light Association. Dr. Holmes, president of Drake University, Des Moines, Iowa, will discuss salesmanship. The electric vehicle situation will also be discussed, and the technical sessions on Friday morning will be addressed by Chairman Carle of the National Technical Section. The program in full is as follows:

WEDNESDAY, SEPT. 21

9:30 A.M.—President's address, William C. Lounsbury, Superior, Wis.; reports of committees; report of secretary-treasurer; address, "Facts and Feeling in Salesmanship," by Dr. A. Holmes, president Drake University, Des Moines, Iowa; address, "Contract Routine," by R. T. Duncan, Detroit Edison Company; report, "Investigation Upon the Relation of Kilowatt-Hours Sold for Appliances and for Lighting in the Average Household," by T. W. Berger, Philadelphia, Pa., and George A. Neal, Hammond, Ind.; address, "Illinois Committee on Public Information and Its Future Plans," by B. J. Mullaney, Chicago; report, "The Electric Vehicle," by Messrs. Cunningham and Carpenter, Chicago.

THURSDAY, SEPT. 22

9:30 A.M.—Address, "Consumer Ownership of Utilities," by R. F. Scheel, Chicago; address, "Public Service," by George P. Barnard, Indiana Public Service Commission; address, "Central-Station Publicity," by J. B. Wootan, New York City; address, "Training for Public Service," by Fred R. Jenkins, chairman educational committee N. E. L. A.; address, M. H. Aylesworth, executive manager N. E. L. A.

FRIDAY, SEPT. 23

9:30 A.M.—Report of technical committee, by George E. Lewis, Ann Arbor, Mich.; paper, "Michigan High-Voltage Transmission Systems," by H. J. Burton, Jackson, Mich.; report of meter committee, by J. C. Langdell, Jackson, Mich.; address, by N. A. Carle, chairman technical committee N. E. L. A.; paper, "Distribution Systems in Small Communities" (author to be named); general discussion on consumers' billing methods led by B. P. Shearon, Hammond, Ind.; J. H. Thomas, Peoria, Ill.; C. H. Hansberger, Grand Rapids, Mich.; H. C. Mitchell, Indianapolis, Ind., and W. A. McDonough, Beloit, Wis.; demonstration of latest mechanical drilling devices.

7:30 P.M.—Address, by Milan R. Bump, president N. E. L. A.; distribution of golf prizes.

THIRTEENTH ANNUAL MEETING INDIANA ELECTRIC LIGHT ASSOCIATION, SATURDAY, SEPT. 24

9:30 A.M.—Reports of committees; report of secretary-treasurer; president's address, by Morse DellPlain, Hammond, Ind.; address, "Capitalizing Your Opportunities," by William L. Goodwin, Society for Electrical Development; address, M. H. Aylesworth, executive manager N. E. L. A.; round-table discussion; election of officers.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Central Maine Power Company Has 7,000 Stockholders.—In the fiscal year ended on June 20 last the Central Maine Power Company gained 3,042 stockholders, which it considers a record for a company with 36,000 customers. These new purchasers brought the number of holders of 7 per cent stock up to 5,968, and, adding in the holders of 6 per cent and common stock, the company now has more than 7,000 investors in its securities.

Prizes for Advertisements and "Stories" of Utility Companies. — J. F. Owens, vice-president and general manager of the Oklahoma Gas & Electric Company, has announced that last year's prize contest among the students of the school of journalism of the University of Oklahoma for the best advertisements and "feature stories" regarding public utilities companies will be made a permanent institution. Five prizes of $5 each for the best monthly contributions and a grand prize of $50 will be awarded each year.

Church Services by Radio.—In Pittsburgh recently the congregation of the Herron Avenue Presbyterian Church, whose pastor was absent, listened to the services. including music and sermon, given at another church 10 miles distant and transmitted by radio telephony and through an amplifier. This innovation was an extension of an arrangement by which the entire religious service of the Calvary Episcopal Church at Pittsburgh is transmitted by radio every Sunday evening to amateur radio stations equipped with the proper receiving and amplifying apparatus. The sermon from the loud-speaking horn is said to have been distinctly heard in all parts of the auditorium.

Turbo-Generator Runs Five Years Without a Breakdown.—For five years a 3,200-kva. Westinghouse turbo-generator has been operated in the city of Saskatoon, Saskatchewan, Canada, without a breakdown and with only a few short stops on account of a light load that could be carried by a smaller turbine. One continuous run of eighteen months is recorded. This record is the more remarkable because of the extremes of temperature encountered in the Canadian Northwest. The loads carried by this machine have varied from 300 kw. to 3,850 kw. The only portion of the equipment that was ever removed was the governor pedestal cap, which was taken off for the purpose of renewing a gasket on the gland runner joint. The condenser, too, has proved reliable. On one occasion when ice shut off the water intake seventeen times in an eight-hour run no trouble to the tubes or plates occurred. The La Blanc air pump never has given any trouble with condensing water at a proper temperature. The turbo-generator is still "going strong."

Wireless Contest to Be Held at New York Electrical Show.—A world's championship speed contest in wireless telegraphy is to be held in New York on Sept. 28, 29 and 30 in connection with the New York Electrical Show at the Seventy-first Regiment Armory. The contest will be open to all comers and some of the fastest army, navy and commercial operators are expected to take part. A silver cup will be presented to the winner. The contest will be under the auspices of the National Amateur Wireless Association and will be conducted by a committee representing the government departments and the commercial telegraph companies. In addition to the professional contest there will be a test in receiving messages through interference. This will be limited strictly to amateurs.

Diesel-Electric Yacht Passes Her Trials.—The Guinevere, a three-masted schooner designed by A. Loring Swasey and built at Neponset, Mass., with a water-line length of 165 ft., over-all length of 195 ft., beam of 33 ft. and displacement of 642 tons, depends for her auxiliary power on Diesel-electric engines. Her power plant consists of two six-cylinder, 350-hp. Winton oil engines operating at 225 r.p.m., each of which is directly connected to a 225-kw., 125-volt Westinghouse direct-current generator. Power from these generators is supplied to the Westinghouse propeller motor, which is a 550-hp., 250-volt, 220-r.p.m. machine. On her trials the Guinevere ran over a measured course of 5¼ nautical miles between Boston Light and the lightship and showed a speed of 11.62 knots, which is a knot more than contract speed.

Commission Tries to End Electrical Strife at Goshen, Ind.—In an effort to terminate the competition that has existed in Goshen, Ind., for twenty-five years between the municipal electric light service and the Hawks Electric Company, the Indiana Public Service Commission has recommended that the rival purveyors of energy either consolidate or divide the territory between them. This advice is contained in an order authorizing the company, from which the city purchases energy, to increase its wholesale rate from 1.45 cents to 2 cents a kilowatt-hour despite a ten-year contract at the former rate entered into less than two years ago. Rates to householders and commercial light users were also raised by from 10 to 15 per cent, and a smaller increase to power consumers was authorized, these advances being in addition to previous ones granted last December. A few years ago the city shut down its own generating plant and contracted with the company for energy, and much bitter feeling has been caused by the resulting situation.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

Philadelphia Section, I. and S. E. E.—The first fall meeting of the Philadelphia Section of the Iron and Steel Electrical Engineers will be held at the Engineers' Club building on Saturday, Oct. 1, at 8:15 p. m., when the topic for discussion will be "Power Distribution in Industrial Plants."

National Association of Railway and Utilities Commissioners.—This association will hold its annual meeting at Atlanta, Ga., on Tuesday to Friday, Oct. 11 to 14, under the presidency of James A. Perry of the Georgia Railroad Commission. President Bump and Executive Manager Aylesworth of the N. E. L. A. will be present.

N. E. L. A., Rocky Mountain Division.—As already announced, the second annual convention of this association will be held, in conjunction with the annual convention of the Colorado Electric Light, Power and Railway Association, at the Hotel Colorado, Glenwood Springs, Col., on Sept. 19, 20 and 21. Men nationally prominent in electrical activities will, it is announced, address the gathering. The executive committee of the Accounting Section, N. E. L. A., will meet in Glenwood Springs on Sept. 20, concurrently with the Rocky Mountain division.

Coming Meetings of Electrical and Other Technical Societies

Association of Iron and Steel Electrical Engineers—Chicago, Sept. 19-24. (For program see issue of Sept. 10, page 535.)

N. E. L. A., Great Lakes Division, and Indiana Electric Light Association—French Lick Springs, Sept. 21-23. (For program see "News of the Industry.")

N. E. L. A., Rocky Mountain Division, and Colorado Electric Light, Power and Railway Association — Glenwood Springs, Sept. 19-21.

West Virginia-Kentucky Association of Mine, Mechanical and Electrical Engineers—Huntington, W. Va., Sept. 20-23.

Electrical Supply Jobbers' Association, Central Division—Chicago, Sept. 22 to 23.

Illuminating Engineering Society—Rochester, N. Y., Sept. 26-29. (For program see issue of Aug. 13, page 336.)

National Safety Council—Boston, Sept. 26-30.

American Electrochemical Society — Lake Placid Club, N. Y., Sept. 29-Oct. 1.

A. I. and S. E. E., Philadelphia Section—Philadelphia, Oct. 1.

American Electric Railway Association—Atlantic City, N. J., Oct. 3-7.

Indiana State Association of Electrical Contractors and Dealers—Indianapolis, Oct. 5 and 6.

Empire State Gas and Electric Association—Lake Placid, N. Y., Oct. 6 and 7.

National Association of Railway and Utilities Commissioners—Atlanta, Ga., Oct. 11-14.

N. E. L. A., Southeastern Section—Chattanooga, Tenn., Oct. 17-19.

Electrical Supply Jobbers' Association, Atlantic Division, Philadelphia, Oct. 20.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies

Responsibility for Unhealthful Conditions Attributed to Power Company's Dam.—The Georgia Court of Appeals has reversed a verdict for the defendant directed by the lower court in Head vs. Towaliga Power Company and ordered a retrial. This is a suit for damages on account of a nuisance and menace to health alleged to have been caused by the backing up of waters obstructed by a dam erected by the power company across the Towaliga River. The higher court held that there was evidence supporting a verdict for damages in some amount and no evidence supporting a verdict for the defendant.

What Constitutes an Extraordinary Flood?—In affirming a judgment for flood damages in Cheatwood vs. City of Richmond, the Supreme Court of Appeals of Virginia thus summarized the law as it bears upon "extraordinary" floods for which damages are not recoverable: "The law is perfectly well settled that no person or corporation has a right to construct a culvert over a natural watercourse in such manner as to obstruct the flow of the stream and throw its waters back on another owner's property to its injury, and the culvert or opening must be sufficient to accommodate not only the natural and normal flow of the stream but such abnormal and excessive flow as may reasonably be anticipated in times of high water and flood. There is no duty to provide for floods so unusual and extraordinary as to bring them within the category of an 'act of God.'" (107 S. E. 830.)

Commission Cannot Reduce Rental of Property Leased by Public Utility.—Where the owner of property devoted to public service has leased it in whole or in part to an operating company for a specified compensation, the Public Service Commission, according to a decision of the Supreme Court of Pennsylvania in a suit brought by the New Street Bridge Company against the commission, can only determine the reasonableness of the rates charged to the public for the service and cannot reduce the compensation paid by the lessee for the use of the property, in which the public has no interest. The commission has no power to subject a lessor or owning company to the duties or obligations of an operating company. The power of the commission extends only to regulation of rates to insure reasonable charges and prevent discrimination and does not permit regulation to reduce contract charges solely for the benefit of the contracting consumers. (114 At. 378.)

What Is Confiscation?—The fixation of rates for a public service corporation cannot be a confiscation, declared the Supreme Court of Pennsylvania in handing down a decision on a disputed commission order (Ben Avon Borough vs. Ohio Valley Water Company), when the utility company receives a reasonable return on its investment, but if it is deprived thereof confiscation necessarily results. The discretion exercised in settling this point by the lower court will not lead to reversal by the Supreme Court unless it is satisfied that this discretion has been abused. The same fundamental principle was affirmed by the Supreme Court in Beaver Valley Water Company vs. Public Service Commission. (114 At. 369.)

Liability of Owner of Building and of Corporation Supplying Electricity for Death from Defective Wiring.—A dairy employee having met death because of grounded wires in the premises of a customer where he tried to reach a switch to turn on the light, the Appellate Court of Indiana (Aurentz vs. Nierman) found that the owner of the building, who knew that the wiring was defective, could not protect himself against liability by the claim that he was not an electrical expert and had relied on the opinion of others, it being his duty to have the defect removed. Nor could the city of Fort Wayne, which furnished the electricity and which had acquired knowledge by inspection on the complaint of the building owner of the defective conditions, escape responsibility because it did not control the building and had not been authorized to make the necessary repairs. (131 N. E. 832.)

Grand Rapids Ordinance Not a Franchise.—The Superior Court of Grand Rapids, Mich., has sustained the Consumers' Power Company in a suit brought against it by the city to enforce rates advertised by the company in 1907 and afterward put into force. These rates were less than those granted in an ordinance passed by the City Council previous to the company's advertisement and subsequently to this advertisement adopted by public referendum. The company has now reverted to the rates originally named in the ordinance. The city's contention was that the ordinance was a franchise and that the company by its own action had substituted the lower rates for those included in the ordinance, these lower rates thus becoming the legal ones. The city had, however, granted an emergency increase to the company on Nov. 4, 1920. It claimed that the rates the company is now charging under the original terms of the ordinance are higher than those accorded in this emergency measure and should be disallowed.

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* The left-hand numbers refer to the volume and the right-hand number to the page of the National Reporter System.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities

Commission Cannot Act in Capacity of Consulting Engineer for Projected Plants.—The Michigan Public Utilities Commission declined to act, at the request of a village contemplating the installation of a municipal electric plant, as a consulting engineer in the preparation of plans, surveys and reports, holding that the advisory functions bestowed on the commission by statute refer only to plants already built and in operation.

Going Value Predicated on Efficiency.—A public utility which is not above the ordinary in the way of operating costs and operating efficiency is not entitled to a going value representing the difference between a utility having a working organization and a business attached to its system and one which has not, according to a decision of the Michigan Public Utilities Commission, although a utility which is superior on account of foresight in design and operation is entitled to a larger allowance for going value than one which falls short in these respects.

Relation of Efficient Operation to Return.—The Light & Power Utility, which operates an electric distribution system in Banning, Cal., requested authority to increase its rates, urging that it was not earning a fair return on the capital invested. The California Railroad Commission declined to allow the increase, saying: "There is and has been a general complaint by applicant's consumers regarding the attitude and manner of applicant in carrying on its business, which prevents its proper and natural development. The commission has urged applicant from time to time to improve these conditions for the betterment of service to consumers and increase of business to applicant. It is the firm conviction of the commission's engineers that applicant's business could be increased to a point where it would pay an adequate return under present rates. Under these conditions the commission does not feel justified in authorizing an increase in rates at this time, and the return is fair, considering the service given. . . . If in the future applicant shows to the commission satisfactorily that it has made suitable changes to improve its conditions and has made a sincere and intelligent effort to develop the business properly, but that an increase in rates is still needed to provide an adequate return, the matter may again be brought to the commission's attention by the filing of a new application."

Men of the Industry

Changes in Personnel—Responsibilities and Association Appointments of Men Engaged in Professional, Executive, Operating and Commercial Branches of the Industry

S. F. SMITH

S. Fred Smith, local manager for Charles H. Tenney & Company of the Salem (Mass.) Electric Lighting Company, celebrated on Aug. 16 the thirtieth anniversary of his appointment as manager. Mr. Smith became connected with the electrical industry in its pioneer days, having been made manager of the Salem telephone exchange in 1881. When he resigned that post in 1891 to become manager of the lighting company, he was succeeded by Robert P. Butterick, who has remained manager of the telephone property ever since, and the two electrical veterans observed together the completion of their third managerial decade. Mr. Smith has seen the Salem Electric Lighting Company expand from the status of an 800-hp. plant to its present size, with an output of 43,000,000 kw.-hr. a year. The system, which is interconnected with Boston, Revere and Walden, ranks as one of the most efficient in New England, generating a kilowatt-hour on about 1.8 lb. of coal.

E. A. Loew, associate professor of electrical engineering at the University of Washington in Seattle, has become connected with the ELECTRICAL WORLD as editorial representative in his territory. His new activities will be in addition to his college duties. Mr. Loew was graduated in electrical engineering from the University of Wisconsin in 1906. Both before and after graduation he gained considerable practical experience with the Chicago Telephone Company, the Wisconsin Telephone Company and the United States government. He then served three years as instructor in electrical engineering at the University of Wisconsin, and then as first assistant professor and later as associate professor of electrical engineering at the University of Washington for nine years. During a leave of absence of three years he was electrical engineer and general superintendent of the American Nitrogen Products Company of Seattle. Mr. Loew is a member of the American Institute of Electrical Engineers and has been active on both local and national committees of the Institute.

Edwin A. Barrows, president of the Narragansett Electric Lighting Company of Providence, R. I., has been elected vice-president of the New England Section of the N. E. L. A.

J. M. Wauchope has been appointed superintendent of the Walla Walla River plant of the Pacific Power & Light Company, Milton, Ore.

C. L. EDGAR

Charles L. Edgar, president of the Edison Electric Illuminating Company of Boston, has been elected president of the New England Section of the N. E. L. A. Mr. Edgar has been prominently identified with N. E. L. A. work, both in the national and local organizations, for a number of years. He has served several times as vice-president of the N. E. L. A. and was president in 1903. He has been closely identified with the electrical industry for thirty-seven years, thirty-three of which have been devoted to the engineering, commercial and executive departments of the Edison Electric Illuminating Company of Boston. Owing to his broad outlook and experience he is widely looked to for counsel and leadership in all phases of central-station work.

L. L. DYER

L. L. Dyer, until recently assistant superintendent of transmission of the Southern California Edison Company, has been promoted to be superintendent of substation operation and will have charge of the operations of all of the company's many substations. Mr. Dyer has been employed by the Southern California Edison Company and its predecessors for nearly twenty years, having entered the employ of the Pacific Light & Power Company as dynamo tender in 1902. Before this he was an electrician in the navy, serving in the battle of Manila Bay. In 1907 he became substation chief and in 1909 chief of the electrical department of the Redondo steam generating station. He became system chief operator in 1910 and was promoted to the position of superintendent of the southern division in 1913. Upon the merger of the Pacific Light & Power Company with the Southern California Edison Company in 1917 he was made assistant superintendent of transmission of the latter company and held this position until his recent promotion.

J. A. Woidill, Jr., formerly chief electrical draftsman at the Hog Island shipyard, has recently become superintendent of the Atlantic County Electric Company and Enterprise Gas Company, Egg Harbor City, N. J.

W. S. Richmond, consulting engineer in hydro-electric and general hydraulic problems, has moved from Detroit to Buffalo, where he will continue practice.

R. H. Bacon, who since early in 1920 has been an associate engineering editor of the ELECTRICAL WORLD, has recently been appointed head of the sales promotion and advertising section of the Imperial Electric Company, Akron, Ohio. Mr. Bacon previous to his connection with the ELECTRICAL WORLD was assistant electrical engineer of the Copper Range Company, Painesdale, Mich. Prior to that connection he had been employed by the Eastern Michigan Power Company, by Woodmansee & Davidson, Chicago, by the L. K. Comstock Company of New York City and by other operating concerns.

W. A. Stearns, who has recently been appointed chairman of the Heating Appliance Section of the Associated Manufacturers of Electrical Supplies, is supervisor of the nickel-chromium resistance-element patents of the General Electric Company. Mr. Stearns has been in the employ of the Fort Wayne Electric Company and the General Electric Company since April, 1904. At that time he joined the sales force of the former company. In September, 1905, he was made sales manager of the Southern district of the Fort Wayne Electric Works, with headquarters at Atlanta, Ga. Four years later he was appointed district manager of the supply department of the General Electric Company at Atlanta. In 1911 he was made assistant sales manager of the Atlanta office of the General Electric Company. In April, 1916, he was transferred to Pittsfield, Mass., as manager of the heating appliance section of the supply department, but later he moved to Schenectady to become supervisor of the patents already mentioned. Two years afterward he was placed in charge of the licenses granted by the General Electric Company under the patents owned by it. Mr. Stearns has served on various merchandising committees of the N. E. L. A. having to do with commercial and testing subjects.

W. A. STEARNS

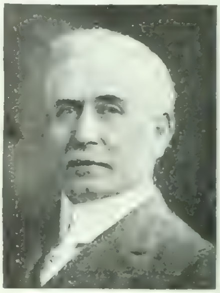
W. W. Mumma, formerly sales manager of the fan department of the Robbins & Myers Company, has been appointed general sales manager, with jurisdiction over fan and motor sales.

Martin J. Wolf, second vice-president and director of W. N. Matthews & Brother, Inc., St. Louis, has been granted an indefinite leave of absence upon request. Mr. Wolf has been associated with the company for more than seven years. He will retain his directorship and official position with it.

George Y. Watt has been appointed New England district manager of the Century Electric Company of St. Louis, Mo., with offices at 10 High Street, Boston. Mr. Watt is a graduate of the electrical engineering course of the Brooklyn (N. Y.) Polytechnic Institute and has been in the Century company's organization about eleven years. During the war he served in the United States Navy for eighteen months. At the time of his appointment to the New England post he was manager of the export department of the Century company.

R. R. Reid has been appointed sales engineer with the Utah Electric & Motor Equipment Company at Salt Lake City. His duties in this newly created position will keep him on the firing line to promote the development of business in electrical contracting, furnishing estimates, etc., particularly in connection with the construction of new buildings. Mr. Reid has had many years' experience in this line of work, having had charge of the electrical work on some of Salt Lake's big buildings and important construction work in the Intermountain West.

Henry W. Marshall, who for a number of years was president of the Public Utilities Company of Evansville, Ind., and who served as vice-president before that time, has been elected vice-president of Purdue University, Lafayette, Ind., with the full powers and duties of president. He will direct the affairs of the university until such time as a successor to the late Dr. Winthrop E. Stone is selected. Mr. Marshall's earlier business experience was gained in the construction industry, and he was president of the Lafayette Bridge Company until its absorption by the American Bridge Company. He is the owner of a daily newspaper, the Lafayette *Journal and Courier*, and for four terms was a representative in the Indiana General Assembly, during one of which he served as Speaker.



H. W. MARSHALL

A. J. Reed of the sales department of the Robbins & Myers Company, who for several years has been manager of the Cleveland branch, has been appointed assistant sales manager of the motor department.

Obituary

Samuel Alfred Varley, a pioneer English electrical engineer, to whom has been ascribed the credit for the compound-wound dynamo, died recently at Winchester, England, at the age of ninety. Mr. Varley was in all probability the last surviving pupil of Michael Faraday. In 1866 he constructed "the first machine which might correctly be termed a dynamo." This is now on exhibition in the South Kensington Museum in London.

George C. Killeen, superintendent of the Southern New York Power & Railway Corporation, which controls the Southern New York Power Company of Cooperstown, N. Y., died on Aug. 31, at the age of forty-six. He was in charge both of the power plants and the trolley lines of the company. Mr. Killeen was born at Elizabeth, N. J., and had for many years held responsible positions in the shops and power houses of electric railway companies in the East.

Frederick Upham Adams, a well known popular and scientific writer, died on Aug. 28 at Larchmont, N. Y. He was born in Boston on Dec. 10, 1859, was graduated from the Elgin (Ill.) High School in 1876 and then studied mechanical engineering. Mr. Adams invented a type of post for electric lamps and also a type of electric light tower.

Earl S. James, assistant superintendent of the electric department of the Oklahoma Gas & Electric Company, died Aug. 28 as a result of injuries sustained when he came in contact with a high-voltage wire on the outdoor substation of the plant at Oklahoma City. Mr. James had served the company efficiently for fourteen years in nearly every position included in his department.

Percy Chandler Henry, superintendent of distribution, New England Power Company, Worcester, Mass., and W. B. Bush, president Bush Electric Company, Cleveland, Ohio, were accidentally killed at the Greendale substation of the New England Company near Worcester on Sept. 9, while testing insulators on the 66,000-volt lines of the system. Mr. Bush had gone to Worcester after conducting a successful demonstration at the New London convention of the New England Division, N. E. L. A. He was about thirty-five years of age. Mr. Henry became superintendent of distribution for the New England Power Company in the fall of 1920. He was a graduate of Purdue University and, besides having been employed by the Commonwealth Edison Company, Chicago, and the Indiana Steel Company, had been electrical superintendent of the Massena (N. Y.) plant of the American Aluminum Company. Mr. Henry was about thirty-two years old.

Trade and Market Conditions

Business Reviews, Together with Market Letters
from Important Trade Centers, on the Supply, Demand and Prevailing Prices of
Electrical Apparatus and Supplies

Building Operations in August Show Increased Activity

CONSTRUCTION activity in August, according to figures published by the F. W. Dodge Company, was 4 per cent greater than in July and 9 per cent greater than in August, 1920. Contracts awarded during August, 1921, in the twenty-seven Northeastern states of the country amounted to $220,922,000. New England's proportion of this was 9.3 per cent; New York State and Northern New Jersey accounted for 27.6 per cent; 17.2 per cent went to the Middle Atlantic States and 14.9 to the Pittsburgh district; the Central West accounted for 27.3 per cent, and the Northwest for 3.6 per cent.

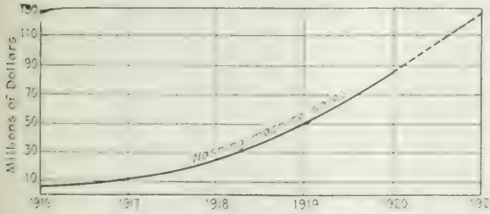
Residential construction continues in the lead over all other classes of buildings, says the report. It accounted for 36 per cent of the total in August, amounting to $80,329,000. Public works and utilities amounted to $44,797,000, or 20 per cent of the total; business building, to $35,526,000, or 16 per cent; educational buildings to $27,959,000, or 13 per cent, and industrial buildings to $10,832,000, or 5 per cent.

Contracts awarded for mercantile buildings in August amounted to more than for any previous month of this year. The total volume of contracts let in the territory covered by the F. W. Dodge Company during the first eight months of this year has been 10 per cent greater than the average for the first eight months of the preceding five years.

Contemplated new work reported from Jan. 1 to Sept. 1, 1921, has amounted to $3,202,731,000, which is more than double the amount of contracts awarded in the same period.

Sales of Washing Machines During Last Five Years

IN DISCUSSING the market for electric washing machines, Enoch B. Seitz, secretary of the American Washing Machine Manufacturers' Association, speaking before a gathering of electrical contractor-dealers in Chicago early in August, gave some figures on sales of washing machines in the last five years. Sales in 1916 amounted to $7,000,000; in 1917 they were $11,000,000; in 1918 they came to $24,000,000; sales in 1919 doubled to $50,000,000 and in 1920 they amounted to $85,000,000. These figures have been plotted to form the curve reproduced herewith. If this curve were extended to cover the year 1921, it would show sales in the present year to an amount of approximately $125,000,000. But from the rate of washing-machine production and sales to date during 1921 it would seem that this figure will not be attained this year.



SALES INCREASED RAPIDLY IN LAST THREE YEARS

The speaker used the figure of 2,500,000 as the number of washing machines in use at the present time and stated that the value of sales in 1919 represented 1,000,000 machines and sales in 1920 represented 880,000 machines. Figures for the previous years were not given.

In the year 1919 it is estimated that there were approximately 7,000,000 homes in the United States which were wired for electricity and about 14,000,000 unwired. The former figure now would probably be nearer 8,000,000, giving a total of 22,000,000 homes. It is easy to see the market for washing machines not only in those homes which are already wired but also in those that remain still to be wired.

Review of Air-Heater Market for Coming Season

OPINIONS among jobbers differ as to the prospects offered for a good season in sales of electric air heaters during the coming winter of 1921-1922. Advices received from this trade in the principal centers of the country seem to take almost an evenly divided stand on this matter, with the preponderance of opinion leaning toward a good season. The New England jobbers are looking for a very good volume of sales, even closely approaching that of last season. The continued high cost of coal and active sales effort are expected to yield due results in this direction, effecting economies by this method of heating limited spaces and of removing chill from larger spaces. At the same time sharp competition is expected there from new lower-priced designs, some of which, it is said, may retail at 50 to 60 per cent of the price of present types.

From several sections it is reported that present prices are expected to act as a sure deterrent to sales in the coming season. In general these prices are about one dollar lower than they were last season, the range varying between $11 and $12.50, depending on the type. Last spring retailers lowered their prices to around $9 and $10 and moved a good amount of their stock.

Nineteen New England jobbers will probably buy from 6,000 to 6,500 heaters from now to Jan. 1, and the chances are that half of these will be ordered by Oct. 15. By Sept. 1 about 6,000 heaters had been ordered. The holdover there from last season amounted to about 2,700 heaters—varying in amounts from a dozen to 500. These nineteen jobbers sold approximately 20,000 heaters last season, and it is estimated that the total New England sales amounted to between 27,000 and 30,000.

Buying Expected Early in October

The New York market is ordering only in small amounts to date as only a moderate season is anticipated at this time. From the first to the fifteenth of October seems to be the time during which orders will be placed. Still, the holdover from last season is not considered high. Several jobbers report no stocks, and there are probably not more than 4,000 heaters in jobbers' stocks in the whole metropolitan district. The attitude is to go slow and feel out the weather. Convenient distributers' stocks are an assistance in this method of buying. Sales in that territory last season probably amounted to between 27,000 and 30,000 heaters.

Extreme caution in the buying of heater stocks for the coming fall and winter trade is found in St. Louis. In most cases the number left over from last year is small, averaging around 100 per jobber. Some are placing their initial orders now for 300 to 400 each. The total stock on hand in St. Louis is about 2,000, and the initial orders will be for about the same amount. It is felt as a rule that this winter will be fairly cold and that good sales will prevail, but purchasing must await the actual demand. Retailers' stocks are low because of reduced price sales made at the close of last season. Their initial purchases have not been determined.

There is little prospect that Chicago jobbers will be able to place many orders with the manufacturers this fall or will be able to dispose of much of their stock to dealers. Nearly all jobbers went into the summer with from 25 per cent to 50 per cent of their normal winter requirements still on hand, and this is true of many dealers, though there are more dealers unstocked than there are jobbers. It is estimated that it will be at least the first of January before even a normal retail demand will be reflected by orders placed with manufacturers. Another consideration which will tend at that time to keep down the size of individual orders is the fact that several of the largest manufacturers of heaters either have factories or warehouses here so that jobbers can replenish their stocks at will. It is felt that unless there is a complete stabilization of prices by the first of the year this policy is apt to be generally followed.

PRICE REDUCTIONS SOUGHT IN SOUTHEAST

Southeastern jobbers were disappointed with last winter's sales, and they feel that the sales of this season will be only nominal. Price reductions are sought particularly from this quarter, compliance with which, it is felt, would bring sales that would approximate normal. Fairly heavy carry-over stocks are reported so that only from 40 to 50 per cent of last season's orders are being contracted for.

Heavy stocks of heaters in the Intermountain district were held over from last season, following a very small demand, and there is small prospect of satisfactory orders being placed with manufacturers in the immediate future. Northwest stocks too are quite heavy; some light orders are being placed, but in other quarters it is expected that present stocks will not be replaced soon.

San Francisco reports a particularly good outlook. Advance orders taken in California are shown to be higher than those taken at this time the previous year. Special efforts were made to get these orders in early, and notwithstanding business conditions and considerable stocks remaining the scheme worked out well. Attention is being paid to larger heaters of both portable and stationary type, and special heavy-duty appliance campaigns have been arranged to get results. It is reported that 60,000 heaters were sold in California last season and that this season promises to see even more disposed of. Record-breaking export sales are also recorded from this state.

Number of Fans Sold in 1921 Season Runs High

THE Fan Motor Section of the Associated Manufacturers of Electrical Supplies met at Hot Springs, Va., on Sept. 8 and 9 to discuss the season just past, the season coming, standardization, concentration of sales efforts, etc. It was brought out there that the fan season of 1921 has been better than that of 1920 in number of units sold, but because of the lower price ruling this year the value of the sales may not reach so large a total as last year.

It has been a particularly good season for the trade outside of the manufacturer because the distributers, jobbers, dealers and contractors virtually have cleaned out their stocks. Starting the season with fair stocks, the trade purchased fans to a great extent in small lots during the season and has come through to September with bare shelves. It is the manufacturer who is holding the stock now. He probably has greater stocks at this time than he normally should have, but this is because the trade has nothing. The total of stock on hand in all quarters is no larger than normal.

One feature of the past season is that the sale of fans for household use showed a percentage increase of total fan sales. This is interesting in that fan manufacturers are looking toward the household market as presenting a very bright field of endeavor. It is felt that this market is less developed and less saturated than the commercial market, and special emphasis is to be placed on sales in that direction this coming season. It is found that non-oscillating fans of the smaller sizes, under 12 in., are supplying the most ready appeal to householders, and once these fans have got a foothold it is easier to sell oscillating and larger types.

Ceiling-fan business of last year seemed to be just ahead of the supply, and virtually the same condition has existed this year. The market has been strong and not always satisfied.

Fan Tax Turns in $297,583

AN ANALYSIS of the taxes collected during the fiscal year ended June 30 shows that the excise tax levied on portable electric fans resulted in the collection of $297,583.14, a decided increase over the revenue from the same source during the fiscal year of 1920, when $174,084.05 was collected. This is a 5 per cent tax paid by the manufacturer on his selling price and represents manufacturers' fan sales of approximately $6,000,000.

Metal Market Situation

SUDDEN strengthening in the price of copper last week has caused many domestic consumers to withdraw their inquiries and await further developments in the trend of the market. So far this has had little or no effect on the price. Electrolytic is being held by producers at 12.25 cents delivered, spot and September, 12.37½ cents for October and 12.50 cents for November-December. Much of the advance in the market since Sept. 1 has been based on larger export buying. Last week nearly all of the foreign orders came from Germany, and out of 3,950 tons shipped abroad from Atlantic ports in that time 3,730 tons went to Germany. That country is temporarily out of the market because of the recent drop in the exchange value of German marks. Compared with a week ago standard copper at London is lower. The market, however, is steadier and transactions few and for small quantities.

In some quarters it is thought that the advance in copper has been too rapid, as since Sept. 1 producers have advanced their asking prices ¼ cent a pound and in the outside market the rise ranged from ¼ cent to ⅜ cent a pound. Few orders have been placed by consumers at 12.25 cents delivered for prompt and September shipment, and it is claimed that this price was shaded ⅛ cent for prompt shipment of electrolytic.

The price of lead has advanced another 10 points to 4.60 cents, New York, and demand continues good. Some producers report even more activity at present than before the rise, and it is noteworthy that prompt shipment is being called for in nearly all instances.

NEW YORK METAL MARKET PRICES

	Sept. 6, 1921	Sept. 13, 1921
Copper:	£ s d	£ s d
London, standard spot	68 7 6	68 17 6
	Cents per Pound	Cents per Pound
Prime Lake	12.00	12.25
Electrolytic	12.12½	12.25
Casting	11.62½	11.75
Wire base	13.50	13.50
Lead, Am. S. & R. Co. price	4.50	4.60
Antimony	4.45	4.45
Nickel, ingot	41.00	41.00
Sheet zinc, f.o.b. smelter	7.00	[illegible]
Zinc, spot	4.70	[illegible]
Tin, Straits	27.25	26.75
Aluminum, 98 to 99 per cent	24.50	24.50

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	9.50 — 10.00	9.50 — 10.00
Brass, heavy	4.50 — 4.75	4.50 — 4.75
Brass, light	3.75 — 4.00	3.75 — 4.00
Lead, heavy	3.25 — 3.37½	3.37½ — 3.50
Zinc, old scrap	2.00 — 2.25	2.00 — 2.37½

THE WEEK
IN TRADE

Prices When Quoted Are Those Prevailing at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

SEVERAL sections of the country report slightly better trade in the electrical field. No high spots have been uncovered, however. Government reports on the corn and other crops, except cotton, show record yields for corn and higher than ten-year averages for other crops. The South, consequently, is anticipating better business this fall.

In Chicago the Landis decision has given an impetus to construction plants, but the electrical trade has felt no reaction to this movement yet. Better business is reported here in high-tension switching equipment, washers, ironers and instruments. Boston shows slightly better business with increasing activity in textile, leather, and shoe trades. Wire, porcelain, line hardware, armored conductor and motors under 50 hp. are quite active.

Increasing orders in the wiring supply field are reported in New York since Labor Day, but most of it seems to come from outlying centers. Trade is holding up well. St. Louis shows small improvement. Building is a little better and meters and distribution transformers are moving fairly well. On the West Coast building is more active in San Francisco, and exports from Seattle and Portland are increasing. Business is taking on a better tone there.

NEW YORK

Trade held up well during the past week, and jobbers generally expressed the opinion that dealers and contractors are buying with more confidence than heretofore. The firmer undertone to business as reported last week continues, and since Labor Day there has been a noticeable increase in orders for wiring supplies. This demand is coming chiefly from out-of-town dealers and indicates activity in the building of homes. Heating appliances are moving at about the same rate, and jobbers state that the trade has not yet placed any orders for holiday stock. It is stated that some dealers expect a further drop in prices of these appliances and for that reason are holding off. However, manufacturers have signified no intention of a downward revision of prices.

While business is showing considerable improvement, jobbers state that competition is very keen and price cutting is in evidence The wire market has been unsteady and prices vary over quite a range. Stocks in many instances are long and jobbers state that the situation has been aggravated by dealers being able to purchase wire from manufacturers in comparatively small quantities at prices below those which can be quoted by jobbers.

Collections are showing some improvement. Current billings are running thirty to sixty days, and the large accounts which have been outstanding for some time present the most difficulty. The latter are being whittled down gradually, and electrical credit men feel that conditions are becoming much better.

Conduit.—Little change in the price of conduit was reported this week. The following prices were quoted: For ½-in. black pipe in 2,500-ft. lots, $54 to $55; ¾-in., $71 to $74.52, and 1-in., $104 to $106.76. Galvanized pipe in the same sizes was quoted as follows: $59 to $62.73, $77 to $81.42 and $116.96. It will be noticed that the above prices for some sizes are slightly lower than the last previous quotation; however, there has been no announcement of a general reduction. Demand is slightly better, but orders continue to be of small to moderate size.

Flexible Armored Conductor. — The demand continues steadily with most buying of a hand-to-mouth nature. Prices remain about as last quoted: $44.50 per 1,000 ft. for No. 14 two-wire, single-strip, in 1,000-ft. lots.

Rubber-Covered Wire.—There is little stability to the wire market at this time, and jobbers state that quotations are only nominal. No. 14 rubber-covered in 5,000-ft. lots is quoted at $6 to $6.25 per 1,000 ft. It has been reported that some sales at $5.85 per 1,000 ft. have been made. Jobbers stocks are good to large.

Loom.—Demand is light in this territory and stocks are kept low accordingly. The increase in price of cotton last week has affected this material, and the $\frac{7}{32}$-in. size is quoted this week at $19.25 to $19.80 and the ¼-in. size at $21 to $21.60.

Lamp Cord.—The demand is light and some jobbers report large stocks on hand. Prices quoted this week are for No. 18 cotton-twisted $11 per 1,000 ft. and for No. 18 parallel $14.60 per 1,000 ft.

Schedule Material.—The new discounts on certain items as reported last week have caused a drop of about 25 per cent in the prices of the material affected. Discounts to the trade for standard-package lots range from 40 to 45 per cent. Most jobbers' stocks are small, but ample to meet the present demand.

CHICAGO

The outstanding feature of the week has been the decision of Judge Landis in the building wage controversy and the impetus it has given to plans for construction. There is considerable dissatisfaction among the trades affected by the wage cut, but this was expected and it is thought will not last long. The electrical workers, whose pay was cut from $1.25 to $1.10 per hour, were among the first to accept the decision formally. The decreases average about 15 per cent, and according to prominent architects this, in conjunction with lower material prices, makes construction approximately 25 per cent cheaper than on Sept. 1, 1920.

Electrical jobbers and manufacturers report a quiet week as far as sales are concerned while there has been virtually no change in price levels. Makers of high-tension switching and protective equipment report business picking up, inquiries from the agricultural districts having come in recently and a number of foreign orders having been placed. Retail business is improving, the main cause being the slightly better movement of washing machines and ironers following the recent price cut. Collections remain at from fifty to sixty days, which may be considered comparatively good.

Rigid Conduit.—Sales are fairly numerous but individually small so that total demand may be considered rather slack. September and October should see a good movement of this item, as contractor-dealers expect a number of jobs to mature during those months and they are not heavily stocked. Card 47 is still in effect, a representative quotation being $55 per 1,000 ft. of ½-in. black.

Meters.—Demand outside of Chicago has become slightly more active, but the farmers are not buying normally yet. The Sanitary District of Chicago, the main local customer, has done no purchasing for some time.

Instruments.—Sales of measuring instruments each month since January have bettered those of the preceding month. At present orders are fairly numerous, but the customers who bought in large lots eighteen months ago are buying now in lots of one and two instruments.

Tape.—The flurries of the cotton market were closely watched by jobbers here in the event that tape prices should be bolstered up by an advance in cotton prices. Large stocks are on hand here, and the quotation of 35 cents per pound on friction tape is purely nominal, as a large purchaser could virtually make the price himself. Rubber tape is firmer at 38 cents per pound, but demand is equally quiet.

House-Wiring Materials.—The Landis decision has not reacted on this line of supplies as yet, and contractor-dealers continue to buy for their immediate needs only. Jobbers' stocks are good, and for a time they will be able to make immediate delivery on nearly all items if demand picks up.

BOSTON

Business reflects slowly improving conditions in the New England electrical field. A healthy revival of activity continues in the textile, shoe and leather industries. Metal-working industries are still dull, and in the building field operations are only moderate in volume. Building and engineering contracts in New England for the week ended Sept. 6 totaled $3,333,400, a better showing than in many earlier weeks in the current year, but still considerably below 1920. The paper industry is improving, though slowly. Electrical jobbers' stocks are still being reduced slowly. Prices are unsettled in porcelain products. Collections are not quite so satisfactory as they were a fortnight ago, sixty days being a common term. Vigorous activity in the washing-machine market is evident in some quarters, following recent price reductions. Informal reports of improving industrial conditions were current at the thirteenth annual convention of the New England Division, N. E. L. A., held last week at New London, Conn., central-station twenty-four-hour outputs being close to or in excess of those of last year in not a few instances.

Wire.—Better movement in wire is reported, weatherproof No. 6 selling at 15 cents per pound up to 500 lb. and at 14⅝ cents in larger quantities. Rubber-covered wire is also stirring more actively, sales at $6.00 per 1,000 ft. in 5,000-ft. lots being representative. Some jobbing interests expect an upward trend in weatherproof, owing to the recent advance in cotton price.

Motors.—Moderate improvement is noted, with well-maintained inquiries and widely distributed sales. Sizes under 50 hp. appear most in demand, and a representative distributer stated Monday that the textile and leather fields were displaying the most interest in this class of equipment.

Washing Machines.—A revival of buying has been noted in some quarters, probably as a result of recent price changes and active sales effort. A Massachusetts factory has reopened with rush orders, offering employment to 1,200 workers.

Flexible Armored Conductor.—Quickened movement is apparent, though current stocks are not being lowered very fast. No. 14 in 5,000-ft. lots sold around $50 per 1,000 ft. at Boston Monday.

Porcelain Material.—Increased activity by contractors is moving more of this class of supplies. "Nail-it" knobs, in good stock, are selling at $14 per 1,000 in barrel lots and 3-in. tubes, 5/16-in. diameter, at $4.60 per 1,000 in barrel lots. It is stated that recent increases in factory prices have not yet been applied by jobbers.

Pole-Line Hardware.—This class of material is selling better of late owing to the carrying out of deferred construction by central-station companies on at least a moderate scale. Price movements have also stimulated buying somewhat, though nothing like rush business is reported.

Steel Fish Tape.—Prices are off, ⅛-in. x 1/16-in. selling at $2 list per 100 ft., with the following discounts: Less than 500 ft., 10 per cent against list before the cut; 500 ft. to 1,000 ft., 25 per cent off against a former 5 per cent; 1,000 ft. and over, 33⅓ per cent against 10 per cent previously. Tinned pipe straps are down 19 to 16 cents per pound on 25-lb. to 100-lb. lots.

ATLANTA

The sensational rise in the price of cotton and the beneficial effect that will accrue to all lines of business in this section has served temporarily to place the consideration of all other subjects in the background. It is the general opinion that bankers and merchants who have long carried their clients will insist upon their borrowers liquidating their debts, thus forcing the sale of the staple at and around 20 cents, and it is generally expected that cotton will settle to a 19-cent base. The government crop report for Sept. 1 has just been released and predicts the largest corn yield for Georgia on record, while the condition percentage of all other crops, cotton excepted, is well above the ten-year average. This, together with the fact that Georgia will realize $100,000,000 from this year's cotton crop, has gone a long way toward insuring the elimination of frozen credits in the rural districts and is lending a most excellent tone to business in general. The direct effect is not yet in evidence as little of the fall crops is as yet on the market, but most lines of business are anticipating the effects of the condition noted above and are making their plans accordingly. The textile trade in particular is very active, nearly all mills being back on the full-time basis, and some inquiries are being received for new construction and for additions to mills.

Lamps.—The demand for large incandescent lamps appears to be increasing with the advent of the fall season. Stocks are in excellent shape.

Schedule Material.—The market is very unstable. There is a general scramble for orders when business is in sight, and as a result no stable market quotations are available. Sockets and rosettes continue to be most in demand. Prices were off approximately 25 per cent last week.

Lock Nuts and Bushings.—The line continues to move steadily, with heavy stocks on hand. A price reduction of 15 per cent was announced last week.

Portable Lighting Fixtures.—Indications point to a very good business in portables this fall, dealers and jobbers anticipating increased sales because of the many new homes being erected. No large orders are being placed with factories so far as jobbers are watching the market carefully. Stocks of the various types are low.

Fans.—The hot wave of the last two weeks has tended to stimulate the sales of fans to a greater extent than has been experienced for the past two or three years at this period of the year.

Motors.—There has been comparatively little call for the fractional sizes, and the market has been sporadic for the larger sizes. However, some substantial sales have been made in the units of 250 hp. and above.

Arresters.—The demand for arresters has been very good throughout the summer and was much better than expected. Present-day sales are fairly satisfactory. Stocks on the 2,300-volt type and below are in excellent shape.

Sewing Machines.—Following the condition of the market of almost all electric appliances, the sales of sewing machines have been very light with the exception of those cases where special campaigns have been put on. In a number of instances prices have been cut in half to move the heavy stocks. On the whole, however, jobbers have been fortunate in not having large stocks on hand.

ST. LOUIS

Improvement in business, though small, was nevertheless definite, as experienced by the St. Louis jobbers last week. Demand for appliances was substantially better and increased interest was noticed in meters, transformers and other equipment for use in small distribution extensions. Demand for wiring supplies showed no appreciable improvement, for building work continues fairly dull. The sudden and marked improvement in the cotton market has been keenly watched here, for if the higher market continues, better business in St. Louis is virtually assured, a large portion of the trade of both manufacturing and commercial establishments being obtained from the Southern States. However, it was too early for any effect to be noticed in last week's business.

Building permits for construction and repairs in St. Louis show a small increase. Since the first of the year the values of the monthly permits have been: January, $333,025; February, $714,845; March, $974,405; April, $1,127,155; May, $1,087,195; June, $2,150,069; July, $1,118,215; August, $1,307,206. The principal portion is for residential work. A considerable amount of construction work, both industrial and residential, has been done in suburban St. Louis but is not included in the above figures.

Money is becoming easier, improvement being particularly noted in the South. Collections, however, continue to be on a basis of forty-five to sixty days. Generally speaking, stocks have been well liquidated, it being only in a few cases that overstocks of any item are found.

Wire.—Slightly easier prices are found, No. 14 rubber-covered being quoted at $6.10 per 1,000 ft. in 5,000-ft. lots, a reduction of about 30 cents. The base price on both bare and weatherproof is being made at 14 cents per pound, a reduction of about 1 cent. Some report slightly better movement, but the general demand is unchanged.

Schedule Material.—Recessions in prices ranging from 20 to 25 per cent are announced in certain lines, some of which are sockets, rosettes, fuse plugs and certain receptacles. New prices on sockets, in standard-package lots, are: Key, $10 per 100; keyless, $18.50; pull, $36. Plug fuses are priced at $2.75 per 100 in lots of 500. Demand is slow except for the fuses, which have maintained fairly steady sales. Stocks as a rule are in line, but there are a few instances of overstock in rosettes and receptacles.

Insulators.—There was some fluctuation in the price of porcelain insulators during the week, but the old levels now prevail. There has been some improvement in demand from the utilities for small-order lots. Deliveries can now be given with reasonable promptness.

Pliers.—Owing to the comparatively quiet market, stocks have been brought to about a normal basis and good deliveries can be had from the factories. Prevailing prices on Klein's side cutters are: 5-in., $2.60; 6-in., $2.80; 7-in., $3.25; 8-in., $3.75; 9-in., $4.45.

Poles.—Improved buying on the part of utility companies for small extensions continues. Prices in car-load lots, f.o.b. St. Louis, are, for 7-in.-top Northern white cedar: 35-ft., $16.25; 40-ft., $20.90; 45-ft., $25.05; 50-ft., $31.20. Corresponding prices on Western red are: 35-ft., $11.70; 40-ft., $13.90; 45-ft., $18.70; 50-ft., $22.10.

Storage Batteries.—A fairly good business has been existing for some time, but further improvement has been noted the past few weeks, particularly for automobiles. One jobber reports business as being 50 per cent higher than last month, owing to his manufacturer bringing out a lower-priced battery.

SAN FRANCISCO

The building strike is definitely past, and all jobs both large and small are now proceeding under the American plan. Increased retail business is reported from all sections except possibly the Mission, where live most of the men who have been out during the sixteen weeks of the strike. Many dealers are now quoting a labor charge of $1.75 per hour instead of the $2 formerly charged. The railroads have petitioned the Interstate Commerce Commission to restore the former Pacific Coast terminal rates which were removed when the Panama Canal was closed to commercial traffic during the war. A very comprehensive commercial survey of San Francisco is now being scientifically made to prepare for the expected industrial increase. Factory sites are being plotted and the boosting campaign will be supported by actual knowledge, affording real information and assistance for those attracted by it. An exceedingly long petition asking it to electrify its suburban lines as far as San José, 50 miles from San Francisco, has been presented to the Southern Pacific Railroad Company by residents along its present steam right-of-way.

Schedule Material.—In accordance with the intention to make low prices for smaller lots than were needful in the past, single-pole, 10-amp. push switches are being sold in lots of 100 for 38½ cents each and three-way push switches of the same type for 60 cents each, which was the former price for lots of 500. Local stocks are good and a much better movement is being reported.

Knife Switches.—Protective knife switches, in accordance with the California state regulations, are experiencing specially keen competition. The sale of double-throw switches is also increasing because of the interest in ranges and water heaters.

Farm Plants.—All business dealing directly with farmers and growers has been rather poor all year because of a certain pessimism on their part, but during July and August an increasing business in farm plants was manifest because of the sale of crops. An unusually large number of these plants are now being sold on time payment.

Washers.—Many of the standard makes have dropped so that the prevailing market price runs from about $135 to $140, an average decrease of approximately $25. The washer market is still rather poor, but it is expected that this sharp decrease will have a more beneficial effect upon the buying public than several small decreases.

SEATTLE—PORTLAND

The general tone of business reports continues to be optimistic, although actual volume may not have increased very materially. The business men of Seattle who were the most pessimistic a month ago now admit that conditions are actually somewhat improved, and it is generally felt that further improvement, although slow, will continue during the coming months. While lumber men report that business is not satisfactory, yet they state that the prospect looks much better than it has for some time past. Lumber production for the last week was about 70 per cent of normal. There is a general increased activity in nearly all industrial lines in the Portland district, and a large local woolen mill will soon be operating at full capacity. In Seattle it is reported that a local branch of a large mail order house has increased its sales 25 per cent in the last ten days.

Import and export business for the port of Seattle in July showed an increase of 34.9 per cent over the low month of May, and it is expected that August in turn will show an increase over July. Custom House reports for the year ended June 30, 1921, show that Portland's exports increased more than 60 per cent over the same period for 1920. Grain exports are increasing very rapidly.

A slight increase in employment is noted throughout the Northwest. Wages are still being revised downward, and an effort is being made to reduce the tax burden.

Electrical jobbers of Seattle report inquiries picking up and business slowly improving. Portland jobbers report sweeping price reductions varying from 10 to 50 per cent on schedule material, while in Seattle declines of 20 per cent in standard light sockets and a like amount in snap switches have gone into effect this week. Feeling that prices have reached the bottom, Portland jobbers' stocks are now being carried on about a four-month basis. Shipments are coming through in from two to three weeks' time. Credits are loosening somewhat and collections are improving slightly. The average length of time in the electrical trade for August was forty-eight days. Seattle reports collections still hanging around forty-five days, and little improvement if any is noted in credits.

SALT LAKE CITY—DENVER

The past week has not recorded any significant changes in the financial and industrial status. Buying is slow in most lines and little electrical merchandise is moving to the ultimate consumer. Dealers are not stocking heavily, while jobbers are well prepared to meet any demands that might arise. The price tendency on electrical merchandise is downward, and slowly but surely factory prices are creeping downward toward the level that will meet with buyers' response. Jobbers and dealers are following the policy of giving the ultimate buyer full advantage of price cuts. There is an eagerness shown to break the deadlock that now exists and to get money more freely in circulation. Collections are about as slow as ever, and banks have not changed much in the policy of ultra conservatism. While there have been no material rate concessions to relieve the shipment of crops, farmers are harvesting big yields and taking extremely low prices on most products.

Washers.—Dealers are advertising a small reduction on several makes of washers, amounting to about $10 on the dolly type and $20 on the cylinder and oscillating types. Sales are not at all brisk.

Line Transmission.—A little activity has been noted in line construction, which has called for considerable equipment. The jobs are not large but the showing is looked upon as a hopeful sign.

Manufacturers' Activities

Devoted to the Business Side of Manufacturing, Distribution and Sales, News fromJobbers and Foreign Fields and a Record of New Devices and Trade Literature

Atlantic Division Jobbers' Meeting Postponed

By direction of the division chairman, George L. Patterson, the meeting of the Atlantic division of the Electrical Supply Jobbers' Association, called for Sept. 22, has been postponed to Oct. 20, at the Bellevue-Stratford, Philadelphia. This action was prompted by the fact that, because of other plans and engagements, many members of the division found it impossible to be in Philadelphia on Sept. 22, and it was deemed wise to postpone the meeting until such time as a full attendance could be expected.

Publication of Engineering Data Urged

Prof. Arthur M. Greene, Jr., new dean of Princeton College of Engineering and chairman of the research committee of the American Society of Mechanical Engineers, in an address to the engineering profession, through the official journal of the society, urges the need for research. He points out that surprising facts have been revealed, for instance, by the report of the committee on elimination of waste in industry of the American Engineering Council, organized by Herbert Hoover. Mechanical engineers should be willing to give their data to the profession after they have used them for development work, Professor Greene says. "Many data," he says, "are buried where they are doing no work, and their publication would not damage our business and would help the profession."

Credit Features of Mexican Locomotive Orders

One of the interesting features of the locomotive orders which the Baldwin Locomotive Works of Philadelphia has taken during the last three months for various interests in Mexico is the terms of credit allowed. Ninety-eight locomotives are included in these orders, aggregating about $5,000,000. The most recent of these orders were for sixty-five locomotives and were negotiated with Obregon by Samuel M. Vauclain, president of the works during his recent trip to Mexico.

The Mexican National Railways, it is reported, has taken eighty-three of the locomotives, on all of which credit is extended. The greatest length of time is three years and covers forty-five locomotives at a cost of $2,000,000. Monthly payments are to be made on this contract for thirty-six months, with interest. A further credit of $500,000 is in fact a loan made to Mexico by the company, to be expended in repairs.

A further credit of $2,500,000 is still under negotiation between Mr. Vauclain and the Mexican officials. On another railway order credit is being extended to cover the payment for eleven locomotives, the cost of one locomotive being liquidated each month. A Mexican oil company is paying cash for four locomotives.

About $8,000,000 worth of business is on the books of the Baldwin Locomotive Company at this time, about evenly divided between domestic and foreign business; but at that the plant is operating at only about 30 per cent capacity. From the amount of Mexican business being taken, however, it would seem as though a revival in industry were under way.

Heine Boiler Company Drops the Word "Safety"

The Heine Boiler Company, St. Louis, is the new name of what was formerly the Heine Safety Boiler Company. No change in financial interest or management was made. The company has purchased additional ground adjacent to its present property and contemplates expansion of its facilities when it feels that building costs warrant new construction.

Apex Adds Ironer to Washer and Cleaner Line

The Apex Electrical Manufacturing Company, Cleveland, announces the adoption of the former Gould electric ironer, which is now being manufactured in its three-acre Apex-Rotapex plant. This machine rounds out the line of major household electrical appliance units and so far is traveling under no particular name. The ironer, however, has been on the market for about a year.

Equitable Equipment Company Formed in New Orleans

O. D. Cleveland announces that he has formed the Equitable Equipment Company, 411 Whitney Central Building, New Orleans, La. Mr. Cleveland was formerly manager of the New Orleans branch office of the General Equipment Company, 30 Church Street, New York City. The new company handles hoisting and construction equipment, boilers, engines, mill supplies, pumps, electrical equipment, air compressors, line shafting, pulleys, link chain, etc.

Wire Building Plant Going Up on West Coast

The California Wire Company, Orange, Cal., announces that it is engaged in building a plant for the manufacture of insulated wires, the first department being a weather-proof wire plant which the company expects to have in operation some time in October.

Louis Koth is president of the company, Fred A. Grote is secretary and treasurer, and Fred H. Alden is sales manager. Mr. Koth was formerly president and Mr. Alden was formerly secretary, treasurer and sales manager of the Illinois Wire & Cable Company, Sycamore, Ill.

The company feels a great deal of confidence in the field offered for wire manufacture on the Pacific Coast, not only for domestic business but also for export business.

Jawitz Electric Motor Established in New Quarters

The Jawitz Electric Motor Company, motor dealer, has removed its plant from 236 Canal Street to 211 Center Street and 147 Lafayette Street, where it has more spacious quarters. The increased facilities will enable the company to handle a larger stock of motors, generators, plating generators, electric drills, grinders, etc.

U. S. Light & Heat Reducing Expenses to Increase Profits

In the company's report for the year ended Dec. 31, 1920, C. O. Mininger, president of the United States Light & Heat Corporation, Buffalo, N. Y., shows that through reduction of overhead and an increase in sales effort the company's business for the first six months of the present year has shown an increasing profit each month. The report has just been issued.

"The management of the business passed into the hands of the present officers on Feb. 7, 1921," said Mr. Mininger. "During the five months preceding this date the company operated at a loss of $296,831, or an average of approximately $60,000 a month. The first attention of the present management was given to correcting the conditions that had created these losses, and there was immediately inaugurated a readjustment of salaries and an elimination of operating expenses wherever possible, and reductions totaling approximately $40,000 a month were made in overhead operating expenses in the executive and manufacturing departments."

Further attention was given to obtaining additional business such that with sufficient volume and reduced operating expenses the result would show a profit. The profit for March was $3,187, and each succeeding month showed an increase through June which stood at $35,847. A considerable part of June's profit, however, resulted from the price at which bonds secured by first mortgage on the company's property were retired.

"As an indication of what has been accomplished," Mr. Mininger said, "it may be stated that in May, 1920, sales of $577,957 resulted in a loss of $10,644, whereas in May, 1921, sales of $346,787 resulted in a profit of $22,816. Every endeavor is being made both in stimulation of sales and the introduction of economies to continue the operation of the company at a profit each month even under present business conditions. While, of course, the volume of business that will be received for the next few months cannot be predicted with certainty, it has been demonstrated that any return to normal times will result in substantial profit.

"The conditions resulting from the radical change in operation expenses above set forth have placed the company where it is assured of continuing to operate without concern as to its finances. It is confidently expected that the next report will show even greater improvement."

During the year 1920 the company added buildings and equipment to the value of $721,374. While the automobile trade supplies a great part of its market, a good share is found in the field of batteries for farm-lighting sets, train-lighting equipment, electric welders, etc.

Pump Manufacturers to Meet to Consider Organization of Entire Industry

At the conference that was called by the Department of Commerce last month Secretary Hoover indicated a desire that the entire pump industry be organized, and it was agreed that committees should be appointed by the Hydraulic Society and by the Compressed Air Society to co-operate with the government and work out plans for mutual benefit and service.

The president of the Hydraulic Society and its plan and scope committee have decided, consequently, to call a meeting at the Drake Hotel in Chicago on Sept. 26, to which meeting have been invited the members of the Compressed Air Society, all non-member manufacturers of hydraulic pumps and air compressors, and all manufacturers of windmills, hand pumps, spray pumps and pneumatic pumps whose names could be ascertained by C. H. Rohrbach, 50 Church Street, New York City, secretary of the two societies named above.

The principal business of the meeting will be to work out some plan of organization for the entire pump industry as desired by the government which will be satisfactory to all of the various interests.

Secretary Rohrbach has sent letters of invitation to approximately twenty-one air-compressor manufacturers, seventy-one hydraulic and centrifugal pump makers, thirty-six hand-pump makers, thirty-three pneumatic, sixty-six spray and nineteen windmill pump manufacturers, a total of approximately 246 manufacturers of all kinds of pumps, and to date has received replies so favorable as to indicate that much interest is taken by these companies in the movement for co-operation fostered by Secretary Hoover.

"United States Radium Corporation" New Name for "Undark" Manufacturer

The United States Radium Corporation, 58 Pine Street, New York City, is the new name which has been taken by the former Radium Luminous Material Company, manufacturer of "Undark" luminous material for push-button switches, pull switches, etc. The change became effective Sept. 1, but no change was made in control, management or any other condition. Because of the extent to which this company has gone into the medical field in its employment of radium it was felt that the old name did not adequately cover the company's activities.

The Remy Electric Company's plant at Anderson, Ind., which has been closed down, has resumed operation with a force of 950 employees.

The George J. Hagan Company, Pittsburgh, manufacturer of electric furnaces for both low-temperature and high-temperature work, has appointed the Clarkson Specialty Company, 1205 Olive Street, St. Louis, as its representative in the St. Louis territory.

The Metal Coating Company of America, manufacturer and distributers of the Schoop metal-spraying process, by means of which metallic coatings may be sprayed on any surface, is now in full operation at its new plant, 495-497 North Third Street, Philadelphia, having removed from its former Boston (Mass.) and Woonsocket (R. I.) locations.

The Elliott Company, Pittsburgh, has removed its Philadelphia district office from the Pennsylvania Building to 812 Morris Building. T. F. Crawford is in charge of the Philadelphia office. In addition to the business of the Elliott Company this office also handles the Philadelphia territory for the Liberty Manufacturing Company, Pittsburgh, and the Lagonda Manufacturing Company, Springfield, Ohio.

The Rutenber Electric Company, Marion, Ind., is opening a sales office at 154 West Lake Street, Chicago, in charge of Herbert H. Frost and H. E. Willmore, experienced heating-device salesmen and engineers, to enable the factory to maintain closer touch with the Chicago territory.

Ajax Electric Specialty Company, 1011 Market Street, St. Louis, importer and manufacturer of electrical specialties, has made arrangements with the I. A. Bennett Company, 112 West Adams Street, Chicago, to act as its exclusive district sales representative for Indiana, Illinois, Wisconsin, Minnesota, North Dakota, South Dakota and the upper peninsula of Michigan.

Foreign Trade Notes

SCHEME TO HARNESS TIDES IN FRANCE.—A detailed scheme to harness the tides of the sea to generate electricity, according to the *Matin*, has been submitted by a committee that has been engaged for two years in study on the subject to M. le Trocquer, Minister of Public Works, who has decided to proceed at once with the necessary investigations. The experimental power station is to be established in Brittany, in Aber-Vrach Bay. A dam 150 m. (492 ft.) in length will be built, and the water inclosed therein will be used to put in motion the turbine engines. It is estimated that 4,800 hp. can be developed by this means.

IMPROVEMENTS PROPOSED FOR PALESTINE.—The government of Palestine, according to Julian E. Gillespie, assistant trade commissioner, who has just completed a visit to Egypt, Syria, Palestine and Smyrna, is considering an enlargement of the ports of Jaffa and Haifa, the erection of a large water-power plant sufficient to meet the needs of all Palestine, the irrigation of the Jordan Valley, and the construction of a railroad from the Sea of Galilee directly east to connect with the Bagdad railway. Improvement to the port at Jaffa is probably all that will be accomplished in the near future.

ELECTRIFICATION PROJECTS IN CZECHOSLOVAKIA.—A plan has been submitted to the Ministry of Public Works, according to one of the newspapers of Prague, for the construction of a dam 70 m. (230 ft.) high at Stechovice 30 km. (18 miles) south of Prague. The proposed dam, it is estimated, would cost between 250,000,000 and 300,000,000 Czechoslovak crowns (1 crown 1⅓ cents) and would develop about 250,000 kw.-hr. of electricity per year.

PROPOSED EXTENSIONS TO EDINBURGH ELECTRIC PLANT.—Extensions are contemplated to the municipal electric plant of the Corporation of Edinburgh, Scotland, involving an expenditure of about £1,068,000, chiefly in connection with the new station at Portobello.

HYDRO-ELECTRIC PROJECT ON RIVER RHONE.—The legislation affecting the proposed combined hydro-electric, irrigation and navigation scheme for the River Rhone, according to reports from Consul Carrigan at Lyons, France, has been passed. The report states that this is simply the putting into legal form of the general plan embracing the principles of the project and the outlining of a scheme of organization, leaving the details to be handled by concessioners.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

A manufacturing firm in Spain (No. 9) is considering the construction of a brewery and wishes to receive catalogs of brewery machinery, electrically operated, with a capacity of 3,000 bottles per hour.

A merchant in the Dutch East Indies (No. 16) desires to purchase and secure an agency for the sale of small refrigerating units for houses, hotels and stores.

A commercial agent in Europe (No. 26) desires to purchase for an Eastern European government copper ingots of 150 to 200 metric tons, suitable for electrical use.

A commercial agent in Italy (No. 35,403) desires to secure an exclusive agency for the sale in Sicily of electrical supplies and materials of all kinds, including motors.

EQUIPMENT FOR MANGAHAO (NEW ZEALAND) POWER SCHEME.—Tenders will be received by the Public Works Department of New Zealand addressed to the Secretary, Public Works Tender Board, Wellington, New Zealand, until Nov. 29, for furnishing equipment required for the Mangahao electric power scheme as follows: Three waterwheels of 6,450 b.hp., and two waterwheels of 3,225 b.hp., complete with governors, couplings and accessories; three 6,000-kva. and two 3,000-kva. alternating-current generators; two three-unit exciter sets, each consisting of one 37[illegible]-b.hp. Pelton wheel, one [illegible]50-kw. direct-current generator and one 350-hp. synchronous motor; seven

1,000-kva., single-phase transformers and accessories; insulators for 110,000-volt, 50-cycle transmission lines; lightning arresters for operation on two 110,000-volt, three-phase transmission lines; switchboard, switches and accessories. Specifications may be seen at the Department of Overseas Trade, 35 Old Queen Street, S.W. 1, London, England.

ELECTRIC EQUIPMENT FOR SAN SALVADOR.—Rafael Lima, chief engineer of the Electric Light & Power Company, San Salvador, Salvador, Central America, would like to receive catalogs of electrical equipment, including lamps, meters, switchboards, plugs, machinery and general supplies, etc.

MACHINERY FOR ELECTRIC PLANT FOR WELLINGTON, NEW ZEALAND.—Tenders will be received by the Wellington City Corporation, addressed to Preece, Cardew & Rider, 8 Queen Anne's Gate, Westminster, S.W. 1, London, England, until Oct. 13, for furnishing and erecting the following equipment: (A) Two water-tube boilers with feed-water heaters, superheaters, stokers, etc.; (B) one 5,000-kw. turbo-alternator, with condensing plant. Specifications and form of tender may be obtained from Preece, Cardew & Rider, 8 Queen Anne's Gate, Westminster, S.W. 1, on payment of £2, which will be returned on receipt of a tender

New Apparatus and Publications

BALL BEARINGS.—The Norma Company of America, Long Island City, N. Y., is distributing a folder "Norma Precision Ball Bearings in Lighting Generators."

IRONING MACHINE.—The Apex Electrical Manufacturing Company, Cleveland, is marketing the former Gould electric ironer, a publication on which it is distributing.

ELECTRIC DRILL.—The Elecyto-Magnetic Tool Company, Chicago, has developed and placed on the market a ½-in. drill which may be used as a drill press by attaching to a portable stand.

LIGHTING.—The National X-Ray Reflector Company, 235 West Jackson Boulevard, Chicago, is distributing a booklet on the use of its indirect light adapter for art lamps, entitled "Perfect Lighting for the Home."

REFLECTORS AND LAMPS.—The National X-Ray Company, 235 West Jackson Boulevard, Chicago, has developed and placed on the market three new products, including a showcase light and reflector, an indirect-lighting art-lamp adapter and a portable floodlamp with color effects for automobile salesrooms.

X-RAY LIGHTING APPARATUS.—The National X-Ray Reflector Company, 235 West Jackson Boulevard, Chicago, has issued catalog No. 22, covering its X-Ray direct lighting products, including show-window lighting and fittings, showcase lighting, industrial lighting and floodlighting. The company is also distributing a booklet entitled "Wrigley Building, Chicago, Ill."

PULLEY-SOCKET REFLECTOR.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has recently placed on the market a new "Cutter" pulley-socket reflector.

CABLEWAY.—The Railway & Industrial Engineering Company, Greensburg, Pa., has developed a new rocking cable way for handling materials.

METAL-SPRAYING PROCESS.—"The Schoop Metal Spraying Process" is the title of a sixteen-page booklet distributed by the Metal Coating Company of America, 495 North Third Street, Philadelphia, describing the Schoop process for coating metal surfaces.

CONDENSERS.—The Wheeler Condenser & Engineering Company, Carteret, N. J., has issued a new catalog entitled "Wheeler Condensers," covering its complete line of condensers and accessories for stationary and marine service.

ELECTRIC PORTABLE DRILL.—The Cincinnati Electrical Tool Company, Cincinnati, has recently placed on the market a new 7/8-in. pistol-grip portable electric drill.

LIGHTING PLANTS.—The Albert F. Hauss Company, 4 West Third Street, Cincinnati, has placed on the market a new line of lighting plants, known as the "Hauss-System," in sizes of ½ kw., ¾ kw., 1 kw. and up.

WASHING MACHINE.—The Upton Machine Company, St. Joseph, Mich., has developed a semi-cabinet type electric washing machine operating on the oscillating cylinder principle.

GENERATING UNIT.—The Kewanee Private Utilities Company, Kewanee, Ill., has recently placed on the market a direct-lighting or battery-charging generating set with an automobile-type engine.

VENTILATING FAN.—A ventilating fan, the "Marathon O.K.," has recently been placed on the market by the Marathon Electric Manufacturing Company, Wausau, Wis.

LIGHT AND POWER PLANT.—An automatic lighting and power plant having a capacity of 1 kw. at 110 volts has recently been brought out by the Instanto Electric Company, Maysville, Ky.

AUTOMATIC VALVE.—The Dual Automatic Valve Company, Rock Island, Ill., is distributing a folder entitled "How to Have Automatic Hard and Soft Water Service with One Pump," in which it describes the "Dual" automatic valve.

HEAVY-DUTY GRINDER.—The Van Dorn Electric Tool Company, Cleveland, has recently put on the market an improved heavy-duty ball-bearing electric grinder driven by a 4-hp. motor.

CIRCUIT EXTENDER.—The M. Propp Company, 24 Broadway, New York City, has developed a new device, known as a "circuit extender, which allows a number of sets of Christmas tree lights to be attached to a single circuit. It can also be used for connecting floor and table lamps and household appliances, etc.

TAP SOCKET.—The E. H. Freeman Electric Company, Inc., 803 East State Street, Trenton, N. J., has recently placed on the market a pull-chain current tap socket designated as No. 651.

CHRISTMAS TREE LIGHTING OUTFIT.—The Ideal Electric Company, Inc., 81 Grand Street, New York City, has placed on the market a christmas tree lighting outfit with tapping block for connecting several sets.

ICE-CREAM FREEZER.—An ice-cream freezer equipped with a direct-connected motor has been placed on the market by Walter S. Edmands, 25 Pearl Street, Boston,

COOKER AND HEATER.—The Faraday Company, 716 Chapel Street, New Haven, Conn., is marketing a small electric cooker under the name of "Kookerette." It may be attached to an ordinary lamp socket and may also be used as an auxiliary heater.

New Incorporations

SAMUEL KLINE, INC., Trenton, N. J., has been incorporated with a capital of $25,000 to manufacture and deal in electrical specialties. The incorporators are Samuel Kline and Laurence S. Harrison.

THE MAPLE SPRINGS POWER COMPANY, Salt Lake City, Utah, has been incorporated with a capital stock of $50,000 for the purpose of operating an electric power plant, etc. The officers are M. Beauregard, Gunnison, president; L. E. Cluff, Salt Lake City, vice-president; H. R. Waldo, Salt Lake City, secretary and treasurer.

THE RYSER STORAGE BATTERY COMPANY, Louisville, Ky., has been incorporated with a capital stock of $45,000 by O. M. Ryser and O. W. Samuels.

THE BEACON LIGHTING FIXTURE COMPANY, New York, N. Y., has been incorporated by L. E. McMahon, E. A. Reilly and M. Ravitch. The company is capitalized at $10,000 and proposes to manufacture electrical fixtures and kindred equipment. O'Brien, Malevinsky and Driscoll, 1482 Broadway, represent the company.

THE BLOOM-HARPER COMPANY, Williamsport, Pa., has been incorporated with a capital stock of $15,000 to manufacture electrical supplies. A. N. Bloom, Williamsport, is treasurer.

THE SCHIMMEL ELECTRIC SUPPLY COMPANY, Philadelphia, Pa., has been chartered with a capital stock of $330,000 to manufacture and deal in electrical supplies. L. D. Schimmel, 318 Market Street, is treasurer.

THE STRONGHEART BATTERY PLATE MANUFACTURING COMPANY, Rochester, N. Y., has been incorporated by E. R. Sherman, H. Leshner and F. Wiedman, E. & B. Building, to manufacture electric storage batteries. The company is capitalized at $15,000.

THE MORTON ELECTRICAL SUPPLY COMPANY, New York, N. Y., has been incorporated by E. R. May, T. Hansen and J. C. Humphrey. The company is capitalized at $10,000 and proposes to manufacture and deal in electrical supplies. Hansen & Dreeben, 50 Broad Street, represent the company.

THE UNITED LAMP MANUFACTURERS' ASSOCIATION, New York, N. Y., has been incorporated by H. Wolff, R. Press and S. Math to manufacture electric lamps, etc. The company is capitalized at $[illegible] E. Hollander, 8 Bline Avenue, Union, N. J., represents the company.

THE BARRY ELECTRIC COMPANY, Allentown, Pa., has been chartered with a capital stock of $5,000 to manufacture and deal in electrical equipment. C. M. Walter, Allentown, is treasurer.

THE H. C. WHITE ELECTRIC COMPANY, 119 South Neil Street, Champaign, Ill., has been incorporated with a capital stock of $20,000 to manufacture and deal in electrical apparatus. The incorporators are M. E., H. C. and K. B. White.

THE ELECTRIC HIGHWAY SIGNAL COMPANY, Boston, Mass., has been incorporated under the State laws to manufacture electrically operated signal devices. The company is capitalized at $10,000. Rishton T. Bailey, Massachusetts Avenue and Tannery Street, Cambridge, is president and treasurer.

THE MARTALEY ELECTRIC CORPORATION, New York, N. Y., has been organized by F. Raab, C. L. Grad and F. Demovitch. The company is capitalized at $20,000 and proposes to manufacture and deal in electrical products. Joseph, Demov & Feinstein, 277 Broadway, represent the company.

THE IDEAL UTILITIES CORPORATION, Homeward, Ill., has been incorporated by Owen D. Kinsey, Willis E. [illegible] and Lewis U. Heller, Homeward. The company proposes to manufacture electrically operated dish-washing machinery and other equipment for domestic service.

MOONEY, DOUGLAS & PEARSON, INC., New York, N. Y., has been incorporated with a capital stock of $100,000 to manufacture electrical equipment. E. I. Cullen, 250 Ninety-third Street, Brooklyn, is one of the incorporators.

THE EMPIRE ELECTRIC GLOBE COMPANY, Brooklyn, N. Y., has been incorporated by S. R. Goldstein, L. Feldman and M. L. Kane, 50 Court Street. The company is capitalized at $100,000 and proposes to manufacture electrical specialties.

THE EAGLE ELECTRICAL SUPPLY COMPANY, Newark, N. J., has been chartered with a capital stock of $[illegible] to manufacture electrical specialties. The incorporators are Joseph P. Kiesinger and Joseph H. Grabowski, 695 Summit Avenue, Jersey City.

THE ELECTRICAL HIGHWAY COMPANY, Boston, Mass., has been incorporated with a capital stock of $10,000 by Robert U. Merrick, Quincy; Charles B. Putnam, Boston, and William T. Miller, Newton.

THE NORTH STATE POWER COMPANY, RALEIGH, N. C., has been chartered with a capital stock of $250,000 to take over the business of the Cumberland Light & Power Company. The new company proposes to furnish power to individuals and corporations in Cumberland, Bladen, Robeson, Hoke, Harnett, Sampson, Johnston, Wayne, Wilson, Lee, Moore, Wake and other counties. The incorporators are L. H. Crouch, Raleigh; J. B. Johnson, Cardenas; J. W. Blalock, Willow Springs, and others.

THE INSTANTANEOUS ELECTRIC WATER HEATER CORPORATION, Brooklyn, N. Y., has been incorporated by L. Feinman, M. Holland and Samuel Rubinton, 32 Court Street, to manufacture electric water heaters and parts.

THE RADIO SERVICE LABORATORIES, INC., Asbury Park, N. J., has been incorporated by Harold M. Lewis, Hobart A. Simpson and Melvin S. Moore. The company is capitalized at $[illegible] to manufacture wireless and other electrical equipment. Joseph M. Turner, 701 Mattison Avenue, represents the company.

Record of Electrical Patents

Notes on United States Patents

(Issued August 16, 1921)

1,387,705. ELECTROLYTIC DIAPHRAGM; William E. Greenawalt, Denver, Col. App. filed May 25, 1920. Unaffected either by the electric current or by the electrolyte.

1,387,736. RADIO-SIGNALING SYSTEM; James H. Rogers, Hyattsville, Md. App. filed March 8, 1920. Pertains particularly to the disposition of the radio conductor or conductors.

1,387,741. ELECTRIC GENERATING SYSTEM; Chester F. Strong, New York, N. Y. App. filed March 31, 1920. Mechanism for changing the speed of the engine and changing the generator characteristics to maintain voltage on the line substantially equal to that of the storage battery.

1,387,742. ELECTRIC GENERATING SYSTEM; Chester F. Strong, New York, N. Y. App. filed March 31, 1920. Speed of prime mover varied so as to maintain voltage on line substantially equal to that of a secondary battery connected therewith.

1,387,785. HAIR CURLER; Elin M. Lindberg, Duluth, Minn. App. filed April 2, 1921. Applied to the head in its entirety.

1,387,814. WALL PLUG; Abraham Ten Bosch, The Hague, Netherlands. App. filed Oct. 25, 1920. Pins made of two separate halves which by means of a socket are fixed together at the foot.

1,387,819. ELECTRIC WATER HEATER; Arthur M. Werner, San Jacinto, Cal. App. filed Sept. 23, 1920. Provides for withdrawl of water as soon as it is heated.

1,387,848. INTERNAL-COMBUSTION-ENGINE POWER PLANT; John Good, Brooklyn, N. Y. App. filed Aug. 30, 1916. Application of heat to internal-combustion engine working on the relatively nonvolatile fuels such as kerosene.

1,387,850. SYSTEM OF RADIO-DIRECTIVE CONTROL; John Hays Hammond, Jr., Gloucester, Mass. App. filed June 7, 1921. Apparatus by which a movable body is made to move or to face in the direction of a source of radiant energy.

1,387,879. MAGNETIC PULLEY; John P. Bethke and Roswell H. Stearns, Milwaukee, Wis. App. filed Jan. 22, 1920. Having a high rate of cooling or radiation and a high flux density.

1,387,885. RADIO-SIGNALING APPARATUS; William R. Davis, Minneapolis, Minn. App. filed March 9, 1918. For classroom work.

1,387,897. SLIDING TROLLEY; Otto Moore, Frankfort, Ind. App. filed April 26, 1920. Means for prolonging the life of such devices.

1,387,9[illegible]. MINIATURE LAMP-SOCKET FOR CHRISTMAS TREES; [illegible], [illegible], Conn. App. filed Dec. 12, 1919. Reduces the cost of manufacturing.

1,387,9[illegible]. DRY CELL CASE; Homer W. Jones, Cleveland, Ohio. App. filed Dec. 22, 1919. Manufactured without the use of a soldered side seam.

1,387,9[illegible]. APPARATUS FOR TELEPHONE CALLING DEVICES; Harry W. Pugh, New York, N. Y. App. filed Nov. 11, 1919. Calling device and a telephone transmitter fitted into a self-contained unit.

1,387,9[illegible]. NEGATIVE RESISTANCE; Albert W. Hull, Schenectady, N. Y. App. filed Aug. [illegible], 19[illegible]. [illegible] in which the current will [illegible] as the potential applied thereto increases.

1,387,9[illegible]. [illegible]; Albert W. Hull, Schenectady, N. Y. App. filed [illegible] 1919. [illegible] suitable for use as relays for amplifying variable currents.

1,387,986. WIRELESS RECEIVING SYSTEM; Albert W. Hull, Schenectady, N. Y. App. filed March 1[illegible], 191[illegible]. [illegible] high degree of amplification of feeble currents produced by received signals.

1,387,9[illegible]. CONTROL SYSTEM; Harold L. Keith, Wilkinsburg, Pa. App. filed Dec. 17, 1919. For motors subjected to quick reversals of their direction of operation.

1,388,086. PROCESS FOR RECOVERING VALUES FROM ORES; Edgar A. Ashcroft, London, England. App. filed Sept. 15, 1920. Process consists in converting the metal constituents of the ore into chlorids.

1,388,088. ELECTRIC THIRD RAIL; Arne K. H. Bjorge, St. Paul, Minn. App. filed Dec. 17, 1919. Third-rail structure affording a maximum degree of safety.

1,388,111. ELECTRIC STOVE; Allan G. Harrington, Chicago, Ill. App. filed May 28, 1920. Generates heat under finer degree of control than is usually the case.

1,388,112. METHOD OF AND APPARATUS FOR TREATING AIR AND GASES ELECTRICALLY; William T. Hoofnagle, Bloomfield, N. J. App. filed March 6, 1920. Treatment of the air in the production of nitrogen oxides.

1,388,116. HEATING UTENSIL; George S. Monson, St. Paul, Minn. App. filed July 31, 1920. Utensils employed in dental offices.

(Issued August 23, 1921)

1,388,167. SYNCHRONIZING-CLOCK SYSTEM; James W. Bryce, Binghamton, N. Y. App. filed Dec. 30, 1920. To control operation of secondary clocks.

1,388,216. ELECTROLYTIC CELL; Charles J. Thatcher, New York, N. Y. App. filed Oct. 21, 1919. For operations on commercial scale.

1,388,217. INSULATOR; Cyril H. Thomas, Chicago, Ill. App. filed May 9, 1919. Stable union between insulator and support.

1,388,270. ELECTRIC HEATER; Frank Kuhn and Jay A. Hand, Detroit, Mich. App. filed May 31, 1918. For chafing dishes, toasting, broiling, etc.

1,388,287. DEVICE FOR PREVENTING WRECKING OF CROSS-WIRES OF TROLLEY SYSTEMS; William F. Murray, Minneapolis, Minn. App. filed April 1, 1921. Shield readily attached to trolley pole.

1,388,336. UNDERGROUND AND SUBMARINE ANTENNA; Earl C. Hanson, Washington, D. C. App. filed Feb. 25, 1919. For reception of radio signals.

1,388,337. ELECTROPLATING APPARATUS; Forest H. Hartzell, Dayton, Ohio. App. filed April 22, 1919. Rotary-barrel type.

1,388,368. CALLING DEVICE; Alfred T. Palmer, Medford, Mass. App. filed March 20, 1919. Automatic telephone system.

1,388,369. SIGNALING DEVICE; Alfred T. Palmer, Medford, Mass. App. filed Feb. 16, 1920. Calling mechanism within base of standard telephone desk set.

1,388,373. HIGH-RESISTANCE UNIT; Floyd K. Richtmyer, Ithaca, N. Y. App. filed Feb. 6, 1919. Of comparatively permanent value.

1,388,402. APPARATUS FOR SINGEING THE HAIR; Isidoro Calvete, London, England. App. filed Jan. 19, 1920. Electric resistance coil to supply the heat.

1,388,420. AMUSEMENT DEVICE; John Flinner, Leavenworth, Kan. App. filed Aug. 5, 1918. Wheel which is apparently self-propelling.

1,388,434. METHOD AND APPARATUS FOR BUTT-WELDING THIN-GAGE TUBING; Gustave V. Johnston, Chicago, Ill. App. filed June 9, 1919. High-speed production of thin-walled tubing.

1,388,44[illegible]. MULTIPLE ANTENNA FOR ELECTRICAL WAVE TRANSMISSION; Michael I. Pupin, Norfolk, Conn. App. filed Oct. 1, 1915. Screening against disturbance.

1,388,448. ELECTRIC PRODUCTION OF AMMONIA; [illegible], [illegible] Grande, Cal. App. filed May 12, 1919. High temperatures avoided.

1,388,4[illegible]. STARTING AND SPEED-CONTROLLING DEVICE; Ernest J. Brasseur, Chicago, Ill. App. filed June 12, 1920. For starting, stopping and varying speed of shafts.

1,388,4[illegible]. TRANSMISSION OF INTELLIGENCE; [illegible]. App. filed Sept. 3, 1915. Sustained oscillations of high frequency employed as carrier waves.

1,388,4[illegible]. [illegible]; [illegible], Pa. App. filed Sept. 29, 1920. Silent in operation.

1,388,4[illegible]. [illegible]; [illegible] H. [illegible], N. Y. App. filed [illegible], 1920. Decomposition of sodium-chloride solutions.

1,388,4[illegible]. APPARATUS FOR ELECTROLYZING [illegible]; [illegible]

Construction News

Projects, Plans, Bids and Contracts Contemplated or Under Way

New England States

SKOWHEGAN, ME.—Work is under way by the Central Maine Power Company preliminary to the construction of the North Channel dam at Showhegan for the development of 13,000 hp. W. G. Elliott is superintendent. J. A. Leonard is designing and consulting engineer.

WESTFIELD, MASS.—The plant of the Westfield Power Company was recently damaged by fire, causing a loss of about $[illegible].

Middle Atlantic States

ALBANY, N. Y.—Plans are being prepared by the State Superintendent of Public Buildings, Capitol Building, for the installation of additional electrical equipment in the Capitol Building. Lewis P. Pilcher is state architect.

EAST AURORA, N. Y. — The Depew & Lancaster Light, Power & Conduit Company has acquired the properties of the East Aurora Electric Light Company. The new owner is planning to erect an 11,000-volt transmission line from its Gardenville substation direct to East Aurora to transmit Niagara Falls power to surrounding territory, including the township of Holland The East Aurora plant will be dismantled, and a substation equipped with new transformers and switching apparatus will be erected within the village limits.

LOCKE, N. Y.—The Empire Gas & Electric Company has been granted a franchise to furnish electricity in the village of Locke. Application has been made to the Public Service Commission by the Empire Company to extend its transmission lines to Locke. L. C. Reynolds, Auburn, is superintendent of the company.

CHESTER, N. J.—Arrangements are being made by the Central New Jersey Power Company to develop property at Lake Takeene, near Chester, including the installation of electric lines for light and power service.

NEWARK, N. J.—The installation of a new electrically operated police signal system is under consideration by W. J. Brennan, director of the Department of Public Safety.

NEWTON, N. J.—Permission has been granted the Newton [illegible] Company by the Board of Public Utility Commissioners to issue stock to the amount of $53,000, the proceeds to be used for extensions, improvements, etc.

CARLISLE, PA.—Plans are under way by the [illegible] of the Chamber of Commerce for the installation of [illegible] Streets. Similar installations will be made on other streets in the business district.

DOYLESTOWN, PA.—The [illegible] Electric Company is considering improvements [illegible] tion of additional machinery.

FOXBURG, PA.—[illegible] River power plant and dam, near Foxburg

JUNIATA, PA.—[illegible] Service Company is planning the installation of [illegible] this section. Application has been made to [illegible]

PHILADELPHIA, PA.—[illegible] and extensions are under consideration by [illegible] $20,000.

PHILADELPHIA, PA.—[illegible]

trically operated pumping plants, was recently damaged by fire. The loss, with machinery, is estimated at about $1,000,000.

PITTSBURGH, PA.—The Bellevue power house of the Duquesne Light Company, it is reported, has been damaged by fire. The loss is estimated at $20,000.

BALTIMORE, MD.—Surveys of the Susquehanna River from Harrisburg, Pa., to Port Deposit, Md., ordered by Congress, are being made by the United States Engineer's office for hydro-electric and navigation developments. The construction of five dams for impounding water for electric power service and five generating stations is provided for in the present plans. The project, including electric transmission and distributing lines, is estimated to cost $100,000,000. Major Harrington, United States Engineer's office, Baltimore, is in charge.

BALTIMORE, MD. — Plans are under consideration by the board of directors of the University of Maryland for the construction of a new power house in connection with the erection of proposed new buildings at Greene and Lombard Streets, estimated to cost about $1,250,000.

CHELYAN, W. VA.—The Chelyan Electric, Water & Ice Company plans to expend $7,000 to erect a transmission line a distance of about 3 miles. The company also contemplates establishing an ice plant soon. Ernest E. Coon is secretary and treasurer; B. M. Green, Charleston, is consulting engineer.

WASHINGTON, D. C.—The Bureau of Supplies and Accounts, Navy Department, Washington, D. C., will receive bids for furnishing the following: Until Sept. 30, Mare Island, Schedule 8,733—miscellaneous quantity of electric wire and cable. Until Sept. 27, Mare Island, Schedule 8,737—miscellaneous quantity of lamp cord and electric wire.

WASHINGTON, D. C.—The Bureau of Yards and Docks, Navy Department, Washington, D. C., will make improvements to the power plant and fire protection system at the navy yard at Lake Denmark, N. J. Applications accompanied by a deposit of $10 may now be filed for plans and specifications (4501), and necessary data for bidding will be forwarded in the near future. All communications should be addressed to the chief of the Bureau of Yards and Docks.

North Central States

GRAND RAPIDS, MICH.—The Marquette Lumber Company, 1555 Taylor Street, N. W., is having plans prepared for the construction of a two-story power house.

LANSING, MICH. — Preliminary plans have been prepared for the construction of a municipal electric light and power plant on the Grand River below the dam near Moore's Park, to cost about $1,650,000. Woodwell & Resler, 501 Fifth Avenue, New York City, are engineers.

EAST LIVERPOOL, OHIO — The Ohio Power Company contemplates improvements to its property in the East Liverpool district, to cost about $37,000. The present plans provide for rebuilding the 13,000-volt line from the Wellsville substation to Boring's Crossing, to cost about $10,000, and repairing the line from Boring's Crossing to Empire, to cost about $7,000. H. G. Sterling is manager.

HAZARD, KY.—The Hazard Power Company has filed notice of increase in capital stock from $50,000 to $100,000, and plans immediate improvements. New machinery and equipment will be purchased, for which bids, it is understood, are being received.

SIMPSONVILLE, KY. — The Simpsonville Lighting Company, recently incorporated with a capital of $30,000, contemplates the establishment of an electric light plant. W. P. Thompson and others are incorporators.

STANTON, KY. — The Stanton Power Company, recently organized with a capital stock of $30,000, is planning the establishment of a plant in Stanton and the erection of transmission lines to connect nearby towns.

INDIANAPOLIS, IND.—Bids will be received by the Board of County Commissioners until Sept. 27 for extensions and improvements to the power house at the county jail. C. S. Bark, 159 East Market Street, is architect.

KENDALLVILLE, IND.—The Board of School Trustees have had plans prepared for the construction of its new power house. Improvements will also be made to the plant now in use.

WELDON, ILL.—The village authorities are considering the construction of a new municipal power station, 35 ft. x 50 ft., to be erected on the site of the present plant. The new building will provide sufficient space for a two-unit plant.

MADISON, WIS.—Bids will be received at the University of Wisconsin until Sept. 26 for the construction of an electric substation and a one-story addition to service building. The cost is estimated at $55,000. A. Peabody, Capitol, is state architect.

PORTAGE, WIS. — The Portage Co-operative Canning Company, Michel Building, is considering the construction of a cannery to cost about $275,000. The plans provide for a three-story main building, two-story power house, warehouse and a one-story office building.

SHEBOYGAN, WIS.—Bids are being received, it is understood, by the East Wisconsin Electric Company for the construction of a generating plant, 60 ft. x 210 ft., on Main Street. A transmission line will also be erected from Sheboygan to Fond du Lac. The total cost is estimated at $350,000. H. Ellis, Eighth and Pennsylvania Avenue, is vice-president.

ST. CHARLES, MO.—Benham & Mullergren, consulting engineers, Firestone Building, Kansas City, has been engaged by the Council to prepare plans for the construction of a municipal electric power plant, to cost about $200,000. Otto Beokemeir is city clerk.

BLUFF CITY, KAN.—Plans are being prepared for the erection of a transmission line from Bluff City to Anthony, to cost about $25,000. W. B. Rollins & Company, Railway Exchange Building, Kansas City, Mo., are engineers

QUINTER, KAN.—The City Council is considering calling an election to submit to the voters the proposal to issue $45,000 in bonds for an addition to the power plant. The Ruckel Engineering Company, Hutchinson, is engineer

Southern States

KINSTON, N. C.—Improvements to the municipal electric light plant, including the erection of a 200-ft. smokestack, to cost about $300,000, are under consideration.

CHESTERFIELD, S. C.—Plans are under consideration by the Teal Light & Power Company for the construction of a new power plant.

DILLON, S. C.—The Town Council and the Commissioners of Public Works of Dillon request manufacturers and dealers in semi-Diesel type oil-engines, generators, exciters and switchboards to quote prices on two 200-hp. units and alternate prices on one 200-hp. unit and one 300-hp. unit. Further information and specifications may be obtained from the Ryan Engineering Company, Arcade Building, Columbia, upon a deposit of $10. Specifications are also on file at the office of the city clerk, Dillon. L. C. Braddy, Jr., is chairman of the Commission of Public Works.

SPRINGFIELD, GA.—The City Council is considering the construction of a municipal electric light and power plant. The machinery is estimated to cost about $25,000.

LEPANTO, ARK. — The installation of electric light, sewer and water systems in Lepanto is under consideration. R. C. Finn is town recorder.

CRESCENT, OKLA. — Plans are under way for the construction of a transmission line from Crescent to Guthrie, to cost about $25,000. A. B. Powell is city clerk. W. B. Rollins & Company, Railway Exchange Building, Kansas City, Mo., are engineers.

KETCHUM, OKLA.—A plan to construct a dam across Grand River near Ketchum in Mayes County is being revived. The project is being promoted by Byron Kirkpatrick and Charles Page of Tulsa, and W. B. Collins of Ketchum, organizers of a $20,000,000 corporation for which a charter has been granted.

KINGSTON, OKLA. — Plans are under consideration by the Kingston Ice & Light Company for rebuilding a portion of its plant recently destroyed by fire. The loss is estimated at about [illegible]

PRYOR, OKLA. — Bids are being received, it is reported by V. V. Long & Company, engineers, Colcord Building, Oklahoma City, for the erection of an [illegible] [illegible] Pryor Creek.

KYLE, TEX.—The power house of the Kyle Light & Power Company was recently destroyed by fire. The plant, it is understood, will be rebuilt.

Pacific and Mountain States

BUENA VISTA, CAL.—G. S. Eyre and associates are considering the erection of a hydro-electric generating plant on Chalk Creek.

DIXON, CAL.—The Pacific Gas & Electric Company contemplates the construction of a main electric substation in Dixon for the purpose of uniting the line running through the hills to the west and the new line from Pit River.

FRESNO, CAL.—Plans are under way by the Department of Public Works for the installation of a fire-alarm system to cost about $175,000. The system will include a central fire-alarm station and an underground cable system for the commercial districts of the city.

FRESNO, CAL.—The San Joaquin Light & Power Corporation has taken out a permit for rebuilding the old central substation at 1137-47 O Street, recently damaged by fire. The new structure will cost about $13,500.

LOS ANGELES, CAL. — The Board of Public Service Commissioners has requested E. F. Scattergood, chief electrical engineer of the bureau of power and light, to present plans and specifications for the construction of the San Fernando power plant and pipe lines. The new plant will be built near the San Fernando Boulevard at the foot of the cascades, a short distance this side of the Newhall tunnel, and will add 8,000 hp. capacity to the city's system. The cost of the plant is estimated at about $83,000.

MARE ISLAND, CAL.—An appropriation of $150,000 has been made for improvements to the central power plant at the Mare Island Navy Yard. The plans provide for the installation of a 500-kva. Allis-Chalmers turbo-alternator, etc.

OROVILLE, CAL. — The Hutchinson Lumber Company has awarded contract to the Great Western Power Company for furnishing power for its forest and mill operations. A transmission line will be erected.

RIVERSIDE, CAL.—The Southern Sierras Power Company is contemplating the construction of a 3,000-hp. plant in Mill Creek Canyon near Forest Home, to cost about $500,000. Application has been made for appropriation of 12.50 sec.-ft. of water from Falls Creek, which is a tributary of Mill Creek.

SACRAMENTO, CAL.—Preliminary estimates for the construction of a municipal power plant for Sacramento place the cost at approximately $8,000,000. A bond issue is proposed. A power-plant site in the vicinity of Folsam has already been secured.

SAN BERNARDINO, CAL.—Properties of the Arrowhead Reservoir & Power Company in the San Bernardino Mountains and along the Mojave River have been transferred to the Title Insurance & Trust Company of Los Angeles, to be held in trust for a syndicate of Los Angeles capitalists headed by Morgan Adams. The plans of the syndicate provide for the completion of a power and irrigation project in connection with Little Bear Lake dam, which was included in the transfer. Surveys are under way for raising dam 9 ft. and constructing a spillway.

STOCKMORE, UTAH.—Plans are under way by the Great Basin Power Company, Walker Bank Building, Salt Lake City, for the construction of a hydro-electric generating plant with an initial capacity of 10,000 kw. in the vicinity of Stockmore. H. A. Strauss is engineer.

SHELLY, IDAHO.—The Shelley Light & Power Company has been granted a fifty-year franchise for furnishing electricity for light and power in Shelley.

Canada

CHARING CROSS, ONT.—Plans are under consideration by the authorities of Raleigh Township for the erection of electric lighting and power distribution systems to Louisville and Kent Center and through the southern part of the township, to cost about $60,000. J. N. Wilson, 190 University Avenue, Toronto, is engineer.

Electrical World

New York, Saturday, September 24, 1921

Tax Delinquency as a Suggestion to the Business Man

THE unusually large delinquency in the last income-tax payment is striking evidence that people in this country are tired of taxes that are hard to pay. Rich and poor are clamoring. Everybody is becoming more and more disgusted. What are we going to do about it—we in the electrical industry? For it affects our own prosperity, and we might as well stand to the facts right now.

No man thinks that he can live tax-free. We all know that we must support our government and continue paying for the war for many years. That is not the point. The trouble is that we are weary of assessments that interfere with our living and our business. We are sick of saving for the revenue collector and periodically paying out more cash than we can spare. We are simply tired of taxes that are *hard to pay*.

A few years of practical application have proved that the principle of the income tax is bad because it penalizes personal prosperity. It drives capital out of business into hoarding, hiding and tax-exempt investments. It discourages initiative and enterprise. It is unfair. Tax what a man spends, however, and you lay the burden equitably upon all according to their voluntary standards of living. As they spend they pay the tax and never know it. And what they save should not be taxed since in the banks or by investment it is loaned to industry to employ labor, develop resources and create wealth. When they spend it, then they pay. It is not only fair, but it does not hurt. And this is the purpose and the method of the sales tax idea.

This sales tax has been well proved in Canada, where for a year manufacturers and importers in all sales direct to the consumer have added 2 per cent for tax and paid it to their government. On sales to jobbers they have collected 1 per cent and the jobber has collected 1 per cent on his resales to the retailer. This is on all sales except exempt necessities of life. The tax has been reported and remitted monthly. Unnoticed by the man who paid, it brought in $50,000,000 last year. The same tax from our population would have meant $600,000,000. This year Canada has slightly increased the rate and cut the exempt list to further ease the income-tax demands that men are tired of.

The ELECTRICAL WORLD believes that American homes and American business need this kind of sensible relief from the exasperating burden of taxes that are hard to pay. Congress has laid the matter aside, but we should have the sales tax now, and we will have it when our business men demand it. Electrical men should keep on working for it.

John Foster Gilchrist

Advocate of a strong N. E. L. A. organization, leader in good-will activities and originator of the idea of state committees on public utility information now spreading over the country.

THROUGH a practical conception of the responsibility of the utility as a public servant John F. Gilchrist has done at least as much as if not more than any other individual in the utility field to promote public good will and understanding. Mr. Gilchrist, who has grown up in the electric light and power business in Chicago, rising from office boy to vice-president of the Commonwealth Edison Company, has shown a marked understanding and sympathy for the public point of view and is a stanch advocate of large corporations, or, as he once called them, "a collection of people working mutually in some business in order to carry out on a large scale and in a co-operative way an enterprise that no one man can carry out." He has for years spent much time in educating utility employees and the consuming public in the belief that if the people once get a right point of view harmonious relations will result. Nor has he confined his efforts in this direction to those regions in the Middle West served by the Insull properties. He [illegible] rather worked on the assumption that good relations in his particular section [illegible] relations elsewhere. When president of the National Electric Light Association in 1911-12, the theme of most of his addresses was the need for [illegible] consciousness of the worth of the public utility corporation. And now, a few years later, he fosters the greatest single movement toward better public understanding, namely, the state committees on public utility information. Beginning with a committee which he got together to disseminate information about all public utilities in Illinois, the idea has spread until twenty-one states now have such committees and others are about to establish them.

It was the bright lights that attracted Mr. Gilchrist to the electric industry. He tells the story himself of how about thirty-six years ago, when a mere boy, he was a ticket seller and lecturer for a concern showing panoramic views of the siege of Paris and how the electric arc lamps used for display purposes around the show aroused his interest and started him on his electrical career. Born in Chicago on March 14, 1868, he was educated in the Chicago high schools and was graduated from the law department of Lake Forest University. He entered the services of the old Chicago Edison Company, predecessor of the present Commonwealth Edison Company, [illegible] to 1896 he was assistant to the manager of the electricity sales department, and he was general contract agent from 1896 to [illegible]. He then became assistant to the president, holding that position until 1914, when he became vice-president in charge of purchasing, stores, transportation and statistical departments. At the present time Mr. Gilchrist is also president of the Federal Sign System (Electric), assistant to the president of the Public Service Company of Northern Illinois, vice-president of [illegible] officer or director in affiliated companies.

Mr. Gilchrist [illegible] having been president of the N. E. L. A., [illegible] of the Association of Edison Illuminating Companies.

While a man of many characteristics, perhaps none is more apparent in his work than that of organization. As an [illegible] national body with sectional, state and [illegible] ously in a well-knit organization. This [illegible] and the results that Mr. Gilchrist predicted are being reaped.

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Volume 78 New York, Saturday, September 24, 1921 *Number* 13

A Plan to Make Convenience Outlets Better Known

MANY persons in the electrical industry do not know what an "electric convenience outlet" is. More than that, they show little appreciation of the tremendous possibilities in store for the industry through a determined effort to bring about a universal use of these individually small pieces of apparatus. When provided in adequate number in the baseboards, floors and walls of modern homes these inconspicuous invitations to use electric service are an effective means of bringing home frequently to the customer of moderate means as well as the more well-to-do the everyday service and convenience of electrical home appliances. That the value of the electric convenience outlet is appreciated by the consumers has been proved in California by the California Electrical Co-operative Campaign. Because they are convinced of the fundamental importance of this matter, the leaders of the electrical co-operative movement in that state are making an effort to enlist the active interest and support of the manufacturers in advertising "electric convenience outlets." The plan is to christen such apparatus with the double name "electric convenience" and to use this name in advertising and on the boxes in which the apparatus is sold. This is a worthy movement, and it is to be hoped that the active aid of the manufacturers, jobbers and dealers alike will be given it.

Put the Kilowatt-Hour in Its Place

HOW can rate schedules be rearranged to eliminate the prominence given to the kilowatt-hour and make the consumer think of the service he is purchasing rather than the measuring unit of that service? One suggestion is in the direction of leading the consumer to think in terms of hours' use of the apparatus he owns. This might be done by showing on the monthly bills the number of hours' use of a given piece of apparatus equivalent to a kilowatt-hour. A 40-watt lamp may be used twenty-five hours on an energy expenditure of 1 kw.-hr. A 1-hp. motor, allowing for the input as distinguished from the output in mechanical effort, will run one hour or a little more on 1 kw.-hr. of energy. A fact or two of this kind presented on the bills sent out each month and hammered on consistently in other forms of advertising would enable the consumer to think intelligently in terms of the service that he is paying for and would help to place the kilowatt-hour in its proper place as a measuring unit only. Martin J. Insull in his talks before the various association meetings during the past year emphasized the utility business as a sale of the use of a property investment. It should not be a difficult matter to present this fact in simple non-technical language. One central-station manager who has had considerable success in the handling of rural business has reduced his efforts to the placing of arguments in the language best known to the farmer—that of the cost of running his farm and maintaining his equipment. It requires a lot of thinking and the exercise of a great deal of ingenuity, but the effort is of the kind that brings the business man closer to his customer and, because of the broadening influence the study exercises, makes him a better business man.

This problem is one of the big ones in the broad problem of better public relations. Subordination of the purely technical and giving increasing prominence to methods of expression that do not require a technically educated man to understand are a necessary part of utility public relations work.

Comforting Effect of Large Coal Piles

NEXT spring the wage agreements with coal miners terminate in both the anthracite and bituminous fields, and there are intimations that a new wage scale 40 per cent higher than the present scale will be sought. The possibility of a railroad strike prior to that time hovers in the air. Both contests will be fought bitterly. Obviously every prudent manager will anticipate trouble by laying in an ample supply of fuel, first to tide him over a possible rail shutdown and then to insure his company against loss due to a coal strike. While the latter is yet a great way off, it is none too soon to prepare for it, and those who are not ready to face a railroad strike have cause to worry. Of course, neither strike may take place; but the only sure way of meeting trouble, impending or real, is to be prepared. Every electric light and power company's coal pile should therefore bulk large.

Commission Regulation of All Electrical Utilities Essential to Western Industries

A SPIRITED debate has arisen in California on the subject of the development of hydro-electric energy in the High Sierras and its transmission to southern California. The agriculturists in the great San Joaquin Valley want to be assured that there will always be available sufficient power to pump irrigation water for the eight million acres in that valley. They protest against power being taken from their vicinity and allocated to uses from which it can never be diverted. In particular, they are opposed to such power development by the city of Los Angeles since that city could not redistribute this power in the San Joaquin Valley. The ranchers claim that the supply of power for agricultural uses should take precedence over the supply to industries. With this in mind they are demanding that their power supply be asssured and look for this assurance to the California Railroad Commission. The commission is empowered to compel the utilities under its regulation to supply power where and when it is needed. However, it has thus far no jurisdiction over politically owned utilities, and the ranchers in the San Joaquin Valley feel they are partly at the mercy of the city of Los Angeles. The most satisfactory solution of the difficulty is complete regulation of both politically owned and consumer owned utilities, a solution which must sooner or later be worked out if Western industry is to continue the marked development that the past few years has witnessed.

The Adjustment of Price to Meet Production Costs

DURING the progress of the war central-station companies, although hard pushed on account of the rising price of fuel and material of every kind, did the best they could to meet the interests of their customers and generally met rising costs by a coal clause or other temporary method of adjustment. On the whole, this expedient tided over the emergency fairly well; but now the question of fixed charges is very much to the front.

The central-station business is growing. It will grow faster in the future than it has in the past, and nearly every item of equipment is up in price with small prospect of reduction in the near future. Moreover, the rise in cost, let us say of transformers, is aggravated by the rising price of money. Companies that could borrow money at 5 per cent before the war now have to pay half as much again in raising a loan for necessary improvements and extensions. P. M. Lincoln points out in the current issue of the ELECTRICAL WORLD that while in steam plants the fixed charges are between 30 and 40 per cent of the total cost of production, in water-power plants they are likely to run from 80 to 90 per cent, thereby very forcibly emphasizing the importance of fair dealing with the fixed charges in transmission work. It cannot be denied that demand is a vital factor in the fixed-charge balance sheet of any consumer. We do not wholly agree with the theory that the amount of demand is the whole story, for in some instances the times at which that demand falls is of a great deal more consequence than its amount, and there are other factors of almost equal importance entering the situation. However, there is no question that the amount of demand deserves consideration. The question regarding the basis on which fixed charges of a growing plant should be computed is not to be answered quite so simply as here indicated. Speaking broadly, neither the pre-war cost nor the present cost is a fair basis for computation, because the present cost may affect a very small part of the equipment and the next decade may improve the cost situation very materially. We doubt now whether any commission would countenance charging a new customer on the somewhat exaggerated prices of the last year or two, while letting an old customer remain on a pre-war basis or charging a future one on some other basis. Probably the matter is best treated, like many other matters of a similar sort, by a general average of the costs.

The methods of determining the demand, which is commonly the biggest factor in the fixed-charge account against any particular customer, is somewhat important, and the special virtue of Mr. Lincoln's excellent article is that he points out a comparatively simple and straightforward way of getting at the demand on a kilovolt-ampere basis. As to the justice of making this the basis of demand we heartily concur. The method outlined by Mr. Lincoln of using the phase-shifting transformer with the standard wattmeter is from a practical standpoint very straightforward and simple. By this device the kilovolt-ampere can be directly measured to a very small error, while the power factor varies within wider limits than would generally be met in practice. From the standpoint of ordinary commonsense fairness the results are sufficiently satisfactory to suit any one not of litigious disposition.

If the precaution is taken of so adjusting matters that any small error committed by the instrument will be in the customer's favor, we do not see how any public service commission could in the least object to this scheme of operations. It is not quite so simple as would be the direct installation of a suitable kilovolt-amperehour meter, but in default of such an instrument it provides a substitute that ought to be acceptable. This whole matter of power factor, always troublesome, has assumed a more serious aspect on account of the enhanced present cost of providing the necessary equipment to meet the consumer's requirements, and it deserves therefore immediate attention, to which we hope Mr. Lincoln's paper will lead the way.

Significance of 1,000,000-Volt Tests

RECENT years have seen noteworthy advances in transformer construction, and designers have spoken with confidence concerning the possibilities for even further progress. The attainment of 1,000,000 volts, as announced in the ELECTRICAL WORLD last week, therefore occasions a feeling of satisfaction rather than of surprise. It is significant, however, that 1,000,000 volts was applied to conductors strung on insulators and that the phenomena of sparkover and corona formation were studied within this hitherto inaccessible region. While investigators of high-tension phenomena have anticipated the observations, it was nevertheless satisfying to find from these tests that the present accepted laws of corona and sparkover between spheres hold at the high voltage mentioned.

The necessity of a conductor four inches in diameter to prevent corona at 1,000,000 volts suggests that some ingenuity will have to be displayed if the "hoodoos" of the past—wind pressure and sleet load—are to be overcome on the 1,000,000-volt lines of the future. However, leading engineers have expressed the opinion that transmission distances greater than 200 miles will rarely suggest themselves. In fact, only recently 220 kw. has been seriously proposed as a standard figure for superpower systems and the longest transmission distances. The importance, then, of an available voltage four times as great must be found elsewhere than in the promise of longer distances of transmission. One obvious field of usefulness lies in the commercial testing of high-voltage insulation; but far more important is the opportunity offered for research and the acquirement through it of further knowledge as to the properties and behavior of all types of high-voltage equipment, leading to their ultimate improvement.

Further details of this important work will be awaited with interest. The announcement so far, while bearing the stamp of authority, is limited to the barest statements of fact. Doubtless more complete accounts in the language of the electrical engineer will soon be forthcoming.

The Biggest Single-Unit Generator Yet Constructed

A SINGLE generator with a rating of 60,000 kva. at 1,000 r.p.m. with provision for increase of speed by 50 per cent is indeed a Goliath. This is the rating of a generating unit now completed by the Siemens-Schuckert Company, which never before turned out a machine with much more than one-third this capacity. The structure, which was described in the ELECTRICAL WORLD for Sept. 10, is rather a peculiar one on account of the high speed, which brought the usual special difficulties in the way of ventilation owing to the necessary length of the laminations, in this instance 3 meters. In output this gigantic generator runs up to pretty nearly the high figure obtained with the composite turbo-generators. The total weight of the huge affair, including both rotor and stator, is about 250 metric tons.

The Allis-Chalmers Manufacturing Company is building some mammoth generators for the Mount Shasta hydro-electric plant, and in point of weight these, oddly enough, are almost exactly the equivalent of the German machine. Although running at one-quarter the speed, the rating is 35,000 kva., while the voltage is 11,000 against 7,000 in the German machine. On the whole, the American machine is as sensational in design as its foreign rival, considering speed and voltage.

It will be extremely interesting to watch the practical performance of these two types of machine, especially with reference to over-all efficiency. The question of how large a generator can be with real advantage under existing conditions as to frequency and rotative speed is constantly arising. Every new colossus gives additional useful information on this point, and we hope that detailed reports both from the Shasta plant and the Goldenberg plant, where the Siemens-Schuckert installation is being made, will be obtainable for the benefit of designing engineers.

Elimination of Confusion in Handling Bills of Material

ONE of the troublesome things encountered in a construction job is handling the material from the time it is ordered till its delivery on the job. Ordinarily the engineers who make the plans get out the bills of material, including enough information to enable the purchasing department to get quotations and finally place orders. It is necessary for the engineers to go through the process of looking up catalog numbers, page numbers and all the requisite information, but this is seldom recorded in such form that those who subsequently must handle the bills of material can do so without looking up at least a part of the data or going back to the engineers in order to procure the wanted information.

It is seldom that the purchasing force makes record of the data in complete form when they are looked up, and as a result there is more or less lost motion throughout the entire job in the handling of material purchases and accounting. A method of keeping the bills of material that will eliminate a large part if not all of this lost motion is described elsewhere in this issue by R. L. Kirk. The use of such time-saving methods as this means real efficiency in the handling of construction. It means not only more time devoted to work that accomplishes something, but also an increase in the efficiency of the routine worker caused by his release from the constant endeavor to avoid the mistakes to which individual peculiarities in designating and calling for wanted material render him liable. Mr. Kirk's plan puts all the information that must be looked up at the beginning in standard record form, eliminating any excuse for confusion.

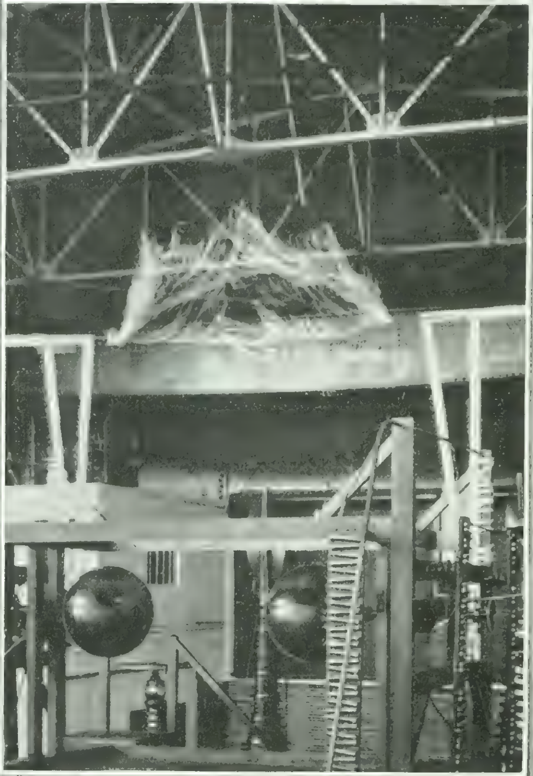
Prepare Your Equipment for Better Times Coming

OWING to the lack of attention which electrical equipment has received in industrial plants, chemical works, mines and other places in the last few years, and particularly during the past twelve months, it is imperative that this equipment be thoroughly examined while opportunity permits, otherwise it may break down when most needed. This is particularly true in those plants where the equipment has been allowed to fall into disuse because of the industrial slump. One abnormal condition for which electrical equipment should be examined with especial care is absorbed moisture. If this be present, pains should be taken to drive it off without overheating the insulation. While the procedure is more or less familiar to most engineers, the article this week on page 616, by R. F. Stokes, may be helpful because of the co-existence at this time of an extensive need for overhauling equipment and an opportunity to do so.

The commonest and perhaps the most satisfactory way of drying out a generator is to turn the machine over slowly by motor or otherwise, bringing up the voltage just enough to get a fairly stiff current with the winding short-circuited or connected through a water rheostat. Mr. Stokes notes one point which is sometimes forgotten—that it is not altogether safe to open the circuit even at low voltage before a machine is thoroughly dried out, since there may be inductive "kick" left in it quite sufficient to damage the windings, inasmuch as the current is likely to be quite as large as it normally is and may even represent an overload. It is always a safe play to cut down the current very greatly by the water rheostat before breaking it. Field coils are sometimes best dealt with by connection in multiple and supplying requisite current at abnormally low voltage. Transformers can generally be run short-circuited on very low voltage.

Induction motors present problems of their own according to the type of winding. If star-connected, one can get at the individual coils with comparative ease. A mesh winding is most easily dealt with by opening the mesh at some point and working on the windings in series.

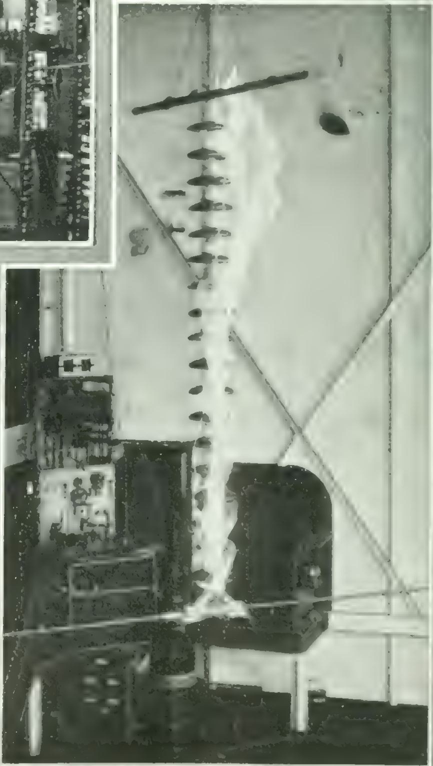
As a last desperate resort a machine can be dried out from the outside, boxing it in and using incandescent lamps or heating coils as a source. The operation of thus drying out windings is so slow, however, that we are inclined to think the operator is justified in going to considerable length to get the proper source of current before he resorts to the employment of any external method.



Tests at 1,000,000 Volts Have Confirmed Corona and Sparkover Laws at Hitherto Uninvestigated Potentials

THE important feature of the 1,000,000-volt tests conducted at the Pittsfield works of the General Electric Company last week was not the voltage attained, because this potential has been developed experimentally before. The achievement was in applying this voltage to conductors hung on ordinary disk insulators and in studying the hitherto unexplored realm between 250,000 volts and 1,000,000 volts and determining the laws which govern corona and sparkover at these enormous potentials. As reported by F. W. Peek, Jr., in last week's issue, no discontinuity was observed in the corona and sparkover voltage curves established for lower potentials. While the occasion is remote, if it ever arises, when potentials of the magnitude investigated will be required for transmitting power, the observations are extremely valuable in establishing a concrete basis for conducting further research at high potentials.

Some of the equipment used in the tests is shown in the accompanying illustrations. Above in the foreground are the sphere and needle gaps, the latter discharging at 1,000,000 volts. Back of the gaps and below them may be seen the top of the step-up transformer. In the illustration at the right is a string of eighteen insulators flashing over at 900,000 volts. Close observation of the conductor and hardware will show corona discharge. To prevent this it was determined that a 4-in. conductor or its equivalent would have to be used. With a string of twenty-two disks no arc-over occurred even at 1,100,000 volts.



Rates Should Meet Higher Production Costs

Coal Clause Takes Care of Increased Operating Expenses, but Demand Charges Also Must Be Increased to Balance Higher Plant Costs—Simple Wattmeter Connection for Measuring Kilovolt-Ampere Demand

P. M. LINCOLN
Consulting Engineer Lincoln Electric Company

INCREASED operating costs of electric service companies can logically be reduced by increasing the energy rate at which power is sold. A convenient and reasonable method for accomplishing this result—and one much used in practice—is to incorporate a coal clause in the power contract, by which the energy rate varies either up or down depending upon the price of coal. The necessity of increasing the demand portion of power rates is not so immediately apparent as that for increasing the energy portion, but must eventually be recognized as soon as the increased cost of equipment has had time to make its effect felt. The demand portion of a power rate should be based on a measured quantity and not inferred from the installed equipment. Power factor should be recognized in the demand portion of a power rate. A method of applying such a rate recognizing power factor is suggested in the following discussion.

Virtually all rate makers in the past have recognized two major divisions in rates for electric service. One of these major divisions recognizes the operating costs and the other the fixed charges. It is generally recognized that operating costs are, as nearly as may be, proportional to the amount of energy delivered. Fuel, for instance, is the largest single item in these costs, and the amount of fuel required to serve a given consumer is nearly in proportion to the energy consumed. When the cost of fuel advances it is perfectly logical—as has been done—to advance the price of this major division of the rate. It is also perfectly logical to make the amount of this advance proportional—as nearly as may be—to the kilowatt-hours consumed. The "coal clause" accomplishes this object as equitably as possible. A slight arbitrary advance in the price per kilowatt-hour might be justified on account of the increase in the cost of operating labor and supplies, but these items are so small that they are easily covered by a slight variation in coal cost. It is unfortunate that some of our utility commissions have ruled against the coal clause. Such an adverse ruling shows that these commissions have been governed by considerations other than fundamental engineering considerations.

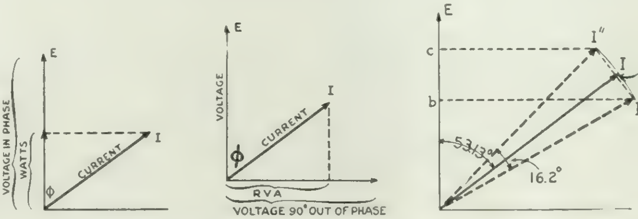


FIG. 1—WATTMETER CONNECTIONS FOR INDICATING WATTS (A), REACTIVE VOLT-AMPERES (B) AND VOLT-AMPERES (C)

While this method serves very satisfactorily for taking care of the variation of those costs that vary with the amount of energy consumed, it does not and cannot recognize equitably those costs which are largely independent of the energy consumed but which vary with the amount of equipment which must be allocated to any individual user. This class of costs is provided for in the second major division into which the rate for service is usually divided, usually called the "demand" charge. It is to this major division of demand charges that the utility must look for compensation for the item of fixed charges in its costs. It is obvious that the equitable allocation of fixed charges among all consumers is not in proportion to the amount of energy used but to the amount of equipment that must be provided for any given consumer. In other words, load factor must be considered in any equitable allocation of costs among the consumers of power.

It is of interest to note the degree by which the item of fixed charges influences the cost of water power as compared with steam. In steam plants the item of fixed charges makes up between 30 and 40 per cent of the total cost of the power, while in water-power plants it constitutes from 80 to 90 per cent of the total. In steam plants, therefore, the energy portion of the rate is somewhat more important than the demand portion, while in water-power plants the importance of the demand portion of the rate overshadows the energy portion many times. In a water-power plant virtually the only thing that determines the cost of serving a given user is the value of the equipment that must be allocated to render him service.

DEMAND CHARGES MUST RISE FOLLOWING INCREASED COST OF PLANT

An examination of the rate increases during the last few years shows that while some changes have been made in the demand rates in some localities, such increases have not been general. Undoubtedly the reason for this is that in most cases the same plant is being used now as before the increase in plant cost went into effect, and that in general public utilities either have not been permitted to raise their demand rates or have not thought it wise to do so. There is a broad economic question involved in this matter. In brief, the question is this: Shall the public utility collect a demand rate based on the price paid for its plant before the war or shall it be on the basis of the price it would have to pay for that equipment today? Whichever way we answer that question today, we must recognize that the increase in equipment cost must eventually determine this question. The power we use today is perhaps developed from equipment purchased five or more years ago, but the power we use some years hence must be developed from equipment purchased today. We may postpone this increase in demand rates, but we cannot deny it eventually.

Customer's Demand Should Be Accurately Measured

At least one-third of the cost of power consists of fixed charges. It is this portion of the costs that is expected to be covered by the demand charge. It is highly important, therefore, that this part of the consumer's bill be accurately determined, and this is particularly true in water-power plants. In the past, owing to the absence of suitable instruments for the determination of demand, it has often—not to say usually—been the custom to estimate this part of a consumer's bill by basing it on the amount of equipment he had installed. It has been customary to aggregate the nameplate rating of all the motors that a consumer had and then base the demand charge on some arbitrary proportion of this aggregate. Some of the objections to and inconsistencies of this practice should be pointed out. In the first place, it puts a penalty on individual motor drive. It is admitted that the aggregate capacity of the individual motors required to drive a hundred separate machines is larger than that of a single motor to drive them all. On the other hand, the losses in the belting and shafting for individual drives will in general be much less than if all are driven by belting and shafting from a single motor. A system of charging for demand that puts a penalty on the individual motor drive is—to say the least—short-sighted.

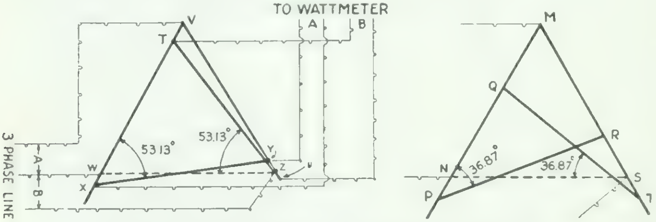


FIG. 2—PHASE SHIFTING TRANSFORMERS FOR MAKING WATTMETER RECORD VOLT-AMPERES

A—For use on load with 60 per cent power factor. B—For load with 80 per cent power factor

A second vital objection to the method of estimating demand from horsepower ratings of the motors lies in the moot question of just what is meant by horsepower in a motor. The horsepower rating of a motor is necessarily tied up to the temperature at which that horsepower is developed. The market today provides standard lines of motors at 50 deg. rise, 40 deg. rise and 35 deg. rise. A 50-deg. motor is supposed never to carry more than its rating, while the lower temperature rise machines will carry 25 per cent overload for at least two hours and much larger overloads for shorter periods. If the practice of estimating demand rates from horsepower ratings is to continue, cognizance must be taken of the temperature rating of the motors used. And then there are some types of load where horsepower rating has no meaning, such as on elevators and similar apparatus. The man who can bring order out of that chaos and estimate an equitable demand rate based on nameplate ratings is wiser than most electrical engineers. After all, it is a consumer's actual use of a demand—it is the actual draft he makes on the system supplying him—that should determine his demand rate, and not his potential possibilities. Demand rate should be a *measured* and not an estimated or inferred quantity.

Another much needed modification in the application of demand rates is the necessity of recognizing power factor therein. The capacity of the transformers, transmission line, distribution circuits and generators to supply a given consumer is fixed by his kva. and not by his kw. The consumer that takes his demand at 100 per cent power factor should not pay the same rate as another that has a 50 per cent power factor, since the equipment needed in the former case is only one-half as great as that needed in the latter. The best cure for this evil is to recognize power factor in demand rate, so that the user of power who makes a proper application of motors to his service can earn a bonus in his power demand rate. Most contracts for power have a clause recognizing power factor, but up to the present this recognition has been largely theoretical only, the reason being that there is no commercial method of measuring kva. of demand. Almost all commercial methods of measuring either energy or demand recognize watts and watts only, and before we can recognize *by measurement* the kva. of demand there is not much use in incorporating a power-factor clause in power contracts.

Simple Scheme for Measuring Kva. Demand

This opportunity is taken to outline and pass on a method of recognizing power factor that has already attracted considerable favorable attention. The method has many points of interest to those engineers who are charged with the responsibility of making rates for power service. It is not fundamentally new, but the writer has no knowledge of the exact modification herein suggested having been proposed before, nor of the suggested equipment having previously been offered.

The standard wattmeter of commerce, whether it be indicating, integrating or demand, is an instrument usually of high accuracy. The quantity measured is $IE \cos \phi$ where E is the voltage, I the current and ϕ the phase angle between E and I, as shown vectorially at A (Fig. 1). If now we should apply to the same wattmeter a voltage of the same value but shifted in phase by 90 electrical degrees, the quantity measured would be $EI \cos (\phi \pm 90^\circ)$ equals $\mp EI \sin \phi$. This is shown diagrammatically at B (Fig. 1). The quantity $EI \sin \phi$ is termed "reactive volt-amperes."

If now the voltage applied to a standard wattmeter which has been shifted in phase by *any* arbitrary angle, θ, the instrument will then measure $EI \cos (\phi \pm \theta)$. The double sign for the angle is used advisedly since this sign will depend upon the direction of angular phase shift as well as the direction of phase rotation in the polyphase meter to which it is applied. If θ be chosen equal to ϕ and of the proper phase rotation, the quantity $(\phi - \theta)$ will become zero and the new quantity measured will be volt-amperes, volt-ampere-hours or volt-amperes of maximum demand, as the case may be. It is also true that there may be a considerable error in choosing the angle θ without a proportionate error in the volt-amperes measured.

This is shown at C (Fig. 1). Suppose a circuit has a power factor of 60 per cent. This corresponds to a phase angle of 53.13 deg. between the current and voltage of the circuit shown. If a phase shift of 53.13 deg. is applied to the voltage of a wattmeter measuring this circuit, the quantity then measured will be volt-amperes. Also, there can be a shift of 8.1 deg. either way from the 53.13 deg. line assumed before the error of measurement becomes more than 1 per cent. The phase of the current may shift from I' to I'' without causing an error greater than that of the small quantity a. The corresponding change in power factor is from b to c.

In the following table these limits of error are given for two definite degrees of phase shift. If a phase shift corresponding to the column headed "0" is applied to any wattmeter, the error of measurement remains within the limits of the other columns so long as the power factor remains within the limits indicated in these columns:

Error, per cent	5	2	1	0	1	2	5
Power factors	0.947 0.820	0.903 0.747	0.877 0.707	0.80 0.60	0.708 0.481	0.665 0.429	0.573 0.320

For instance, if phase shift of 53.13 deg., corresponding to 60 per cent power factor, is applied to the voltage, the wattmeter will read volt-amperes with an error of less than 1 per cent as long as the power factor remains anywhere between 0.481 and 0.707. The error will then be less than 2 per cent for any power factor between 0.429 and 0.747 and less than 5 per cent for any power factor between 0.320 and 0.820. The range of power factor thus is very large for a comparatively small error. If, therefore, the power factor of a load is known in advance and is fairly uniform, it is possible to measure the volt-amperes with a reasonable degree of accuracy by means of any standard wattmeter and a phase-shifting voltage transformer. Unfortunately, the average power load does not possess a high degree of uniformity in its power factor as power factor varies over wide limits depending upon the load. However, the power factor that exists in a given plant at the time of its maximum demand can usually be determined with sufficient exactness to permit its maximum demand in volt-amperes to be determined by this method with an entirely satisfactory degree of accuracy.

ONLY DEMAND PORTION OF BILL REQUIRES CORRECTION

The way to correct bad power factor is to make it affect the demand portion of the user's bill, and this can be done by the method outlined. It should be particularly noted, however, that only the demand portion of the bill for power should be subject to correction for power factor and not the energy portion. There is no defense for increasing the energy portion of the bill on account of bad power factor.

Another thing that might be noted is that in applying the foregoing method any error in assuming the power factor of maximum demand results in a reduction of the demand rather than an increase. The final result therefore is a smaller bill for service than where the true volt-amperes of demand are used as a basis for the bill. This is the "safe" direction for an error, if any is to be made—the user cannot attack the method on the ground of any possible over-registration of his demand.

The practical man will ask: How can the methods outlined be applied in actual practice? For three-phase circuits it is possible to obtain phase shifts of 30 deg., 60 deg or 90 deg. by proper manipulation of the line voltage connections, provided that the neutral connection is available. On a two-phase circuit only a 90-deg. shift is available. To obtain other degrees of phase shift it is necessary to use some form of phase-shifting transformer. Such a transformer is not a difficult thing to build, and a few words concerning its possibilities may be in order.

PRACTICAL METHODS OF METERING POWER FACTOR

The internal connections of a phase-shifting transformer to give phase shifts corresponding to 60 per cent power factor and 80 per cent power factor are shown diagrammatically in Fig. 2 (A and B). These transformers are for application to any standard three-phase circuit. For a two-phase circuit the connections must be modified. Referring to A (Fig. 2), the three-phase line circuit is connected to WVZ, WV being one transformer and VZ another. Taps are then made on the windings so that the voltage XY is shifted 53.13 deg. from VW and is of the same value as VW. The other phase element of the wattmeter voltage is given a similar phase shift as indicated. Diagram B indicates the method of obtaining the phase shift corresponding to 80 per cent power factor. The whole basis of the method is the existence of a fixed 60-deg. phase relation between transformers XV and VZ. So long as this phase angle remains at 60 deg. the results are as indicated and are independent of load unbalance. If the phase angle departs from 60 deg., the results will be somewhat in error, but even then the error is not large. For each degree of departure from 60 deg. between the two transformers the resulting error is approximately one-half of 1 per cent, being plus for phase angles greater than 60 deg. and minus for less than 60 deg. In any commercial three-phase system the departure from the 60-deg. angle between phases is not great enough to prevent the application of the method.

By the use of such a phase-shifting transformer, therefore, and any standard demand wattmeter it is possible to measure kva. of demand within a 2 per cent error at any power factor between 43 per cent and 90 per cent. This range will cover virtually all cases arising in usual power service.

One transformer made for this purpose is a small affair weighing about 8 lb. or 9 lb. (3.6 kg. or 4 kg.) and is applicable to any standard wattmeter. Tests carefully made have shown that the sample transformers are entirely accurate both in the matter of the angle of phase shift and regarding the value of the derived voltage obtained.

Direct Current Recommended for Dutch Electrification

THE commission appointed in January, 1920, to study the desirability of electrification of all railways in Holland has prepared a report which, it is understood, not only favors such a scheme but recommends the use of 1,500 volts direct current. It is also recommended that the electrification be made in connection with the proposed unification of electric light and power service throughout the country. There is no indication, however, that this work will be undertaken in the near future, according to Consul-General George E. Anderson, who sent this information.

Method of Keeping Bills of Material

System Primarily Intended for Electrical Construction Jobs, Although Modifications Can Be Readily Adapted to Any Kind of Engineering Work

By R. L. KIRK

DESPITE the careful investigation which accounting and cost records receive at the hands of engineers and executives, it is surprising that little or no attention is directed to the methods of keeping the bills of material which constitute such an important part of nearly all engineering. Some such scheme as outlined below will be found extremely effective. This method is intended primarily for electrical construction jobs, but modifications of this system can readily be adapted to almost any kind of engineering work.

At the beginning of a job a schedule for the classification of material should be made out in some such manner as follows: (a) Iron conduit, elbows and couplings; (b) condulets, boxes and fittings; (c) steel and iron work; (e) bolts, nuts and screws, etc. A separate bill of material sheet should be started for each class.

One of the chief advantages of the alphabetical system is the ease with which material may be subdivided under classified heads. This is made possible by the use of two or more letters for each item, the first indicating the class and the second (third and fourth if any) the individual letter. This groups all material of the same nature under one head, which not only reduces the time required by the designer in making up an individual bill of material for a drawing, but is of material assistance to the engineer and purchasing department in handling the orders.

Obviously, after the single letters of the alphabet have been exhausted, it will become necessary to repeat the letters, thus: x, y, z, aa, ab, ac, etc., which can be carried to three or four places if need be. In doing this, however, care should be taken not to have the item letters spell words, since such words as "cap," "nut," etc., might easily be taken to indicate a pipe cap or a nut for a bolt. This difficulty can be eliminated by omitting all vowels from the second letter of the series. Thus "bat would become "bbt," "ham" "hbm," "cow" "cbw," etc. The letters i, l, o and q should be entirely omitted, as when printed i and l may be mistaken for the numeral one, o for naught, and q for g.

For all jobs of any consequence a master bill of material is essential. This should show at all times the various items and quantity used on the job to date and should be so arranged that each item is completely described, in order to eliminate constant reference to catalogs to determine the exact physical nature of an item, entailing duplication and needless waste of time. All material used on the various drawings should first be entered in the master bill, from which all individual bills of material should be made. With this in mind the following method was developed, which seems to meet all the above requirements.

Two forms, shown in the illustrations, are required. These should be printed on standard 8-in. x 10½-in. letter-size sheets, with the horizontal lines parallel to the long dimension of the paper. Punched holes should be provided at the top of the sheet to allow binding in loose-leaf folders. It is well to have these forms printed on tracing cloth in order that prints may be made from time to time. Vellum can also be used to advantage, but this should have cloth reinforcing tabs at the holes to prevent tearing from the binder. The printing should be on the reverse side of the sheets to allow changing the entries without erasing the lines. All entries should be made in pencil until the job is finished, at which time they may be inked in. This allows changes from time to time.

In starting a master bill of material one or two sheets of Form I followed by as many Form II sheets as there are classes should be bound together in a separate binder. Many companies keep a "job book" for each job, in which are kept copies of requisitions, orders, various instructions and letters, together with the master bill. However, it is better to keep the master bill separate in order that it may be used independently of the job book. This practice will often avoid delay, and the time thus saved will many times pay for the cost of an additional binder.

The purpose and need of the various columns, together with the method of making entries, are as follows:

NATURE OF FORM II AND METHOD OF USING

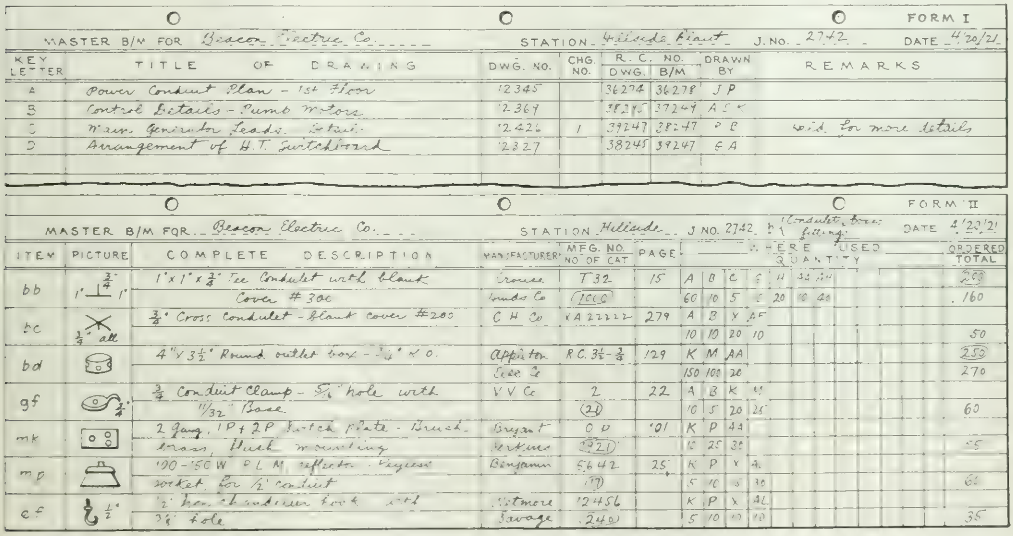
The Heading.—This can be made to meet the individual requirements of the different companies, but should give the name and number of the job, the location, date and classification of material to be entered on the sheet.

Item.—Here are entered the item letters in alphabetical order, always two or more, the first the class letter, the others the individual letters. Thus, for conduit, bb, bc, bd, bf, etc. (omitting the vowels as the second letter).

Picture.—In large jobs the items under any class soon fill several pages, so that if only a description of the article is given, it is necessary to read and assimilate each entry in order to determine if a given article has already been assigned an item letter, which on large jobs requires considerable time. However, as the mind can grasp a picture of an article much quicker than it can a written description, it is advisable to sketch a simple picture of the item. It then becomes an easy matter to run down the column until the article is found. If in doubt as to the picture, reference should be made to the next column. In some cases, such as "conduit," "wire," etc., the picture is not needed. Only simple, easily made pictures should be used, as shown in the illustration, but all important information should be recorded. Thus for item gf, a ¾-in. conduit clamp, it is not sufficient to give only the size of the pipe, but the size of the bolt hole and the thickness of the base should be given, for if this information were omitted it would be necessary to refer to the catalog in order to determine the size of bolt required each time the item was used. This column and the next should give all the essential details in order to eliminate the constant reference to catalogs.

Complete Description.—A complete description of an item should be entered here, not simply "outlet box," but "4-in. x 2-in. round outlet box, 1-in. K.O." Again, "condulet," even with the catalog number "XA22222," means very little to one unfamiliar with these fittings, yet "cross condulet, bottom outlet, ¾-in. all," tells the whole story.

Manufacturer's Number; Number of Catalog.—On the top line is entered the manufacturer's number as given in the catalog. On the second line the number or date of the catalog should be entered, inclosed in a circle to prevent any possibility of mistaking it for the manufacturer's number. This is advisable in order that there be no misunderstanding as to the article and also in order that it may be readily found in the proper catalog.



FORM I

MASTER B/M FOR Beacon Electric Co. STATION Hillside Plant J. NO. 2742 DATE 4/20/21

KEY LETTER	TITLE OF DRAWING	DWG. NO.	CHG. NO.	R. C. NO. DWG.	R. C. NO. B/M	DRAWN BY	REMARKS
A	Power Conduit Plan - 1st Floor	12345		36274	36278	J P	
B	Control Details - Pump Motors	12369		38245	37249	A S K	
C	Main Generator Leads. Detail	12426	1	39247	38247	P B	Void for more details
D	Arrangement of H.T. Switchboard	12327		38245	39247	G A	

FORM II

MASTER B/M FOR Beacon Electric Co. STATION Hillside J NO. 2742 B{ Condulet, boxes; fittings. DATE 4/20/21

ITEM	PICTURE	COMPLETE DESCRIPTION	MANUFACTURER	MFG. NO. NO OF CAT	PAGE	WHERE USED QUANTITY							ORDERED TOTAL
bb	1" ¾" 1"	1"x1"x¾" Tee Condulet with blank	Crouse	T32	15	A	B	C	F	H	AA	AH	(200)
		Cover #30C	Hinds Co	(1000)		60	10	5	5	20	10	40	160
bc	¾" all	¾" Cross Condulet - blank cover #200	C H Co	XA22222	279	A	B	X	AF				
						10	10	20	10				50
bd		4"x3½" Round outlet box - ¾" K O.	Appleton	R C. 3½-¾	129	K	M	AA					(250)
			Elec Co			150	100	20					270
gf	¾"	¾ Conduit Clamp - 5/16" hole with	V V Co	2	22	A	B	K	W				
		11/32" Base		(21)		10	5	20	25				60
mk		2 Gang, 1P+2P Switch plate - Brush-	Bryant	O D	101	K	P	AA					
		brass, flush mounting	Perkins	(1921)		10	25	30					55
mp		100-150W R L M reflector - Keyless	Benjamin	5642	25	K	P	X	A				
		socket, for ½" conduit		(17)		5	10	5	30				60
cf	½"	½" hex. chandelier hook with	Whitmore	12456		K	P	X	AL				
		⅜" hole	Savage	(240)		5	10	10	10				35

FORMS THAT PERMIT CONSIDERABLE SAVING IN TIME WHEN KEEPING BILLS OF MATERIAL

Page.—As the checker, engineer, purchasing department and often various designers will be required to refer to the catalog for each item in order to make the proper check, the page number on which the article is listed will be of material assistance. The time thus saved in a week will often pay for the work.

Where Used; Quantity.—An effective master bill should show the quantities of an item used on every drawing and identify the drawings on which they are used. Some companies provide a vertical column in which they put the drawing numbers on which the item is used followed by the quantity. This means that each item must be spaced many lines apart in order to allow for future entries. As this is only a guess at the beginning, it frequently means that too much or too little space is allowed. If the latter, it means rewriting the sheet with the proper spacing. The method used on Form II allows for twelve drawings on one line, and in case it is estimated that an item will be used on more than this number of drawings, one or two extra lines should be left open.

When the designer is ready to make up an individual bill of material for a drawing, he turns to Form I and enters thereon the title and number of the drawing. The corresponding key letter is used on Form II to represent this drawing, and is entered in the top space of this column, with the quantity used in the space below. The designer making the original entry may always change an item provided that it has not been used on another drawing in the meantime, which would be indicated by another key letter entered in the column. In this case the designer should erase his key letter and take out another item letter. In checking the individual bills of material against the master bill, it will be found much easier to carry the key letter in mind than the drawing number of four or five figures. Thus, if the drawing No. 36,483 has the key letter H, simply look for the item in question and note the quantity entered under H. This same letter H is used throughout the checking of that particular bill of material.

Ordered; Total.—At the end of the job the total quantity is placed in the bottom space. If any material is ordered before the drawings are completed, the amount is entered in the top space inclosed in a circle. Thus it is possible to tell at a glance, as the job progresses, whether the amount ordered is sufficient, and the quantity which is left over at the end. The requisitions and orders for material should also be kept in the master bill folder, in order that they may be checked at any time.

CHARACTER OF FORM I AND METHOD OF USING

Heading.—Same as in Form II.

Key Letter.—These should be capital letters in order to differentiate from the item letters and should be used in a similar manner, except that no letters should be omitted.

Title and Drawing Number. — Explained under Form II.

Change Number.—This column records the change number of the drawing (if any) on which the bill of material is drawn.

Record Card Number; Drawing; Bill of Materials.—Enter here the record card numbers on which time is charged when working on the drawing and its bill of material. This column can be made to meet the requirements of the individual company.

Drawn By.—The designer's initials should appear here in order that it shall be known to whom to turn for information relative to any item.

THE INDIVIDUAL BILL OF MATERIAL

The individual bill of material for each drawing should be made up from the master bill, but as these bills are not required to convey the complete information recorded in the master bill, they are of a much simpler nature. This bill of material need give only the item, description (not nearly so much detail as given in the master bill), the manufacturer, catalog number (manufacturer's number), quantity and remarks. Such columns as picture and page may be added, or some of the others omitted if desired. Some concerns prefer to place the bill of material on the drawing, while others issue it on a small separate sheet. Much can be said of both methods, both pro and con, although it is believed that the former has a slight advantage inasmuch as with this system only one print need be handled at a time, which is particularly desirable in the field. In any event, the master bill should be the key to the whole job, and except in rare cases all material should be ordered from this bill.

110-Kv. Transmission Line on Wood Poles

Narrow Right of Way Limited San Joaquin Power Company to Choice Between Wood and Steel Poles—Wood Cost Less Than Half Steel—Future Duplicate Line Will Insure Good Service—Cost of 72-Mile Line

By L. J. MOORE
Electrical Engineer San Joaquin Light & Power Corporation, Fresno, Cal.

IN DESIGNING the transmission line which is to carry the power from the San Joaquin Light & Power Corporation's Kerckhoff power house into the San Joaquin Valley one of the most important considerations was that of right-of-way. The line must of necessity be constructed for the greater part of its length through the most highly cultivated part of the valley. Private rights-of-way then would naturally have cost a large sum of money, both on account of the high value of the land and on account of the large acreage being owned by foreign-born citizens, many of whom practically refused any concession. The only alternative left was to build along public highways, which meant structures with very narrow bases, or, in other words, steel or wood poles.

A cost comparison between wood and steel pole lines showed that, for conditions under which the line was to be built and for a line voltage of 110 kv., the former would cost $69.50 per mile, against $148.60 for steel. Furthermore, with sufficiently heavy poles ample mechanical strength could be provided. Although in the matter of service wooden poles are not equal to steel, still the former has the advantage economically, and a duplicate line which will be required in the future will permit construction or maintenance changes with substantially no interruption to service, irrespective of the choice of pole. For this line 60-ft. (18-m.) wooden poles spaced 587 ft. (180 m.) were chosen to support 266,800-circ.mil stranded aluminum conductors with wishbone cross-arm construction.

The construction of a high-tension power line on poles immediately raised the problem of clearances between conductors. Ten feet (3 m.) clearance was considered quite feasible, but any more than that was considered rather dangerous on account of the fact that it would make the poles topheavy and would further hang the conductors too great a distance into the private property along the highway. The matter of clearance in such construction then worked out toward a medium high voltage line.

The location of substations and sources of power along the line also favored the more moderate voltage. From the accompanying map it will be seen that the company had already in operation a large ring system of 66,000-volt lines, approximately covering the San Joaquin Valley. It will be noted further that a line running practically due south from the Kerckhoff power house would cut across this ring system, dividing it very closely in half and permitting step-downs to 66 kv. at very advantageous points. A substation on the line east of Fresno and provided with the necessary outgoing 66-kv. line to Fresno and Reedley would effectivelty serve Fresno, the largest city in the valley, as well as the heavy irrigating load thereabouts. Another step down at Corcoran would carry the Coalinga oil

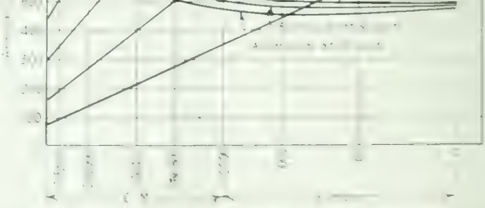


FIG. 1—APPLICATION OF KELVIN'S LAW TO DETERMINE ECONOMIC CONDUCTOR

[illegible]

fields and the 66-kv. line to the coast. Another step-down station at McKittrick would adequately care for the oil field loads in that district. Stations at these locations would allow the old ring system to be operated in sections, so that in no case would the economical transmission distance for 66 kv. be exceeded and the new line would operate as a high-tension bus for the system, provision being made for incoming lines from the company's Kings River plants to connect at the substation east of Fresno. To take care of the north district around Merced an extension of the high-voltage bus is contemplated to extend west from the Kerckhoff plant and reach as near the center of distribution as practical, there stepping down, as in the other cases, to 66 kv. and feeding into the old network of lines of that voltage. Power from the Bakersfield steam plant would enter the high-tension line through the station at McKittrick, thus providing at least three points at which power would be fed into the line, with more than that many points where power would be distributed from the line, and in no case would the actual straightaway distance of transmission greatly exceed 70 miles (110 km.), with the steam plant operating. The short distance of transmission thus obtained was another reason for adopting a voltage only moderately high.

The altitude on the line is practically sea level; the highest point reached from the plant south is about 1,200 ft. (360 m.), and that for a very short distance. Therefore, the best possible corona conditions existed. A study of all conditions showed that by using stranded aluminum conductors a cross-section could be obtained which would be safe from corona and at the same time have the economical carrying capacity for the estimated load of the plant. This was obtained by figuring the plant at 30,000 kw. maximum with a load factor of 70 per cent, using a line 135 miles (217 km.) long with a voltage of 110,000. From the discussion already given of the location of incoming feeds and distribution points it is evident that much more than 30,000 kw. can be handled over the line without exceeding the economical current density.

With 110,000 volts chosen as the transmission voltage, a line was designed using 266,800 circ.mil all-aluminum conductors on 60-ft. (18-m.) steel poles, spaced 587 ft. (180 m.) apart, or nine to the mile. A loading of 8.75 lb. of wind per square foot (0.6 kg. per sq.cm.) without any ice or snow was used in the calculations However, the question arose of using wood poles of the same length instead of steel, leaving the spans the same. With the same conductor and wind pressure it was found that a 60-ft. wood pole with a 9-in. (23-cm.) top and 15-in. (38-cm.) diameter at the ground line had a factor of safety of 3.10 against horizontal loads and of 10 as a column. When the fact is considered that the Weather Bureau records of Fresno for a period of over thirty years show a maximum of 4.5 lb. per sq.ft. (0.3 kg. per sq.cm.) of wind pressure, the factor of safety is then seen to be more nearly 6, which provides ample safety. As a matter of fact the poles as installed ran near to 20 in. (50 cm.) in diameter at the ground, so the line is safe enough from overturning if the setting is secure. All poles in straightaway work were set 8 ft. (2.4 m.) in the ground and all dead ends and corners were set 9 ft. (2.7 cm.) in the ground. As a check on the depth of setting, all poles were stamped with the company's initials at a distance of 10 ft. (3 m.) from the bottom. The distance of this mark out of the ground is a direct indication of the depth of setting.

As to the economy of wood poles as compared to the steel poles, the following figures are given:

The lowest priced satisfactory steel pole, set in place, would have cost, using July, 1920, prices, $148.60. This includes a concrete base. A creosoted wood pole installed would cost $69.50, showing a saving of $79.10 per pole. This saving at 7 per cent interest compounded annually would amount to $306.12 at the end of twenty years. From the past experience of this company, and the opinions expressed by others, creosoted wood poles should show an average life of about twenty years. The interest alone on the money saved in this particular instance would amount to $227.02 in twenty years. This is 3.26 times the original cost of the wood pole installed, and it is thus seen that, even if poles practically trebled in cost in that time, it would still be possible to replace them with the interest on the money saved. At the time of construction the difference between wood and steel was even greater than that here indicated because wood poles at that time cost about 50 per cent of what they do today. The increase in the cost of steel, however, has not been so great.

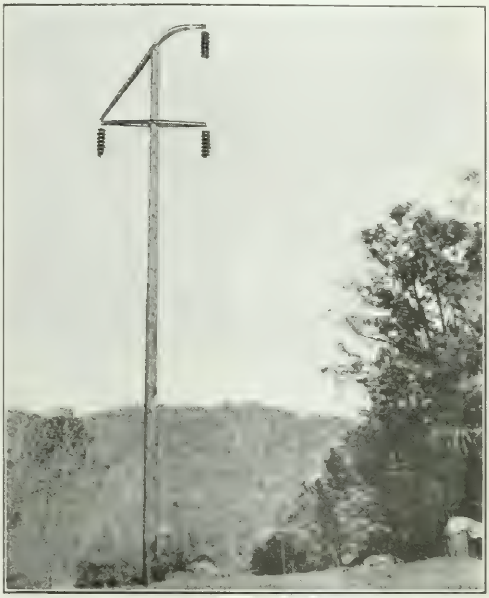


FIG. 2—INEXPENSIVE POLE LINE FOR 110,000-VOLT TRANSMISSION

This line conveys the output of the new Kerckhoff power development to the chief distributing points in the company's territory. The cedar poles are creosoted at the base.

The wood poles show greater mechanical strength when they are new than the steel pole which was considered. This is as it should be, since the rate of deterioration of wood is much greater than of steel. However, it shows an angle in the matter of choosing between the two materials which must not be overlooked. If the steel pole is to compete with the wood pole in price it must be designed with as small factors of safety as are at all safe for the individual installation in mind. Wood poles as a rule have larger factors of safety than necessary, especially where the conductors used are medium or small in size. It is often possible then to increase the size of conductor on an existing wood pole line without any danger whatever, whereas the same procedure on a steel pole line might not be allowable on account of exceeding the mechanical strength of the supporting members. In distribution work it is often necessary to hang a bank of transformers on a pole already installed in the line. If the pole is of wood the chances are that the procedure is entirely safe, but if it is a steel pole the loading must be carefully calculated and the strength of the pole compared with the result to see whether or not it is necessary to install a heavier pole. From a standpoint of service, it is no doubt true that a steel pole is the better. Its life is, of course, longer than that of a wood pole, and if this is twice as long it naturally holds that the interruptions to service for the changing of supports would be not over one-half the number in case of steel as of wood. However, in the particular instance herein described it is felt that the line as constructed is not large enough to handle the ultimate power transmission of the company and that at least a second one of the same capacity paralleling the first in route, as near as possible, must be constructed sooner or later. It is hoped to carry this line through the same substations as the first and to install balanced relay protection between the two in all sections. This will practically eliminate the interruptions from ordinary cases of trouble, and the fact that the line is constructed in duplicate will make it possible to change poles when necessary without interruption to service. This will be possible, too, in most of the sections when the new Kings River plants are brought into the line at Sanger and the new steam plant at Button Willow is constructed and the line looped through it, because the supply points will be so distributed along the line that sections can be taken out without separating a substation from one or the other sources of supply. It is possible, therefore, to maintain practically continuous service even though replacements will become necessary at some future time.

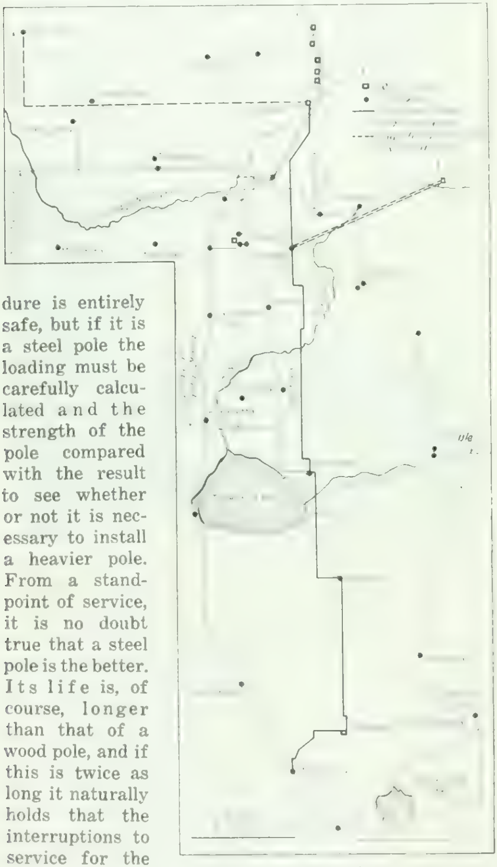


FIG. 3 — THE NEW 110-KV. LINES CONSTITUTE A BUS DIVIDING THE COMPANY'S 66-KV. TRANSMISSION RING IN HALF

In methods of making calculations of transmission line economics practically all writers agree on considering the conductor only, or rather that the price of conductor is the only variable in the equation. This may be true where tower lines on private rights-of-way are considered, but for transmission lines on single poles along public highways the cost of supports must also be variable. The 110,000-volt line described in this paper shows the lowest factor of safety against horizontal loads, and if the size of the conductor were increased and the length of spans left the same the line would be weak against horizontal loads. The supports must be spaced more closely then, or a different type must be used. Closer spacing means more insulators and the cost per mile of the line would show a much greater increase than that caused by the increased size of the conductor alone. "A" frames or "H" frames could be used and would keep the number of insulators down, but this would require at least one of the poles of the frame to be placed on private property, and thus the right-of-way question is immediately raised.

In making the economic calculations for this line, then, estimates were prepared on the costs of 1 mile of line using different sizes of aluminum conductors and varying the pole spacing in line with the discussion just given. Then the annual charges per mile of line were calculated on the basis of 9 per cent interest, 4 per cent depreciation and 2 per cent maintenance and the results are plotted against the annual cost of the power lost per mile of line at 5.25 mills per kw.-hr. Then, according to Kelvin's law, the line which shows an annual charge equal to the annual cost of power lost, or, in other words, the line indicated by the crossing of the curves of annual cost and the power lost for the given load, is the most economical line. It will be noted from the curve sheet here shown that with an aluminum conductor of 266,800 circ.mils cross-section, the economical load is 20,000 to 21,000 kw. at 100 per cent load factor and a power factor of 85 per cent lag, which is roughly the same as 30,000 kw. at a 70 per cent load factor. The critical disruptive corona voltage for that size conductor at sea level at a temperature of 120 deg. F. is approximately 130,000 at a spacing of 10 ft. between conductors. It was then chosen as being the most economical conductor for the load as well as being safe from corona at the operating voltage of 110 kv.

The accompanying table shows the segregated costs for 72 miles (116 km.) of the Kerckhoff line without the customary 15 per cent overhead. The standard spans are 587 ft. (180 m.), but in one or two instances spans up to 700 ft. (213 m.) were made on single poles by guying span poles all four ways. A few longer spans were made on "A" frames. Spans were shortened to 200 ft. (60 m.) over railroads. Poles were raised with a gin wagon in the valley country, but 15 miles (24 km.) of the line passes through foothill

TABLE—ITEMIZED COST OF 72-MILE, 110-KV LINE IN SAN JOAQUIN VALLEY

	Survey:	
1	Cost of labor and expenses, including transportation, etc., making survey	$2,905 89
2	Right-of-way, cost of salaries and expense securing rights-of-way, easements, etc	4,958 24
3	Clearing right-of-way, cost of labor and expense, including material used clearing right-of-way	13,384 02
4	Digging pole holes, cost of labor and expense, including material digging holes	11,708 19
5	Delivery of poles and cross-arms, cost of labor and expense	6,682 20
6	Delivery of wire and insulators, cost of labor and expense	3,509.55
7	Framing poles, cost of labor and expense, including framing material	66,925.29
8	Setting poles, cost of labor and expense setting poles, including material	29,056 76
9	Guying, cost of labor and expense, including material	5,426 22
10	Stringing wire, cost of labor and expense stringing wire, including material	86,309.27
11	Pulling up and tying in, cost of labor and expense	5,530 22
14	Office salaries and expense, including office supplies and stationery	3,633 69
15	Megging insulators, cost of salaries and expense	627 35
16	Casualty insurance	20 69
17	Interest during construction	11,605 84
18	Warehouse Sanger sub	309.88
	Total	$252,593.30

Total cost per mile, $3,508.24

country and in that distance poles were raised by piking. Poles were framed on the ground and, where possible to use the gin wagon, the insulators were hung in place before raising. The holes were 8 ft. (2.4 m.) deep and dug by hand, bars and spoons being used. Considerable hardpan was encountered and in the foothill country many of the holes were in rock, making dynamite necessary. Linemen's wages ran $6.75 per day and groundmen's wages were $4.50 per day. Transpositions were installed making complete barrels about every 9 miles. These were made by simply reversing the arm on the transposition pole and thus rolling the line. The line is built almost entirely along public highways, thus the small cost of rights-of-way. Clearing of right-of-way includes cost of trimming and removing trees along highways. Many of these trees had to be purchased from property owners.

FIGS. 4 AND 5—RAILROAD CROSSINGS AND RIGHT-ANGLE TURNS ARE READILY PROVIDED FOR

In all of the costs given in the table transportation of men, losses in the boarding houses, auto mileage, etc., are included.

Following are some actual labor unit costs:

Digging pole holes, per hole	[illegible]
Setting poles, per pole	[illegible]
Framing poles, per pole	[illegible]
Guying	[illegible]

In the item of guying all labor of digging hole, burying slug and placing guy on the pole is included.

Rhone Development Bill Passes French Parliament

AFTER two years of parliamentary debate the bill for the development of the River Rhone, the great southern artery of France, from the triple standpoint of electric supply, water traffic and irrigation, has at last become law, and it will now be possible, says a special correspondent of the New York *Times*, for a syndicate or syndicates to be formed to undertake simultaneously work of the three above categories and thereby, in addition to providing eventually a water transport line that will rival the Rhine in importance and to irrigating more than 600,000 acres of what is at present unsuitable land for agriculture, to provide the country with 900,000 kw. of cheap electric energy, this energy representing a saving in imports which amounts to at least 800,000,000 francs a year.

Concessions may now be granted for the above purpose for a period of seventy-five years over an area represented by at least one "section," whose limits are laid down in the law, but it is hoped that a single corporation will be found to undertake the whole "amenagement." The government is to wait three years in this aim, but should no company come forward by then smaller syndicates, which on account of the geographical conditions imposed cannot number more than six, will receive concessions.

Those who live in departments washed by the waters of the Rhone may have the right to all the power generated by the first station erected in any section, granted that application be made within one year from the moment production commences; if such application is made at a later date the right is nevertheless maintained at a quarter. If a single section is being exploited by a syndicate, building on another station must start as soon as consumers have been found for three-fourths of the existing plant's output. But concessionaries have the complete control of a quarter of their production, and, on the other hand, the department of the Seine—*i.e.*, Paris and neighborhood—has the right to 200,000 kw. as long as this amount does not exceed three-quarters of the total production.

This scheme may be supported out of public funds during the initial stage, and the state has always the right to at least 50 per cent of the profits.

Preparing Equipment for Resumption of Business

Electrical Apparatus Which Has Been Lying Idle During the Past Business Depression Should Be Inspected to Ascertain if Insulation Has Absorbed Moisture—Methods of Drying Out Are Described

By R. F. STOKES
Walton-on-Thames, England

WHEN business activity starts again some of the factories, mills and other industrial establishments which have been closed or operated on only part capacity may experience trouble from electrical breakdowns unless precautions are taken to restore normal operating conditions. This may prove particularly true if the usual operating care has been curtailed, in collieries, chemical plants, paper mills and similar places where dampness is prevalent. Even where the equipment has received normal attention the methods of drying out insulation here described should be of value, since there are many other conditions than inactivity under which excessive moisture may be absorbed.

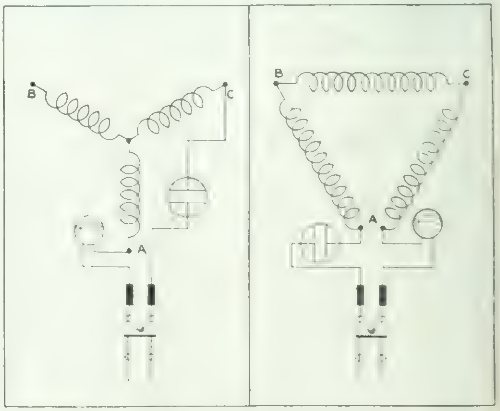
The conditions under which drying is necessary may be briefly summarized as follows: (1) After apparatus has been lying unused in a damp situation for more than a few days and shows on test a low insulation resistance; (2) where apparatus has become wet during transit from the makers; (3) where new coils have been placed in high-voltage machines. It should be borne in mind in deciding whether or not a machine requires drying that a good insulation test to the frame of the apparatus does not prove conclusively that it is in good condition. Experience with alternating-current machinery and transformers shows that the majority of breakdowns of windings do not occur from these to the frame of the apparatus, but as a rule the breakdowns result from short circuits between the turns of the coils in a winding. Many motor windings are incased in micanite, which very effectively resists moisture; but while this invariably gives a fair insulation test to the frame, no indication of the condition of the insulation between successive turns of the coils is thus afforded. Moisture may find its way in at the slot linings, or in the case of coils rewound on the site the insulation on the wire may become damp during replacing coils. Further, machinery may become damp in transit owing to neglect in packing or carelessness on the part of railroad men.

Methods of Drying

Different types of apparatus call for different treatment. In some instances drying would be effected by placing the machine or transformers, as the case might be, in series with a resistance such as a tub of water containing two metal plates, or, if available, a suitable metallic resistance might be employed. Since the former can be obtained almost anywhere, its use is the more frequent. With other apparatus, such as generators, it is possible to dry out by running the machine short-circuited at a low speed, driven by a motor or an engine as convenient. Whatever method is employed, the chief object should be to see that only a low voltage is used, and where direct current is taken from a circuit with one pole earthed the apparatus being dried should be placed on the earthed side of the resistance, as shown in Fig. 1, where *M* is the apparatus to be dried, *W* the water rheostat, *A* an ammeter, *F* a fuse and *S* a single-pole switch for disconnecting the supply. When the supply has neither of its poles earthed, a double-pole switch and fuses should be used invariably.

In using a tub of water as a resistance the circuit should never be interrupted by means of the switch. Most apparatus is highly inductive, and the sudden interruption of a heavy drying current might give rise to an electromotive force sufficient to break down the insulation, especially should it happen to be in a very damp condition. To stop drying, one of the plates should be lifted from the tub and the switch then opened. This procedure reduces the current gradually and produces no ill effects. The plate may be replaced after the switch has been opened and drying may be recommenced when desired by merely closing the switch.

Since the usual electrolyte (salt solution) in a water rheostat increases in conductivity as the temperature rises, it is always advisable to start drying with a weak solution and low current, which will increase as the water gets hot. Then, if the drying current is insufficient, salt may be added until the desired current is obtained. The result of starting with a solution too strong is that the current soon rises beyond the required value, and to reduce it the solution has to be



FIGS. 1 AND 2—CONNECTIONS FOR DRYING THREE-PHASE WINDINGS

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removed from the rheostat and clean water added to weaken it. This interrupts drying operations and should be avoided.

When commencing to dry out a machine the current should be raised very gradually, since the windings, not being ventilated by the rotation of the rotor, will become hot with a considerably lower current than the normal full-load value. Furthermore, since connections for drying are of a temporary nature, care is necessary to ascertain that instruments are working properly before strengthening the resistance solution to give a high drying current. Since the heat generated inside an insulated conductor has to pass through very poor heat-conducting material, the temperature outside will lag considerably behind that inside. Therefore the drying current should be increased very gradually; otherwise, before the outside temperature is sufficient to indicate overheating internal damage may have been done.

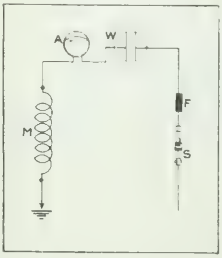


FIG. 3 — DRYING MOTOR OR TRANSFORMER FROM DIRECT-CURRENT CIRCUIT WITH GROUNDED LINE

So far as a generating plant is concerned, it is as a rule well housed and once installed is unlikely to need further attention in that respect even after a prolonged stoppage. However, when first installed it is sometimes necessary to dry the windings; but this is quite a simple matter, and all that is required is to drive the generator, whether direct-current or alternating, at reduced speed, with the amature or stator short-circuited through the main automatic circuit breaker and ammeter. The machine should be excited only sufficiently to generate enough current to warm up the windings.

DRYING DIRECT-CURRENT MOTORS

Direct-current motors in collieries or industrial works are usually of the shunt or compound type. One way to dry these is to run a machine short-circuited, using another motor or the overhead shafting in a machine shop as the driving medium. The motor to be dried should be separately excited from the lighting circuit with a lamp bank in series with it, so that the exciting current may be adjusted to make the armature generate full-load current. The preferable way is to disconnect the armature from its field windings and to pass a current through it while it is standing still, using connections similar to those shown in Fig. 3. In neither of these methods will the field windings be dried. Obviously the only way to warm the field winding without altering the connections is to connect it to the voltage for which it was designed, but assuming the insulation to be so damp as to render it inadvisable to do this, then the coils should be connected in parallel, so that a much lower voltage would be sufficient to effect the drying. This method would, of course, take a larger current, but provided a source of ample current at a reasonable voltage not above 500 is available, the connections in Fig. 3 would again meet the case.

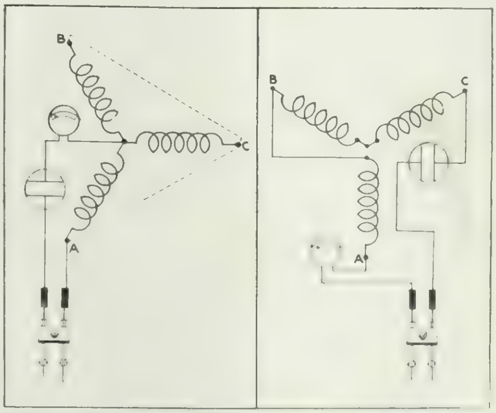
There are a number of methods of drying an induction motor. Everything depends on the type of winding and how it is connected. If the source of supply is alternating current, the rotor should be short-circuited if it is of the slip-ring type, so that it will be dried by induced current while the stator is being dealt with. If the supply is direct current, no current will be induced in the rotor, so that if it is of the slip-ring type, it will have to be treated separately. Short-circuited rotors need no drying, as they start with a heavy current and run up to speed immediately, whereas a slip-ring motor may be called upon to withstand an open circuit, or with very little current passing the electromotive force across the slip ring would be sufficient to cause a breakdown were the rotor insulation defective. In all cases where a three-phase supply at low pressure is available and where the voltage may be regulated at will the easiest method of drying is to connect the motor as for running, secure the rotor against turning and gradually raise the applied potential until sufficient current is indicated on an ammeter connected in the stator circuit. Under circumstances which preclude anything but drying by means of a temporary supply, using the method shown in Fig. 3, it is sometimes difficult to dry three-phase windings owing to the different methods of connection.

CONNECTIONS FOR STAR-CONNECTED WINDINGS

In machines with star connected windings a terminal box is often available at each end of the motor. One of these boxes contains the neutral or star point made by clamping a bridge across the three terminals. Under such conditions it is only necessary to remove the clamp, connect the three windings in series and join them as indicated in Fig. 5.

In most small motors in which the star connection is easily accessible, a convenient method of drying is to connect the three windings in parallel, as shown by the dotted line in Fig. 4, and make a connection from the star as indicated. The three windings are then in parallel and in series with the artificial resistance and the applied potential.

While the star connection of a large motor may be accessible, the parallel method of drying might require a very large current, possibly three times full-load current. Under such circumstances the connection of one winding should be broken at the star as shown in Fig. 5



FIGS. 4 AND 5—DRYING STAR CONNECTED WINDINGS WHEN NEUTRAL POINT MAY BE REACHED

Left—Three phases temporarily connected in parallel. Right—Neutral opened, putting all phases in series.

and the three windings connected in series for drying. If the star connection of a motor is inaccessible, then the only course open is to dry two phases in series at a time as shown in Fig. 1. For instance, the connection is first made across, say, phases *A* and *C*, and after a few hours changed to *A* and *B*, and later to *B* and *C*, so that in turn all windings receive the same amount of treatment.

A mesh-connected winding may easily be dealt with by breaking the winding at a point *A*, shown in Fig. 2, and connecting the three windings in series.

In some cases it may happen that a potential suitable for drying in the manner described is unobtainable. Under such circumstances a machine should be covered over and a group of ordinary incandescent lamps hung inside the rotor spider, care being taken to see that they do not touch the insulation anywhere. Of course, this method of drying takes a much longer time than drying by passing a current through the windings, but given plenty of time it is quite effective.

Duration of Drying

No hard and fast rule can be laid down as to how long a given machine should be dried to insure complete removal of moisture. An insulation test should be taken before drying commences. Another should be taken soon after a steady and sufficient temperature has been reached. The second test will always be found to be much lower than the first, but as drying proceeds the resistance should gradually rise. After, say, twenty-four hours current should be removed and the machine allowed to cool, after which, unless the machine was exceptionally damp, the insulation test will be quite satisfactory. In drying transformers they should always be removed from the tank so that the windings are accessible for judging the temperature. Thermometers should be inserted in the center of the windings since at these points the temperature is always highest and may reach a dangerous point before the exposed portions indicate that the drying current is too high. In conclusion, it should be noted that apparatus which has been saturated through being submerged may take weeks to dry, but careful attention and continuous application of drying current will as a rule bring about normal conditions of insulation.

Water-Power Applications Total 15,093,086 Hp.

Federal Power Commission Has Received 244 Applications for Preliminary Permits and Licenses and Has Issued Thirty-one

APPLICATIONS for preliminary permits and licenses continued to be filed with the Federal Power Commission during the summer months but at a slightly decreased rate. The commission on Aug. 31 reported that 244 applications were on file, an increase of 22 during the months of June, July and August. The net installed capacity of the projects on file Aug. 31 totaled 15,093,086 hp., which is about one and one-half times the present hydro-electric development of the country.

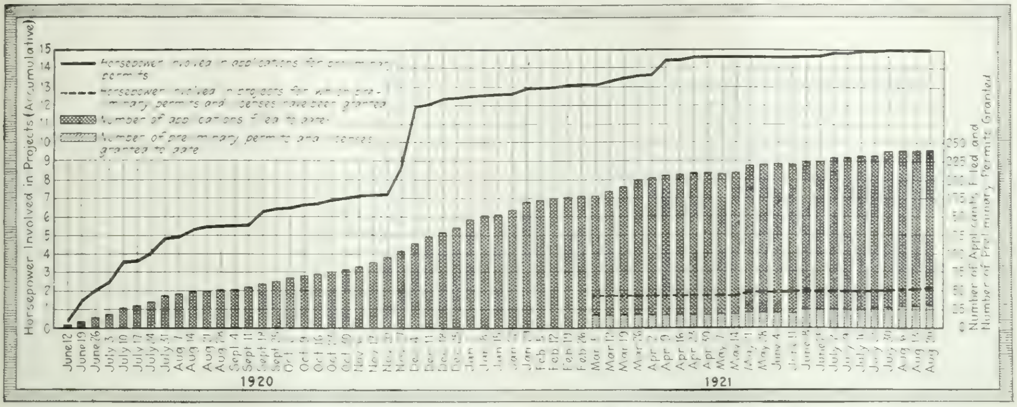
A recent compilation has been made giving the "power capacity" of the various applications as determined in accordance with the regulations of the commission on the basis of average static head, the stream flow estimated to be available 90 per cent of the time and operating at 70 per cent efficiency. This compilation indicates that the 244 applications filed with the commission total 10,274,000 hp. net power capacity.

The projects included in filings made during June, July and August involve an average of 34,100 hp. This is somewhat higher than the average horsepower involved in prior applications, if the unusually large project of the Southern California Edison Company in the Grand Canyon of Colorado is eliminated. Almost every section in the country is represented in the applications filed during these three months. Four of the projects are in Arizona, three in Alaska, California and Minnesota respectively, and one each in Arkansas, Idaho, Montana, Utah, Washington and West Virginia. Three applications for licenses were filed for transmission lines to be erected in California, Oregon and South Carolina respectively.

The largest project recorded during these three months was that of the city of Los Angeles at Boulder Canyon, Colorado River, involving a 600-ft. dam and a development of 600,000 hp. This application, however, is in conflict with previous filings. Two other projects in the Grand Canyon of the Colorado River, involving 130,000 hp. each, are also in conflict with former appli-

TABLE I—LOCATION AND SIZE OF WATER-POWER PROJECTS FOR WHICH APPLICATIONS FOR PRELIMINARY PERMITS WERE FILED WITH THE FEDERAL POWER COMMISSION FROM JUNE 4, 1921, TO AND THROUGH AUG. 31, 1921

Name of Company	Location of Project	Capacity Hp
ALASKA:		
Frank C. Dougherty, Palace Hotel, San Francisco, Cal	Green, Baranof and Second Lakes	20,000
Frank C. Dougherty, Palace Hotel, San Francisco, Cal.	Karta River, head of Karta Bay	6,000
Freshwater Bay Lumber Co., Douglas, Alaska	Stream at head of Pavloff Harbor, Chichagof Island	
ARIZONA:		
James B. Girand, Gooding Bldg., Phoenix, Ariz	Colorado River at the mouth of Andrus Canyon	130,000
Steve Consolidated Copper Co., Phoenix, Aris	Big Williams River	......
James B. Girand, Gooding Bldg., Phoenix, Aris	Colorado River, just above Pierce's Ferry	130,000
City of Los Angeles, Cal	Boulder Canyon, Colorado River, Nev. and Aris	600,000
ARKANSAS:		
Dixie Power Co., Title Guaranty Bldg., St. Louis, Mo	Buffalo River, near its junction with Panther Creek	19,000
CALIFORNIA:		
San Joaquin Light & Power Corpn., Fresno, Cal	Three projects, Kings and Roaring Rivers and Bubbs Creek	50,000
James Hulme et al., Pine Knot, Cal.	Transmission line	......
Mount Shasta Power Corporation, San Francisco	Pit River in Shasta County	114,000
Excelsior Water & Mining Co., 920 Forum Bldg., Sacramento, Cal	Middle and South Forks of Yuba River and in Deer Creek	116,800
IDAHO:		
Haynes-Stellite Co., 30 East Forty-second St., New York City	Big Creek (plant constructed)	270
MINNESOTA:		
City of St. Paul	U. S. Government Dam, Mississippi River at St. Paul	16,000
City of Minneapolis	U. S. Dam No. 1, Mississippi River	...
Northern States Power Co	U. S. Government Dam, Mississippi River, at St. Paul	16,000
MONTANA:		
Kootenai Power Construction Co., 347 Madison Ave., N. Y. City	Kootenai Falls, Kootenai River, and at Mouth of Yaak River	85,000
OREGON:		
Portland Railway, Light & Power Co., Portland, Ore	Main Fork Clackamas River	
SOUTH CAROLINA:		
Southern Power Co., Charlotte, N. C.	Transmission line	
UTAH:		
Blue Mountain Irrigation Co., Monticello, Utah	Pole canyon (constructed plant)	40
WASHINGTON:		
Washington Water Power Co., Spokane, Wash	Kettle Falls, Columbia River	153,000
WEST VIRGINIA:		
C. B. Hawley, 450 Munsey Bldg., Washington, D. C.	Sandstone Falls, New River	4,500



GROWTH IN NUMBER OF APPLICATIONS FILED AND GRANTED AND NET HORSEPOWER INVOLVED

cations. The largest project which is not all or partly in conflict with former applications is that of the Washington Water Power Company at Kettle Falls, Columbia River, involving a development of 153,000 hp.

Table I gives the location and size of the water-power projects for which applications for preliminary permits and licenses were filed with the Federal Power Commission from June 4, 1921, to and through Aug. 31, 1921. The list of applications filed prior to June 4 appeared in the issues of the ELECTRICAL WORLD for Jan. 1, Jan. 15, Feb. 12, March 12, April 9 and June 18.

A total of thirty-one permits had been granted by the commission on Aug. 24, of which fourteen were preliminary permits and seventeen were licenses. The developments represented in these projects involve a total of 2,255,696 hp. and are scattered throughout the country. California leads in proposed horsepower to be developed with 784,386 hp., followed by New York State with 663,250 hp. The largest project for which a license has been granted by the commission is that of the Southern California Edison Company on Big Creek and the South Fork of the San Joaquin River, California, involving a total development of 545,000 hp.

Table II gives the location and size of the projects for which preliminary permits and licenses have been granted.

TABLE II—LOCATION AND SIZE OF WATER-POWER PROJECTS FOR WHICH PRELIMINARY PERMITS OR LICENSES HAVE BEEN GRANTED BY THE FEDERAL POWER COMMISSION THROUGH AUG. 24, 1921

Name of Company	Location of Project	Capacity Hp.
ALABAMA (120,000 hp.):		
Alabama Power Co., Birmingham, Ala. (license)	Duncan's Riffle, Coosa River	120,000
ARIZONA (60,000 hp.):		
James B. Girand, Gooding Bldg., Phoenix (preliminary permit)	Colorado River near Diamond Creek	60,000
ARKANSAS (100,000 hp.):		
Dixie Power Co., Title Guaranty Bldg., St. Louis, Mo. (preliminary permit)	White River	100,000
CALIFORNIA (784,386 hp.):		
Pit River Power Co., San Francisco (preliminary permit)	Pit River	92,000
Merced Irrigation District, Merced Cal. (preliminary permit)	Exchequer on Merced River	40,000
R. W. Hawley, 233 Market St., San Francisco (preliminary permit)	Silver Creek	107,000
Luther Hill, Independence, Cal. (license)	Sam Mill Creek	386
Southern California Edison Co., Edison Bldg., Los Angeles, (license)	Big Creek and South Fork of San Joaquin River	545,000
Southern California Edison Co., Edison Bldg., Los Angeles (license)	Transmission line	
C. B. Johnson, Care V. G. Preston, Bishop (license)	Transmission line	
Coast Valleys Gas & Electric Co., San Francisco (license)	Transmission line	
COLORADO:		
Thomas P. Mitchell, Ouray, Col. (license)	Transmission line	
IDAHO (21,900 hp.):		
Utah Power & Light Co., Salt Lake City, Utah (preliminary permit)	Soda Point, Lava, Narrows and Mink power sites on Bear River	21,500
John R. Lore, et al., Care J. D. Fisher, Colorado Springs, Colo. (license)	Salmon River, Custer County	400
ILLINOIS (40,000 hp.):		
State of Illinois, Springfield, Ill. (preliminary permit)	Desplaines and Illinois Rivers	40,000
MISSOURI (4,000 hp.):		
Western Tie & Timber Co., 902 Syndicate Trust Bldg., St. Louis, Mo. (preliminary permit)	Current River	4,000
MONTANA:		
Butte-Jardine Metals Mines Co., Butte, Mont. (license)	Transmission line	
MONTANA		
Amazon Dixie Mining Co., Wallace, Idaho (license)	Transmission line	
NEVADA:		
Consolidated Spanish Belt Silver Mining Co., 629 Nicholas Bldg., Toledo, Ohio (license)	Transmission line	
NEW YORK (663,250 hp.):		
Hydraulic Race Co., Lockport, N. Y. (preliminary permit)	Niagara River	5,000
Lower Niagara River Power & Water Supply Co., Care H. L. Cooper, 101 Park Ave., N. Y. City (preliminary permit)	Niagara River	250,000
Ford Motor Co., Dearborn, Mich. (license)	Green Island, Hudson River	8,250
Niagara Falls Power Co., Niagara Falls, N. Y. (license)	Niagara River	400,000
NORTH CAROLINA (2,000 hp.)		
Granite Falls Manufacturing Co., Granite Falls, N. C. (preliminary permit)	Wilson Creek	2,000
OHIO (150 hp.):		
McConnelsville-Malta Electric Co. McConnelsville, Ohio (license)	U. S. Dam No. 7, Muskingum River	150
SOUTH DAKOTA:		
Paving Granite Quarry Co., Rapid City, S. D. (license)	Transmission line	
UTAH (25,000 hp.):		
Great Basin Power Co., Walker Bank Bldg., Salt Lake City (preliminary permit)	North Fork Duchesne River	25,000
VIRGINIA (60,000 hp.):		
Roanoke River Development Co., 318 Mutual Bldg., Richmond, Va. (preliminary permit)	Roanoke River	60,000
WASHINGTON (300,000 hp.):		
Washington Irrigation & Development Co., Care Electric Bond & Share Co., 71 Broadway, New York City (preliminary permit)	Columbia River	300,000
WISCONSIN (75,000 hp.):		
Wisconsin-Minnesota Light & Power Co., 1107 Grand Rapids Savings Bldg., Grand Rapids Mich. (license)	Forks of Chippewa River	75,000
WYOMING (10 hp.):		
Home Colony, Cody, Wyo. (license)	[illegible] Creek, Park County	10

Readers' Views and Comments

This is a readers' forum. Comments on questions before the electrical industry presenting economic, financial, engineering or commercial aspects and new or supplementary viewpoints on published articles are cordially invited

Interplanetary Communication

To the Editors of the ELECTRICAL WORLD:

There are countless worlds such as ours in the universe—planets revolving around their suns in elliptical orbits and spinning on their axes like gigantic tops. They are composed of the same elements and subject to the same forces as the earth. Inevitably at some period in their evolution light, heat and moisture are bound to be present, when inorganic matter will begin to run into organic forms. The first impulse is probably given by heliotropism; then other influences assert themselves, and in the course of ages, through continuous adjustment to the environment, automata of inconceivable complexity of structure result. In the workshop of nature these automatic engines are turned out in all essential respects alike and exposed to the same external influences.

The identity of construction and sameness of environment result in a concordance of action, giving birth to reason; thus intelligence, as the human, is gradually developed. The chief controlling agent in this process must be radiant energy acting upon a sense organ as the eye, which conveys a true conception of form. We may therefore conclude with certitude that, however constructively different may be the automata on other planets, their response to rays of light and their perceptions of the outside world must be similar to a degree so that the difficulties in the way of mutual understanding should not be insuperable.

Irrespective of astronomical and electrical evidences, such as have been obtained by the late Percival Lowell and myself, there is a solid foundation for a systematic attempt to establish communication with one of our heavenly neighbors, as Mars, which through some inventions of mine is reduced to a comparatively simple problem of electrical engineering. Others may scoff at this suggestion or treat it as a practical joke, but I have been in deep earnest about it ever since I made the first observations at my wireless plant in Colorado Springs from 1889 to 1900. Those who are interested in the subject may be referred to my articles in the *Century Magazine* of June, 1900, *Collier's Weekly* of Feb. 9, 1901, the *Harvard Illustrated Magazine* of March, 1907, the New York *Times* of May 23, 1909, and the New York *Herald* of Oct. 12, 1919.

At the time I carried on those investigations there existed no wireless plant on the globe other than mine, at least none that could produce a disturbance perceptible in a radius of more than a few miles. Furthermore, the conditions under which I operated were ideal, and I was well trained for the work. The arrangement of my receiving apparatus and the character of the disturbances recorded precluded the possibility of their being of terrestrial origin, and I also eliminated the influence of the sun, moon and Venus. As I then announced, the signals consisted in a regular repetition of numbers, and subsequent study convinced me that they must have emanated from Mars, this planet having been just then close to the earth.

Since 1900 I have spent a great deal of my time in trying to develop a thoroughly practical apparatus for the purpose and have evolved numerous designs. In one of these I find that an activity of 10,000,000.000 hp. in effective wave energy could be attained. Assuming the most unfavorable conditions—namely, half-spherical propagation—then at a distance of 34,000,000 miles the energy rate would be about $\frac{1}{730{,}000}$ hp. per square mile, which is far more than necessary to affect a properly designed receiver. In fact, apparatus similar to that used in the transmission of pictures could be operated, and in this manner mathematical, geometrical and other accurate information could be conveyed.

I was naturally very much interested in reports given out about two years ago that similar observations had been made, but soon ascertained that these supposed planetary signals were nothing else than interfering undertones of wireless transmitters, and since I announced this fact other experts have apparently taken the same view. These disturbances I observed for the first time from 1906 to 1907. At that time they occurred rarely, but subsequently they increased in frequency. Every transmitter emits undertones, and these give by interference long beats, the wave length being anything from 50 miles to 300 or 400 miles. In all probability they would have been observed by many other experimenters if it were not so troublesome to prepare receiving circuits suitable for such long waves.

The idea that they would be used in interplanetary signaling by any intelligent beings is too absurd to be seriously commented upon. These waves have no suitable relation to any dimensions, physical constants or succession of events, such as would be naturally and logically considered in an intelligent attempt to communicate with us, and every student familiar with the fundamental theoretical principles will readily see that such waves would be entirely ineffective. The activity being inversely as the cube of the wave length, a short wave would be immensely more efficient as a means for planetary signaling, and we must assume that any beings who had mastered the art would also be possessed of this knowledge. On careful reflection I find, however, that the disturbances as reported, if they have been actually noted, cannot be anything else but forced vibrations of a transmitter and in all likelihood beats of undertones.

While I am not prepared to discuss the various aspects of this subject at length, I may say that a skillful experimenter who is in the position to expend considerable money and time will undoubtedly detect waves of about 25,470,000 m.

NIKOLA TESLA.

New York City.

Period of Repose in Rate Cases

To the Editors of the ELECTRICAL WORLD:

In a decision of the New York Public Service Commission, Second District, as quoted in the Aug. 20 issue of the ELECTRICAL WORLD, page 389, there are two points that should be corrected. The first is a typographical error and the other concerns a fact not generally known.

The name of the company is the Lockport (not Lockwood) Light, Heat & Power Company. The other point is that about two weeks after the decision referred to was handed down the commission reversed itself and decided that it had been in error as to the law.

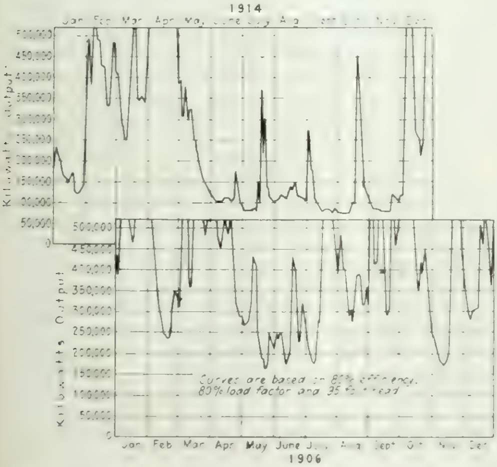
This reversal, like many such decisions of public utility commissions, does not seem to have received much publicity. However, the Lockport company received the increase for which it asked. H. C. HOPSON.

New York City.

Primary Power Possible of Development at Muscle Shoals

To the Editors of the ELECTRICAL WORLD:

I have read with interest the discussion which has taken place in the press regarding the Wilson Dam development at Muscle Shoals and the offer which has been made by Henry Ford for taking over that proposition. Throughout this discussion there has been apparent an exaggerated idea of the hydraulic capacity of the plant. Reference has been made in the various published articles to the development as a "second Niagara," "the enormous power of Muscle Shoals," etc. In a recent issue of *Power* Gifford Pinchot makes the following statement: "The amount of power Mr. Ford could develop under his offer is greater by half than that now being developed at Niagara Falls." Since the power now developed at Niagara Falls is in round figures about 600,000 kw. continuous power, Mr. Pinchot's statement would indicate for the Wilson Dam a capacity of 900,000 kw. continuous power. Such statements are misleading and contrary to fact.



HYDROGRAPHS SHOWING LOWEST FLOW OF TENNESSEE RIVER (1914) AND THE HIGHEST FLOW YEAR (1906)

I inclose herewith two hydrographs showing the hydraulic capacity of the Wilson Dam based upon the run of the stream converted into electrical output. The over-all efficiency in these curves is taken at 80 per cent. The daily load factor is assumed to be 80 per cent, since that is approximately the load factor of the Niagara system and of other large power systems where an electrochemical load predominates. One hydrograph shows the result for the lowest flow year in a period of twenty-one years and the other for the highest year for the same period. An average year would lie between.

On account of the navigation restrictions the pond back of the Wilson Dam cannot be drawn down more than one or two feet, consequently the storage back of the dam is only sufficient to take care of the daily fluctuations in load. The output of the plant will therefore be proportional only to the natural flow of the Tennessee River at the dam.

From the curves it will be seen that for a low year such as 1914 the primary power which could be generated throughout the year from water power alone would not exceed 80,000 kw. at 80 per cent load factor. For a particularly favorable year such as 1906 the primary power would be about 180,000 kw. Neither of these figures is comparable to the present output at Niagara Falls.

If the primary power capacity of the Wilson Dam is to be raised to say 200,000 kw., for all years, then a steam plant of not less than 120,000 kw. will be necessary to make up the deficiency in water power and a large proportion of the annual kilowatt-hour output must be generated by steam. The capital and operating cost of such a steam plant must, of course, be added to the water-power estimates.

There would, of course, be a large amount of secondary power available from the plant for perhaps six months in the year which might be utilized for electrochemical processes. The high capital cost, however, of an electrochemical plant per kilowatt used in its processes makes it unprofitable in most cases to use secondary power for only part of the year even where the secondary power rate is low. Power companies have found it very difficult to induce electrochemical industries to establish themselves on the basis of secondary power use alone.

Possibly the argument over the Muscle Shoals enterprise might be clarified if a reasonable power rating were assigned to the plant within the natural limitations of river flow and a value discussed for the plant which had an appropriate relation to such rating.

Vielé, Blackwell & Buck, H. W. BUCK.

New York City.

Electric Steam Generators for Heating Railway Cars

To the Editors of the ELECTRICAL WORLD:

The writer has noticed a short item in the June 25 issue of the ELECTRICAL WORLD, page 1485, in which Henry L. Geissel of Thoune, Switzerland, refers to electrical heating methods to be used on the cars of the Swiss Federal Railways.

Some ten or twelve years ago the writer was connected with investigations in connection with boilers for generating steam to be used for heating cars in the Pennsylvania Railway Company's tunnel in New York City. In that case the steam generator was placed in the cab of the locomotive and steam was applied to the passenger cars through the usual steam lines of the train. Those boilers were for operation on 650 volts direct current and consisted of flat copper tubes extending vertically between the headers of the boiler. In these copper tubes were flat slotted-ribbon resistance elements. These elements were insulated from the copper tube by casings of mica.

The operating results from the high-tension boilers which the Swiss Railways are using, after they have been in service for a sufficient period, will be very interesting from the standpoints of usefulness and durability.

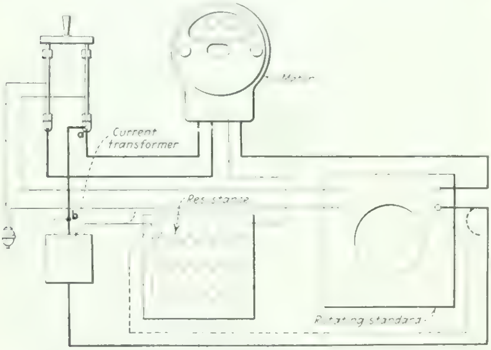
FRANK THORNTON, JR.,
Manager Electric Heating Engineering Department.
Westinghouse Electric & Manufacturing Company,
Mansfield, Ohio.

Industrial and Station Practice

Installation, Operation and Maintenance of
Generating and Distribution Equipment and Economical Utilization of Electrical Energy
in Mills and Factories, Including Testing and Repair Methods

Current Transformer for Testing Meters

An ordinary current transformer will be found very convenient in testing alternating-current house meters of medium and large size (above 20 amp.) if a loading box of sufficient capacity is not available or is too large to be easily carried around. The transformer is connected backward so that it multiplies the current capacity of the loading resistance by what is virtually the transformer ratio. Thus a 10-amp. resistance box and a 50/5-amp. current transformer will give almost 100 amp. load.



METHOD OF CONNECTING CURRENT TRANSFORMER FOR METER TEST

The connections are easy to make, as shown by the diagram, which gives connections for a single-phase, two-wire meter. Connections for other meters can easily be worked out. A spade terminal on the cable at *a* will facilitate making easy connection with the service switch. The dotted lines show necessary change in connections for testing on "light load" without having a transformer in the circuit. After the first meter is tested permanent connection may be made at *b*, and there will be no further trouble in getting the right polarity. **Otis T. Farry.**

Nevada, Mo.

Receiver for Determining Grounded Service Wire

An ordinary telephone receiver, or, better still, one of the wireless headset type, will serve as a convenient device for determining which secondary service wire is grounded when installing and testing two-wire alternating-current meters. A small receiver is less likely to be injured while being carried around than the test-lamp set ordinarily employed, and, besides, it requires less space in the meter installer's or tester's kit. Furthermore, it can be used where the test lamp cannot, owing to the fact that a good earth connection is not necessary.

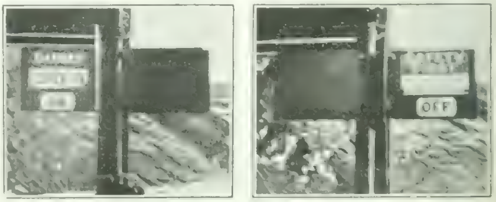
To use the receiver for this purpose a single-conductor cord with a tip is attached to one of the receiver terminals, the operator's finger touched to the other terminal, and the conductor tip touched to each of the service wires in turn. A decided hum will be heard when the cord tip is applied to the ungrounded side, while no hum at all or at least only a slight one will be heard when it is connected to the grounded wire.

The theory of operation is simple, the capacity effect of the body causing a slight charging current from the line to pass through the receiver. The greatest effect will be detected when the ungrounded service wire is touched, since under this condition the body and earth will at every instant be charged at opposite potentials.

Red Oak Electric Company, **Foss C. Hush.**
Oakland, Iowa.

Indicator Shows When Pole-Top Switch Is Closed

After the occurrence of several accidents due to climbing poles when the power was on, a company which uses a large number of pole-top switches decided that some sort of an indicator to show the position of the switch would be worth while. The switches are of the horizontal-break type with rotating operating rod, but the plan as described could be modified to suit the vertical-break type of switch having an up-and-down movement of the operating rod. Standard steel enameled signs are mounted on the baseboard, which is so clamped to the operating rod as to expose the "Danger, current on," sign when the switch is closed. When the switch is opened the movement of the operating rod through an arc of 90 deg. turns the shutter so as to cover up the first sign and expose the "Safety first, off," sign. This has an additional reminder to "Lock switch open before working a line" so as to prevent another person closing the switch. The shutter is a piece of No. 10 sheet steel, 11 in. x 33 in., bent at right angles. This is bolted to the switch operating rod by two standard 1¼-in. "U."-bolt panel supports. A baseboard of 12-in. x 30-in. No. 8 gage sheet steel is fastened to the pole, and on this are fastened the signs.



SIGNAL SHOWS WHETHER POLE-TOP SWITCH IS OPEN OR CLOSED

The pole steps should be attached to the pole upon which the indicating device is mounted so that a lineman must climb past the sign on his way up. An actual installation is shown by the photographs, showing the position of the switch closed and open. This device has been in service for over a year and has proved very satisfactory.

E. B. WAGNER,
Electrical Engineer.
Lehigh Valley Coal Co.,
Kingston, Pa.

The Penalty for Carelessness in Operation

ON PAGE 22 of the July 2 issue of the ELECTRICAL WORLD "E. A. L." criticises the connection of oil-switch tripping coils to the station exciter bus. The writer has a different opinion on the subject. In the majority of power houses, and especially those of the larger sizes, there are usually automatic voltage regulators.

When a short circuit occurs on one of the high-tension lines the regulator tends to maintain the alternating current busbar voltage as close to normal as possible, and in so doing the exciter voltage is, of course, correspondingly increased. This is particularly desirable to assure positive operation of the tripping coils. Usually, however, direct-current tripping coils connected for switch protection have an operating range of 75 volts to 125 volts.

R. H. N. LOCKYER.
Bonnington Falls, British Columbia.

Complete Transformer Records

IT IS desirable to have complete and accessible records of the data on station transformers, not only at the station where the transformers are installed, but also in the various offices which are concerned with those particular transformers. With this end in view the Southern California Edison Company has developed a station transformer data sheet, a copy of which is attached directly to the transformer where it may be easily seen, while other copies are placed in the hands of those concerned.

This data sheet covers the following points: location of the transformer as to station and bank, name-plate information, physical characteristics, date of purchase, rated voltages (that is, all possible voltages that can be obtained by terminal-board connections) and present voltage connections. Space is allowed to enter several previous connections, the polarity of the transformer together with a definition of polarity and directions for determining it, the insulation resistance obtained when the transformer was last dried out, the oil record, the record of oil tests and instructions as to the use of the data sheet.

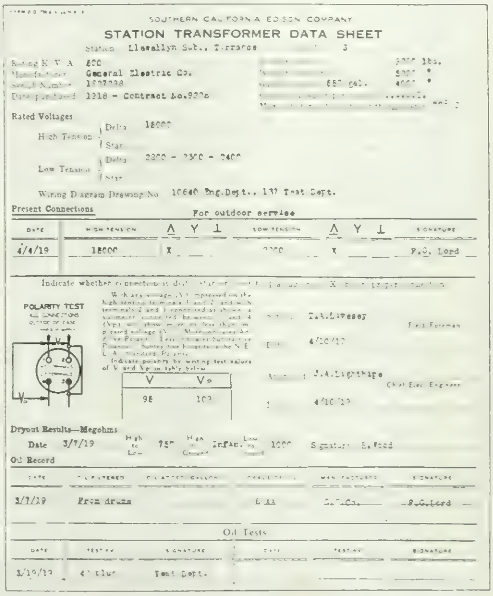
This form is printed on sheets of three different colors, white, brown and yellow. The white and yellow sheets are 8½ in. x 11 in., so that they may be filed in letter files. The brown sheets, which are never filed, but are used only for pasting on the transformers, are 8½ in. x 13 in. This added length is for the purpose of giving more space for the oil-test records, which are made quite frequently.

The white sheets are intended for the field foreman to use in sending the information to the electrical engineer's office. In that office the white copy is checked and all available additional information is entered thereon. Then one brown copy and five yellow copies are typed, the brown copy being returned to the field foreman for pasting on the transformer and the yellow copies being sent to the various offices concerned. White shellac is used to paste the brown copy on the transformer. This has proved quite durable, even on outdoor transformers.

The data sheet, while originally intended for station transformers only, is now being used for all transformers of 250 kva. or larger. On transformers having a corrugated tank the sheet is pasted on a piece of sheet metal which is hung by a metal strap from the top casting.

This form of transformer data sheet has been found to meet the requirements quite completely, with the one exception that no provision was made for the statement that the transformer is for outdoor or indoor service. This information is being typed in a blank space on the sheet at present, but will be included in the form in the future.

H. MICHENER.
Southern California Edison Company,
Los Angeles, Cal.



SOUTHERN CALIFORNIA EDISON COMPANY
STATION TRANSFORMER DATA SHEET
Station Llewallyn Sub., Torrance 3
Manufacturer General Electric Co.
Date purchased 1918 - Contract No.
Rated Voltages
High Tension Delta 18000
Star
Low Tension Delta 2200 - 2300 - 2400
Star
Wiring Diagram Drawing No. 10640 Eng.Dept., 137 Test Dept.
Present Connections
For outdoor service

Date	High Tension	Δ	Y	⊥	Low Tension	Δ	Y	⊥	Signature
4/4/19	18000	X			[illegible]	X			P.G. Lord

POLARITY TEST
T.A.Livesey
Field Foreman
4/10/19
J.A.Lighthipe
Chief Elec. Engineer
4/10/19

V	Vp
98	[illegible]

Dryout Results—Megohms
Date 3/7/19 High to Low 750 High to Ground Infin. Low to Ground 1000 Signature
Oil Record

Date				Manufacturer	Signature
3/7/19	From drums		[illegible]	G.E.Co.	P.G.Lord

Oil Tests

Date	Tested by	Signature	Date	Tested by	Signature
3/19/19	[illegible]	Test Dept.			

ONE RECORD LIKE THIS IS PASTED ON STATION TRANSFORMERS AND COPIES ARE SENT TO VARIOUS FILES

The following instructions are printed at one side of the sheet though not shown in the above cut:

A. When a new installation of transformers is made in any station: (1) Field foreman shall make out and forward to the office of chief electrical engineer a single white copy of data sheet, noting thereon "new installation, brown copy required." (2) Office of chief electrical engineer shall make up on typewriter: (a) One brown copy for foreman in field to paste on transformer with white shellac, where it can be easily read by person standing on floor; (b) five yellow copies, one for load dispatcher, two for general superintendent of division concerned, one for test department and one for chief electrical engineer.

B. When connections are changed on any existing installation of transformers: (1) Field foreman shall make out and forward to office of chief electrical engineer a single white copy of data sheet, covering changes. (2) Field foreman shall make a record of changes in table of "present connections" with drawing (India) ink on brown copy attached to transformer. (3) Office of chief electrical engineer shall make up on typewriter five yellow copies as per instructions under A-2-(b) above.

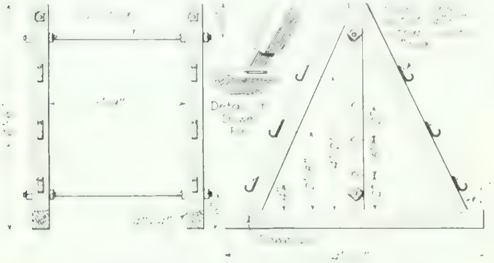
C. When oil is tested, filtered, changed or added in an existing installation of transformers, field foreman shall make record with drawing (India) ink under "Oil Record" on sheet attached to transformer.

D. When table of "Present Connections," or table of "Oil Record" becomes full, instructions under "A" above shall be followed, except that field foreman's notation shall be "Record full, new brown copy required." Field foreman shall make white copy and exact duplicate of the brown copy posted on transformer, except that only the last two records of "Oil Tests" shall be given.

Rack Holds Ten Rolls of Insulating Material

A RACK built to hold the various rolls of insulating material used around an electrical repair shop is shown in the accompanying illustration. The stand is made to hold ten rolls of material. It is placed directly back of a 44-in. strawboard-cutting machine, so that the material can be fed from any roll and cut on the machine. This keeps the ends true and reduces waste.

In this shop an insulation-cutting department has been established and put in charge of a young man whose duties are to cut material of all kinds for the whole shop. Having one man in charge of the work eliminated the waste incident to the old system of having each winder or other mechanic get out and cut his own material. The man in charge of the insulation department receives a copy of all coil orders, which is his notice to cut winding material. He makes all measurements and supplies the required slot material, fillers, etc., which are approved by the man in charge of the department in which the motor is being rewound. In no case is a written order required for material. The man requiring material just notifies the insulation cutter, who takes the required notes, and the material and the time used in cutting are charged by the cutter to the proper order number.


INSULATING MATERIAL STORED IN THIS RACK IS EASILY HANDLED BY THE CUTTER

The material is issued to the cutter in bulk, *i.e.*, 100-yd. rolls and 25-lb. lots in sheet form, by the main storeroom, which has a card for each kind of material containing the date and the amount issued. The cutter weighs the material for each job and makes out a material requisition, which is turned into the storeroom each morning. Here the weights of the different materials turned in on job numbers are totaled and then put on the cards, one for each material.

The materials kept on hand in the cutting department are shown in the attached table. Segment mica and heavy fiber are kept in the main storeroom.

Detroit, Mich. A. C. ROE.

INSTRUCTIONS FOR SELECTING SLOT MATERIAL

Fullerboard (FB) used as a slider in open-slot machines where a tight fit is wanted and where a slider is desired that will not pull down with the coil.

Fishpaper (FP) used for sliders on alternating-current and direct-current open-slot machines. This slider is used in the majority of cases in preference to fullerboard, particularly in bad cores where the laminations are uneven. It is a very hard paper and will resist abrasion and at the same time it is very flexible and easy to crease.

Treated Cloth (TC) used for cells, etc., on alternating-current and direct-current machines together with fishpaper and fullerboard and also as insulation between coil ends or threaded-in windings, for which purpose it is cut in triangular shape.

Oiled Duck (OD) used between top and bottom layers of coil ends and under leads, etc.

Fiber used for wedges, separators and fillers.

Combination (Comb) used for cells in all closed-slot machines, also for channel-shaped separators between the top and bottom coils in a slot. Combination insulation is made with a fishpaper base and with 0.008-in. tan or black treated cloth shellacked to the base. The most convenient size has a total thickness of 0.023 in. This material was developed primarily to be used for cells on partially-closed slot machines where the opening was narrow and a treated cloth slider projecting through this opening would decrease the width through which the wire was put; also on jobs where a treated cloth cell would pull down with the wires and fill up the slot.

Kraft Paper (KP) used for top-winding cells, when combination is used. Kraft paper is 0.004 in. thick and is a thin, hard, treated paper that will not pull down or crack easily.

Fishpaper [illegible] used for wedges in connection with combination.

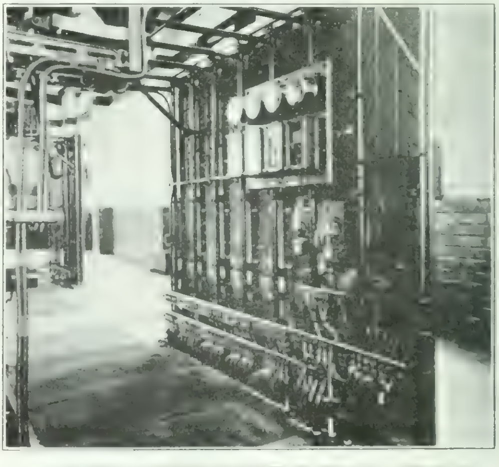
INSULATING MATERIAL KEPT IN CUTTING DEPARTMENT OF LARGE MOTOR REPAIR SHOP

Material	[illegible]	[illegible]	[illegible]
Fishpaper	0.004, 0.007, 0.010, [illegible]	[illegible]	[illegible]
	0.023	[illegible]	[illegible]
[illegible]	0.007, 0.010, [illegible]	36 or 40	100-yd. roll
[illegible]		36 or 40	[illegible]
[illegible]	[illegible]	36 or 40	[illegible]
Tan-treated cloth	0.008	36 or 40	[illegible]
[illegible] paper	0.023	36	[illegible]
Fiber	[illegible]	36	40-in. sheet

[illegible]

Accessible Terminal Connections at Industrial Switchboard

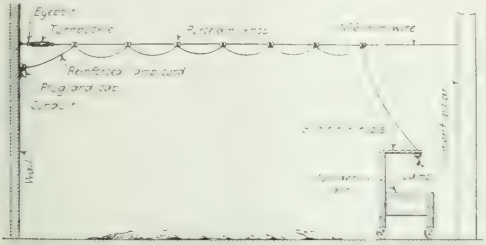
IN A MASSACHUSETTS industrial plant where the electrical equipment has been installed to facilitate continuous production special attention was given to convenient switchboard wiring. For example, the board illustrated in the accompanying photograph is provided with terminal strips at the rear to which all the principal control circuits are attached, the leads being brought up from a conduit through below as vertical risers passing through floor bushings. Provision is made on the terminal strips for fuse clips where necessary, and all connections are made at from 8 in. to 15 in. above the floor to facilitate testing. Circuits are run from various points in rigid conduit to the floor trench shown, access being easy by raising the corrugated plates covering the trough. This arrangement facilitates the initial pull-in of conductors, makes changes and testing rapid and inexpensive, and cuts down exposed wiring runs above the floor to the minimum.


ALL CONTROL CIRCUITS CONNECT TO TERMINAL STRIP AT BACK OF BOARD

Boston, Mass. FIELD EDITOR ELECTRICAL WORLD.

Cord for Portable Machine Kept from Injury

A SAFE plan for supplying current to portable machines is used by the writer in foundry work for molders' carts. This plan is to stretch over the sand pile a heavy iron wire with a turnbuckle at one or both ends. On this wire a few porcelain knobs or spools are strung. Heavy reinforced lamp cord is looped to each porcelain insulator, to which it is held by strong marlin or other non-conductor cord. There must be enough knobs to keep the loops from sagging low enough to hit the molder's head. At the end of the wire is the outlet from conduit or other source. The outlet has a plug receptacle for taking a two-prong plug on the lamp cord. A plug on the other end of the cord fits a socket on the cart. The wires of the cord used in a foundry should be well tinned before being placed under the screws of the plug.



CORD LOOPS OUT OF WAY AS CART MOVES AROUND

With this installation the molder can move his cart back and forth and his cord will follow without injury. If he should pull too hard on the cord, it will pull the plug from the receptacle without injury to the cord. It may be replaced without aid of an electrician. Before this system was installed the cord was allowed to drag on the floor, which often resulted in the cord being run over and becoming tangled in the wheels of the cart and often having hot ladles or hot iron placed on it. In the former installation the cord was tapped directly on to the main feeder at the outlet, and when the cord was pulled at that connection short circuits often resulted.

Batavia, N. Y. N. S. Davis.

Electric Power Saves Cost in Oil Well Drilling

AS THE result of several tests made in the mid-continent field electric power has shown a material saving in the cost of oil-well drilling as compared with steam. The savings arise from use of less water and no oil fuel, from smaller depreciation of equipment and from the increased oil production gained by the saving in time when changing from drilling to pumping equipment. The data in the accompanying tables are taken from a well-drilling operation in the El Dorado field in Kansas in August and September, 1919. A 75-hp., 440-volt induction motor was used as standard drive in these operations. The total saving on each well drilled was $3,882.67, of which $2,577.67 was in equipment, installation and operation costs and $1,305 due to increased production. A tabulation of weekly electrical costs for three weeks is given in Table I.

Chicago, Ill. Field Editor Electrical World.

TABLE I—WEEKLY COSTS OF DRILLING OIL WELL WITH ELECTRICAL EQUIPMENT

	Week 1	Week 2	Week 3
Line construction labor	$52 28	$94 70	$74 06
Motor installation labor	50 50	64 14	75 04
Transportation	28 75	168 75	37 72
Inspector	109 50	118 01	182 69
Material not reclaimable	40 00	40 00	40 00
Changing motor and service to pumping equipment	101 56	101 14	135 29
Sub-total	$382 29	$586 74	$504 90
Cost of electricity	316 65	506 90	367 40
Grand total	$699 23	$1,093 64	$872 30
Cost per foot drilled, electricity only	0 134	0 210	0 155
Cost per foot drilled, total electrical costs	0 294	0 454	0 [illegible]

TABLE II—COST OF ELECTRIC OIL-WELL EQUIPMENT COMPARED WITH STEAM-DRIVEN EQUIPMENT
El Dorado Field, Kansas, August and September, 1919

	Boiler and Engine	Electric Motor
Initial cost of equipment	$1,862 00	$1,625 00
Cost of installation	432 50	768 03
Estimated depreciation per well	290 00	32 50
Cost of water	480 60	60 00
Total	$3,065 10	$2,475 53
Saving in cost of electrical equipment over steam equipment....		$579 57
Saving in difference between cost of fuel and electricity............		1,811 94
Saving in installation of pumping motor (house and foundation).....		186 16
*Increase in oil production due to quick change to pumping equipment		1,305 00
Total saving per well drilled..................................		$2,577 67

*These figures are based on oil at $3.50 per barrel. Will change with value of oil.

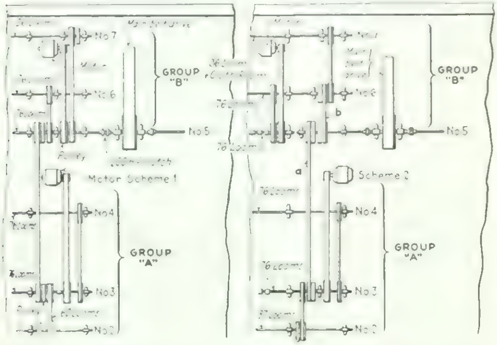
Mechanical Problems in Auxiliary Motor Drives

IT IS an old story that it often becomes desirable, especially in textile plants, to operate a small part of the machinery at times when the rest of the factory is shut down. For instance, in a cotton mill equipped with automatic looms it is possible to make quite a labor saving by running these looms unattended during the noon hour or after closing time until they automatically stop because of broken threads or empty magazines. Or perhaps a change in styles slows up certain links in the chain of manufacture, which calls for overtime work on that particular part of the process. In an electrically-driven mill using purchased power such partial overtime production is a simple matter, but in the mill mechanically-driven from one or more large steam engines it is a very expensive thing, since it means the turning over of a large prime mover and driving hundreds of feet of shafting and belts in parts of plant where no work is being done.

The solution of this problem, of course, lies in the purchase of auxiliary electric power to operate the machines which the mill owner desires to run overtime. The installation of such an auxiliary drive is, however, not always a simple matter, since it is necessary to provide for quick changes back to steam drive and from steam drive back again to motor drive.

Experience of this company has shown that the master mechanics of most textile mills prefer tight and loose pulleys to clutches, but if a clutch must be used, a positive-jaw type of clutch is chosen rather than a friction type. The accompanying layouts show two schemes out of several recently submitted for caring for an auxiliary drive for automatic looms in a cotton mill, scheme No. 1 using both a clutch and a loose pulley and scheme No. 2 using loose pulleys only. The very obvious and simple method of using one 150-hp. motor and one clutch only was not considered, as it was not thought desirable to install so large a unit in this particular case. (The tendency toward more and smaller units is very marked in textile circles.)

It will be noted that in both schemes, when the plant is under mechanical drive, motor belts are left on and motors are allowed to turn over idle. This practice is condemned by some engineers, but has been used in this locality for years with good success; motors, of course, always being alternating-current. There are two objections to this method: first, that it causes unnecessary wear on the motor bearings, and, second, that it is quite possible with careless handling to make the motor try to drive the entire mill, because of forgetfulness in opening clutches or throwing belts to loose pulleys. In practice neither objection has been of any importance. However, if desired, a wide-face pulley can be placed on the motor, driving to a tight and loose pulley on the driven shaft; care, of course, being taken to have the tight pulley line up with the inboard side of the motor pulley.



TWO PLANS FOR AUXILIARY MOTOR DRIVE IN MECHANICALLY DRIVEN TEXTILE MILL

Scheme 1 has a main clutch and loose pulleys. In Group A one 75-hp. motor drives shafts 1 (not shown) and 2, 3 and 4. When on engine drive motor switch is open and motor is turned over idle. When motor is driving, belts on 3 and 5 are shifted to loose pulleys before engine is stopped and before motor switch is thrown. In group B a 75-hp. motor drives shafts 5, 6 and 7. When on engine drive clutch in shaft 5 is engaged and motor runs idle with switch open. When on motor drive clutch is opened before motor switch is closed.

Scheme 2 employs loose pulleys but no clutch. In group A a 75-hp. motor drives shafts 1 (not shown) and 2, 3 and 4. When on engine drive motor switch is opened and motor turns over idle. Belt (a) is on the tight pulleys. When on motor drive belt on shafts 3 and 5 is shifted to loose pulley before engine is stopped and before motor switch is thrown. In group B a 75-hp. motor drives shafts 5, 6 and 7. When on engine drive belt (b) is shifted to tight pulleys and motor runs idle with switch open. On electric drive belt (b) is shifted to loose pulley before engine is stopped and before motor switch is thrown on.

F. S. Root,
Power Engineer.
Fall River Electric Light Co.,
Fall River, Mass.

High Mounting Saves Push Buttons on Grinders

Mounting the push-button control for a direct-driven grinding wheel on top of the motor frame has been found by one electrical manufacturer to save the push buttons from unnecessary hard usage. On previous machines these push-button stations were mounted in front of the motor frame, but it was found that the workmen in using these grinders would start the motor by jabbing the button with the material which they intended to grind. With the new position for the button it is easier for a workman to operate it with his hand than with the tool, which naturally prevents misuse.

Small Heat-Treating Furnace with New Elements and Control

To overcome the objections that have been made to small electric heat-treating furnaces, especially as regards time of heating and flexibility of temperature control, the General Electric Company has recently developed a new type of automatic furnace, known as the semi-cylindrical type. This furnace, which possesses several new and improved features in design and construction, is primarily designed for operation at 1,800 deg. Fahr., although by removing the temperature-limit fuse it can be safely operated at 2,000 deg. Fahr.

It is in the design of the heating element that the most radical departure from former types has been made. The element consists of a continuous strip of resistor ribbon formed into an arch, or succession of semi-circular turns conforming to the arch of the furnace chamber, and extending the whole length thereof, the proper spacing between turns being maintained by insulators. This arrangement gives a strong winding which is self-supporting and still flexible to expansion and contraction. The two ends of the winding are brought out at the back wall of the chamber for attachment to the power supply. The heat is radiated directly to the charge, the absence of a muffle allowing a lower temperature gradient. Furthermore, since the resistor is of large cross section, a high power input for the heating-up period is possible without a burnout.

The heat distribution of the furnace is said to be excellent owing to the spacing of the resistor ribbon, which tends to produce a uniform temperature from the front to the back of the chamber. The manufacturers also claim that it is possible to obtain rapid changes of temperature over the range of from 1,000 deg. to 2,000 deg. Fahr. Another feature is that the whole heating unit may be pulled out bodily for inspection or repair by simply removing the front of the furnace and disconnecting the terminals at the back.

The transformer, which is mounted on the pipe frame of the control board, has four primary coils insulated from the secondary. The coils may be connected in multiple, multiple series or series, for 110, 220 or 440 volts respectively, at 60 cycles. The secondary has two taps, one rated at 70 volts and giving 10 kw. for rapid heating and the other rated at 50 volts and giving 5 kw. for normal operation. A small-capacity extension to the secondary is also provided which supplies 110 volts to the contactor coil and for the motor of the temperature-control instrument. The transformer is rated normally at 7.5 kw., normal, but will give 10 kw. for short periods such as mentioned above, or for one-hour or two-hour periods during the day when it is desired to change the temperature quickly.

The temperature-control instrument on the lower half of the control panel has a scale range of from 1,000 deg. to 2,000 deg. Fahr., so that the furnace is protected from being set at too high a temperature. If for any reason the instrument should fail or become inoperative, further protection is provided by a special fuse which melts at a little above 1,800 deg. Fahr., opening the main-line contactor when it melts and disconnecting the furnace from power supply.

The time required for raising the temperature from cool to 1,560 deg. Fahr. in the morning is 1½ hours when the furnace has been run the previous day and two hours on Monday morning, when the furnace is cold.

Central Station Service

A Department Devoted to Commercial Policy and Management Topics, Including Methods of Increasing the Use of Electric Light, Power and Heat

Increasing Electric Sales in Vancouver, B. C.

By James N. Lightbody
Publicity Manager British Columbia Electric Railway Company

IN ORDER to judge of the results of an energetic advertising campaign to increase the use of electrical energy in residential districts in Vancouver, B. C., the British Columbia Electric Railway Company has analyzed the accounts of a considerable number of its residence consumers, which were carefully selected in order to be representative of the entire residence district. A group of consumers in each block in every section of the district was selected, and without exception an increase in the consumption of energy as compared with the previous year is noted. Ten consumers were taken in each block, and their accounts were averaged for the first six months of 1920 and of 1921. The increases per month were as high as 35 and 45 per cent. The actual consumption per month per consumer ranged as high as 81 kw.-hr. in some sections.

The causes of these increases are the reduction of domestic lighting rates from 8.8 cents net per kilowatt-hour to 6 cents net, the increased sale and use of electrical appliances, an advertising campaign to encourage the use of porch lamps, a gradual abandonment of the popular idea that electricity is costly, and a somewhat increased use of large energy-consuming appliances, particularly electric ranges.

Nearly a year ago the company started a campaign to promote porch lighting. Newspaper advertisements, street-car cards, window cards and a motion-picture film were used. The street-car advertising particularly carried the slogan that a porch light would cost not more than one-sixth of a cent per hour. Capital was made of such incidents as hold-ups on dark streets. The motion-picture film used had no reference to the central-station company, but showed a burglar holding up the resident of a house with no porch lamp. In the next scene the burglar was shown approaching a house with a porch lamp, but was deterred from entering it by the illumination. The slogan "A porch light at night puts the burglars to flight" was effectively used on window cards, electric light bills and in other advertising. The results of this campaign were clearly seen from the start. In nearly every section of the city porch lamps were put into use.

About the same time another slogan was adopted, "The cheapest good thing today is electric current." In the advertising carrying this slogan comparisons were made between the lighting rates in Vancouver and those of other cities. In the fall of this year and the coming winter a series of advertisements will be run still further advertising the fact of cheap electricity. One of these advertisements says that the cost of lighting has dropped 40 per cent since 1917, and another that in Canada only Winnipeg, Ottawa, Fort William, Port Arthur and the cities served with Niagara power have lower rates than Vancouver. These advertisements have a direct effect upon the good will of the public toward the company and in addition do much to remove the idea that electric lighting is expensive.

How a Customer-Ownership Campaign Distributed 5,000 Shares of Stock

AFTER completing the sale of an issue of 5,000 shares of 8 per cent preferred stock to its customers and employees in twenty-two working days, the Adirondack Power & Light Company prepared an interesting analysis of the distribution of the shares among the new stockholders. Stock was sold in nine different cities and towns, a quota being assigned to each based on its size. The issue was oversubscribed 260 shares, and soon after the sale was closed the accompanying "want ad" appeared in a Schenectady paper. It speaks well for the customer-ownership plan of financing and the Adirondack company's method of conducting the sale.

WANTED TO BUY:
50 SHARES

Adirondack Power & Light Corporation 8 per cent PREFERRED STOCK

Cash and Immediate Delivery

Address Box SS, Gazette

A study of the stockholders' list shows that stock was sold to customers representing seventy-six different occupations. Of the company's total of 46,495 customers, 937, or 2 per cent, purchased stock, leaving 98 per cent of the customers as prospective new stockholders of possible future issues, to say nothing of additional sales to present stockholders. The company has 637 employees of whom 228, or 35.8 per cent, became stockholders. The average number of shares purchased per customer was 4.97 and the average per employee was 2.64. The summary shows how the stock was distributed:

Number of customers subscribing	937	
Number of shares purchased		4,657
Number of employees subscribing	228	
Number of shares purchased		603
Stockholders subscribing	7	
Number of shares purchased		87
Total number of customers and employees subscribing and shares purchased	1,172	5,347
Total number of customers, all districts		46,495
Number of customers subscribing		937
Per cent of customers subscribing		2.0
Total number of employees, all districts		637
Number of employees subscribing		228
Per cent of employees subscribing		35.8
Average number of shares purchased per customer		4.97
Average number of shares purchased per employee		2.64
Number of shares purchased for cash		4,679
Number of shares purchased, divided payment		668
Per cent subscribed for on cash basis		87
Per cent subscribed for on divided-payment basis		13

Some Advantages of Advertising the Desire to Serve

BY O. R. TOMAN

Manager, Bedford [illegible] Heat & Power Company

THE good will of the consumer is of more importance today than at any other time in the history of the electrical industry. It will not be obtained by one violent spurt in advertising, nor by mounting a platform and expounding the utility's troubles for hours. Even the doormen would leave.

It has been proved that the American public likes to be served. Not only have the European resorts "cashed in" on this fact, but it is being learned here every day. To convince the consumer that the utilities are his servants, not only today but every day, is the principal task. At times this may be rather unpleasant, but the venture will produce results not even anticipated. The value of good and continuous service is constantly discussed today from many points of view. It is not only necessary that we shall show the consumer that we are giving good service, but also that we convey to him our desire to serve him even more. A few lines in a regular advertising schedule will convey this idea more forcibly than a letter which may or may not be read.

If the power of the press were measured by a meter, there is no doubt the pointer would indicate the maximum figure. This makes the association of the industry and the press one of utmost importance. Informing the press of new problems, of contemplated extensions or of work which is under way has often materially aided in obtaining the good will of the consumer.

To tell the consumer in time of trouble that there is a short circuit means very little to him. He is interested, however, in knowing how long the current will be off and why it is off. In such cases the assistance of the telephone company is invaluable. Giving a little more information to the operator will often enable her to answer the incessant inquiries and permit the officials to devote their attention to restoring service.

In a word, if we are to prosper, it is necessary to convince the consumer that we are his servants and ready to serve him.

Kilowatt-Hour Sales Growing Despite Quiet Business

IN CURRENT advertisements the Union Electric Light & Power Company of St. Louis announces increased sales of electricity regardless of the quietness of industrial enterprises. The increase for the first six months of 1921 over the corresponding period of 1920 is about 3 per cent, and industrial power represents a very large portion of the company's load. The monthly comparison of kilowatt-hour sales is:

	1920	1921	Increase
January	34,534,314	35,046,080	511,666
February	32,616,506	32,608,284	*7,222
March	33,918,499	35,172,123	1,153,624
April	33,008,078	35,054,439	2,046,361
May	34,272,994	34,901,053	628,059
June	33,943,756	34,733,577	789,821
July	32,728,483	34,655,017	1,826,534
Total	235,022,630	242,170,573	7,147,943

*Decrease [illegible] February, 1920, had [illegible] February, 1921. [illegible] February, 1921, were [illegible] February, 1920.

The advertisements state that "this growth represents an average monthly net gain of 1,000 new customers and a steady increase in the average monthly use of energy per customer. Increase of customers has been obtained by energetic sales effort, aided by the constantly increasing desire of everybody to enjoy the money-saving, labor-saving and time-saving benefits of electric service. Increase in average monthly use of electrical energy per customer is mainly due, we believe, to the fact that the generation which regarded electric service with its old-time high rates as a luxury has been followed by a generation which regards electric service with the low rates of today as an indispensable necessity."

From Here and There

Lewiston, Me.—During the month of August the Central Maine Power Company conducted a sale of vacuum cleaners which proved highly satisfactory. In the first three weeks of the campaign sales reached a volume of $1,100, comparing favorably with any merchandising activity which the company had undertaken previously. With the closing of the cleaner sale on Aug. 31, a sale of washing machines was launched, and it is expected that at least a hundred washers will be sold in the district during September. R. Rannacher is store manager at Lewiston.

San Francisco, Cal.—The Pacific Gas & Electric Company of California has just completed a series of newspaper advertisements entitled "That the People May Know." The basis for these advertisements was a series of seven short papers on matters vital to the public service in California by W. E. Creed, president of the Pacific Gas & Electric Company. These papers dealt particularly with the problems in the satisfactory solution of which the public service corporations and the public they serve are mutually concerned. They were published in the *Pacific Service Magazine* of the Pacific Gas & Electric Company, and now the entire series of seven articles has been printed in one booklet for distribution to stockholders, employees and the public.

Louisville, Ky.—Robert Montgomery, manager investment department of the Louisville Gas & Electric Company, relates an interesting incident which shows the value of electrical advertising in connection with the sale of stock to customers. Mr. Montgomery said: "A few days ago an old gentleman called on me, opening the conversation with this question: 'Can I lend your company some money at 7 per cent?' I assured him that we could effect such a thing by selling him our bonds, or preferably making him a partner in our business by selling him some stock. He then explained that he had gone to several banks and offered to lend several thousand dollars for an indefinite period, but 4 per cent was the best interest rate offered him, and later that evening, while walking out Fourth Street, he noticed the big 7 per cent on our electric sign and concluded he would see if the electric company wanted to borrow some money. The result was that the old gentleman succeeded in lending his money to us at 7 per cent, the total amount of the sale being more than twice the cost of the advertising."

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
of the World

Generation, Transmission and Distribution

Protection Against Earths.—A. Roth.—An abstract of an article in the *B. B. C. Mitteilungen*, Vol. 8, page 71, dealing with the effects of grounds, excess pressures due to grounds and double grounds, surges, rise of pressure to ground in the sound phases, protective devices, extinguishing coils, earthing the neutral, limitation of grounding, horn arresters with resistances, roller dischargers with resistances, aluminum cells or electrolytic dischargers, lead-peroxide dischargers, arrangement of protective devices, overhead and cable networks, mixed networks and experiments with extinguishing coils. With intermittent grounds the pressure to ground in some phases of unprotected networks may reach two or three times the line pressure, according to the article. Owing to the arc formed every half-wave, a dangerous pressure may be produced between the turns of winding and may break down the insulation. The extinguishing coils referred to offer the maximum protection against grounds. These are constructed as air-cooled, oil-insulated transformers. Under certain conditions direct grounding of the neutral can reduce the pressure rise in sound phases to the line pressure. This action depends on the ratio of the impedance of the earth transformer and generator to the short-circuit impedance of the whole system. The type of protection to use depends on what type of protection is preferred. For instance, grounds in an overhead system are mostly temporary in character and the complete suppression of the arc is to be aimed at. Cutting out of the faulty section is to be avoided. The opposite holds for a cable network.—London *Electrician*, July 22, 1921.

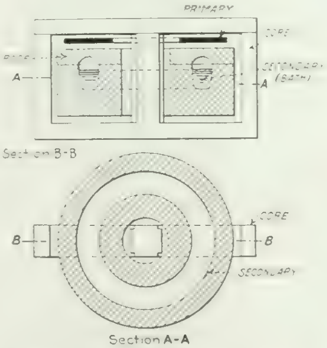
Firing Pulverized Coal.—N. Nishi.—The author deals first with the historical development of the art of burning pulverized coal in the furnace and the present-day tendency in its use. The advantages derived by the use of pulverized coal and the results of actual test are carefully discussed. Later he describes the construction of the more important parts of the pulverized coal plant and compares the relative merit of the various types of plants now in service. The last part of the paper is taken up by the economics of pulverized coal plant and factors to be considered in the selection of the type of plant.—*Journal of Institute of Electrical Engineers of Japan*, July 10, 1921.

London Electricity Inquiry.—The Electricity Commissioners of London are approaching the end of their long inquiry into the organization of electricity supply in the London area. In this report the benefits for East London are outlined, and comments are presented on the functions of the district boards, the expenditures per kilowatt of station capacity, probable interest rates for borrowed money, terms of transfer of companies' stations and the railway companies' schemes. The article concludes with opinions for and against the general plan.—London *Electrician*, July 22, 1921.

Insulation Tests on Live Direct-Current Systems.—G. W. Stubbings.—In small central stations or in isolated plants supplying large institutions or industrial works, measuring the resistance of insulation between the ground and the line conductors will determine the condition of all apparatus on the system. One of the simplest tests of this kind consists in connecting to each main of a two-wire system in succession a voltmeter the other terminal of which is connected to ground. By making such tests at different times it may be seen whether the insulation has developed any leaks which were not present in the former tests.—*Beama* (British Electrical and Allied Manufacturers' Association), July, 1921.

Installations, Systems and Appliances

New Type of Induction Electric Furnace.—In the new furnace the primary winding is placed above the crucible and is entirely out of danger in case the metal should leak out of the crucible. The winding is surrounded by a non-magnetic casing which gives mechanical protection and also serves as a guide for the cooling air which is brought in at the bottom of the furnace so as to flow along the center leg of the core and out horizontally over the winding. The winding with its casing is attached to the upper leg or top yoke of the core so that this unit can be detached and removed from the furnace. The combined effect of the electromagnetic forces acting on the bath is as follows: The metallic or current-carrying parts of the bath are forced toward the center of the conductor so that impurities are squeezed out radially. The metal is also repelled toward the bottom of the crucible, causing impurities to rise to the surface. The bath is, furthermore, subjected to circulation, (1) in vertical planes perpendicular to the direction of the current, and (2) in horizontal planes in the direction of current. The former circulation is generally far more pronounced than the latter, which can, however, be increased by tilting the furnace, thus making purposely the cross-section of the bath uniform. One ton of metal may be poured every three and one-half hours with an average energy consumption of 750 kw.-hr. at the furnace and 950 kw.-hr. at the busbars. This includes power for the crane,



PRIMARY WINDING IS ABOVE THE BATH OR SECONDARY CIRCUIT lights, etc., and losses in the motor-generator set and blowers. When melting down scrap which is in such form that the entire charge of one ton can be put in the furnace at one time, the energy consumption at the busbars is lowered from 950 kw.-hr. to 775 kw.-hr. per ton of metal poured, and the time per heat from three and one-half to two and three-quarter hours.—*Iron Age*, Aug. 11, 1921.

Electrophysics and Magnetism

Electrical Resistance Materials.—WALTER KENNEDY.—Eight of the most commonly used resistance materials in steel plants are considered, such properties as specific resistance, temperature coefficient, permissible working temperature, melting point and mechanical properties involved being given the most attention. A tabulation of data is reproduced here. Temperature coefficient and melting point are the two most important factors in determining the value of resistance. The most satisfactory materials now available for high-temperature work such as 2,000 deg. Fahr. are nickel-chromium alloys, says the author. Cast iron can stand a higher working temperature than either wrought iron or steel on account of its slower oxidation. Owing to its high specific heat, cast iron is very valuable because it can store a lot of heat. To put it another way, for a given temperature cycle cast iron could be worked harder than some other material of higher resistance in which the actual weight of the material would be less.—*Bulletin Association of Iron and Steel Electrical Engineers*, August, 1921.

DATA ON EIGHT MATERIALS USED FOR ELECTRICAL RESISTANCE IN STEEL PLANTS

Material	Composition	Ohms per Circ.mil Foot	Comp. Resistance Approx.	Temp. Coef.	Working Temp.*	Melting Point
Copper		10.4	1.0	0.00217	500	1,981
Iron wire		60.0	6.0	0.0028	750	2,700
Steel wire...		85.0	8.0	....		.....
Cast iron.....	..	400.0	38.5	....	1,000	2,700
Nickel......	....	70.0	6.8	0.004	1,800	2,940
Nickel silver.	18% C. Ni.,Zn....	200.0	19.2	0.00017	500	1,880
Monel ..	Copper-nickel	256.0	24.6	0.00400	1,112	2,480
Chromel A..	80% N., 20% Cr...	620.0	60.0	0.00006	2,000	3,000

* All temperatures in degrees Fahrenheit

Kink in the Characteristic of a Soft Three-Electrode Valve.—B. HODGSON and L. S. PALMER.—The kink has been obtained in five types of valves with four different gases. The conditions necessary for obtaining a kink are: First, the valve should be soft; second, the function V_a must be at least the ionizing potential of the gas in the tube; third, the function V_g must be a resonance potential of the gas in the tube; fourth, the resonance potential must exceed in value the minimum potential necessary for the emission of photo-electrons from the material of the grid. The kink is independent of the gas pressure, the valve geometry and the nature of the external circuit.—*Radio Review*, London, July, 1921.

Units, Measurements and Instruments

Current Transformers.—KIYOSHI TAKATSU.—An extensive investigation of the characteristics of instrument transformers which includes forty-one sets of curves. The effect of the interconnection of the secondary circuits of current transformers in a polyphase circuit and the combined errors of meter and instrument transformers are considered under various conditions. A new method of design which will give a definite ratio error and phase angle is outlined. Among other things contained in the investigation were magnetizing and core-loss currents, characteristics under various loads, secondary power factors, secondary impedances and frequencies and the rating of current transformers.—*Researches of Electrotechnical Laboratory* (Tokyo, Japan), No. 95.

Telegraphy, Telephony and Signals

Current Suppression by Means of Parallel Resonance.—H. G. CORDES.—The author considers series and parallel resonance with zero parallel reactance and with zero series reactance and, after giving a numerical example, considers suppression of interfering current in an aërial circuit as well as selectivity and quality of waves.—*Radio Review* (London), July, 1921.

Telephone Service.—An extensive analysis of 208 pages is presented on telephone practices and service. Following the general classification of the telephone service, there are four sections in which the telephone plant and its operation are described. In the first section the developments of the art are arranged approximately in chronological order; the second part contains a description of manually operated equipment; in the third part the three basic systems of automatically operated equipment are described; the fourth part gives a description of outside plant. Next the handling of calls from a quantitative standpoint is considered. Then the elementary characteristics of telephone service are explained in relation to grade of service. A section regarding public relations is included to cover commission regulation of telephone service. A statistical section is appended.—*Circular Bureau of Standards, No. 112.*

Miscellaneous

Electrical Equipment for the Lyndonia Stabilizer.—T. P. KIRKPATRICK and H. C. COLEMAN.—The principal operations of stabilizing a vessel are controlled by two motors, the spinning motor and the precession motor. The operations of starting, stopping and controlling these motors are described and some of the duties performed by the motors are outlined to indicate the characteristics necessary. Attention is directed principally to the construction of the spinning motor and its performance under various conditions.—*Electric Journal*, August, 1921.

Formulas for the Bending of Steel Towers.—A. HEINEMEYER.—A mathematical derivation of several new and simple formulas for the exact calculation of the amount of bending of a steel latticework tower subjected to horizontal pull.—*Elektrotechnische Zeitschrift*, July 28, 1921.

War Work of the Bureau of Standards.—This paper contains descriptions of the investigations and tests conducted by the bureau during the war which were of service to the military department. Photographs illustrating the apparatus used are given in some cases. As no attempt has been made to cover each subject completely, the bureau advises that the various publications issued in connection with the investigations be consulted for more complete data on any particular line of work. Among the subjects which may be of interest to electrical engineers are the following: Electric batteries, electric blasting apparatus, electric tractors and trucks, electric location of metal bodies, illuminating engineering, invisible signaling, magnetic investigation, radio communication, insulated wire and X-rays.—*Bureau of Standards Bulletin No. 46.*

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

Sir Robert Hadfield Asks United Effort by English-Speaking Engineers

A MESSAGE to the engineers of this country from Sir Robert Hadfield, the British scientist and engineer, upon whom the John Fritz medal was recently conferred by a mission of thirteen prominent American engineers, has just been made public at the headquarters of the national engineering societies in New York. Sir Robert warmly advocates a "world engineering council of Anglo-Saxons," alluding to the co-operation between Great Britain and the United States along engineering lines in the war and quoting William Ewart Gladstone as a statesman whose principles would go far to solve international difficulties. He also advocates the federation of the engineering societies of the entire British Empire with an executive council similar to the American Engineering Council of the Federated American Engineering Societies. "Engineering," Sir Robert says, "does not lend itself to politics or diplomacy, but engineering of all kinds lends itself to improving human effort and helps on in a very high degree the march of civilization."

The message from Sir Robert Hadfield was prepared in anticipation of the dinner to be given on Oct. 10 at the Engineers' Club in New York in celebration of the return of the delegates who conferred the medal upon him and Eugene Schneider of Paris, as announced in the ELECTRICAL WORLD for Sept. 10, page 533.

Consolidation Project in Indiana Disapproved

THE Public Service Commission of Indiana has denied the petition of the Indiana Electric Corporation for authority to buy seven Indiana public utilities and to issue a total of $12,100,000 in stocks, bonds and notes to finance the purchase, as well as to assume a total of $8,962,000 liens outstanding against two of the selling companies. (See ELECTRICAL WORLD for Aug. 20, page 384.) In denying the petition the commission said that while it was favorably inclined toward the petitioner's project of a centralized power plant in the heart of the Indiana coal field to provide electric power to distant places, if such a project could be made to provide energy at low cost, yet it was of the opinion that such a project could not be carried out along the lines proposed by the petitioner.

Commissioner George M. Barnard, who had charge of the case for the state and who wrote the order, thus summarized the reasons why the commission declined to grant the request:

"The commission is not unmindful of the possible benefits that might accrue to the citizens of the various communities through the establishment of a central generating plant serving the consolidated properties. Under the law, however, any consolidation of utility properties must have a proper basis of value, a proper relation between value and securities and a sufficient annual income to carry proper capital charges. Permitting the consolidation on the basis proposed would have capitalized excessive values against the consumers. This, of course, is improper. The petition was therefore denied."

Otto Kahn Sees Signs of Prosperity Ahead

OTTO H. KAHN, the well-known banker, who has just returned from Europe, was most optimistic on the industrial outlook. "The road lies before us broad and straight," he said, "and if we take it resolutely, refusing to be enticed into byways or alleged short cuts, we shall soon find ourselves within sight again of prosperity and national well being." After some cogent observations on European conditions, Mr. Kahn observed:

"America looms so large as an actual, and still more a potential, factor in world affairs that her domestic affairs form an appropriate subject for discussion in even a cursory survey of world matters. Our own house must be in order before we can be effective in those affairs abroad which are of concern to us. It seems to me that the time has come when we should rouse ourselves out of our slough of industrial despond. And I believe we can do so if we make a determined effort and pull together and follow that road which is marked by the signposts of economic soundness. Some of these signposts are:

"(1) A wise taxation policy. We cannot have a return to normal business conditions, we cannot have vigorous enterprise, until we shall have corrected the most glaring, at least, among the faults of our present system of raising revenue.

"(2) A wise credit and loan policy. There has been too much willingness in certain financial quarters to promote enterprises, to float securities for public sales and to facilitate business expansion when prices were abnormally high and a policy of caution and restriction was indicated.

"In times like the present the attitude of those who are in charge of the business of loans and credits should be one of active encouragement and of a ready willingness, within the limits of prudence and capacity, to extend adequate facilities to borrowers for legitimate needs at home and abroad.

"(3) A wise tariff policy. If we want the foreigner to buy from us, we must be willing that he should also sell to us. Trade in the long run cannot be a one-sided matter of sensational export balances.

"I am in favor of the principle of a protective tariff for America to the extent that its application is necessary to preserve our industries and the American standard of wages and living. But the American standard of wages and living does not and cannot and should not mean that extravagant and wholly fortuitous standard which resulted from the war and from its after-effects.

"In order to use the capacity of our industrial plants and to give full employment to our workers, we must make every effort to hold our own in the markets of the world. And that is only possible if the cost of production can be brought into line with existing conditions. All of us, including labor, will be better off in the long run by getting away from an artificial level which has been of genuine benefit to no one and of considerable harm to a large fraction of our population.

"(4) Sound and effective measures to aid the farming industry.

"Second only to agriculture in national importance is the railroad industry, affecting, as it does, the public at large, the shipper, the investor and many industrial and commercial activities dependent on it to a considerable degree. It is greatly to be hoped that the long-pending settlement between the government and the railroads will at last be consummated without further delay.

"(5) Cultivation of our export trade. That is a difficult task at best. It requires us to protect our thoughts and plans internationally and to establish serviceable affiliations and appropriate co-operation abroad."

Prices of Farm Products Only Business Barometer, Says Douglas

THAT the measure of the country's volume of business and of its commercial welfare in the future is to be found in the demand for farm products and their consequent prices is the opinion of Archer Wall Douglas, chairman of the committee on statistics of the Chamber of Commerce of the United States, as expressed in his monthly review of crop and business conditions. All other barometers can be sent to the scrapheap, Mr. Douglas says.

"Sustained higher prices for cotton mean an amount of business in the South that can come from no other cause," he declares. "Nor does it seem to be likely that there will be that fatal and futile holding of cotton for possibly higher prices that characterized the previous season. The memory of that desperate mistake and its enduring consequences are too recent to bring its repetition."

The improved cotton situation already finds expression not only in a widespread more cheerful feeling in the South but also in somewhat freer buying. This is true likewise in the grain regions, where farmers are liberally marketing hogs, Mr. Douglas says, but he adds: "The commercial world, however, will not reap as much benefit from this as surface indications seem to promise. A very considerable proportion of the money the farmers receive for their products will go to settling the obligations carried over. In some sections when banks and dealers have been satisfied there will not be much left for the farmers for new purchases. Yet when all has been said the situation will be far better than at present."

Purchase Information Bureau Serves New Englanders

TO ENABLE New England electric utilities to keep in closer touch with the prices of power-plant and other supplies, a Bureau of Purchase Information has recently been established at 77 Franklin Street, Boston, in charge of H. L. Ogden of the Massachusetts Lighting Company. At the recent New London convention of the New England Division, N. E. L. A., it was stated that there are now thirty-three members receiving the service of the bureau at a charge of $10 per month each. Bulletins on market prices are issued weekly to members taking the service. At first attention was confined chiefly to prices of coal and fuel oil, but of late various other materials have been added, owing to the increasing inquiries received. Six bulletins had been issued up to the date of the convention, and Vincent Goldthwaite, chairman of the bureau, stated that savings to members had already ranged from $100 to $1,300 in specific cases. One company saved $300 in purchasing two carloads of coke, and in another case the "spread" in price of twin-conductor arc-lighting cable was found to extend from 20 cents to 8 cents per pound.

Utilities Commissioners Convene in Atlanta Next Month

DEFENSE of state railroad and utility regulation against encroachments by the federal government will, according to official announcement, be vigorously maintained by the National Association of Railway and Utilities Commissioners at its thirty-third annual convention, to be held in the roof garden of the Ansley Hotel, Atlanta, Ga., beginning Tuesday, Oct. 11. "Roundtable" discussions will be held as in former years. On Oct. 12 the topic will be "After-the-War Phases of Regulation," and E. I. Lewis, formerly a state commissioner of Indiana and now a member of the Interstate Commerce Commission, will be the chairman. On Oct. 13 the important committees on valuation, litigation and state and federal legislation will report. Executive Manager Aylesworth of the National Electric Light Association will speak on Friday.

Carl D. Jackson, chairman Wisconsin Railroad Commission, is chairman of the executive committee of the association, and other committee chairmen are: Public ownership and operation, A. K. Patterson, Alabama; safety of operation of public utility companies, T. W. D. Worthen, New Hampshire; service of public utility companies, W. M. Smith, Michigan; public utility rates, Lewis E. Gettle, Wisconsin; statistics and accounts of public utility companies, O. O. Calderhead, Washington; valuation, H. G. Taylor, Nebraska; capitalization and intercorporate relations, W. A. Prendergast, New York; state and federal legislation, Charles Webster, Iowa; litigation, F. W. Putnam, Minnesota; publication of decisions and orders, James B. Walker, New York.

Indiana Communities Ask Commission for Decreased Utility Rates

NINE Indiana cities and towns have petitions pending before the State Public Service Commission asking for a decrease in the rates of various public utilities. The cases are all separate proceedings brought by the municipal officials with the view of obtaining relief from alleged excessive rates fixed in war time and have no connection with the scores of protests filed by the cities against proposed rate increases initiated in petitions filed by utility corporations.

Many of the community petitions referred to have been filed within the last two or three weeks, indicating, it is said, a concerted movement on the part of municipal officials to obtain reductions in the charges for utility service. Commission officials, it is understood, believe that similar petitions will be filed by other municipalities. The places seeking a reduction of utility rates are in many sections of the state, and the utility corporations affected include electric, gas, telephone and heating companies. Hearing these cases will constitute an important part of the work of the commission this fall.

An analysis of the petitions filed reveals a belief on the part of city officials and consumers generally that the peak in the cost of producing public utility service has long since passed. Most of the rates complained of were established by the commission during the emergency war-time period.

President Harding Summons a National Conference on Non-Employment

WITH Secretary of Commerce Hoover as chairman, a conference called by President Harding will meet in Washington on Monday next, Sept. 26, at 10 a.m., "to inquire into the volume and distribution of unemployment, to advise upon emergency measures that can be properly taken by employers, local authorities and civic bodies, and to consider such measures as would tend to give impulse to the recovery of business and commerce to normal." The President had up to Tuesday received acceptances of his invitation to participate in the conference from thirty-two prominent persons representing producing, manufacturing, industrial and labor interests in all sections of the nation. In addition, twenty prominent economists and statisticians have been formed into an economic advisory committee.

M. S. Sloan Elected President of Edison Association

AT THE concluding session of the convention of the Association of Edison Illuminating Companies held at Spring Lake, N. J., last week, M. S. Sloan, president of the Brooklyn Edison Company, was elected president of the association; John F. Gilchrist, vice-president of the Commonwealth Edison Company of Chicago, was elected vice-president, and W. H. Atkins, general manager of the Edison Electric Illuminating Company of Boston, was elected treasurer. Mr. Sloan has been intimately associated with the electrical industry for a great many years and is chairman of the committee on electrical resources of the nation and of the committee on relations with bankers of the National Electric Light Association.

Utilities Opposing Large Cash Depreciation Fund

THE hearing before the District of Columbia Public Utilities Commission on the proposed rule regulating depreciation and maintenance accounts, which was to have been held on Wednesday of this week, has been postponed indefinitely. The commission proposes to establish a depreciation fund in cash based upon life tables of equipment. From this fund the utilities would be allowed to borrow for extensions, provided that they put up collateral and paid interest to the fund on the amount borrowed.

It is also suggested that in case the earnings of any utility in any month are insufficient to provide for the retirement fund and the financial condition of the utility will not permit of such transfer of cash, a credit corresponding to the amount that should be charged to the retirement fund account shall be made and interest thereon, componuded semi-annually, paid.

The utilities are objecting to these proposals and through the National Electric Light Association are advocating a retirement reserve to take care of recurring retirements rather than the building up of a reserve fund which has no use. All that is asked by the utilities is a fund sufficient to take care of the retirement of property when it occurs with sufficient surplus to iron out any considerable unevenness in the operating expense charged to this item. They oppose crediting into the retirement fund any money not earned because of insufficient rates. They take the position that money for the fund must come from the consumers and not from the utility.

Toledo $13,500,000 Bond Issue Goes on 7.33 Basis

THE $13,500,000 7 per cent first mortgage gold bond issue of the Toledo Edison Company, due 1941, was greatly oversubscribed at 96½, to yield 7.33 per cent. This company has but recently been organized as a merger of the light and power business of the former Toledo Railways & Light Company and the Acme Power Company. This price of 7.33 per cent was considered very low by financial interests and is said to be a very good indication of the strengthening of the utility securities market. There was later issued $2,500,000 of the 8 per cent cumulative series A prior preferred stock of the company at 98, yielding 8.15 per cent.

An issue of $750,000 of 7 per cent gold notes, series A, due 1925, of the El Paso (Tex.) Electric Company came out this week at 96¾, yielding 8 per cent.

Manufacturers Again Producing Electric Ship Equipment for Navy

ELECTRICAL manufacturers are again going ahead on production of electric propulsion machinery for the navy, although no payment can be expected before the next fiscal year, which starts July 1, 1922.

George E. Emmons, in charge of manufacturing of the General Electric Company, has stated that the Navy Department has authorized the resumption of work on electrical equipment for one battle cruiser, with the understanding, however, that shipment will not be required until the next summer and that no payment for materials or labor will be made until the next government fiscal year.

While this necessitates that the company lock up capital for materials and labor until next July, it is going ahead with the work in order to provide employment for those who otherwise would be out of work during the coming winter.

"When the resumption of work is fully under way," said Mr. Emmons, "about 500 additional hands will have employment. It is hoped that similar arrangements can be made with respect to equipment for another cruiser. If they are, work for still more hands will be provided."

At the office of the Westinghouse Electric & Manufacturing Company it was learned that this company also is going ahead with electric propulsion work on a greatly reduced production.

Carolina Company Still Suffering from Shortage of Water

LAST week the Carolina Power & Light Company was forced again to shut off power to cotton mills owing to low water. This time, however, it was only on Friday and Saturday instead of three days as in the previous week. There had been rains, and it was hoped that as a result it might not be necessary again to curtail service. The rains, however, were light and did not raise the water level to the extent necessary.

Other companies in the Southeast have been running their steam plants in the emergency, but the Carolina Power & Light has been unable to operate its Raleigh plant. Formal request for permission to operate this plant was refused by the Raleigh city officials, on account of the scarcity of water.

New York Merchants' Association Opposes Ford Offer

A VIGOROUS protest against accepting the offer of Henry Ford for the Muscle Shoals plant has been made to Secretary of War Weeks by the Merchants' Association of New York City. The association takes the stand that the government by letting Mr. Ford have the water-power and nitrate plants at his own figures would be subsidizing him in the production of fertilizer. Among other things the protest of the association declared:

> It is the firm conviction of this association, reached after long and intimate study of the subject, that under no circumstances is the government justified in invading the industrial field, either directly or by means of a subsidy to a single interest under conditions which will give it a great competitive advantage over other private capital.
>
> We believe, therefore, that the Ford proposal should be rejected, both on financial grounds and because it covers in effect a huge subsidy to the Ford interests of a nature seriously destructive to the development of industrial chemistry in this country, and particularly to the production of an increased supply of nitrates, necessary both for military protection and agricultural development.

Northwest Electrical League to Stage Electrical Show

THE Northwest Electrical League has arranged for an electrical show to be held in Tacoma, Wash., on Sept. 28 to Oct. 1 inclusive. The league has been very active since its organization was perfected less than a year ago and is doing much to bring about better relations and closer co-operation between contractors, manufacturers and dealers, as well as to educate the public.

The present electrical show is the first one of the kind to be held in Tacoma and among the first in the Northwest. As an exhibition room the league has obtained the use of the new city warehouse which has just been completed at the corner of Twenty-fourth and Holgate Streets.

Another Offer Made for Muscle Shoals

AN OFFER has been made for the Muscle Shoals plants to the Secretary of War by C. E. James of Chattanooga, who was associated with the Brady interests in the Hale's Bar hydro-electric development on the Tennessee River. Mr. James also asks permission, if his proposal is accepted, to build a high dam for power and storage in the Clinch River at some point near Kingston, Tenn., so as to increase the flow of water at Muscle Shoals and also to take care of distribution losses and to make service more regular between Muscle Shoals and Kingston.

Mr. James' offer is as follows:

> First I will pay for the general plants, land and material at Muscle Shoals, Sheffield, Ala., $5,000,000.
>
> Second- For rent of Wilson Dam and Dam No. 3, I will pay the following amounts for a ninety-seven-year lease: $1 per annum for average horsepower first year, $1.50 second year, $2 third year, $2.50 fourth year, $3 fifth year, $3.50 sixth year, $4.50 seventh year, $5.50 eighth year, $6.50 ninth year and thereafter. All taxes on government property and equipment to be paid by the government.
>
> I would not ask the government to guarantee any specified amount of power. I would want it to put in electric equipment capable of producing 400,000 hp.
>
> If the government put in additional dams above Muscle Shoals in the Tennessee River to aid navigation all the way to Chattanooga, to a boating stage of 9 ft. and 6 ft., Chattanooga to Knoxville, the horsepower would run to 800,000 at Muscle Shoals. If so, the government would receive rental on 800,000 hp., the government to have the right to equip the plant to 800,000 hp. if it decided to do so—I to take the increased power as produced at above rates.
>
> The concrete foundations in dams ought to be made capable of installing a total of 800,000 hp. in machinery, but I would install only 400,000 hp. now, the government to have free 300 hp. to operate lock gates.
>
> I would operate nitrate plants for fertilizers on a basis of 8 per cent profit and keep in good condition Plant No. 2, subject to being turned over to the government in case of emergency.

Ford's Muscle Shoals Estimates Too Low

THE Secretary of War conferred on Sept. 19 with W. B. Mayo and Col. J. W. Worthington, engineers representing Henry Ford, with regard to the Muscle Shoals development. Secretary Weeks said later that the estimates of Mr. Ford's engineers and of the army engineers disagree as to the amount required to complete the work. The Ford estimate is $28,000,000 and the army estimate $58,000,000. These estimates, Secretary Weeks has indicated, must be reconciled before any action can be taken.

Secretary Weeks said that he had asked Mr. Ford's engineers for the details of their plan for converting the nitrate plant into a fertilizer factory. These data are to be worked up and will be supplied, the engineers stated, at a later date. Assurance was given Secretary Weeks, he said, that Mr. Ford had no intention of requiring a guarantee of the government for a definite minimum horsepower.

Before leaving for Detroit to review their estimates Mr. Ford's engineers told the correspondent of the ELECTRICAL WORLD that Mr. Ford will go to Washington to discuss the matter personally with Secretary Weeks at the proper time.

Oklahoma Avoids Issuing Interference Rules for the Present

THE Corporation Commission of Oklahoma will soon issue an order making effective regulations governing overhead construction but eliminating any mandatory order affecting inductive interference. The order is the result of co-operative work between all the interests concerned. The commission had issued a tentative order containing the Illinois overhead-construction rules and the California inductive-interference rules, both in nearly complete form. A committee representing the electric light and power, telephone, steam railroad, electric railroad and gas and oil pipe-line companies was appointed in August to consider the matter, and on Sept. 13 at a formal hearing it recommended that those portions of the National Electrical Safety Code dealing with overhead construction and maintenance be adopted with the addition of a few general rules and that no specific rules for inductive interference be considered until such time as the joint study of the National Electric Light Association and the American Telephone & Telegraph Company shall be completed. After some minor amendments to the committee suggestions had been made the report was unanimously approved by all the interests concerned. Chairman Russell of the commission made a statement complimenting the utility companies on their willingness to co-operate and stating that the report of the committee would be adopted as the order of the commission.

Nebraska Men Told Freight Rates Prevent Coal Cost Relief

PRICES lower and supply ample but relief in total cost not apparent as yet because of the high freight rates was the summary of the coal situation in Nebraska given in the address of President Harvey before the Nebraska Section of the National Electric Light Association at Omaha Thursday and Friday of last week. Contracts can now be made with a provision for adjustments to lower levels as the current market prices fall because of the reduction of labor and other mining costs. Loads on the Nebraska central stations have been steadily increasing, according to President Harvey, as that territory has been less affected by the industrial slump than most others.

DELEGATES AT CONVENTION OF NEBRASKA SECTION OF THE NATIONAL ELECTRIC LIGHT ASSOCIATION

The inductive-interference committee report brought out a discussion on co-operative work between the telephone and power interests in which President Patten of the Northwestern Bell Telephone Company emphasized the country-wide nature of the service that the telephone companies are aiming to give and made a plea for co-operative work and agreements that will keep the different utilities friendly without the necessity of surrendering any rights to satisfy unreasonable demands. The need of looking forward to the ultimate development of both services was dwelt upon. C. J. Snyder, chairman of the inductive-interference committee, President Bump and Executive Manager Aylesworth discussed the activities of the joint committee representing the power and telephone interests, while Dr. M. G. Lloyd of the Bureau of Standards told of the action of the Oklahoma Corporation Commission a few days before in substituting the safety code for the construction rules previously proposed and leaving the interference situation to be settled after the results of the national co-operative work shall be complete.

The rural service committee, through Chairman F. H. Brooks, submitted a report that embodied the last report of the Wisconsin Electrical Association committee. A. J. Cole in discussing this report called for efforts to educate the farmer in the proper and economical use of electricity and spoke of the reduction in price of energy per kilowatt-hour that might be brought about by increased use for farm purposes. N. T. Wilcox urged the central-station companies not to underestimate the cost of the service or its value to the farmer.

That the electric range properly selected, installed and maintained is the best method of developing good will was asserted by K. P. Goewey in discussing the sale and service of electric ranges. Ranges should not be scattered over the widest possible territory. On the contrary, Mr. Goewey recommended that definite sections of company territory be selected and each section saturated before work is begun on the next, in order that the greatest possible benefit from the diversity factor may be derived. This course was also recommended by F. S. Dewey of the Kansas City Power & Light Company, who asserted that the diversity factor so far fonud was approximately five and not ten.

The Thursday sessions included discussions on practical lighting for the home and store and a consideration by George A. Lee, an attorney of Omaha and former chairman of the Washington State Public Utilities Commission, of the recent trend of court and commission decisions on rates and valuation. The change from no interference with municipal control over rates to denial of such control, the allowance as proper practice of the requirement of consumers' deposits, the reversal of early holdings that utilities were not entitled to expect any return on investment and other similar findings were cited as indicating an awakening on the part of the courts to the real situation.

The officers elected for the coming year were: President, W. B. Roberts, Omaha; vice-president, J. E. Harsh, Lincoln; secretary, Horace M. Davis, Lincoln.

New York Commission Enunciates Radical Policy on Utility Earnings

A CLEW to the general attitude that the new Public Service Commission of New York State is likely to assume as between the proponents and the opponents of the liberal treatment of public utilities in the matter of allowed earnings was in some degree provided last week when Chairman William A. Prendergast handed down a unanimous opinion of the commission denying to the New York State Railways Company permission to increase its street-car fares in the city of Utica from 6 cents to 10 cents, this being the first fare-increase case of importance to be decided by the commission. Holding that the war-time emergency had subsided and that the advance from 5 cents to 6 cents already conceded by the local authorities had not been proved inadequate, the commission summarized its position in these words:

"Public utilities, just as other departments of business, must expect to cope with periods of depression and short earnings, just as at other times they enjoy periods of prosperity and full dividends. If the public is expected to make up every deficiency in order to give a utility a good round rate of earning power, then the public is entitled to the benefit of the surplus over the agreed earning rate in times of prosperity."

Intermountain Conventions Advocate Complete Frankness with Public

ESTABLISHMENT of an absolute understanding on the part of the consuming public of the problems of the electric utility companies was the keynote of the combined annual convention of the Rocky Mountain Geographic Division of the National Electric Light Association, the Colorado Electric Light, Power and Railway Association and the Accounting Section of the National Electric Light Association, held at Glenwood Springs, Col., beginning Monday, Sept. 19. The meetings were attended by 150 delegates.

The problem of inductive interference and similar subjects of general interest to electrical men received the attention of the telephone, telegraph and electric light and power company delegates. Tax-free securities and kindred evils of the financial world were emphasized and the relationship of these problems to financing the electric utility companies was dwelt on.

The delegates were officially welcomed to Glenwood Springs by Mayor W. G. McDonald. President C. A. Semrad of the Colorado Electric Light, Power and Railway Association spoke briefly on the work accomplished by his organization during the last year and made suggestions relative to possibilities for the future. S. E. Doane, chief engineer National Lamp Works of the General Electric Company, Cleveland, gave an address of more than ordinary interest on electric illumination, predicting lighting developments that would eclipse anything done in the past. The national financial situation was brought forcibly before the convention by Frank N. Briggs, president of the Interstate Trust Company of Denver.

The first afternoon session was entirely devoted to the National Electric Light Association. E. A. Phinney, president of the Rocky Mountain Division, who is president of the Jefferson County Power & Light Company, Golden, Col., gave a résumé of the last year's work. M. R. Bump, president of the N. E. L. A., recounted in detail the problems confronting the electric industry and the plans for financing local power companies. The plans of the association are exceedingly comprehensive in scope, as it is the intention that the consuming public shall be fully informed regarding the exact condition of its activities. Ben S. Read, president of the Mountain States Telephone & Telegraph Company spoke of the necessity of utilities having the good will and entire confidence of the public.

When the consumers are told the truth about the public utilities serving them, then will come an understanding of mutual helpfulness and a desire by the public to assume part of the burdens of operation, according to M. H. Aylesworth, executive manager N. E. L. A., who addressed the opening session of the second day.

F. C. Hamilton, rate expert of New York City, emphasized the necessity of thoroughly explaining to consumers all the innermost details of a company's operations. "How to Reverse Radical Sentiment" was the subject of an address by Fred R. Marvin, editor of the *Mountain States Banker* of Denver. Latest developments in street-lighting equipment were discussed by L. A. S. Wood of the Westinghouse Electric & Manufacturing Company. Grant E. Halderman, chairman of the Colorado Public Utilities Commission, and S. W. Bishop, executive manager of the Denver Electrical Co-operative League, also made addresses.

The meetings of the last day were given over to business and to hearing of the work done by the National Accounting Section of the N. E. L. A. through E. J. Fowler, the chairman, who is the statistician of the Commonwealth Edison Company of Chicago.

The officers of the Colorado association elected for the year 1921-1922 are: President, Fred Norcross, Greeley; first vice-president, Walter F. Brown, Denver; second vice-president, C. R. Rudy, Denver; secretary-treasurer, Miss Minnie B. W. Baker, Denver. The Rocky Mountain Division of the N. E. L. A. elected as officers: President, T. O. Kennedy, general superintendent Denver Gas & Electric Light Company, Denver; first vice-president, E. P. Bacon, Natrona Power Company, Casper, Wyo.; second vice-president, Arthur Prager, general manager Albuquerque Gas & Electric Company, Albuquerque, N. M.; third vice-president, D. C. McClure, electrical superintendent Denver Gas & Electric Light Company, Denver; secretary-treasurer, A. C. Cornell, manager Intermountain District Western Electric Company, Denver.

Southern California Edison Company to Start 150,000-Kw. Station

PRELIMINARY surveys have been completed and actual work is to be started immediately by the Southern California Edison Company upon the construction of a hydro-electric station which is to have an ultimate rating of 150,000 kw. This station, Big Creek No. 3, will be the fourth plant in the Big Creek development. It will be the second to be built directly upon the main stream of the San Joaquin River, the first being the recently completed 22,500-kw. station known as Big Creek No. 8. At the tailrace of No. 8 station a forebay of 700 acre-feet capacity will be constructed. From this the water will be taken to No. 3 station through 30,000 ft. of 23-ft. tunnel having a capacity of 3,000 second-feet. The maximum static head will be 825 ft. The station will ultimately have six units of 25,000-kw. capacity each, and the output of these is to be stepped up to 220,000 volts through 50,000-kva. transformer banks. The estimated cost of the development up to the first three units is $12,989,000. It is planned to place the first unit in operation in the spring of 1923, the second in 1923 and the third in 1924.

STEAM SHOVEL STARTING ROAD INTO BIG CREEK NO. 3 SITE

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest

Big Gain in Pacific N. E. L. A. Membership.—It is announced that membership in the Pacific Coast Geographic Division of the National Electric Light Association increased in the fiscal year 1920-1921 no less than 42 per cent. The report of the membership committee, of which R. A. Balzari is chairman, showed 883 new memberships, of which 814 are in class B.

Ontario Town Prefers Utility Electric Service to Control by Hydro Commission.—Cornwall, Ontario, a town of about 7,000 people, has by popular vote extended for ten years the franchise of the local electric utility, the Stormont Electric & Power Company, thus negativing a proposed arrangement fathered by Sir Adam Beck of the Hydro-Electric Commission of Ontario, by which the town would have discontinued the service of the utility and purchased its electricity from the commission.

Icelandic Electricity.—Reykjavik, the capital of Iceland, is rejoicing in the opening of a new electric power house, which is supplying the town with energy at a lower rate than was formerly paid. There are two water-driven generators, one rated at 1,000 hp. and the other at 500 hp. Two water-power companies are established in the island, one under Danish and the other under Norwegian control. Together they are said to own millions of potential horsepower which could be easily produced were there a market for it.

Electrical Progress in China. — The Westernized city of Shanghai naturally stands in the forefront of Chinese communities from the point of view of electrical developments. In 1920 sales of 144,540,000 kw.-hr. were reported by the municipal electrical engineer as against 102,338,000 kw.-hr. in 1919. Of the former amount 117,000,000 kw.-hr. was consumed for industrial purposes, or about 47 per cent more than in the previous year. All former records were surpassed, an accomplishment largely due to the connection of many new factories. The load factor was 46.7 per cent, which the London *Electrician* compares with 25.28 per cent in Manchester and 25.54 per cent in Glasgow, the only two British communities which exceed Shanghai in industrial load. Heating and cooking load in Shanghai advanced 30 per cent in 1920 and reached a total of 1,240,136 kw.-hr. The tendency to discard steam for electric drive is, the British Chamber of Commerce at Shanghai reports, evident in other districts of the Celestial Republic, and the demand for electric lighting constantly grows.

British Electrical Engineers Get Royal Charter.—A "royal charter" recently granted by the British Privy Council to the Institution of Electrical Engineers gives to that body increased power and an enhanced status along the lines of preventing incompetent persons assuming the title of electrical engineer and also of enforcing rules of professional conduct and promoting the standardization of work and material. Previously, the institution, operating under the companies act, was greatly hampered in such respects, and it had long sought to obtain a charter.

Drought in Virginia Affects Supply of Electrical Energy.—A summer-long drought in some sections of Virginia had its effect not only on the water supply of the towns but also on the supply of electricity to consumers. At Fredericksburg, for instance, the Rappahannock River was said to be lower than for seventy years, and no water went over the dam of the Spottsylvania Power Company for several days. A number of industrial plants had to suspend operations, street lighting was restricted, and the energy available went to operate the city's water plant, a creamery plant and ice factories. At Danville, owing to low water in the Dan River, the condensing apparatus in the municipal steam-electric plant worked so badly because of the low vacuum that an excessive consumption of coal was forced.

Bureau of Standards Develops New Test for Purity of Gold.—Spectroscopic experts in the Bureau of Standards have perfected a method of testing gold which will be used in the national mints in addition to the familiar assayer's furnace. It is based on the knowledge that every metal or other element gives off light rays unlike those of any other, and it will, the bureau says, prove much more accurate than the old method, detecting impurities as small as 0.000001 per cent, whereas by the assay process there may remain undetected impurities as large as 0.0002 per cent. Analysis by the spark spectrum method will be faster and less expensive than by the assay method. The bureau experts have made up samples of gold that contain known and varying amounts of impurities, and duplicate sets of the samples have been tested. These samples will become standards. In making them a specially refined gold was needed. The "1000 fine" gold of the mint, which is its highest grade, was found to be only 99.997 per cent pure, while the gold used in the samples was 99.999 per cent pure. The routine process of testing, which can be repeated many times in a single day, will consist in clamping two pieces close together and allowing a spark to play across with a potential difference of several thousand volts. A diffraction grating will be used to break up the light that the spark creates, and a permanent record of it will be made on an ordinary photographic plate that can be compared with photographs of the standard samples.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

Electric Club of Chicago.—The opening fall meeting of the Electric Club of Chicago took place on Tuesday, Sept. 20, at 12.15 p.m., at the Hotel Morrison, the business meeting being followed by a musical and vaudeville entertainment.

Vancouver Electric Club.—Officers elected by the Vancouver (B. C.) Electric Club for the current year are: President, E. E. Walker; vice-president, H. Pim; secretary, J. Lightbody; treasurer, F. W. MacNeill. The directors are H. R. Smith, C. K. Dunbar, J. R. Reid, B. Crann, J. Churchland, W. E. Dawson, C. C. Carter and J. D. Ormsby.

N. E. L. A. Committee Meetings.—This week meetings of the Technical Section of the National Electric Light Association have been held in St. Louis from Monday to Friday inclusive. Next week further meetings of this section are scheduled to be held at the Hotel Utah, Salt Lake City as follows: Sept. 26 and 27, sub-groups of the meter, inductive-interference and underground-systems committees; Sept. 28 and 29, dual groups of the overhead-systems and hydraulic-power committees and sub-group of the electrical apparatus committee; Sept. 29 and 30, sub-groups of the safety rules and prime movers committees. The Commercial National Section will hold these meetings in Rochester, N. Y.: Sept. 26, Power Sales, Electric Vehicle and Merchandise Sales Bureaus; Sept. 27, Advertising and Publicity Service Bureau, education committee, Lighting Sales Bureau, committees on commercial service and relations with customers, "Electrical Salesman's Handbook" and electrically equipped furniture; Sept. 28, executive committee.

Coming Meetings of Electrical and Other Technical Societies

Illuminating Engineering Society—Rochester, N. Y., Sept. 26-29. (For program see issue of Aug. 13, page 336.)

National Safety Council—Boston, Sept. 26-30. (For program see issue of Sept. 17, page 582.)

American Electrochemical Society—Lake Placid Club, N. Y., Sept. 29-Oct. 1.

A. I. and S. E. E., Philadelphia Section—Philadelphia, Oct. 1.

American Electric Railway Association—Atlantic City, N. J., Oct. 3-7.

Indiana State Association of Electrical Contractors and Dealers—Indianapolis, Oct. 5 and 6.

Empire State Gas and Electric Association—Lake Placid, N. Y., Oct. 6 and 7.

National Association of Railway and Utilities Commissioners—Atlanta, Ga., Oct. 11-14.

N. E. L. A., Southeastern Section—Chattanooga, Tenn., Oct. 17-19.

Electrical Supply Jobbers' Association, Atlantic Division—Philadelphia, Oct. 20.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities

Proper Operation of Municipal Plant.—In a hearing of complaints by customers of the municipal electric plant of Butler, Mo., the Missouri Public Service Commission held (1) that the cost of changing from direct-current to alternating-current meters was properly placed upon the customers, (2) that it was reasonable to refuse to take on new customers during this change of service, (3) that the proper official's permission was rightly held requisite before individual service wires could be connected with the system, (4) that a cash deposit or a guarantee from a responsible person was properly required before the installation of service, but (5) that demands for service from taxpayers should be met immediately upon their compliance with the company's reasonable rules and regulations.

Discrimination Involved in Constructing Extra Cable to Refrigerating Plant at Electric Service Company's Expense.—The cost of installing an extra cable to supply energy to a refrigerating plant in case of breakdown should be borne by the refrigerating company, according to the Missouri Public Service Commission, the cost of only one cable being properly chargeable to the central-station company. Otherwise there would be discrimination against other companies which might also require breakdown service but to whose plants only one cable had been carried. This was the outcome of a complaint brought against the Union Electric Light & Power Company by the St. Louis Refrigerating & Cold Storage Company because of the refusal of the former to extend two cables to the refrigeration plant

Proper Treatment of Income Tax.—In discussing the operating expenses of an electric utility recently, the Wisconsin Railroad Commission said: "As to the income tax, methods of procedure differ. Some authorities treat it as an operating expense and others handle it as a deduction from net income. In either case the final result is unchanged. The utility under normal conditions is entitled to a fair return. If from the net income which makes up such return income taxes are deducted, the remainder must still be sufficient to be compensatory to capital or the return will be insufficient to permit of the development of the industry. In making an allowance of 8 per cent for return the commission considers such allowance necessary after meeting all tax requirements. We have endeavored to compute the normal tax on the assumption that the utility will earn a fair return."

Company Has Right to Refuse Service Where Equipment Is Not Standard.—The Board of Public Utilities Commissioners of New Jersey denied an application for an order to compel central-station service which had been refused because the would-be customer had installed a switch box and safety cabinet which did not conform with the rules of the company. The commission pointed out that the primary objects of standardization are the development of the best appliance for the purpose intended, safety, reduced cost of installation and reduced cost of operation and maintenance, and while a variance in some particulars might be held to be immaterial and the company's action in refusing service unreasonable, still specifications for standardization purposes must necessarily be more or less arbitrary, and in the case under review the company's refusal was justified especially by variations in the size of the equipment.

Basis of Rates to Be Charged Electric Light and Power Company for Energy from Irrigation District.—The California Railroad Commission in a decision approving an agreement entered into between the Merced Irrigation District and the San Joaquin Light & Power Corporation has fixed 4.5 mills a killowatt-hour at the plant switchboard as the price the power utility is to pay the district for electric power to be developed by the district at its proposed plant at Exchequer, Mariposa County. With cost of transmission, including loss of energy, this figure is found comparable to the price of the exchange by the power companies of electrical energy at substations. In arriving at the plant switchboard rate the commission adopted the principle that the value of the power should be measured by the average estimated cost of future developments of streamflow plants to be constructed by power companies. Average cost of present power development based on pre-war and war prices of plant construction was adopted as the best index of future costs, and according to opinions of the electrical engineers of the commission the price of 4.5 mills, plant switchboard measurement, should not be subject to future variation. Owing to the rapid growth of the San Joaquin Light & Power Corporation the commission found it would have no difficulty in absorbing this additional power. The Merced Irrigation District plans the development of electric power as a by-product of its irrigation system, by which it contemplates the storage of 250,000 acre-feet by a dam across the Merced River, near Exchequer, 25 miles northeast of Merced. At the price fixed for the 25,000-kw. capacity of the proposed plant, the commission estimated the gross revenue at $450,000 a year. An allowance of $190,000 for operating expenses and fixed charges on the power plant will leave $260,000 available to reduce the annual charges on the irrigation district for water development.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies

Temporary Rates May Be Ordered Pending Investigation.—The rate-making power of the Oklahoma Corporation Commission is not limited to any particular theory or method, declared the Supreme Court of Oklahoma in a suit brought by the city of Bartlesville against the commission to prohibit it from authorizing an increase in gas rates, and the commission may, if it has the necessary facts before it, prescribe a temporary schedule of rates to be effective until it has had time to make an investigation and a valuation of the public utility's property. The state's sovereign interest in the regulation of rates precludes the cities of the state from entering this field by charter provisions or otherwise. (199 Pac. 396).[*]

Contract Between Municipality and Public Utilities Company Not Subject to Review by Ohio Commission.—The Ohio Supreme Court, in Link vs. Public Utilities Commission, has sustained the commission in its refusal to take jurisdiction of a complaint filed with it, pursuant to statute, by more than 2 per cent of the electors of Cleveland against the contract rates made for steam and hot-water service by the Cleveland Electric Illuminating Company. A contract, the court holds, entered into by the passage of an ordinance fixing the rates and terms of a designated product and service for a specified period and by the duly filed written acceptance thereof by the company cannot, under the Ohio constitution, be reviewed by the commission. (131 N. E. 796.)

Incorrect Statement to Workman that Lines Are Not Charged Is Negligence—"Casual" Employment.—In a case (Porter vs. Mapleton Electric Light Company) where a workman was severely burned by wires on which he was working and which his superior had told him were not charged, a clear instance of negligence on the part of the company was established, according to the Supreme Court of Iowa. The victim of the accident, being a lineman of the telephone company temporarily "loaned" to the electric light company, came under the category of a "casual" employee of the latter company and, having been injured by its negligence, was entitled to sue for damages instead of proceeding under the workmen's compensation law. (183 N. W. 803.)

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[*] The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel—Responsibilities and Association Appointments of Men Engaged in Professional, Executive, Operating and Commercial Branches of the Industry

C. Ernest Greenwood, the newly appointed chairman of the Merchandise Sales Bureau, N. E. L. A., is widely known in the central-station field for his work in the national organization and in the Edison Electric Illuminating Company of Boston, where he is superintendent of the sales department and editor of *Edison Life*, the company's monthly publication for employees. Mr. Greenwood was born in Boston in 1880 and was graduated from Harvard College in 1904. In May, 1906, he entered the electrical industry as a special agent of the Boston Edison company. After about two years' work on the standardization of contracts with customers and other related tasks, he was transferred to the statistical department. This was followed by field service for the sales department, including district agency duties and work on isolated plants. About nine years ago he was made editor of *Edison Life*, which was then being established by the company on broader foundations, and his faithful service to this periodical in the midst of other tasks of increasing responsibility has been a potent factor in its high reputation as a company publication. Since 1916 he has been at the head of the appliance department, the activities of which include the promotion and sale of socket devices throughout the company's territory of more than 600 square miles. During the last five years Mr. Greenwood has been very active in association committee work. He was a member of the electric range committee for three years and has been chairman of the committees on electric shop management and of merchandise sales of the Merchandise Sales Bureau, as well as chairman of the New England N. E. L. A. Commercial Section, president of the Boston Edison Company Section of the N. E. L. A., and for the last two years vice-chairman of the Merchandise Sales Bureau. He has also served as treasurer of the Edison Employees' Club. He is a member of the Engineers' and Harvard Clubs of Boston and of the Hunnewell Club of Newton.

C. E. GREENWOOD

Prof. Harold J. Lockwood has resigned as instructor in physics, electrical engineering and other subjects at Lafayette College, Easton, Pa., to become professor of electrical engineering at the Thayer School of Civil Engineering, Dartmouth College, Hanover, N. H.

Joseph F. Becker, who has been appointed chairman of a new N. E. L. A. committee to promote electrically equipped furniture, is sales manager of the United Electric Light & Power Company of New York City, which position he has held since 1910. Previous to that he was associated with the Brooklyn Edison Company. His first connection with that company was in 1898 as meterman. From that post he rose rapidly to superintendent of the meter department, later being appointed general agent for the company, which position he held until he accepted his present appointment. Mr. Becker's activities in the N. E. L. A. are well known. He was chairman of the Commercial Section in 1916. He has also been closely identified with the activities of the Sales Managers' Association and was chairman of that organization in 1917.

J. F. BECKER

James T. Hutchings, who recently resigned as president and general manager of the Rochester Gas & Electric Company to become assistant general manager of the United Gas Improvement Company of Philadelphia, has been appointed general manager of that company. Mr. Hutchings was associated with the Rochester Railway & Light Company from June, 1904, to April, 1920, advancing from the position of superintendent of the electrical department to general manager, vice-president and president. During this sixteen-year period he was largely responsible for the physical growth of the Rochester company. Previous to his Rochester association Mr. Hutchings was associated with the Philadelphia Electric Company and before that with the Germantown (Pa.) Electric Light Company as assistant superintendent in 1890. He was born in Amherst, Mass., on Feb. 18, 1869, and was graduated from the Massachusetts Agricultural College at that place in 1889.

J. T. HUTCHINGS

Charles F. Backstrand, until recently assistant district manager of the Holton Power Company, El Centro, Cal., is now associated with Howard F. Ross in the Riverdale (Cal.) Electric Company.

Frank M. Tait and Mrs. Tait are receiving messages of sympathy from their many friends owing to the death of their only child Frank M. Tait, Jr., on Sept. 17. Mr. Tait is now associated with the Anthony Brady estate and is well known in the electrical industry, having served as president of the N. E. L. A.

F. R. Winders, electrical engineer of the Railroad Commission of Wisconsin, has obtained a three months' leave of absence in order to assist the joint committee of all Ohio utilities working on the compilation of rules for overhead-line construction to comply with state regulations requiring the Ohio Public Utilities Commission to put such rules in effect not later than six months from Aug. 1, 1921.

H. S. Cooper has resigned as secretary of the Southwestern Electrical and Gas Association, to take effect as soon as a successor can be selected, after which he expects to take a much-needed rest. Mr. Cooper has been secretary of the association for the past nine years and has earned for himself the reputation of having made the Southwestern association of unusual value to the member companies and of making the meetings extremely interesting. He was one of those who started the association back in 1904, having been president of it and always active in its development even before he became secretary. Before becoming secretary of the association he had been engaged for a number of years in the Southwest in utility and engineering work. In addition to his association duties he has for the past six years been engaged in the practice of consulting engineering in the utility field. Mr. Cooper was born in 1856 and at the age of twenty engaged in the manufacture of agricultural equipment in the South, shortly afterward entering the electrical field. In 1893 he was appointed manager of the Schenectady (N. Y.) properties of the Electric Development Company, and after placing the electric lighting, gas and railway utilities there on a paying basis he directed the rehabilitation of the Ithaca (N. Y.) Railway. He later joined the staff of the Development Company of New York City, preparing critical reports on electrical projects for clients. In 1904 he became general manager of the Galveston City Railway, continuing until 1910 with that company's successor, the Galveston Electric Company. At that time he was retained to supervise the design and construction of the Galvez Hotel at Galveston. In 1912 he became secretary of the Southwestern Gas & Electric Association.

H. S. COOPER

E. D. Kilburn, vice-president and general manager of the Westinghouse Electric International Company, has left New York for a trip to Mexico. While there Mr. Kilburn will make a survey of general business conditions. He looks forward to considerable expansion in the electrical industry in that country.

F. W. Burmeister of the fan sales department of the Robbins & Myers Company has been appointed assistant sales manager of the fan department.

W. Wilder, formerly of the Steel & Tube Company of America and the Allis-Chalmers Company, has become associated with the Elliott Company of Pittsburgh, and will make his headquarters at its Pittsburgh office, covering surrounding territory in the interest of the products manufactured by that company with special regard to promoting the sale of Elliott-Ehrhart condensers.

Daniel R. W. Murdock, who has been made chairman of the new Radio Section of the Associated Manufacturers of Electrical Supplies, is a partner in the long-established house of the William J. Murdock Company, Chelsea, Mass., manufacturer of electrical specialties and producer of telephone and radio apparatus. Mr. Murdock was born thirty-nine years ago at Charlestown, Mass., and after receiving instruction in the Boston schools entered the manufacturing field at Boston in close association with his elder brother, William J. Murdock, founder of the organization above mentioned. In 1900 the firm moved from Boston to Chelsea, and about 1904 it enlarged its production facilities to include radio apparatus. After a period of factory experience Mr. Murdock began to devote his attention to sales work, and he now has charge of that branch of the business. He is also the company's treasurer. The organization of sales offices at San Francisco and New York has been carried out by him in this connection. He is a member of the Institute of Radio Engineers of America and the Radio Club of America.

D. R. W. MURDOCK

Obituary

Silas C. Linbarger, ceramic engineer for the Carborundum Company, died Sept. 10 at his home in Niagara Falls, N. Y. He had been with the Carborundum Company since December, 1915.

Horace M. Briggs, for twenty-four years in the power engineering sales service of the Edison Electric Illuminating Company of Boston, died at his home near that city Sept. 6 after a brief illness. Mr. Briggs was born at Canton, Mass., in 1853 and as a young man was employed by the Gold & Stock Ticker Telegraph Company of New York in the line and trouble handling departments. After a term of employment in various electrical manufacturing and sales organizations, Mr. Briggs joined the commercial department of the Boston Electric Light Company, and he continued with the Boston Edison Company when the two utilities were consolidated. Mr. Briggs had much to do with the commercial engineering problems involved in the substitution of central-station for isolated-plant service in the Boston territory and will be kindly remembered by a very large group of electrical men in eastern Massachusetts utility circles.

Charles W. Davis, vice-president and general sales manager of the Standard Underground Cable Company, Pittsburgh, Pa., died Sunday, Sept. 11, in the Memorial Hospital, New York. He had been in failing health for several years and had gone to New York for special medical treatment. Mr. Davis was born in Pittsburgh forty-eight years ago and was educated at the Western University of Pennsylvania, now the University of Pittsburgh, and at the Massachusetts Institute of Technology. His connection with the Standard Underground Cable Company begun shortly after his graduation from college, or about 1899, at which time he was employed by the company as construction engineer on a large cable installation in Mexico City. Later he became superintendent of construction and manager of the central sales department, continuing in these positions until 1915, when he was elected vice-president in charge of the general sales, construction and accessories departments. Mr. Davis was well known in the electrical industry as an expert on the design, manufacture and installation of electric cables and acessories, and had contributed largely to the development of the art by his investigations and occasional technical papers and by his many inventions dealing with improvements in methods of cable construction, installation and operation. He was a member of the American Institute of Electrical Engineers, the Pittsburgh Club, the Edgeworth Club and the Allegheny Country Club of Sewickley, Pa.

Trade and Market Conditions

Business Reviews, Together with Market Letters
from Important Trade Centers, on the Supply, Demand and Prevailing Prices of
Electrical Apparatus and Supplies

Wire Producers to Furnish Statistics to Department of Commerce

REPRESENTATIVES of thirty-four bare and insulated copper-wire manufacturers met at the Hotel Commodore, New York, on Sept. 13 to discuss the advisability of asking the Department of Commerce to include wire production statistics in its "Monthly Survey of Current Business." The meeting was called at the suggestion of L. S. Horner, vice-president of the Acme Wire Company, who presided.

About two-thirds of those present voted to furnish the necessary figures, three objected, and the rest preferred to defer decision until they had had more time to consider the matter. Prior to the meeting Mr. Horner received from a few wire manufacturers who could not be represented letters commending the idea of the meeting. There was every assurance at the meeting that, provided the Department of Commerce would collect, tabulate and print such wire statistics, at least 60 per cent of the copper-wire producers of the country would be represented at the very outset.

W. M. Steuart, director of the Department of Commerce, who is director of the survey, was present and described the department's plan and method of working. Statistics are furnished at the department's request. These are tabulated and printed monthly, and individual reports are kept entirely confidential.

Wire manufacture divides itself naturally into four groups —bare, rubber-covered, weatherproof and magnet. For each of these it has been proposed to gather monthly statistics on production, stocks and shipments. The definite form of report which the manufacturers will recommend to the Department of Commerce is now under consideration by a committee composed of H. D. Keresey, Anaconda Copper Mining Company, representing the bare-wire group; Edward Sawyer, Atlantic Insulated Wire Company, representing the rubber-covered wire group; L. S. Horner, Acme Wire Company, representing the magnet-wire group and W. F. Field, Phillips Wire Company, representing the weatherproof-wire group. This committee of four selected LeRoy Clark, Safety Insulated Wire & Cable Company, as chairman.

Two Sizes of Ceiling Fans Felt to Cover Requirements

FAN manufacturers are satisfied that there should be two standardized sizes of ceiling fans, it was brought out at the Hot Springs convention of the Fan Motor Section of the A. M. E. S., held early this month. Heretofore it was thought that the fan with 56-in. sweep would satisfy all demands that would be made for this type of ceiling fan. It is true that there are sizes a few inches under and a few inches above this figure that are still being made, but the tendency in manufacture is decidedly toward this 56-in. size, which has been set as a standard for this type of fan. The factor of cost of change-over is said to be holding up complete compliance with the standard at this time.

It is felt that there is a need for a ceiling fan with 40-in. sweep, or just under this figure, and the manufacturers represented at the meeting have decided to go into this matter and determine on a size which will best suit the requirements. A maximum of 40 in. is thought to be enough. The demand for this size comes particularly from the Southern territory, where smaller rooms and narrower halls and passageways than are found in other parts of the country have been a deciding factor in the use of ceiling fans. No standard has been determined upon, but it is expected that in the near future the result of experiments by manufacturers will point the way to the size best suited.

Higher Steel-Sheet Base Does Not Affect Electrical Sheets

TOWARD the end of last week most of the prominent independent manufacturers of sheets advanced their prices $5 per ton. Black sheets went from 2.75 cents to 3 cents, galvanized from 3.75 cents to 4 cents, and blue annealed from 2.25 cents to 2.5 cents per pound, Pittsburgh base. Considerable booking was done before the old price was cleared off the boards. At this time of writing the leading sheet producer has not made any advance in price to the new bases taken by the independents.

As far as can be learned, there has been no advance in electrical steel sheets for magnetic use. This market is still quiet, although it is reported better than it was in the early summer. Under this condition it is considered unlikely that a higher price will be placed on it at this time unless it reacts in that direction through the influence of the general sheet market.

Electric Furnace Market Good in Some Quarters

WITH the generally recognized low volume of operation of the steel and iron mills and also of the brass mills throughout the months of this year to date, it would not be surprising to find the electric furnace industry on a rather low basis also. To an extent and in some quarters this is the case, but, on the other hand, certain manufacturers of this equipment report a satisfactory volume of business in both ferrous and non-ferrous furnaces throughout the past spring and summer.

The condition of the steel mills and brass mills has generally been considered to act as a barometer for the electric furnace market. With steel and iron mills operating this year at around 10 to 20 per cent of capacity and many of them shut down for rather long periods, the ferrous furnace business did not flourish in its entirety. Some steel plants took that slack time to rehabilitate their properties and to put in more economical methods of steel production, and certain furnace makers picked up some good business. As this business was limited this summer, it is to be expected that reports should be received showing from several sources rather a quiet market.

The important factor to consider at this time, it would seem, is the returning activity of the steel mills. Furnace manufacturers report a great number of inquiries for installations, showing that the steel mills are alive to the fact that a higher-quality product is being demanded and a lower price is being sought by the trade. Considering this fact of quality and price, the manufacturers are looking forward to a very strong market in the future, which should show some signs of life this fall In some quarters of this industry a turn toward better business was noticed in July.

A return of business in general seems to be the awaited signal that will start off a good number of steel mills in the actual purchase of electric furnaces. They already have their figures on costs and installation. At the present time steel ingot production has increased to about 33 per cent of capacity, whereas in July it was about 21 per cent. This in itself is indication of a returning market. One manufacturer feels that economies of production rule the market when he says: "A properly designed, ruggedly constructed electric furnace for brass, aluminum, gray iron or steel is an economically correct implement for competitive production of high-class metal, and consequently at the present time, when competition is keen in all metal trades, should receive remarkable attention from all industries employing melting apparatus."

The export market is one which also gives promise of a bright future. Canada and some of the European nations stand out quite prominently in this respect.

School Installations Providing Field for Lighting Fixtures

ONE of the most promising markets in the lighting fixture field at present would appear to be that of lighting fixtures for school buildings. Reports have recently been received from several sections of the country showing activity in that direction in various local instances. The field seems to be peculiarly fitted for the application of unit lighting fixtures, and certain manufacturers have been putting the situation squarely up to local contractors to go out and sell the equipment.

One manufacturer of unit lighting fixtures attributes the demand for school lighting equipment both to a normal increase in population, necessitating additional school facilities each succeeding year, and to the lack of building activity during the last five years, both factors combining to create an actual shortage of school facilities. Because of high construction charges new facilities are not in all cases being provided, and this is leading to longer school periods in the day and even to night classes. At the same time additional advantages are being offered for night school work through organizations not directly affiliated with the educational institutions, and this is requiring the use of more room for night periods. In addition, unused portions of buildings are being put to use for educational classes.

With the coming of shorter days and the increasing use of educational buildings during periods when artificial illumination is necessary it would seem that manufacturers and distributers of suitable lighting equipment should bend additional efforts in this direction through local electrical contractors.

Iron Conduit Reduced in Price Nearly 7 per Cent

RIGID iron conduit reacted to a further price drop on Sept. 16. Card 48 was issued as of that date, placing discounts four points higher. In carload lots ½-in. black now takes 45 per cent and ½-in. white takes 39 per cent discount. These figures are the same as those issued under date of Feb. 15, 1917, showing pipe to be back to where it was four and one-half years ago. Meanwhile the discounts have been reduced to a low figure of 21 per cent—a record high price in May, 1917, since which time they have tended upward to the present figure.

General Electric Orders at the Rate of Approximately $180,000,000

IN A LETTER to the stockholders of the General Electric Company, dated Aug. 27, Charles A. Coffin, chairman of the board of directors of that company, states that the yearly rate of orders received for the first thirty-three weeks in 1921 is $180,440,000. Following this statement, it was officially pointed out to a representative of the ELECTRICAL WORLD that orders to date are approximately at this same figure. Considering the fact that business placed with this company during the successive weeks of this year has been in general on a downward trend, present conditions seem to indicate that buying is again on a slightly upward curve.

The apparatus market, it was pointed out, is the one uncertain market today. Financing of public utilities through the seven months of this year to date has amounted to over $346,500,000, of which nearly 85 per cent is new capital and the remainder is for refunding. The utilities have been especially successful in the marketing of these securities to such an extent that virtually the entire issues have been taken up. It would appear from this that the central-station companies have the money in hand for expansion, but that so far very little of it is going into new electrical apparatus and equipment. It was brought out that manufacturing capacity on this electrical equipment will not be in excess when the utilities again enter the market to fill their apparatus and equipment needs, in many cases quite pressing.

Electrical Materials Little Affected by Higher Cotton Prices

WITH the higher cotton prices which have been holding quite steadily for the past two weeks at just around 20 cents a pound, there has been some inquiry as to whether or not certain electrical materials containing cotton have reacted to higher levels or are liable to go there in the near future. So far as can be learned, there has been no advance in general. The exceptions found are in flat insulations. Certain woven white tapes have been marked up 4 per cent, and one brand of sheet varnished cambric is reported 15 per cent higher. No change was noted in varnished cambric tape, insulated wires and cables or nonmetallic flexible conduit. Local reports of higher prices on loom and insulated wire are undoubtedly the result of local conditions in distributing channels

Metal Market Situation

COPPER is holding its position as far as the price is concerned, although demand is quite light. There are some orders coming through, it is true, but the tonnages are small. Producers are sitting tight on 12.25 cents per pound, delivered for September, but in some quarters this price is being extended into the first half of October. The outside market is a trifle easier, and quotations here are about on the basis of 12.25 cents delivered, a slight recession since last week. Export prices f.a.s. New York are 12.12½ cents for electrolytic, but the demand is for copper nearer 12 cents.

Another advance in price of lead was announced on Sept. 20 by the American Smelting & Refining Company. This was a five-point jump, bringing the New York price to 4.65 cents. Producers and outside markets are reported well sold up for several weeks under a well-distributed demand. The zinc market continues its slight improvement.

NEW YORK METAL MARKET PRICES

	Sept. 13, 1921	Sept. 20, 1921
Copper:	£ s d	£ s d
London, standard spot	68 17 6	67 15 0
	Cents per Pound	Cents per Pound
Prime Lake	12.25	12.25
Electrolytic	12.25	12.25
Casting	11.75	11.75
Wire base	13.50	13.75
Lead, Am. S. & R. Co. price	4.60	4.65
Antimony	4.45	4.45
Nickel, ingot	41.00	41.00
Sheet zinc, f.o.b. smelter	10.00	10.00
Zinc, spot	4.70	4.67½
Tin, Straits	26.75	26.50
Aluminum, 98 to 99 per cent	24.50	24.50

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	9.50 — 10.00	9.62½ — 10.12½
Brass, heavy	4.50 — 4.75	4.75 — 5.00
Brass, light	3.75 — 4.00	4.00 — 4.25
Lead, heavy	3.37½ — 3.50	3.37½ — 3.62½
Zinc, old scrap	2.00 — 2.37½	2.00 — 2.37½

THE WEEK
IN TRADE

Prices When Quoted Are Those Prevailing at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for all Eastern Points

AS A WHOLE a slow, steady improvement in buying on the part of the contracting and jobbing trades is reported this week. Emphasis is laid on absence of speed and the condition is regarded as healthy. Wiring materials are moving better in such sections as those tributary to New York, Boston, Chicago, St. Louis and Atlanta, and appliances seem to have taken a new lease of life in those districts. The Northwest reports a satisfactory recovery in business and in tone and, with excellent wheat and apple crops reported, trade recovery is expected to be even greater in the fall. The Intermountain region is expecting a better recovery through government agricultural loans now in progress of allotment.

In the Southeastern States the cotton prices are stimulating sales of all commodities, especially in rural districts. St. Louis jobbers are, it appears, getting a better net profit than they were a few months ago.

Lower prices are shown in rigid conduit and higher prices in knobs and tubes and in some cotton tapes and sheet varnished cambric.

NEW YORK

Conditions in the electrical trade continue to improve, and the general impression among the jobbers is that the low point is definitely passed and a steady but gradual recovery is under way. An encouraging sign is the increase not only in the number but in the size of individual orders received by jobbers. Contractors and dealers appear to have more confidence and to a limited extent are replenishing their depleted stocks of wiring material. Several sales of conduit in carload lots to contractors have been made, and one jobber reports the sale of 100,000 ft. of flexible armored conductor to a contractor who expressed the belief that present prices are at the bottom. The demand for wiring material of all kinds has increased, not to such an extent as to cause any shortage, but it has shown a gradual and healthy improvement.

Collections remain about as last reported. Except for that class of outstanding accounts which are chronically slow, collections are running thirty to sixty days. With the increased activity in the trade electrical credit men are watching the opening of new accounts very carefully.

Conduit.—Announcement by the manufacturers of new discounts on conduit which became effective last week has lowered the price on the larger sizes. Jobbers' prices are quoted under the new discount as follows: For ½ in. black pipe in 2,500 ft. lots, $54.75; ¾ in., $70.79, and 1 in., $101.42 per 1,000 ft. Galvanized pipe in the same sizes is quoted at $59.59, $77.34 and $111.11 per 1,000 ft. Demand continues to be fair and a few sales of carload lots have been reported. Stocks are good in most sizes.

Flexible Armored Conductor.—Buying of flexible conductor continues steadily, and there are indications of a general belief that prices this week have touched bottom. No. 14, two-wire, single-strip is quoted at $43 per 1,000 ft. in lots of that quantity, and double strip at $44.50 per 1,000 ft. Jobbers' stocks are fair to good.

Rubber Covered Wire.—Recent strength in copper quotations has tended to steady the price of wire. No. 14 rubber covered in 5,000-ft. lots is quoted at $6 to $6.25 per 1,000 ft. Demand shows little improvement and buying is all of a hand-to-mouth nature. Jobbers' stocks are good and in some cases large.

Metal Molding.—No price changes are reported this week. The three-wire size is quoted at $5.60 per 100 ft. in 1,000 ft. lots. Demand is fair and stocks as a rule are small.

Loom.—The relative small demand for this material in this territory keeps stocks low. Although cotton has increased, no change has been announced in the quotations on loom. The 7/32-in. size is quoted at $19.25 and $19.80 and the 1/4-in. size at $21 to $21.60 per 1,000 ft. in 1,000 ft. lots.

Heating Appliances.—These devices are moving better than at any time during the summer, but no orders for holiday trade have appeared. Dealers seem to be reluctant to put in stocks of any appliances but those which afford a quick turnover. Jobbers state that there is still a shortage of some makes of flatirons and also a scarcity of curling irons. Stocks of other appliances, while sufficient to meet current demand, are not large.

Porcelain.—Effective Sept. 12, prices on porcelain knobs and tubes were increased in price about 25 per cent. The discounts were lowered 5 points.

CHICAGO

Some improvement has been noted in the past week by jobbers and by manufacturers, who report a considerable increase in inquiries of all sorts though orders continue to lag behind. The inquiries include almost the whole line of contractors' supplies and indicate that interest in construction is awakening in spite of the fact that not much actual work is being started. Retail buying sustains the improvement noted last week, with sales of washing machines, vacuum cleaners and ironers holding up fairly well.

The building boom which in some quarters was confidently expected to follow the Landis decision has struck an unexpected snag in the failures of several groups of workers to abide by the award and the refusal of the arbitrator to grant a rehearing while the men are on strike. The steel market locally has relapsed into a state of coma following the recent flurry of railroad buying, which failed to last. To counteract this outlook there has been a noticeable upturn in agricultural lines, as shown by the liquidation of excessive loans by country banks.

Wire.—The market is firmer, with quotations ranging from a 15-cent to a 15½-cent base for bare wire. Inquiries have increased and a few good orders are reported. The movement of rubber-covered wire is slow and No. 14 may be obtained in 2,500-ft. quantities at $6 per 1,000 ft. Weatherproof wire sales are fair and are being made at 16 cents per pound in 1,000-lb. lots

Non-Metallic Flexible Conduit.—There has been little buying and stocks are generally large. The nominal quotation on the 7/32-in size is $18, while the ¼-in is offered at $20. These prices represent a slight reduction.

Rigid Conduit.—Quotations are unstable, a small price decrease being reported by some jobbers while others report no change. This has very little effect on the market as contractors are buying only according to their immediate light requirements. Prices on ½-in. black range from $47 to $49 per 1,000 ft.

Line Material.—Inquiries are brisker on all sorts of line material. The Sanitary District of Chicago is planning to buy, and short extensions in rural territory are being planned by a number of utilities in Illinois, Michigan, Kentucky and Indiana.

Transformers.—Distribution transformers continue to be in moderate demand in territory around Chicago, and jobbers are able to make deliveries out of stock. There is little call for power transformers.

Lamp Cord.—Sales are running along fairly well with a much better demand for the cotton-covered than for the silk-covered. A nominal quotation for No. 18 cotton-twisted is $13 per 1,000 ft.

Schedule Material.—There has been a reduction of from 10 to 15 per cent on schedule material and demand has picked up somewhat. Orders for sockets and ordinary switches are numerous, though individually small, and this demand is expected to hold up all fall. Distributers have succeeded in bringing their stocks down to thirty days.

BOSTON

The volume of trade continues to reflect improvement in many lines of business. Wiring materials moved fairly well last week and a better demand for appliances was seen in some quarters. Jobbers' stocks, while sufficient for current demands, are much smaller than heretofore, and buying from manufacturers is somewhat better. Collections are about the same. Labor conditions are quiet this week, with some improvement reported in regard to employment. The textile and leather industries are holding their own in New England, and some specialty manufacturers are busier. Electric railway net earnings are improving and telephone traffic in New England is growing with leaps and bounds. Central-station outputs are holding up well and wiring contractors are busy on many jobs of moderate size. A sharp increase in porcelain prices was a feature of the week's activities.

Wire.—Better movement is reported, although orders of moderate size are common. Bare copper wire is dull, with base at 13⅞ cents and ample stocks. Weatherproof is selling fairly well around 15 cents per pound, and so far no advance has been reported on account of stiffening cotton prices. Rubber-covered wire is in larger call owing to more active building operations. No. 14 in 5,000-ft. lots sells nominally at $6.25 per 1,000 ft., but on substantially larger orders under close competition prices ranging between $6 and $5.75 are not uncommon. Stocks of wire are still large, and the pressure to unload is strong.

Knobs and Tubes.—Prices moved upward last week about 25 to 35 per cent on these products and buying is more active. Representative prices now in effect are as follows on tubes: 5/16-in.x3-in., $6.20 per 1,000 in barrel lots. Six-inch tubes are moving at $13.50 per 1,000 in barrel lots. "Nail-it" knobs bring $18.50 per 1,000 in barrel lots, and two and three-wire unglazed cleats, $14 per 1,000 in barrel lots.

Non-Metallic Flexible Conduit.—With sizable stocks and moderate demand prices are firm. In 1,000-ft. lots the 7/32-in. size moves at $17.50 per 1,000 ft. and the ¼-in size at $20.

Flexible Armored Conductor.—Moderate sales, usually in lots not over 1,000 ft., feature the market. No. 14 single-strip sells around $47 per 1,000 ft. in 1,000-ft. lots. A good many small orders, however, are being handled.

Radiators.—Increased sales are reported and a heavy demand is apparent for a new unit 8 in. in diameter, retailing at $5. A fair movement on radiators listing at $11 and $12 is also evident. Sales to dealers on all these are being made at list less 30 per cent for moderate quantities. The outlook is good for fall trade in this line.

Washers.—Popular interest in electric washers is reflected in a decidedly improved demand.

Portable Lamps.—With the fall season opening, sales are bound to quicken in the next fortnight. Interest has been well developed by good merchandising and prices are attractive, stocks being large and well diversified. The fixture trade is much improved.

Motors.—Orders show continued moderate improvements, especially on integral sizes up to 25 hp. Business is scattered and few groups of motors of any magnitude are included in sales, but interest and actual buying are distinctly better. Prices are firm.

ATLANTA

The continued advance in the price of cotton is having the expected effect in stimulating all lines of trade. The morale of the section has been further improved by the prospect of excellent crops in other lines, and as a result the construction of various long-delayed projects has begun. A number of ice plants and large business buildings are under way, and these, together with home and small commercial construction, have reduced non-employment to a low figure. The improvement in rural districts is reflected in the electrical jobbing trade by a large increase in the number of orders received from the small towns distributing to the rural districts, with trade in the larger cities holding its own. Most of the orders up to date are for construction material and are coming from the small contractors, while small central-station companies and municipal plants are actively undertaking long-delayed maintenance work, causing a brisk demand for line material. The hot weather helps the sale of fans, but at the same time the late fall is causing a delay in the placing of orders for fall and winter stocks. The large banks are offering through their correspondents to make loans on cotton up to 75 per cent of the market price, and this is placing funds in districts that have long been handicapped by the lack of credits.

Condulets.—A reduction of approximately 5 per cent in the price of condulets is noted, but this specialty continues to move slowly. Such orders as are being received emanate largely from industrial plant jobs and therefore should increase in number in the near future. Stocks are large throughout the section.

Non-Metallic Flexible Conduit.—Another slight reduction in price is reported in this line, which continues slow on account of heavy consumers' stocks. Jobbers' and contractors' stocks are in fine shape.

Flexible Armored Conductor.—The market price continues very unstable, prices varying as much as $5 to $7.50 per 1,000 ft. A considerable demand is noted.

Poles.—No further price reductions are reported on poles. Western red cedar and chestnut are reported in considerable demand, the latter showing signs of regaining the popularity it enjoyed several years ago. Most of this material is going to small central-station companies for maintenance work. Stocks are in good shape.

Exhaust Fans.—The season has been somewhat disappointing in this line, sales amounting to 60 per cent of those last year, and a carry-over is inevitable.

Pole-Line Hardware.—The entire line of pole-line hardware is reported to be quite active, with prices on a firm basis for several weeks past. Stocks are considered sufficient to meet the requirements.

Distributing Transformers.—This item has not kept pace with the movement of poles and hardware, thus indicating that the bulk of the two latter items is going for maintenance and not to new construction and extensions. A fair assortment of sizes is to be had from local stocks.

Wire.—The lowest price for several years is noted in No. 12 and No. 14 rubber-covered, No. 12 being offered at $9 and No. 14 at $6.50 per 1,000 ft., though the prices of the larger sizes are more firm. Jobbers are accumulating good stocks in these sizes. The movement of weatherproof wire continues steady.

ST. LOUIS

The commencement of construction of an industrial building in which will be installed about 750 hp. in motors was of outstanding interest here last week, for it was the first industrial construction job of appreciable magnitude that has been started for several months. All indications point to a gradual yet healthy increase in construction work.

The situation in the South as a result of the higher cotton market is being closely studied by St. Louis jobbers. It is probable that the demand for electrical goods will become stronger and that payments will be on a better basis, but so far a very conservative policy it being followed in making sales and extending credits.

As a whole, jobbers here report a slight improvement in business last week and net profits are decidedly better than a few months ago. Appliances are moving more rapidly, particularly vacuum cleaners, washing machines and flatirons. Especially good demand obtains for dry cells. Wiring materials are finding steady call, and schedule materials, largely as a result of recent price reductions, are selling on a substantially better basis. Payments are becoming more regular, yet there are still a large number of long-standing obligations that are being paid but slowly, particularly in the South. Credit conditions in Illinois are reported better than in the other states of this territory.

Wire.—The stiffening of the copper market has not shown its effect in wire prices, No. 14 rubber-covered still selling at $6.10 per 1,000 ft. in 10,000-ft. lots. This is an average price, and quotations are sometimes made 10 cents to 20 cents lower. The base price on both bare and weatherproof remains at 14½ cents per pound. A steady demand, with tendency to improve, is found. The larger sizes of rubber-covered are moving better than they have done for some time. Stocks are in excellent condition.

Dry Cells.—A heavy demand has obtained for dry cells in the last week, one company reporting orders for seven car loads. In a number of instances the stocks are somewhat short. The regular is priced at 31 cents and the igniter at 32 cents, both in barrel lots.

Schedule Material.—Since the recent price reductions there has been a decided increase in demand. Sockets, rosettes and fuses are leading in sales.

Safety Switches.—Entrance switches for residential work are finding some call, but the other lines are very quiet, chiefly because of the lack of industrial building. The demand is expected to improve this fall and winter as manufacturing conditions improve.

Lighting Fixtures.—There is virtually no movement in industrial lighting fixtures of the metal type, but fairly good business is found in the glass fixture. In the latter one jobber reported exceptionally good business last week on account of some school jobs.

Ranges.—The sales in this territory are exceptionally quiet and no special efforts are being made to move them. Stocks are on a conservative basis, and in a number of instances the central-station companies are averse to pushing sales because of limited plant capacity.

Flatirons.—Movement is definitely better and is being aided by the price reductions. Stocks are well in hand. Other heating appliances are moving quite slowly.

Washing Machines.—Better business is reported, largely owing to lower prices which have been established on almost all makes of machines. A rather general reduction of 10 per cent was made on Sept. 1. Further reductions have been temporarily placed on a few lines that are being campaigned.

Motors.—Sales of motors ranging in size from 5 hp. to 50 hp. are showing improvement, and there are an increasing number of inquiries regarding the larger sizes. Fractional sizes are not moving well. A few good sales of motor-generator sets are reported. Jobber stocks are fairly well in hand, but dealer stocks are in a number of cases somewhat heavy.

Air Heaters.—A very conservative buying policy prevails. Stocks were fairly well reduced last season, yet jobbers are placing only small initial orders. No orders from dealers have as yet been received.

SAN FRANCISCO

Business conditions show some improvement, although the return to normal is rather slow. Orders are increasing in size and some substantial stock orders for wiring staples are reported. The general feeling is that it will be next year before really big business returns. Rather early rains threatened some of the late crops, especially raisins, but a timely warning prevented a serious loss.

Sockets.—A 30 per cent reduction in sockets and other schedule material is effective, making the dealers' price on standard packages of ⅛-in. cap key sockets 18 cents per socket.

Sewing Machines.—Increased activity of sewing machine sales is probably the result of seasonable home-sewing advertising. So far dealers have not solved the question of allowances for exchanged machines, probably because their volume of sales has not yet reached the stage where many of such propositions are encountered. In general it may be said that good stocks are carried by them.

Dishwashers.—The larger mercantile stores are prominently displaying dishwashers and are giving window demonstrations, besides devoting an increased amount of advertising space to their exploitation. A number of "prospects," with a satisfactory amount of sales, are reported.

Ironers.—Although the sale of ironers has suffered along with the sales of the larger socket appliances, it is significant that more and more dealers are appreciating the possibilities of the field and will push their sale when conditions warrant.

SEATTLE—PORTLAND—SPOKANE

Indications show that the Northwest, and especially that territory tributary to Portland, is recovering very quickly and decidedly from the business depression. Buying is limited mostly to necessities, but these are being purchased in large quantities, indicating a much improved condition. The towing business, which is an important index to business conditions in the Puget Sound district, has steadily increased since the first of June. Lumber and grain are moving in good quantities from both the ports of Seattle and Portland. A spirit of optimism prevails in the Spokane district, and it is felt that the worst of the depression has been passed. The most encouraging features of the local situation are the excellent wheat crop and the prospects of a good apple crop. There is little activity in the mines and most of the larger lumber mills have shut down for the winter. Lumber production in 101 mills of western Oregon and Washington was 20 per cent below normal during the past week. In spite of better feeling and improved business conditions throughout the Northwest, there is a large employment problem ahead for the winter, and all of the larger cities have well formulated plans to cope with the situation.

Electrical jobbers of Seattle report business gradually improving, with stocks in good shape and deliveries uniformly good. Portland jobbers report that their stocks have been somewhat depleted in the lines in which most active demands exist, but orders are being placed at once to overcome this condition. Deliveries are good. Spokane jobbers report a large increase in business as the result of price reductions of electrical goods during the last sixty days. One firm reports more business in the last sixty days than during any two months previous this year. Cedar-pole men report many inquiries and some orders. Inquiries are mostly from electric railway companies.

Contractor-dealers of Portland report that construction work appears to be considerably better than in the past. Store sales are not greatly changed, although there is more activity in the sale of lamps. Seattle dealers report that radiant-type heaters are beginning to move.

SALT LAKE CITY—DENVER

Collections in the electrical field are still slow, sixty days being about the average period for settlement. Demand for money is still so strong that banks would be swamped if they granted all or even part of the applications for loans and only the very best secured loans are granted. The general demand for good bond and mortgage investments is unusually strong, indicating that there is not so much a lack of money as a lack of inclination to spend it on the retail market. With prevailing favorable weather the lumber trade is showing steady improvement. Building is confined chiefly to residential subdivisions. The chairman of the War Finance Corporation is just now making a tour of cities in the Intermountain West, allotting loan funds to be available soon to farmers. It is believed that together with liquidated crops the proposed relief will go a long way toward solving agriculture's biggest problem.

Salt Lake City's new "electric home" is now open. The venture is considered to be unusually timely coming at a period of extensive home building.

Vacuum Cleaners.—Jobbers report a slight tendency to overstocks, with dealers showing the usual reluctance to buy in large lots. Dealers advertise unusual payment plans, offering to take as little as $1 as initial payment. Others have premium propositions to stimulate buying.

Air Heaters.—Temperature that is somewhat below the normal average of mid-September is making a better market for air heaters. The demand, however, is scattered and the movement sluggish. Better activity is noted for radiant heaters and a pick-up in sales is reported. For the past week the lowest advertised price was $11.

Manufacturers' Activities

Devoted to the Business Side of Manufacturing, Distribution and Sales, News from Jobbers and Foreign Fields and a Record of New Devices and Trade Literature

"Autovent" New Name for Batterman-Truitt

The Autovent Fan & Blower Company is the name which the Batterman-Truitt Company, 736-738 West Monroe Street, Chicago, has taken since early in September. The company manufactures fans and blowers for ventilating work and it was felt that it would be better to utilize the trade name "Autovent" and have the company name convey the idea of the products of manufacture than to continue with a designation disconnected from the ventilating field. No change was made, it is announced, in executive or sales personnel, nor has there been any in manufacturing or sales policies.

A. M. E. S. Section Meetings for Oct. 5

Announcement is made of the following section meetings of the Associated Manufacturers of Electrical Supplies set for Oct. 5: Heating Appliance Section in the association rooms in New York City; in Pittsburgh, the Outlet Box Section, Cast Box Section, Outlet Box Fittings Section and Switch Box Section.

Electrical Division Collecting Data on Foreign Construction

The new electrical divison of the Department of Commerce has started the collection of information concerning prospective electrical construction abroad. All the available machinery of the Department of Commerce and of the State Department is being utilized in that connection. In this way it is believed that this information can be given to American manufacturers sufficiently in advance to afford them an opportunity to sell the necessary supplies and equipment.

The division also is gathering information with regard to central stations throughout the world. The data in regard to organization, equipment and the system used will be compiled.

It is the opinion of R. A. Lundquist, the head of the division, that never before in the history of the electrical industry have there been in contemplation many projects for railway electrification as there are now. This trend toward electrification of railways has been stimulated by the high price of coal. Among the electrification projects now being considered are:

The Brazilian Central Railway, the Paulista Railway in Brazil, portions of the Chilean state railways, a nitrate railroad at Iquique, Chili; a heavy traffic line in the vicinity of Bombay, India, and also a line running out of Calcutta. Other foreign developments of importance concerning which Mr. Lundquist has gathered some information are the Aberdeen-Laxapana water-power development in Ceylon, the expansion of the Tata hydro-electric system near Bombay and the Mysore, a government scheme in the native state of Mysore.

Perfection Hoist & Engine Company Moves Plant to Two Rivers

The Perfection Hoist & Engine Company, 352 Railway Exchange Building, Chicago, has purchased the plant of the Two Rivers (Wis.) Plating & Manufacturing Company and has moved all of its machinery from Milwaukee to the new plant in Three Rivers. The company manufactures a 1½-kw. unit light and power plant for farms which it will distribute through dealers and distributers, nationally and internationally.

The company also manufactures a mechanical non-hydraulic hoist for dropping trucks. The officers of the company are: George Garens, president; A. P. Schoeffler, vice-president; Walter Mayer, secretary, and F. A. Emmons, sales manager.

Canadian Crocker-Wheeler Purchased by English Electric of Canada, Ltd.

English Electric of Great Britain Forms Subsidiary in Canada to Take Over Manufacture of British and Canadian Electrical Products of Well Established Companies

After many months of investigation, the English Electric Company, Ltd., of Great Britain has decided to enter the Canadian field, and through its associate company, the English Electric Company of Canada, Ltd., which has just been incorporated with main offices in Montreal, Canada, it has purchased the capital stock of the Canadian Crocker-Wheeler Company, Ltd., St. Catharines, Ontario. It was only last week that the final financial details of the purchase and consolidation were effected.

The Canadian Crocker-Wheeler Company, Ltd., was organized in 1910 under the general managership of R. A. Stinson. Mr. Stinson, who was vice-president and general manager of the Canadian Crocker-Wheeler Company, Ltd., will be president and general manager of the new company.

The English Electric Company of Canada, Ltd., is associated with and holds the exclusive manufacturing rights in perpetuity for Canada of the English Electric Company, Ltd., of Great Britain, and will in addition act as the exclusive agency through which all selling, engineering and construction work in Canada will be done. It has the use of all the patents, designs and processes of the English company and also holds the right to sell its products in the United States and Newfoundland. This company, through the purchase of capital stock of the Canadian Crocker-Wheeler, will have the benefit of the entire fixed and current assets and all the patents, designs and processes of that company.

Co-operating actively with the Canadian company will be the research and technical departments of the parent company. The most modern British and Canadian methods of manufacturing will, therefore, be used and all the latest developments be placed at the disposal of the Canadian company. The plant and equipment are of the most modern type. Manufacturing facilities will be extended from time to time to cope with the constantly growing demand for electrical apparatus in the various branches of the industry.

In addition to the Canadian members of the board of directors of the new company there will be three directors of the parent company besides the London advisory committee, which is composed of men of wide engineering and manufacturing experience in Great Britain.

It is understood that the electrical equipment peculiar to the former Canadian Crocker-Wheeler Company, Lt., will be manufactured under that name, while equipment peculiar to the English Electric Company, Ltd., of Great Britain, will be manufactured under that name.

In the report of the Canadian Debentures Corporation, Ltd., Toronto, which offers part of an issue of $2,000,000 of 8 per cent preferred stock of the new Canadian company, it is stated that through its association with the British company this new company will be in a position to import all electrical equipment and supplies not manufactured in Canada from England, thus having the advantage of the preferential tariff and the present favorable exchange rate. The report further states that the earnings of Canadian Crocker-Wheeler for the past five years have been at a rate more than sufficient to pay the dividend charges on the new issue of preferred stock of the English Electric Company of Canada, Ltd.

Wm. J. Murdock Company Opens New York Office

The Wm. J. Murdock Company, Chelsea, Mass., manufacturer of telephone and radio equipment and other electrical specialties, has established a sales office at 1270 Broadway, New York City, in charge of Pearcy W. Mack. Commenting on business conditions last week to a representative of the ELECTRICAL WORLD, one of the company's officials stated that the demand for these products is more active than a year ago and that conditions are favorable for continued active production.

State Manufacturers' Association's National Conference in September

The National Conference of State Manufacturers' Associations has been called for Sept. 29 and 30, to meet at the Congress Hotel in Chicago, to consider the industrial situation, giving special attention to congressional legislation, such as the tariff, taxation and transportation.

The convention has been called at the urgent request of manufacturers generally and manufacturers' associations, with particular reference to pending legislations. Invitations are being extended to manufacturing organizations of the United States anl also to individual manufacturing firms to send representatives and to co-operate.

Every line of manufacturing business will have an opportunity to be heard so far as is possible in a two-day session, the call for the convention states, and at the close of the convention resolutions resulting from the deliberations will be offered for action by the convention. The office of the secretary, John M. Glenn, is 104 South Michigan Avenue, Chicago.

Federal Trade Commission Favors Proper Promotion of Uniform Cost Accounting

The attitude of the Federal Trade Commission toward uniform cost accounting has, it would seem, been clarified in some recent correspondence between Nelson B. Gaskill, acting chairman of the commission, and the fabricated production department of the Chamber of Commerce of the United States. This department of the chamber asked the commission for a statement of its position in regard to the promotion of uniform cost accounting and its use by members of trade associations. In his letter of Aug. 2, Mr. Gaskill further explains a previous letter by saying:

"Stated in another way, the conception of the commission is that the efforts of a trade association to educate the individual member in the application of sound principles of cost accounting in his individual business are proper, but that any subsequent effort of the association to reduce the individual costs to an average or uniform cost basis and to procure the use of the group standard as a basis of price making by each of the individuals in the group is improper. The individual must fix his own cost and his own margin. The group may not attempt to substitute a group average or standard either of cost or margin for the individual's figures without being in peril of becoming an unlawful combination.

"Applying this statement to your interpretation of our letter of the twenty-fifth, it may be said that for a trade association to set up and induce the use by its members of a scientific and accurate plan of cost accounting is not only legal but highly beneficial to the individual members of the association. The use of this legal and highly beneficial information by each individual in establishing his own production cost and determining his own margin is entirely proper. If thereafter the association attempts to induce its members to disregard their own varying figures and use a common average or uniform figure of cost or margin or both, it has departed from its proper position of instructor and may easily take on the appearance of a price-fixing combination in restraint of trade or in suppression of competition."

Employee-Representation Plan Working Well at G. E. Lynn Factory

Further testimony as to the successful operation of the plan of employee representation in use at the Lynn (Mass.) works of the General Electric Company was given recently at the Babson Industrial Conference at Wellesley Hills, Mass., by F. P. Cox, manager of the Federal Street works of the company at Lynn. The general principles of this plan were outlined in the ELECTRICAL WORLD of March 1, 1919, soon after the establishment of the arrangement at Lynn by R. H. Rice, manager of the Lynn works. Mr. Cox said that during the first year of operation of the plan out of 1,200 cases which arose 1,020 were settled without going to any shop committee, and all the remaining cases were settled by one of these committees without going to the manager. In the two and one-half years that the plan has been in force only three cases have gone to the manager, and these three were satisfactorily settled.

Report of Fair Vehicle Charger Business in New York

The Autolectric Devices Corporation 1966 Broadway, New York City, finds its volume of business in connection with the electric truck and the motion-picture field almost as good as it was last year, according to Otto Sarvas, who is in charge at that address. The company handles motor-generator sets and other charging and rectifying equipment for these two fields for replacements, repairs, servicing and new installations. Present business is quite good. Early in the summer Mr. Sarvas took on the exclusive distribution in New York territory for the Westinghouse electric vehicle charger and also distribution of the rectifying equipment of the Acme Electric & Manufacturing Company, Cleveland, in addition to the charging apparatus it was already carrying of the Automatic Electrical Devices Company, Cincinnati.

Tubular Woven Fabric Announces Changes in Organization

The Tubular Woven Fabric Company Pawtucket, R. I., manufacturer of "Duraduct" and "Duracord," announces the following changes recently made in its organization: P. S. Klees, who has recently been in charge of the New York territory, has been appointed general sales manager of the company, with headquarters at the factory in Pawtucket. Mr. Klees has been connected with the electrical industry for more than twenty years, serving with the Franklin Electric Manufacturing Company and afterward with the Pierce Fuse Company. The New York territory will be divided, with F. W. Brower in charge of the northern half, including New York City, with headquarters at New York, and F. M. MacDuffie in charge of the southern half, with headquarters in Philadelphia. Ernest C. Alcott, who has been connected with the sales department of the company at the factory in Pawtucket, has been given charge of the Michigan and Indiana territory, with headquarters at Detroit.

J. H. Schmidt, Muskogee, Okla., has awarded a contract for the construction of a one-story factory for the manufacture of electric batteries and other electrical equipment, to cost including equipment about $50,000.

The American Electric Service & Maintenance Company, 51-57 Taylor Street, Springfield, Mass., operating a plant for machine and electrical repair work, is making arrangements for the removal of its plant to a new building on Liberty Street, where it will have double the floor space now occupied.

The Northern Equipment Company, Erie, Pa., announces the appointment of the Ernest E. Lee Company, 115 South Dearborn Street, Chicago, as its district representatives for "Copes" boiler-feed regulators and pump governors.

E. G. Bartling announces the removal of his office from the Ford Building to 617 Book Building, Detroit. He has also taken the agency for the Passaic Rubber Company, handling a full line of tape, and for L. D. McFarlan, Sandpoint, Idaho, shipper of red cedar poles.

Automatic Reclosing Circuit Breaker Company, Columbus, Ohio, has established a branch office at 1613 Chestnut Street, Philadelphia, in charge of H. A. Van Dyke.

The Standard Underground Cable Company, Westinghouse Building, Pittsburgh, has awarded contract for a two-story building, 300 ft. x 525 ft., to be erected on Kingshighway and St. Slevin Street, St. Louis. The cost is estimated at about $1,000,000.

Foreign Trade Notes

SCHEME TO SUPPLY ELECTRICITY IN BURMAH, INDIA.—Plans are said to be under way to supply electricity in the town of Insein, Burmah, India.

PROPOSED WATER-POWER DEVELOPMENT IN ALGERIA, AFRICA.—A commission appointed by the Governor General of Algeria, which has been investigating the development of water power to generate electricity for railways, proposes to utilize the falls of Oued-Agricun, in the Department of Constantine. It is estimated that sufficient power could be developed for the electrification of a railway line from Bougie to Setif (about 50 miles) and another line from Bougie to Beni-Mancour, a distance of about 57 miles. It is planned to have a special commission study further the matter of electric power on the basis of a three-phase circuit of low frequency.

ELECTRIFICATION OF VADSTENA-FAAGELSTA RAILWAY.—Permission has been granted by the Swedish government for equipping the Vadstena-Faagelsta Railway for electrical operation.

PROPOSED WATER DEVELOPMENT FOR AYR, SCOTLAND. — The proposed scheme for developing the water power of Loch Doon to supply electricity in Ayr, according to *Electrical Industries*, has been recommended by the lighting committee to the Town Council for approval. The cost of the project is estimated at £250,000.

PRIZES FOR ELECTRIFICATION SCHEME OFFERED BY LIEGE, BELGIUM.—In order that the electrification of the province may be most advantageously effected the local government of the province of Liege, Belgium, is considering how best to reorganize the existing and projected generating stations. In order to get assistance in the solution of this problem it is offering four prizes, one of 25,000 francs, one of 15,000 francs and two of 10,000 francs each, for the four best schemes which may be submitted on or before March 1, 1922. Full conditions as to this competition and details of the present position of electricity supply in the province may be obtained from the Governor, Place St. Lambert, Liege, or from the headquarters of the Technical Department, 33 Rue Derchis, Liege.

POWER PLANT FOR TOOWOOMBA, AUSTRALIA, TRAMWAYS.—A revised estimate for a power house and substation for the proposed tramways scheme at Toowoomba, Queensland, Australia, has been submitted by F. A. McCarthy & Company, consulting engineers, to cost £72,700. The City Council has requested the government to instruct an expert to go ahead with the project.

PROPOSED POWER PROJECT FOR LITHGOW, AUSTRALIA. — The Lithgow (New South Wales) Council has been informed by the New South Wales Railway Department that it proposes to establish a large power station in the west part of New South Wales when funds are available. The station will be supplied with coal from the State coal mine at Lithgow.

GENERAL ELECTRIC SERVICE FOR PROVINCE OF ZEELAND, NETHERLANDS.—Arrangements have been made for the installation of a general electric service for the Province of Zeeland, Netherlands. The scheme has been arranged through commissioners of a concern organized as the Namloose Venoopschap Provinciale Zeeuwwijze Electriciteits Matchappy, with a capital of a million florins (normal exchange about $400,000). This has been raised by subscription on the part of seven communities in the province which have taken a small share, the rest of the capital being subscribed by the provincial government. Land has been purchased at Sluiskil for a central station, for which a contract has been awarded. At Hengelo a contract for erecting the first high-tension transmission line for a distance of 65 km. has been granted. The cost of the entire electrification of Zeeland, Flanders, is estimated at 1,600,000 florins. For the middle group of islands, North and South Beveland and Walcheren, which work is to be undertaken as soon as possible, the cost is estimated at 2,000,000 florins ($800,000 at normal exchange). It has been decided that it would be more practicable to erect a central station for these islands than to attempt to connect them with the power lines of North Brabant. No arrangements have been made for the electrification of the northern group of islands. The commissioner, basing estimates on the gradual expansion of the lines have made the following estimates of the total cost of the project: Zeeland, Flanders, 2,300,000 florins; central group, 2,600,000 florins; northern group, 800,000 florins, making a total of 5,700,000 florins, for which 1,000,000 florins has already been subscribed.

ELECTRIFICATION OF SOUTH AFRICAN RAILWAY.—The latest reports regarding the proposals for equipping certain sections of the government railways of the Union of South Africa for electrical operation are to the effect that no bids have as yet been accepted and that it is possible that the program may not be carried through at this time to the full extent provided for. Uncertain business conditions, it is reported, may influence the government to defer this work to some extent.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

E. Sacquet, electrical engineer, 81 Rue de Maubeuge, Geumont, Nord, France, desires information as to the manufacturers of transformer-oil purifying, filtering, drying and preserving apparatus and also manufacturers of presses for baling sheet-steel waste from the punching room.

A merchant in Chile (No. 58) desires to purchase electrical goods and motors, automobile accessories, electric lamps of 110 volts and 220 volts, supplies and parts.

An agency is desired by a mercantile company in France (No. 69) for the sale of refrigerating machinery.

New Apparatus and Publications

CONSTRUCTION.—Sanderson & Porter, New York City, consulting and construction engineers, have issued a folder showing some of the properties—power plants, transmission lines, etc.—built by them.

LIGHTNING ARRESTERS. — The Hi-Voltage Equipment Company, Cleveland, has issued Bulletin No. 2, on its new flash-rod lightning arresters and choke coils and fuses.

VACUUM CLEANER. — The Electric Vacuum Cleaner Company, Inc., Euclid Avenue and Ivanhoe Road, Cleveland, has developed a small "Premier Handy" vacuum cleaner weighing 6 lb.

DOUBLE TIGHTENING VALVE. — "Tight In Two Places" is the title of pamphlet DT-1601 issued by the Yarnall-Waring Company, Chestnut Hill, Philadelphia, describing the "Yarway" double tightening valve.

MAST ARM.—The Erie Electrical Equipment Company, Inc., Johnstown, Pa., is distributing a folder describing the "Erie" mast arm.

GRAPHIC INSTRUMENTS. — "Do It Graphically" is the title of a booklet distributed by the Esterline-Angus Company, Indianapolis, covering the Esterline graphic instruments.

WIRING FITTINGS. — The Michigan Stamping Company, Detroit, has issued bulletin No. 10, covering "Michigan" wiring fittings, including a patented sectional switch box, panel surface cabinets and stamped steel fixture stud.

PIPING SYSTEM.—The M. J. Dougherty Company, Twenty-fifth and Washington Avenue, Philadelphia, piping fabricators and engineers, is distributing bulletin W-10 on modern piping practice.

TANK RHEOSTATS.—The Ward Leonard Electric Company, Mount Vernon, N. Y., is distributing a four-leaf pamphlet describing "Ward Leonard" tank rheostats.

SIGNALING HORN.—The Klaxon Company, Newark, N. J., has placed on the market an alternating-current duplex horn for sounding alarms and code; time and telephone call signals.

PUSH-BUTTON.—The Fahnestock Electric Company, East Avenue and Eighth Street, Long Island City, New York, has placed on the market a push button equipped with spring clip terminals.

TERMINAL AND CONNECTOR.—The Battery Equipment & Supply Company, Inc., 1400 South Michigan Avenue, Chicago, has placed on the market "Uni-All" terminal, designed for storage-battery use.

PUSH-BUTTON SWITCH.—The [illegible] Electric Company, Inc., Philadelphia Stock Exchange Building, Philadelphia, has recently placed on the market a push-button switch, made in both single-pole and three-way types.

PANEL-MOUNTING RHEOSTAT.—A panel-mounting rheostat ("Fada") designed to control filament temperature of vacuum tubes in radio work has recently been developed by Frank A. D. Andrea, 1581 Jerome Avenue, New York City.

HEATER.—An electric bathroom heater and radiator which may be set in the wall has been developed by the William H. Jackson Company, 2 West Forty-seventh Street, New York City.

WASHING MACHINE.—An electric washing machine known as "Klean Kwick," which operates on vacuum principle, has been developed by the Du Mond Manufacturing Company, Cedar Falls, Iowa.

RANGE.—An electric range known as "Light-Wire," built for operation on the lighting circuit, has been placed on the market by the Standard Electric Stove Company, 1720 North Twelfth Street, Toledo.

New Incorporations

THE MIDDLE STATES ELECTRIC COMPANY, New York, N. Y., has been incorporated with a capital stock of $5,000 to manufacture electrical products. The incorporators are J. Mittleman, M. Eisenstadt and A. Zahn. The company is represented by Barondess & Chaitin, 27 Cedar Street.

THE SCHOOLFIELD-HARVEY ELECTRIC COMPANY, Charleston, W. Va., has been incorporated by Raymond R. and G. C. Schoolfield and Leonard P. Harvey. The company is capitalized at $10,000 and proposes to manufacture electrical supplies.

THE HOME WIRING COMPANY, 409 East Jefferson Street, Joliet, Ill., has been incorporated by Earl L. Rohm and Harry C. Norris to manufacture and deal in electrical appliances and fixtures. The company is capitalized at $35,000.

THE EXCELLIGHT COMPANY, Forestville, Conn., has been incorporated by Frederick N. Manross, Rudolph Stern, H. Geruldson, C. W. Armstrong and C. I. Johnson of New Haven, to manufacture and deal in lamp products. The new company will be a subsidiary of the Nationarl Marine Lamp Company.

THE RURAL ELECTRIC SERVICE COMPANY, Shelby, Ohio, has been incorporated with a capital of $10,000 to furnish electricity in the vicinity of Shelby. The incorporators are U. Spangler, C. J. Laser, J. W. Marriott, T. C. Hahn and R. M. Mead.

THE MECHANICAL & ELECTRICAL MANUFACTURING COMPANY, Bethel, Maine, has been chartered with a capital stock of $100,000 to manufacture electrical equipment and machine products. The officers of the company are Theodore Morin, Bethel, president and treasurer, and Ellery C. Park, secretary.

THE SCHOEZLER-ASH MANUFACTURING COMPANY, Buffalo, N. Y., has been incorporated by M. J. and L. F. Schoezler and J. H. Ash, to manufacture electric motors and kindred equipment. William J. Volker, Mutual Life Building, represents the company.

THE ROBERT BOSCH MAGNETO COMPANY, New York, N. Y., has been incorporated with a capital stock of $[illegible] to manufacture and deal in engineering appliances. The incorporators are O. Heins and G. Jahn. H. T. Andrews, 115 Broadway, is attorney.

THE NASSAU ELECTRIC PLATING WORKS, Freeport, N. Y. has been chartered with a capital stock of $5,000 by H. Weber, T. E. Gaffey and E. O. Chandler. J. C. Judge, 44 Court Street, Brooklyn, is attorney.

THE S. K. RUCKMAN ELECTRIC COMPANY, 217½ South Gay Street, Knoxville, Tenn., has been incorporated with a capital stock of $10,000 by S. K. Ruckman and H. B. Angel.

THE LEONARD A. SYLVIA COMPANY, New Bedford, Mass., has been incorporated with a capital stock of $15,000 to manufacture electrical machinery. The incorporators are Leonard A. Sylvia, F. W. Sylvia, and George W. Gifford, New Bedford.

Record of Electrical Patents

Notes on United States Patents

(Issued Aug. 23, 1921)

1,388,479. Electrical Water-Level-Indicating Apparatus; Walter D. Nickum, Glendale, Cal. App. filed Sept. 16, 1918. For giving alarm upon occurrence of low water in boilers, reservoirs, etc.

1,388,488. Electrovapor-Heated Steering Wheel; Arthur L. Senn, Seattle, Wash. App. filed May 24, 1920. Heated as desired.

1,388,507. Synchronizing System; John H. Bell, South Orange, N. J. App. filed May 1, 1920. For printing telegraph systems.

1,388,512. Secondary Electric Clock; Thaddeus S. Casner, Plainfield, N. J. App. filed April 19, 1921. Small number of moving parts.

1,388,526. Hot-Air Syringe. Oscar H. Pieper and Alphonse F. Pieper, Rochester, N. Y. App. filed Aug. 13, 1917. Employed by dentists.

1,388,527. Ionization-Current Regulator; Oscar H. Pieper and Alphonse F. Pieper, Rochester, N. Y. App. filed Nov. 5, 1918. For use of dentists.

1,388,528. Trolley Shoe; Lewis H. Shipman, Boston, Mass. App. filed July 18, 1918. Sliding shoe.

1,388,536. Electrode for Storage Batteries; Vincent C. Stanley, Brookline, Mass. App. filed Feb. 4, 1920. For comparatively small cells.

1,388,541. Circuit-Controlling Apparatus; Homer C. Woodbury, Providence, R. I. App. filed Feb. 13, 1919. For use with a rotary hydrocarbon burner.

1,388,555. Dynamo-Electric Machine; Herbert S. Eadesm, Philadelphia, Pa. App. filed June 29, 1920. Mutiple-rotor dynamo-electric machines.

1,388,[illegible]. Heating-Element-Controlling Device; Paul M. Mueller, Erie, Pa. App. filed March 24, 1920. Automatic switch prevents overheating.

1,388,590. Trolley Wheel for Electric Street Cars; Julio S. Navarro, Havana, Cuba. App. filed March 21, 1921. Made in separate halves (in disk form).

1,388,613. Process of Automatically Regulating the Addition of a Treating Agent to Water; [illegible], Philadelphia, Pa. App. filed Oct. 25, 1918. Treatment of water, sewage, etc.

1,388,647. Electric Lamp Socket; David Hjorth, Bridgeport, Conn. App. filed March 27, 1919. Two-part socket including shell and cap.

1,388,[illegible]. Storage Battery; Lamar Lyndon, West Orange, N. J. App. filed April 30, 1919. Improved mounting for electrode plates.

1,388,[illegible]. [illegible] Switch; John T. Gray, Great Falls, Mont. App. filed Aug. 13, 1919. Maximum opening movement transmitted to contact members.

1,388,[illegible]. Electric Iron; [illegible], Salt Lake City, Utah. App. filed [illegible]. Means for holding electric cord tight.

1,388,[illegible]. Telephone Attachment; [illegible], New York, N. Y. App. filed [illegible] mouthpiece.

1,388,[illegible]. Battery Tester; [illegible] 9, 1919. For testing flashlight batteries.

1,388,[illegible]. [illegible] June 1, 1920. Thin, porous diaphragm.

1,388,759. Electric [illegible] and Curling Iron; [illegible] To fold and curl hairs, stuffs, etc.

1,388,792. Vacuum-Type Converter; Wilfred T. [illegible], N. J. App. filed Jan. [illegible], 1917. Operates with stability and efficiency.

1,388,805. Curling Iron; Thomas L. Dennis, New York, N. Y. App. filed Aug. 18, 1920. Heating element does not interfere with movable parts.

1,388,822. Circulator Heater; Herman E. Roys, New York, N. Y. App. filed Nov. 15, 1919. For attachment to an electric fan.

1,388,834. Spark-Gap Apparatus; Fritz Lowenstein, Brooklyn, N. Y. App. filed Jan. 19, 1918. Quenched spark gap for radio transmitter.

(Issued Aug. 30, 1921)

1,388,850. Storage Battery; Thomas R. Cook, Pittsburgh, Pa. App. filed July 21, 1920. Employed in portable electric flashlamps.

1,388,858. Time-Controlled Mechanism; William H. Greenleaf, Hartford, Conn. App. filed March 29, 1920. Self-winding timepiece.

1,388,874. Forming Dielectric Films, Ralph D. Mershon, New York, N. Y. App. filed Feb. 18, 1920. For condensers, rectifiers and other devices.

1,388,887. Indicating System; Lipa Polinkowsky, Antwerp, Belgium. App. filed Nov. 1, 1919. For visually indicating to operators the lines with which connections are desired.

1,388,906. Electric Motor-Control System; Harry A. Wackerly, Alliance, Ohio. App. filed July 21, 1920. For automatically controlling the limit of travel of machinery.

1,388,936. Radio Telegraphic and Telephonic Apparatus; Horace St. John de Aula Donisthorpe, London, England. App. filed April 28, 1920. Portable receiving sets.

1,388,948. Hand Lamp; Carl Hambuechen, Belleville, Ill. App. filed April 27, 1917. Conducting strip placed outside of battery chamber.

1,388,949. Audio-Frequency Wireless Fog-Signal System; E. C. Hanson, Los Angeles, Cal. App. filed June 4, 1918. For indicating to navigator position of ship.

1,388,963. Sound-Transmitting Instrument; Alexander Marr, Biggin Hill, England. App. filed May 27, 1919. Microphonic instrument in which vibration of a diaphragm alters resistance of a cell.

1,388,966. Electric Heating and Regulating Device for Incubators; William G. Nelson, Racine, Wis. App. filed Jan. 15, 1920. Means to open and close circuit automatically.

1,388,974. Electric Heater for Poultry Plants; John P. Schreiner, Mount Vernon, N. Y. App. filed July 10, 1920. Utilizes ordinary incandescent bulb for heating purposes.

1,388,990. Dry Cell; H. de Olaneta, New Haven, Conn. App. filed May 7, 1920. Deleterious gases harmlessly disposed of.

1,389,018. Grid for Storage Batteries; John C. Sundby, Enderlin, N. D. App. filed Sept. 7, 1920. Constructed to prevent undue buckling.

1,389,026. Radio Receiving System; Vannevar Bush, Chelsea, Mass. App filed May 19, 1920. For transforming sustained oscillations into groups at audible frequency.

1,389,032. Electric Iron; Ralph C. Curth, Columbus, Ohio. App. filed Feb. 10, 1920. Switch mounted in handle.

1,389,051. Continuous-Current Dynamo; Fritz Kesselring, Neuhausen, Switzerland. App. filed June 12, 1920. Approximately constant voltage obtained at variable speed.

1,389,061. Signal System; Daniel J. McCarthy, Elgin, Ill. App. filed June 28, 1920. Railway signal lights.

1,389,080. System of Motor Control; [illegible], Chicago, Ill. App. filed Nov. 28, 1919. For controlling plurality of motors connected to drive same mechanism.

1,389,[illegible]. Control Apparatus; Karl A. [illegible]. App. filed Dec. 13, 1919. Manually operated, rotative-type controllers.

1,389,110. Dynamo-Electric Machine; [illegible], Wilkinsburg, Pa. App. filed March 9, 1917. Regenerative operation of electric railway vehicle motors.

1,389,112. Incandescent-Lamp Lock Socket; [illegible], New York, N. Y. App. filed March 25, 1920. Inexpensive socket from which bulb cannot be removed.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

CAMBRIDGE, MASS.—A. F. Robinson contemplates the construction of a two-story addition, 95 ft. x 105 ft., to the power house at his plant at Binney and Second Streets. The cost is estimated at $75,000.

DEXTER, MASS.—The city authorities contemplate the erection of a transmission line from Dexter to Winfield, to cost about $24,000

Middle Atlantic States

BRADFORD, N. Y.—The construction of a municipal electric plant in Bradford is under consideration by the City Council.

HAMILTON, N. Y.—The Madison Power Company has been granted permission by the Public Service Commission to erect and operate a transmission line in Easton Street, and to furnish electricity for light and power under a franchise granted by the village authorities.

NEW YORK, N. Y.—Plans have been prepared by the Rice Foundation Company, 12 East Eighty-seventh Street, in co-operation with the city authorities, for the construction of a one-story power house, 73 ft. x 73 ft., at Pelham Bay Park.

PATTERSON, N. Y.—The Carmel (N. Y.) Light & Power Company has applied to the Public Service Commission for authority to construct an addition to its electric power plant at Patterson. Extensions, it is understood, will also be made to the distributing lines for local service.

STAPLETON, S. I., N. Y.—Bids will be received by M. Hulbert, Commissioner of Docks, foot of Battery Place, North River, New York City, until Oct. 4, for furnishing and installing cranes, elevators and electric power transmission equipment at piers 12 and 13, Stapleton, S. I. The work includes new boiler plants.

SYRACUSE, N. Y.—The Syracuse Lighting Company, a subsidiary of the United Gas Improvement Company, has filed notice of increase in its capital stock from $4,000,000 to $5,000,000.

ESSEX FELLS, N. J. — Bonds to the amount of $30,000 have been authorized by the Borough Council, the proceeds to be used for improvements to the municipal waterworks, including the installation of electrically operated pumping machinery.

BERWICK, PA. — The pumping station, including four large pumps, electrical motors and other equipment, of the Berwick Water Company was recently destroyed by fire. The loss is estimated at about $100,000.

CLIFTON HEIGHTS, PA.—The construction of a power house, 25 ft. x 52 ft., in connection with other extensions at the Clifton Yarn Mills, is under consideration.

DOYLESTOWN, PA.—The Bucks County Public Service Company is contemplating extensions of its service lines to Mechanics Valley, Buckingham, Lanhasha and Holicog for local distribution of electricity for lamps and motors. Extension of its transmission lines to New Hope and Aquetong are also under consideration.

PEQUEA, PA. — The Pequea Electric Company, recently organized by John H. Myers and others, has purchased from the Farmers' Electric Company, Lancaster, the entire lighting system south of Marticville. The new owners are planning to rebuild and extend the lines.

PHILADELPHIA, PA.—S. W. Evans & Son, manufacturers of metal products, 4623 Paul Street, contemplate the construction of a [illegible] in connection with a proposed addition to their plant, to cost about [illegible].

PITTSBURGH, PA.—Enlargement of the [illegible] plant of the [illegible] and Butler Streets [illegible]. Three [illegible] will be installed, with auxiliary power equipment.

WILKES-BARRE, PA.—Negotiations are [illegible] between the Wilkes-Barre Company and the Pennsylvania Power & Light Company to supply the city of Wilkes-Barre with electricity on a contract basis. This arrangement, should the proposition be accepted, will include the erection of a high-tension transmission line by the Pennsylvania Power & Light Company from its nearest power station into Wyoming Valley. Iron towers would be used to support the cables. The cost of the line would involve an expenditure of approximately $750,000. E. A. Wakeman is general manager of the Wilkes-Barre Company.

CATONSVILLE, MD.—The construction of a power plant at the St. Charles' College at Catonsville near Maryland, in connection with other buildings, is under consideration by the board of directors of the institution. The cost is estimated at $180,000.

GRAHAM, VA.—The Princeton Power Company has filed notice of an increase in capital stock from $100,000 to $200,000.

HARRISONBURG, VA.—Plans are under consideration by the finance committee of the City Council and a committee of ten to ascertain the feasibility of completing the power plant near Grove Hill on the Shenandoah River, to furnish additional electric power to Harrisonburg.

NORFOLK, VA.—Plans are under way by the Anheuser-Busch Company for an addition to its local ice and cold-storage plant, to cost, with equipment, about $250,000. Ophuls, Hill & McCreery, Inc., 112 West Forty-second Street, New York City, are engineers.

North Central States

GALION, OHIO.—The James H. Heron Company, engineer, in its report to the City Council recommends the removal of the municipal electric plant to a new location and a combination, if possible, with the waterworks pumping station. The maximum cost of the proposed plant is placed at $132,000.

TOLEDO, OHIO.—Bids will be received by C. A. Benedict, Director of Public Service, Toledo, Ohio, until Oct. 4, for the construction of a sewage pumping station and the installation of equipment including five centrifugal pumps with 300-hp. and 200-hp. motors, vacuum pumps, piping, valves, meters and gages for the pumps, electric crane, sewage screens and hoists, switchboard and electrical equipment. Plans and specifications may be obtained from the office of the Director of Public Service, 225 Valentine Building, Toledo, and from Fuller & McClintock, engineers, 170 Broadway, New York City.

LOUISVILLE, KY.—Arrangements have been made by the Louisville Gas & Electric Company for the installation of new lamp standards on Fifth Street between Green and Walnut Streets, to cost about $20,000.

FORT WAYNE, IND.—Work will be started at once by the Indiana Public Service Company on the construction of a power house at 301 Militia Street.

HARTFORD CITY, IND.—The Board of Blackford County Commissioners is planning to install an electric lighting system in the county infirmary.

INDIANAPOLIS, IND.—Plans are under way by the Board of County Commissioners for extensions and improvements to the local power plant used for county institutions.

ATLANTA, ILL.—The Atlanta Electric Light Company contemplates the erection of a transmission line, a distance of 13 miles, to connect Lincoln with Atlanta. Energy will be purchased from the Lincoln Water & Light Company.

JOLIET, ILL.—Bids will be received by Zimmerman, Saxe & Zimmerman, [illegible] East Van Buren Street, Chicago, for a one-story power house, 70 ft. x 80 ft., to cost $45,000, at the Illinois Penitentiary, Joliet.

SHERRARD, ILL.—The Sherrard Electric Company is considering the erection of a transmission line to furnish electricity in the town of Reynolds and adjacent territory.

VERGAS, MINN.—Bonds have been voted for the erection of a high-tension transmission line from Vergas to connect with the line of the Otter Tail Power Company at Frazee.

MAQUOKETA, IOWA.—The Iowa Electric Light Company is having plans prepared for the construction of a hydro-electric plant at Maquoketa, to cost about $75,-[illegible] Holland, [illegible] & [illegible] Liberty Street, Ann Arbor, Mich., are engineers.

LA MOURE, N. D.—The Dakota Utilities Company contemplates the erection of a transmission line from La Moure to Verona.

HECLA, S. D.—Plans have been prepared for the construction of a new municipal electric power house. W. H. Higby is city clerk.

MAGNET, NEB.—The village authorities are contemplating the sale of the municipal electric light system and connecting up with the line of the Tri-State Utilities Company. The cost of the improvement is estimated at $12,000.

HAYS, KAN. — Improvements to the municipal electric light plant, to cost about $19,000, are under consideration .

McCRACKEN, KAN.—The City Council is considering calling an election to submit to the voters the proposal to issue bonds for the construction of a municipal electric plant.

Southern States

MARION, S. C.—The City Council is considering the installation of an electric lighting system in Marion.

GAINESVILLE, FLA.—Plans are under consideration by the Council for extensions and improvements to the municipal electric power plant, to cost about $30,000.

JACKSONVILLE, FLA.—The Tidewater Glass Company is planning the construction of a new plant to comprise two manufacturing units, to cost about $150,000 each. The installation will include mold shop, power house and other departments. C. H. Dankworth and F. W. Stewart are interested in the company.

ABBEVILLE, LA.—Bonds to the amount of $125,000 have been voted for rebuilding the municipal electric system, including overhead lines, improvements to the street-lighting system, installing internal-combustion engines, etc. Henry A. Mentz, Magnolia, Miss., is consulting engineer.

CROWLEY, LA.—Bids will be received by the city of Crowley, Louisiana, at the office of J. O. Herin, city manager, until Oct. 17, for power-plant equipment f.o.b. as follows: (1) One crude-oil engine, between 350 b. hp. and 400 b. hp. standard rating, complete with all accessories, including exhaust muffler, outboard bearing and extension shaft to carry direct-connected alternator and exciter. (2) One three-phase, 60-cycle, 2,300-volt oil-engine type alternator of capacity and speed to suit selected engine, without base, shaft or bearings, but with dampening winding, generator rheostat, discharge resistance foundation bolts, sole plates and pressing rotor on extension shaft. (3) One engine-type exciter of capacity and speed to suit selected engine and alternator, without base shaft or bearings, but with rheostat, foundation bolts, sole plates and pressing armature on extension shaft. (4) One switchboard as per specifications on file in the office of the city manager at Crowley. Bidders will submit their own specifications, guarantees, etc.

LAHOMA, OKLA.—The City Council is considering the installation of a lighting system in Lahoma.

MANCHESTER, OKLA.—The erection of a transmission line from Manchester, Okla. to Anthony, Kan., to cost $27,000, is under consideration. W. B. Rollins, Railway Exchange Building, Kansas City, Mo., is engineer.

WOODWARD, OKLA.—Improvements to the municipal electric light plant are under consideration by the City Council.

WAXAHACHIE, TEX.—Work will be started at once by the Texas Oil Products Company on the construction of an oil refinery, to cost about $750,000. The present plans provide for a power house, installation of electrical machinery, etc.

Pacific and Mountain States

PUGET SOUND, WASH.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Sept. 27 for two dynamo condenser, condensate, centrifugal turbine-driven pumps, with miscellaneous spare parts, at the Puget Sound Navy Yard.

COTTAGE GROVE, ORE.—Bonds to the amount of $50,000 have been voted to establish a municipal electric light system in Cottage Grove.

LOS ANGELES, CAL.—The Southern [illegible] authorized by the Railroad Commission to proceed with the construction of an additional unit at its Big Creek hydro-electric development.

MARE ISLAND, CAL.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C. for the following: Until Oct. 4, Mare Island, Schedule 8,753—2,000 ft. telephone cable; Schedule 8,754—miscellaneous insulating fiber, 12,200 fuse elements, 6,000 flanged-heel globes, 500 receptacles, 200 lb. hard sheet rubber, 4,500 cable terminals and six voltmeters.

POMONA, CAL.—The City Council is considering the installation of an ornamental lighting system on Randolph Street between Park and Wisconsin Streets.

REDONDO, CAL. — The installation of ornamental lamps on the business streets in Redondo is under consideration.

SAN FRANCISCO, CAL. — The Pacific Gas Electric Company is considering the installation of new switching equipment at the Artois substation, north of Willows, and increasing the capacity of that station from 15,000 kw. to 45,000 kw., to cost about $30,000. The company also contemplates the construction of a substation at Wilkins Slough between Knight's Landing and Coulsa, etc., to cost $45,000.

SONOMA, CAL.—The Sonoma Valley Water, Light & Power Company has been granted conditional permission by the Railroad Commission to issue $100,000 in bonds, the proceeds to be used for the acquisition of the property of the Sonoma City Water Works and the Sonoma Vista Water Company, also for extensions, improvements and to pay indebtedness.

BOISE, IDAHO.—A site on the Payette River has been purchased by the Dead Ox Flat Irrigation District for the establishment of a power plant.

FRANKLIN, IDAHO.—The Utah Power & Light Company, Salt Lake City, Utah, is considering the construction of another large dam.

PHOENIX, ARIZ.—The Garrick & Mangham Agua Fria Lands & Irrigation Company has made arrangements with the Shattuck Construction Company, San Francisco, to take over all the construction work in connection with the development of an irrigation project in the district west of Phoenix, to cost approximately $1,800,000. The present plans provide for pumping plants, siphons across the Agua Fria, transmission lines, canals, etc. The work is to start not later than March 1, 1922.

NEVADA CITY, NEV.—The Delhi Power Company is having plans prepared for the construction of a power house, penstock and transmission [illegible]

Canada

WINNIPEG, MAN.—Announcement has been made by A. W. McLimont, vice-president of the Winnipeg Electric Railway Company, that arrangements have been completed for financing a 168,000-hp. hydro-electric development at Great Falls on the Winnipeg River, 63 miles from Winnipeg, to cost $10,000,000. Work is already under way on the project, which will be carried out under the charter of the Manitoba Power Company. The latter company is taking over the plant and assets of the Winnipeg River Power Company, Ltd.

DRESDEN, ONT.—The authorities of Camden Township are planning the erection [illegible] 190 University Avenue, Toronto, is the [illegible]

PAISLEY, ONT.—A by-law [illegible] of hydro-electric service in Paisley. Electricity will be furnished from the Eugenia [illegible]

THEDFORD, ONT.—[illegible] authorized providing for $16,500 for hydro-electric service in Thedford.

COTEAU DU LAC, QUE.—Bids will be received by Joseph Langevin until Sept. 30 for the construction of electric light and [illegible]

MONTREAL, QUE.—[illegible] by the Administrative Commission appropriating $15,000 for replacing the boilers at the Craig Street pumping station and $11,000 for renewing pumps at the Rielee Street pumping station will be again con-[illegible]

Electrical World

New York, Saturday, October 1, 1921

The Great Issue Now Before All Our Associations

MEN have a way of joining associations, to express approval and to lend support, and then doing nothing more. Every society and association in the electrical industry is suffering from this abandonment by members—due to failure to realize what such an association is and what it is for.

The N.E.L.A., the A.I.E.E., the S.E.D., the I.E.S., the N.E.C.A., the E.S.J.A., the A.M.E.S., the Power Club, etc., are simply associations of men who have banded together in the effort to achieve through co-operation some purpose that they feel cannot be accomplished by the individual. Each man has joined because this league or that society is striving to do something that he wants done. He is received as a member because he thus expresses a desire to help, and as a member he stands voluntarily committed to contribute his active aid. The act of joining in no way fulfills his obligation. No member can conscientiously sit back and wait for the secretary or the headquarters staff to do the work.

But men are just as human in association work as in anything else. They do largely what they like to do and apply themselves to the thing that interests them most at the time. If they are to take part in association work, it must be made not only worthy but timely and appealing. And just as soon as an association ceases to have such clearly defined objectives and to make real progress toward their attainment, that association is dead. For it can flourish only on the interest, the active unity and influence of its membership. And it justifies itself only in the measure of the practical service which it renders broadly to the industry as well as to the individual, along lines that do not duplicate and overlap the work of correlated bodies.

Electrical men believe in co-operation, and they have grouped themselves into a number of associations of large membership and great potential strength that have done some very big and useful things for the advancement of the industry. They have accomplished but a fraction of the good they could have done, however, if their collective purposes and influence had been expressed more actively to the individual members and applied more intimately by them in their local contact. Most members abandon their associations only because the association fails to sustain their eager interest and gives them work to do.

The ELECTRICAL WORLD believes that there is no more urgent issue before our associated bodies than this one. The member *must* be made to appreciate that he is the association; the association itself must employ its membership with more purpose and effect.

Matthew Scott Sloan

An engineer who has achieved early distinction among leaders in central-station-company affairs through his qualifications as an executive and a sympathetic understanding of public relations has been elected president of the Association of Edison Illuminating Companies.

AT ITS recent annual meeting in Spring Lake, N. J., the Association of Edison Illuminating Companies elected as its president a man young in years and young in the Edison group. These companies, which are generally recognized as the leaders in electric light and power company policy and engineering practice, date back from the early days of the commercial use of electricity. To become the spokesman of this group, therefore, stamps one as a leader among leaders. M. S. Sloan, president of the Brooklyn Edison Company, the new president of the Edison association, has been engaged in the public utility business for the last fifteen years. By education and by early training he is an engineer. By instinct and inclination, however, he is an executive. Possessed of a keen perception and sympathetic understanding of public relations, he has shown a marked ability to analyze those situations in the operations of a public utility which frequently pass unobserved and prevent a company from making the most of its opportunities. However, he has the courage to apply the needed corrective measures. In addition, Mr. Sloan has a clear understanding of utility financing and has as a result been able to be of considerable assistance not only to his own company but also to bankers and others interested in the issuance of public utility securities. In recognition of this understanding he has been appointed chairman of the N. E. L. A. committee on relations with bankers. A Southerner by birth, nature has endowed him with an attractive personality, making it easy for him to meet other men and win them over to his point of view.

Mr. Sloan was born in Mobile, Ala., Sept. 5, 1881. In 1901, before he had actually reached his twentieth birthday, he was graduated from the Alabama Polytechnic Institute at Auburn. It was in 1906 that he left the General Electric Company to enter the utility field as chief engineer of the Birmingham (Ala.) Railway, Light & Power Company. Later he was made assistant superintendent of the lighting and power departments of that company, and in 1907 he was appointed superintendent of power. The following year he was appointed superintendent of the company's electric department, with jurisdiction over the operation and commercial sales of that department. In 1910 he was made assistant to the president of the company, in which capacity he had supervision over all departments, with full executive power. Toward the end of 1913 he became connected with the New Orleans Railway & Light Company, an affiliated property, as assistant to the vice-president. A few months later he became manager of that company's railway and electrical departments, and in 1917 was elevated to vice-president and general manager. Within a short time, however, he resigned to join the executive staff of the New York Edison Company as assistant to Vice-president John W. Lieb and in that capacity became operating manager of the company. In the summer of 1919, upon the resignation of Nicholas F. Brady, he became president of the Brooklyn Edison Company.

Mr. Sloan has been a conscientious association worker, and while he lived in the South he was a tower of strength to the Southeastern Section of the N. E. L. A. In addition to the N. E. L. A. work previously mentioned, he is chairman of the committee on electrical resources of the nation and he also is a member of the public policy committee.

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All Eyes on the Washington Employment Conference

NO UNOFFICIAL body meeting under official auspices in recent days has attracted a larger measure of public support than the conference on the employment situation that has met in Washington at the President's call this week. Employers great and small, workingmen employed and idle, professional men, clerks, wives and children—all would hail its outcome if it meant that the way was clear for a resumption of the industrial activity of two years ago. The conference cannot work miracles or by a wave of its wand restore the sick to bounding health. But it can at least clear the way. It can produce an accurate census of the unemployed by sections, cities and industries; it can marshal for demolition the obstacles in the way of "starting up," and all patriots will hope that it can bring together for prosperity in peace as they were brought together for defense in war the leaders of capital and the leaders of labor.

Who Should Develop the Colorado River?

WHAT agencies should be the ones to develop the tremendous power possibilities of the Colorado River? How is the financing to be done, who should supply the funds, and how should these be repaid? How should the power be distributed? How should the flood control and irrigation benefits relate to the power development? These are the fundamental questions which must be answered before anything further can be done toward realizing upon this great asset of the Southwest which flows through Nevada, Arizona and Utah.

The recent statement credited to Secretary of the Interior A. B. Fall that "no dam should be built on the Colorado River by any agency except the federal government, as the enterprise is altogether too large, too important and involves too many interstate and international problems to permit of its being undertaken by any other agency," is of great significance. That the federal government is qualified to raise the funds for the construction of the necessary dams and power houses, and that of all agencies it alone can settle any interstate or international disputes which arise, goes without question. But is government to compete with private enterprise in work which private enterprise is eminently qualified to undertake? Present-day developments in power engineering and in the existing great transmission systems, outrivaling the proposed superpower system of the Atlantic seaboard fostered by the federal government, have reached their high plane under private initiative. These agencies also have been unusually successful in obtaining all the funds needed to extend their plants as power is demanded. The Colorado River developments offer no problems that cannot be solved by the same agencies that have been responsible heretofore for the country's electrical growth. There is no necessity for the government to develop the Colorado so long as private initiative equally resourceful and competent is willing to undertake the job.

The Effect of Increased Taxes on Rates

THE Senate committee dealing with taxation has indicated a possible change in the corporation tax section of the proposed act amending and simplifying the revenue act of 1918. Originally levying a tax of 10 per cent on the net earnings of corporations, the House committee increased this to 12½ per cent, and now the Senate committee proposes to increase it still further by making it 15 per cent. And all the while there is a clamor for a reduction in the price of freight and passenger transportation as well as in the rates for all public utility service. Apparently the work of the special taxation committee representing the electric light, railway and gas associations has been fruitless, or at least its warnings as to the effect of increased taxation on public utility corporations have gone unheeded. The public should be made to understand the full purport of such a change. Lower rates are out of the question if taxes are to be increased 50 per cent.

At Last True Figures on the Appliance Load

THE electrical industry owes a vote of thanks to C. J. Russell and T. W. Berger of the Philadelphia Electric Company for their study of residence kilowatt load with reference to relative consumption by appliances and lamps. Their paper, which appears in this issue of the ELECTRICAL WORLD, is a notable contribution to the common fund of knowledge, the first accurate analysis of what is really going on in the modern home in the matter of appliance use under actually existing conditions. It is particularly interesting and valuable because of its conservatism.

We have long known that the number of electric household appliances in service was increasing and that their habitual use was becoming more general. How this was affecting the load, however, and its worth to the central station have been matters for conjecture and theorizing. Now comes a study of the daily and hourly consumption of 1,332 households in Philadelphia, selected in groups in four different neighborhoods that provide an average well under what might be called the normally equipped home. Graphic wattmeters were attached to the poles in circuit with the transformers serving these groups of homes and continuous readings were taken over a week's period. A survey was made of the appliances in use in each home. Although the test was made in the summer when appliances naturally have their minimum use, still the findings were surprising, for they prove that the total weekly consumption of residence appliances has already grown as great as the consumption for light; that on three certain days each week the appliance load is larger, while on the other days the light load is larger, and that this doubling of the consumption of energy has been accomplished with an appliance equipment averaging only two devices per house.

The report of this investigation has been presented before the recent convention of the Association of Edison Illuminating Companies and the meeting of the Great Lakes Division, N. E. L. A. It deserves the widest possible dissemination and the most thoughtful consideration. It raises plentiful questions that should be followed through. What are the facts in larger and smaller homes? What are the conditions in smaller communities and in other parts of the country? How will the comparison stand in winter, when both more light and more appliances are used? What can be done to increase the appliance load on Thursday, Friday, Saturday and Sunday? These are further facts for which the industry has vital need, and the Russell-Berger paper points the only way in which they can be developed. We have all talked about it long enough. Now let us find out what the actual conditions are in other cities. Such an investigation by any company can be made to pay for itself many times.

Effective Co-operation in Oklahoma

THE course followed in the recent movement to establish line construction rules in Oklahoma is a credit to the central-station and telephone interests involved. With a set of rules governing not only overhead construction but also inductive interference already issued in tentative form, the utilities came together in a joint committee and agreed on a recommendation involving the use of the National Electrical Safety Code for overhead construction. It was unanimously agreed that this was no time to consider the issuance of inductive-interference rules. The committee went before the commission with its recommendations and they were accepted.

We have had occasion to point out the danger of continuing actions before the state commissions or in the legislatures while the study of inductive interference is yet in an incomplete state. The Oklahoma action shows that this danger is being recognized, and it is with a great deal of pleasure that we record the fact, particularly as a similar attitude has been indicated in other cases that have not as yet reached so definite a conclusion. It is gratifying to note that the overhead situation has reached a point where the various interests can meet and avoid embarrassing controversies. It is due to the power and telephone interests and the public as well that the same sort of a basis for agreement be reached as promptly as possible in the inductive-interference situation. Electric light and power company men should appreciate the action taken in Oklahoma and not only do all they can to expedite this work but also give credit to the men representing both industries for the action they have taken in that state and appear likely to take in other states. It means progress.

Discriminating Influences that Accompany Municipal Ownership

IN THOSE days when a single community was served by five or six separate power installations and few, if any, power users were to be found in the surrounding agricultural districts the subject of power supply was one of simplicity. When one stops to consider, however, present transmission and distribution networks that not only serve entire cities and groups of cities but spread out into the country areas, and indeed on through several states, as they do in the South in Alabama, Georgia, east Tennessee and the Carolinas, or in the Pacific Coast areas in Oregon, California, Arizona and Nevada, the problem becomes far more complicated.

The ELECTRICAL WORLD has published no little information covering the trend in the West which leads thoughtful men to see that the inflexibility of power development under city control is likely to sound the death knell of such municipal activities unless means can be devised to overcome the problems of service caused by present-day demands for power. To this issue E. O. Edgerton contributes a convincing discussion of this timely subject. It will be recalled that Mr. Edgerton has proved himself a leader in many things connected with recent evolution in utility regulation. As president of the California Railroad Commission in former years, it was he who boldly came forth to champion the cause of a fair return on investments in spite of the fact that uneducated public opinion was at times violently opposed to advances in rates to meet increasing costs of production.

Mr. Edgerton in his article points out that the participation by a municipality or a number of municipalities in power development upon any particular stream or river, such as has lately been proposed in California—where municipal development is allowed to proceed independently of state regulatory bodies—would probably result in a definite allocation to each governmental entity, and that such allocation would at once result not only in confusion but in tying up power resources to such a degree that full service to power consumers, both within the city and within the rural communities beyond its boundaries where great areas are covered by interconnected power service, would be seriously jeopardized.

The power problem of the future in any state is not confined within city boundaries, and the demands of all customers must be equitably served as they present themselves, irrespective of their location. Without serious financial obstacles and expensive operating difficulties this is only possible through development and distribution by private capital. Under even partial municipal control of power developments large financial risks are invited, as well as discrimination in the division of power. In the former, and more particularly in the latter, contingency the rights of power users are protected when commission regulation has the fullest opportunity of expression. For under such expression flexibility, one of the outstanding demands of modern power service, is fully met and at the same time the rights of all taxpayers are fully safeguarded.

Intensity of Illumination and Visual Efficiency

THE paper by M. Luckiesh, A. H. Taylor and R. H. Sinden which is published in the current issue of the Electrical World gives the results of some extremely interesting experiments upon the desirable intensities of illumination for the simple visual operation of reading. These experiments are striking in several respects. The fundamental observations were tests with reading matter of both strong and weak contrast, but always involving the idea of speed. It is already well known that rapid discrimination requires somewhat higher lighting intensities than deliberate observation, and the experiments recounted strongly emphasize this fact. Perhaps, indeed, they emphasize it a little too strongly, since the conditions involved the reading of moving type. This is, of course, not the condition found in practice, since the motion of the eyes in reading a moving page is entirely different from that which occurs in perusing an ordinary page at rest, however quickly. What effect this change of physiological condition had upon the results it is impossible to tell from the data presented. One would expect, however, that the difference involved with respect to the reactions on the ocular muscles would be very material, and *a priori* one would judge that the results would be just such as were obtained, that is to say, that the unfamiliar condition would require much stronger illumination than the familiar one for equal apparent ease of seeing.

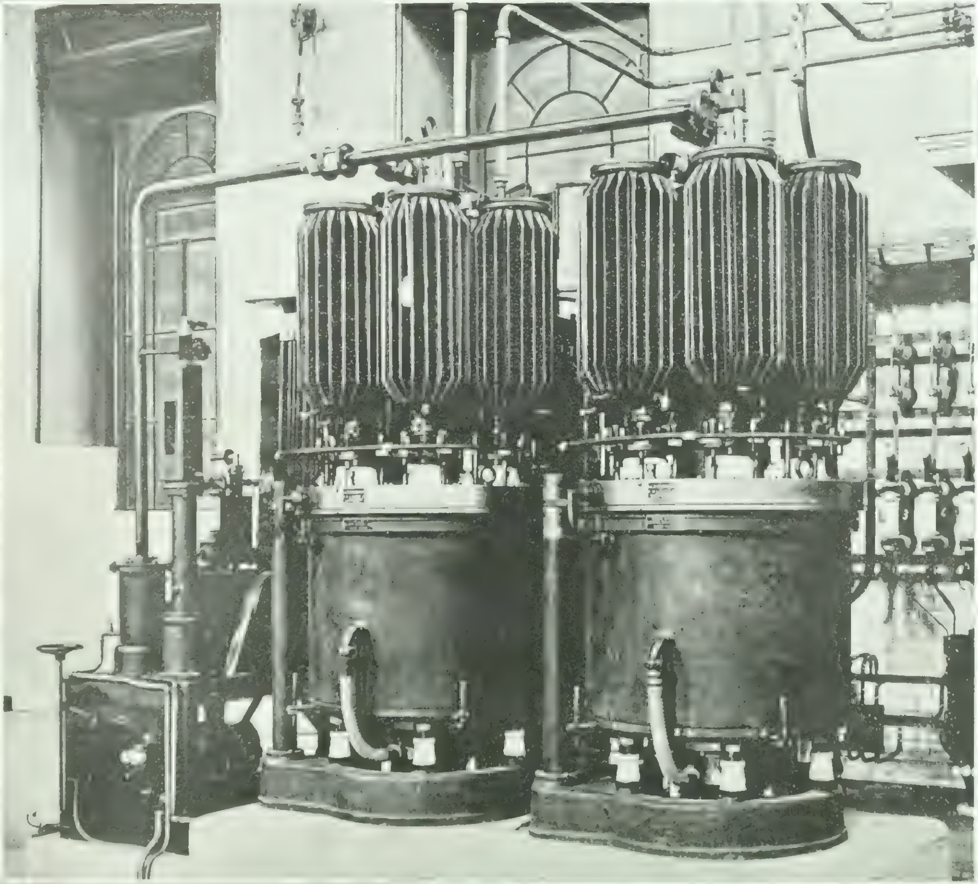
Of course, the tests were not carried out to the fatigue point as they have been in some experiments. Moreover, the intensities available were much greater than are usually found, so that the higher values would be unlikely, on account of irradiation, to be chosen by the observers. The actual facts showed that under the circumstances of the test the intensities of illumination selected were two or three times those common even in extremely well-illuminated reading rooms. It would be worth while to follow this phase of the matter into the domain of fatigue to discover whether in reading matter at rest, which is the normal condition of reading, these same intensities would or would not prove more wearying to the eyes than higher or lower ones.

Another striking series of experiments was carried out by comparing ordinary and monochromatic light, the gas-filled tungsten lamp being chosen for the former and the mercury arc for the latter. Here the tests were reading tests pure and simple and on stationary matter. They were not long continued, so that again the question of fatigue was eliminated, nor did they involve unusual muscular effort in following the type. The results showed that in general the observers selected a rather stronger light from the mercury arc, which is approximately monochromatic, than they did from the incandescent lamp, which covers a wide range of spectrum. This is the reverse of the well-known results obtained in testing for acuity under these two sources, and we are very strongly of the opinion that the experiments depended more on the psychological than on the actual visual factors. We are not inclined to deny that visual acuity is the determining factor for illumination for reading, and we fancy that the explanation of the curiously discordant results in this respect is the failure to take into account some of the very substantial psychological factors that appear when comparing two lights which obviously are radically different in spectral character, and, moreover, comparing them in succession rather than simultaneously. In some of the previous work on this subject a similar comparison has been made with test type in juxtaposition illuminated simultaneously from the two different illuminants, and in this case the monochromatic light was found to have large advantage in the matter of acuity. One cannot analyze without investigation of the exact circumstances of the test the difference between the two results, but it is sufficiently great to demand a further threshing over of the whole question, which is one of large practical importance in the matter of determining the character and intensity of illuminants. The psychology of illumination is a field as yet altogether too little investigated.

Electric Truck Operation Will Withstand Economic Comparisons

IF ANY ONE who has any doubt in his mind regarding the economy of electric street trucks will take the trouble to interview users of such vehicles, he will usually find that the trucks are fully justified on economic grounds. The only regret is that data on the experiences of various electric truck users have not been made more readily available, for then much of the illusion regarding the limitations of the electric vehicle would be dispelled. The case we describe this week is a thoroughly typical one, including the operation of 149 trucks in the service of a single company in the simple task of delivering bread from the bakery to the retailer. The region covered is Greater New York and its vicinity. The delivery cost in the bakery business seems to be an important item, and in the instance we describe the electric truck has thoroughly justified its employment after experience both with horses and with gasoline trucks. One of the most interesting features of this varied experience was the relation found to exist between the most economical type of haulage and the distance to be covered. For trips between 15 miles and 45 miles in length, in the course of the regular deliveries, electric trucks proved the most economical. For very short delivery trips, under 15 miles, horses held their own, and for long runs, more than 45 miles, the gasoline trucks had enough advantage in speed to push themselves to the front.

The average run of the electric trucks is about 35 miles a day, in the course of which about fifty deliveries are made. The experience of several years has shown that the depreciation can be distributed over a decade. Repairs and maintenance average $25 a month and battery charging $22 a month, the company doing this work itself. The depreciation on the batteries is on a five-year basis. These figures apply to those of the trucks which are of the 1-ton variety. The ½-ton trucks cover a little less ground and cost a little less for maintenance and a good deal less for charging. The average speed is about 14 miles an hour, to which figure the trucks are geared. This relatively low speed is believed to be advantageous and is certainly productive of fewer accidents than occur with the gasoline trucks. A very interesting feature of the situation is that the "electrics" have more advantage over the gasoline trucks than over horse-drawn vehicles, although they are superior in economy to both. Any one who has seen the ordinary gasoline truck on the wild joy ride of its return journey will divine the reason for himself.



Large Power Rectifier Merits Consideration in This Country

WITH a record of 100,000 kw. installed capacity in Europe, the large power rectifier has reached a point in development where it merits consideration in American practice. Nearly every one is familiar with the glass-bulb type of mercury-arc rectifier which has established itself rather firmly in this country for charging batteries, operating arc lamps, etc., but its big brother—the large power rectifier—has not become commercially known on this side of the water, with few exceptions, although some large manufacturers have been known to experiment with its development. The steel-clad rectifiers shown here are installed in a railway substation in Milan, Italy, and are rated at 500 kw., 550 volts direct current. Brown, Boveri & Company of Baden, Switzerland, have developed the European rectifiers to their present state of perfection, making them for 300, 600 and 900 amp. and any voltage up to 800 and in 300 amp. size for 1,200 volts.

Inflexibility of Power Development by Municipalities

Limitations Surrounding Municipal and Government Operation of Electric Utilities, with Especial Reference to Development of Large Power Sites Where Demands for Service Come from Customers in Several States

By EDWIN O. EDGERTON
President East Bay Water Company and Formerly President California Railroad Commission

DISCUSSION of the merits of municipal development and distribution of hydro-electric energy as contrasted with development and distribution by privately owned public utility companies under state regulation is bringing out many aspects of the problem not heretofore adequately considered. One of these aspects which is of importance is the relation of consumers of electricity to the electric supply. It may be laid down as a premise that electric service will not be completely satisfactory unless there be at all times readily available to each consumer service in such amount and of such character as to fit his particular needs. Rates, of course, are important but are not finally controlling. It is idle to enlarge upon the benefits of low electric rates if the service is not available. Much confusion has occurred from the loose use of words such as "municipal ownership," "public ownership" and "government ownership."

LIMITATIONS SURROUNDING MUNICIPAL AND GOVERNMENT OPERATION

Municipal ownership and operation of a utility service is confined to a separate distinct group of people organized as a city, or possibly as a municipal corporation such as an irrigation district, and the operation of a public utility service by such a group for the sole use and benefit of the people constituting this group, with no regard to outside communities or individuals.

Government ownership, on the other hand, implies the idea of a governmental unit sufficiently large to embrace all of the people, such as a state or the nation. Particularly must this distinction be made because of the modern status of electric service where, as in so many instances, the service has outgrown the boundary of any city or group of cities and has spread over great portions of the state, so that any adequate consideration of public ownership must include operation by the state itself. For instance, it would not seriously be considered that even the largest city in California—Los Angeles—could take over and operate the public utility electric company which operates throughout southern California and whose service is only 10 per cent within the boundaries of that city. Neither could the county of Los Angeles successfully operate this business because a large amount of service is given in other counties. Therefore the only governmental unit sufficiently comprehensive would be the state.

There are certain aspects of the electric power situation which involve service from given points of generation throughout as many as seven states, and here is an operation which of necessity must be performed, if to be done publicly, by the national government. Short of the complete governmental development and distribution of electric power without discrimination as between consumers, and which must at all times be ready and able to produce service to any and all consumers when and as needed, there is no form of governmental interposition in the power business which could possibly give satisfactory service.

HYDRO-ELECTRIC DEVELOPMENT BY MUNICIPALITIES CANNOT PROVIDE FOR SERVICE OUTSIDE

A municipality in seeking to develop electric power from sources outside of its boundaries must of necessity act selfishly. The only method of financing such development is through the issuance of municipal bonds. Naturally citizens who are called upon to vote such bonds require the assurance that a specified minimum amount of power will become available for the sole use of the city or its citizens to the exclusion of all other consumers, and it cannot be maintained that a city having an opportunity to seize and hold power rights on mountain streams will take only so much as will result in its receiving a fair proportion of power to be developed considering all other municipalities which may thereafter desire to make like developments. The fact is that a city acts for its own interests and seeks to secure for itself power sufficient not only for its present needs but for such needs as may be expected in the future, and it does this without any consideration whatever for other municipalities or other consumers.

Furthermore, the participation by a municipality or a number of municipalities in the development of a given stream would undoubtedly result in a definite allocation to each governmental entity; and once fixed this allocation would be inflexible, there being no governmental agency to make any adjustment based on the needs of all power consumers. Once a city obtained rights and developed power on a stream, there could be no hope thereafter of a division of such power between such city and other consumers, no matter how great the needs of such other consumers might be.

The only way in which hydro-electric energy could be developed by municipalities in fairness to all present and prospective consumers would be for the cities to develop power which would be available at all times for distribution to consumers both inside and outside of city boundaries; but this, as has been shown, is a virtual impossibility. No city or group of cities would invest municipal funds in a power enterprise and risk the possibility and probability of having to share the power developed with any consumer present or prospective who might thereafter need service.

If a city did this, it might and probably would find itself in a position after investing municipal funds where its power supply would be seriously cut in order that consumers outside of the city should be given service, with the result that the city's enterprise would be unremunerative unless the city went into the general power business and sold power to the outside consumers, and this, as has been suggested, is an impossible conception of a municipal enterprise.

Public Utility Company Can Furnish Service Wherever Needed

Contrasted with this situation, the public utility under regulation provides complete elasticity and is an agency from which, without discrimination, all consumers may receive service when and as needed, no matter where they are located, provided, of course, that they are within a practicable distribution area. A public utility company must at all times be ready to give service not only to old consumers but to new consumers who desire to be attached to the system. Regulation does not permit favoring any one locality over another in the matter of service, and the development of electric power by a public utility company cannot be made for any given locality but must be made for the benefit of all consumers within a reasonable distribution area.

The truth of what has been said becomes apparent when we consider the proposed development of electric power on the Colorado River, and here the conditions incident to municipal development as outlined would apply equally to state development. On the Colorado River there is a possibility of developing energy to be distributed in at least seven states, and it may fairly be said that the development of this energy should be made with a comprehensive consideration of the needs of the consumers in all of these states. No one city, no group of cities and no one state has a right to claim all of this electrical energy as it must be distributed fairly throughout the Southwest.

Development of Colorado River by Private Capital an Example of Equitable Service

For any city or group of cities or for any state to obtain rigid and perpetual rights to definite amounts of power on the Colorado River would create the inflexible condition which has been shown as impossible if service is to be given to all consumers. In the first place, there is no reasonable basis upon which a definite allotment could be made to each governmental unit, and if an allotment were made either upon an arbitrary basis or on a basis of population or on a basis of present consumption, this allotment would definitely restrict development as to those great areas which will undoubtedly be developed but which would have received no allotment because of their present unorganized condition. Furthermore, such an allotment must of necessity contemplate future needs as well as present ones, and if made on that basis, it would as to some areas now sparsely settled hold out of use electrical energy for a long period of time at great economic loss.

Moreover, most of the governmental units which might seek an allotment at the time of the division of power rights on the Colorado River are wholly unprepared to develop and use such power and have no present thought of going into the power business.

On the other hand, the public utility company under regulation affords a remarkably adequate agency for the logical development of power and the distribution of energy fairly and equitably among the consumers as they present themselves, wherever they may be located. There need be no definite allotment of power to any given community, because the power company would develop power in logical steps, keeping somewhat in advance of demand but seeking always to prevent a heavy investment for power development which for a long period would remain idle because of a lack of demand. Under this scheme the public, with no financial risk except as it might invest in the securities of the company, would obtain electrical energy at times and in quantities to suit the needs of consumers, and all of the citizens of all of the states would be assured of non-discriminatory treatment and a division of the power fairly and equitably made under governmental regulation and free from the rigid, inflexible dedication of definite amounts of power to any given community or state.

Operating Expenses Decrease 16 per Cent

Gross Revenue of Electric Light and Power Companies Increases, While Operating and Maintenance Expenses Decrease

REPORTS received by the Electrical World for the month of July from central generating and distributing companies representing 78 per cent of the installed rating of the country indicate that the average electrical energy requirements of the country were the lowest since September, 1919. However, a comparison with the war-time energy output of the central generating stations shows that the cutput during July was still higher than that reported during the war period. The average gross revenue for July was the lowest since August of last year, but was still more than 15 per cent greater than that reported for any month during the war.

Also, in spite of the fact that with but few excep-

TABLE I—CENTRAL-STATION RETURNS FOR TWELVE MONTHS

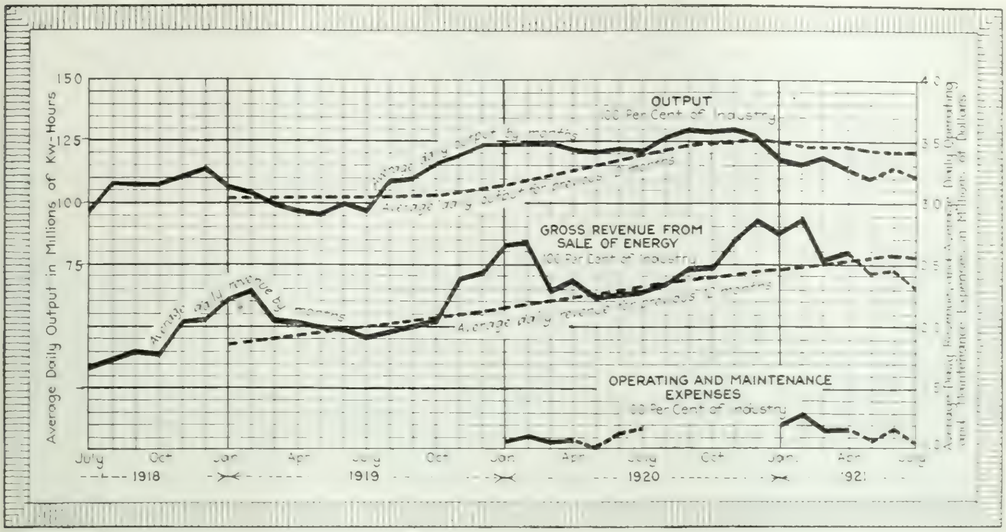
	Percentage of Installed Ratings Represented	Kw.-Hr. Output (Companies Reporting) 1920 Thousands	Kw.-Hr. Output (Companies Reporting) 1919 Thousands	Per Cent Increase	Percentage of Installed Ratings Represented	Revenue from the Sale of Energy (Companies Reporting) 1920 Thousands	Revenue from the Sale of Energy (Companies Reporting) 1919 Thousands	Per Cent Increase
Aug	71	[illegible]	2.303 099	20.1	66	$47 410	$36,713	29 1
Sept	71	2 734 174	2.327.460	17 4	66	49 224	38,209	28 5
Oct.	71	2 797.625	2.499 488	11 9	66	51.370	41.055	25.1
Nov	71	2 741 705	2 503 402	9 6	66	54.620	44.711	22 0
Dec.	71	2 792 554	2 648 746	5 4	66	57 697	48.580	18 6
		1921	1920			1921	1920	
Jan.	76	2.765 632	2 943.349	6 0	70	58.855	50.861	15.8
Feb	76	2.453.671	2.711 800	[illegible] 4	70	55.540	[illegible]	14 3
Mar	77	2.806.609	[illegible]	6 1	72	55.513	49,071	[illegible]
April	78	2.675.949	2 895 067	−7 0	72	55.326	49,064	12 8
May	78*	2.668 457	[illegible]	−7 6	72	[illegible]	47.932	12 [illegible]
June	78†	[illegible]	[illegible]	−7 2	72	52.548	47.891	[illegible]
July	78‡	2 681 844	2 916 678	−8 1	72	51.362	48 957	4 [illegible]

	Percentage of Installed Ratings Represented	Operating and Maintenance Expenses (Companies reporting) 1921 Thousands of Dollars	Operating and Maintenance Expenses (Companies reporting) 1920 Thousands of Dollars	Per Cent Increase	Operating Ratio: Steam Plants 1921	Steam Plants 1920	Hydro Plants 1921	Hydro Plants 1920	Combined Systems of Steam and Hydro 1921	Combined Systems of Steam and Hydro 1920
Jan	40	14,562	13,085	11.3	56.1	55 3	26 8	27 0	38 1	45.6
Feb.	43	15,085	13,640	10.5	55 6	54 5	22 9	26 [illegible]	44 1	47 3
Mar.	53	18 757	17 248	8 7	56 1	57 7	23 4	19 6	41 2	44 8
April	53	17 815	16 641	7 1	53 0	[illegible]	23 9	19 8	41 4	43 3
May	53	17,274	16,727	3.1	55.4	56 8	24 2	22 9	40 6	44 8
June	54	18,646	18,758	−0 5	56 2	62 5	20 4	21 6	15 0	50 9
July	54	17.779	19,874	−10 5	56 8	65 9.	20 6	20 2	43 0	52 6

*Includes estimates for [illegible] companies, representing 9 7 per cent of the total installed rating of all central stations.

†Includes estimates for seventy-eight companies representing 16 3 per cent of the total installed rating of all central stations.

‡Includes estimates for one hundred and seventeen companies representing 20 9 per cent of the total installed rating of all central stations.



CENTRAL-STATION GROSS REVENUE, OPERATING EXPENSES AND OUTPUT DECREASE DURING JULY

tions virtually all the primary industries of the nation were operating at only a small percentage of their capacity and were reporting correspondingly decreased financial returns, the electric light and power industry, while selling 8 per cent less electrical energy in July of this year than in July of 1920, reported gross revenue 4.8 per cent in excess of that received in July of last year. In addition, the operating and maintenance expenses during July were 16 per cent below those of July, 1920. Expressing these figures in terms of the operating ratio, or ratio between operating expenses and gross revenue, gives further evidence of the tendency toward financial prosperity in the electric light and power industry. During July of the present year the operating ratio of all companies taken in the aggregate was 46.1 per cent, as against 54.1 per cent reported

TABLE II—CENTRAL-STATION RETURNS BY SECTIONS OVER A TWELVE-MONTH PERIOD

Month	Percentage of Installed Ratings Represented	New England States 1920 Thousands	New England States 1919 Thousands	Per Cent Increase	Percentage of Installed Ratings Represented	Atlantic States 1920 Thousands	Atlantic States 1919 Thousands	Per Cent Increase	Percentage of Installed Ratings Represented	North Central States 1920 Thousands	North Central States 1919 Thousands	Per Cent Increase	Percentage of Installed Ratings Represented	South Central States 1920 Thousands	South Central States 1919 Thousands	Per Cent Increase	Percentage of Installed Ratings Represented	Pacific and Mountain States 1920 Thousands	Pacific and Mountain States 1919 Thousands	Per Cent Increase
KW-HR OUTPUT																				
Aug.	82	194,028	171,002	13.5	66	905,170	728,097	24.2	74	891,712	750,787	18.6	56	147,082	111,573	[illegible]	79	631,183	541,640	16.5
Sept.	82	[illegible]	170,593	14.1	66	905,872	758,737	19.5	74	878,237	758,017	15.9	56	147,524	[illegible]	[illegible]	79	607,816	526,464	15.5
Oct.	82	[illegible]	191,132	2.7	66	964,739	841,694	14.5	74	896,241	817,757	9.5	56	157,267	126,769	24.1	79	583,068	522,136	11.7
Nov.	82	193,231	183,624	5.4	66	953,436	825,011	15.5	74	895,229	861,352	10.5	56	144,889	125,438	15.0	79	554,920	507,977	9.2
Dec.	82	210,494	227,403	7.4	66	969,909	917,945	5.7	74	903,628	852,264	[illegible]	56	140,485	133,419	5.3	79	568,038	517,715	9.6
		1921	1920			1921	1920			1921	1920			1921	1920			1921	1920	
Jan.	81	200,269	247,800	-19.2	77	1,003,223	1,043,650	-3.9	73	860,643	956,078	-10.0	62	144,936	145,336	0.3	81	556,561	[illegible]	[illegible]
Feb.	81	[illegible]	[illegible]	-17.6	77	[illegible]	970,539	7.0	73	789,539	882,873	-10.6	63	131,654	[illegible]	[illegible]	[illegible]	451,754	508,961	-11.2
Mar.	81	205,348	[illegible]	-10.8	79	1,029,120	1,119,428	8.1	73	894,500	[illegible]	[illegible]	63	139,381	[illegible]	2.4	[illegible]	538,260	561,934	4.2
Apr.	81	[illegible]	227,008	-13.3	79	[illegible]	1,052,716	8.4	73	828,457	[illegible]	[illegible]	63	132,075	[illegible]	[illegible]	[illegible]	555,048	586,894	-5.4
May	82	191,141	219,298	-12.8	79	934,973	989,408	5.5	73	819,506	[illegible]	[illegible]	63	136,573	138,416	-1.3	89	586,264	642,495	-8.7
June	82	[illegible]	218,646	-12.3	79	941,058	1,003,870	6.2	73	801,705	891,253	-10.0	63	136,548	130,015	5.0	89	604,108	639,779	-5.5
July	81	168,238	219,159	-14.1	79	937,900	1,017,530	7.8	73	792,992	879,743	-9.9	64	138,013	138,946	6.7	89	[illegible]	662,300	-5.4
REVENUE		1920	1919			1920	1919			1920	1919			1920	1919			1920	1919	
Aug.	82	$5,075	[illegible]	[illegible]	65	[illegible]	$13,731	25.9	57	$13,497	$10,151	32.9	54	$3,168	$2,281	38.1	79	$8,460	$6,457	31.1
Sept.	82	5,409	[illegible]	[illegible]	65	18,081	[illegible]	[illegible]	57	13,834	[illegible]	[illegible]	54	3,262	2,386	36.5	79	8,638	6,549	32.0
Oct.	82	[illegible]	[illegible]	22.7	65	19,201	[illegible]	[illegible]	57	14,458	11,667	23.9	54	3,504	2,551	37.3	79	8,532	6,492	31.5
Nov.	82	5,898	5,017	17.5	65	20,938	[illegible]	[illegible]	57	15,158	12,561	20.8	54	3,853	2,910	32.4	79	8,775	7,104	23.5
Dec.	82	6,548	[illegible]	[illegible]	65	22,332	[illegible]	16.7	57	[illegible]	13,142	21.8	54	3,722	3,113	19.8	79	9,091	7,432	22.3
		1921	1920			1921	1920			1921	1920			1921	1920			1921	1920	
Jan.	81	[illegible]	6,170	3.5	74	22,180	19,225	15.3	59	[illegible]	14,436	17.3	62	4,155	[illegible]	[illegible]	81	9,323	7,546	23.6
Feb.	81	5,925	5,728	3.4	74	[illegible]	18,327	17.4	59	15,971	14,070	13.6	62	3,915	3,329	17.6	81	8,237	7,179	14.7
Mar.	81	5,784	[illegible]	[illegible]	76	21,822	18,934	15.3	59	15,853	14,103	12.4	63	3,747	[illegible]	[illegible]	81	8,307	7,222	15.0
Apr.	81	[illegible]	[illegible]	[illegible]	76	[illegible]	[illegible]	[illegible]	[illegible]	15,506	13,822	12.2	63	3,744	3,312	13.2	88	8,817	7,767	13.6
May	82	5,362	[illegible]	[illegible]	76	20,795	[illegible]	[illegible]	[illegible]	14,866	13,558	9.8	63	3,516	3,179	10.7	89	9,362	8,240	13.7
June	82	[illegible]	[illegible]	[illegible]	76	20,091	17,442	15.3	60	[illegible]	[illegible]	7.7	63	3,531	[illegible]	[illegible]	[illegible]	9,157	[illegible]	[illegible]
July	81	5,189	5,135	1.0	76	[illegible]	17,107	11.9	60	14,269	14,677	2.7	63	3,505	3,129	12.1	89	9,250	8,909	3.8
OPERATING EXPENSES		1921	1920			1921	1920			1921	1920			1921	1920			1921	1920	
Jan.	34	[illegible]	[illegible]	14.7	49	[illegible]	[illegible]	[illegible]	28	$3,941	$3,451	14.2	57	$1,015	[illegible]	[illegible]	[illegible]	$2,135	$2,030	5.2
Feb.	35	1,069	[illegible]	[illegible]	[illegible]	6,799	5,937	14.5	29	[illegible]	3,445	14.8	44	1,217	1,053	15.5	55	2,042	[illegible]	[illegible]
Mar.	45	[illegible]	[illegible]	[illegible]	[illegible]	7,969	7,241	10.0	35	4,570	4,228	8.2	51	1,776	[illegible]	[illegible]	[illegible]	2,866	[illegible]	[illegible]
Apr.	45	1,418	1,479	4.1	59	[illegible]	7,168	5.9	36	4,347	[illegible]	[illegible]	51	1,567	[illegible]	[illegible]	[illegible]	2,893	[illegible]	[illegible]
May	48	[illegible]	1,577	[illegible]	[illegible]	6,921	6,660	4.0	37	4,274	4,292	0.4	52	1,563	[illegible]	[illegible]	[illegible]	2,969	2,713	9.5
June	[illegible]	1,714	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	60	1,859	1,665	11.6	83	[illegible]	[illegible]	[illegible]
July	47	[illegible]	2,022	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	39	4,776	[illegible]	-15.5	62	1,862	1,921	-3.1	[illegible]	[illegible]	3,714	-12.6

for July, 1920, or a decrease in the operating ratio of 8 per cent during the twelve-month period. It would seem from these figures that, from a financial viewpoint at least, the electric light and power industry is experiencing the almost ideal economic condition of increased gross revenue and decreased operating expenses.

Reports of industrial conditions during July indicate that further curtailments were continuing in every manufacturing industry with few exceptions. Materially increased activity, however, was reported by the railroad repair shops from every section of the country.

In New England the textile industry reported a continued high percentage of activities, certain sections of the industry reaching normal and frequently exceeding it. Otherwise the industrial energy requirements throughout this section were about the same as during June. The extent of the general industrial depression in the New England section, however, is apparent from the fact that the electrical energy consumed in this section during July was more than 14 per cent below the energy requirements of July, 1920. Despite this large drop in output during the twelve-month period, the gross revenue of the electric light and power companies of this section increased by 1 per cent and the operating expenses decreased by 16 per cent during the period.

The stone, clay and glass industries of the Middle Atlantic States reported curtailment under June operations of from 22 to 53 per cent, and the iron and steel operations in this section were further curtailed by more than 7 per cent. In contrast to these decreases in electrical energy requirements was a material increase in the operations of the railroad repair shops in this portion of the Atlantic section. In the South Atlantic States textile operations were about the same as during June, the only material increased activity being that reported by the railroad repair shops. Taking the Atlantic States as a whole, the decreased industrial energy requirements resulted in an average electrical output of 1,400,000 kw.-hr. below that reported in June, in spite of a gradually increasing lighting load.

Stagnation continued in most of the essential industries of the North Central States. Railroad repair shops in the East North Central States, however, reported materially increased operations, and increased operations were reported by the milling and packing industries of the West North Central States. Despite these increased industrial energy requirements and a slightly increased lighting load, the electric light and power companies of this section, as a whole, reported an average daily output of 1,600,000 kw.-hr. under June.

The operations of the central generating companies of the South Central States reflected the increased industrial depression existing in that section. Many of the large factories were entirely cut down, while the remainder were working on part time only. Very few mines were operating over two or three days a week.

The mining and allied industries of the Mountain States reported no improvement over June, with additional curtailments in several localities. Industrial conditions in the Pacific States averaged about the same as during June, some industries decreasing operations slightly and others showing a slow recovery. Taking the Mountain and Pacific States as a whole, the electrical energy requirements were approximately the same as during the month of June.

TABLE III—AGGREGATE OPERATING RATIO OF COMPANIES REPORTING DATA MONTHLY TO THE "ELECTRICAL WORLD"

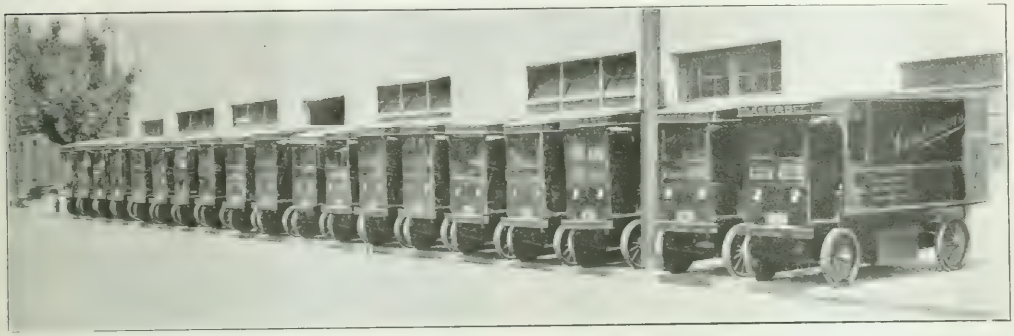
Type of Generating Plant and Month	New England States				Atlantic States				North Central States				South Central States				Mountain and Pacific States			
			Average for Year				Average for Year				Average for Year				Average for Year				Average for Year	
	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920
Steam Plants.																				
January	54 0	60.8	54 0	60.8	53.5	50 9	53.5	50.9	61 2	61.8	61.2	61.8	53 1	53.7	53.1	53.7	69 0	60.5	69 0	60 5
February	54.3	59 5	54 2	60.3	52.3	53.0	52.7	52.1	63 0	57.9	62 1	59.8	59.1	51 2	56 2	52.3	60 2	60.3	64 6	60 3
March	64.0	70 0	56.7	62.5	54.5	56.7	53.3	53.7	58.4	59.7	60.8	59 8	53 3	50 9	55 0	51.9	68 4	62 5	65 9	61 2
April	59.4	63.5	57.3	62.7	50.9	54.3	52.8	53.8	54.8	61 2	59.3	60.2	54 1	52.8	54 7	52.1	53 7	53.7	[illegible]	[illegible]
May	63.2	69.1	58.3	63 8	56 2	58 6	53.4	54 5	54.7	63.3	58 5	60 8	53.3	56.0	54 4	53.0	55.0	57.0	59 9	58 3
June	60 1	71 2	58 7	64 9	55.8	59 5	53 8	55 3	56 6	68 3	58 3	61 8	55 3	60 0	54 6	53 8	53 4	56 2	58 6	57 8
July	60.7	77.3	59.0	66.7	57.2	62.7	54 1	56.1	56.9	70.6	58.1	63 0	55 1	62.4	54.7	55.3	53.3	59.3	57.8	58.9
Hydro Plants.																				
January	26.5	35 2	26.5	35.2	21 2	21.2	21.2	21 2	25 0	20 8	25.0	20.8	26 4	20 1	26 4	20.1	27.5	27.3	27 5	27.3
February	30.1	46.5	26.8	35.6	20.1	20 6	20.7	20 9	24 1	20.6	24.6	20.6	28.6	21.4	27.4	20 5	23.9	27 9	26.0	27.6
March	29.9	30 0	26.9	35.3	21.0	20 6	20.8	20 8	23.0	20.6	23.5	20.6	30 4	23.2	28 4	21.3	24.9	19.0	25 8	25.6
April	24.6	34.7	26.5	35.2	18.2	18 8	20.2	20.3	24 8	20.8	24.2	20 7	22 4	25 0	26 8	21.2	27 3	19.2	26 0	24 2
May	26.5	25.6	26 5	34.3	15 5	17.4	19 2	19 7	21.5	20 1	22.5	20 5	27.9	21 2	27 1	21.2	29 8	22 9	26 6	24 0
June	29 2	21 5	26 6	33 8	17 6	18 8	19 0	19 6	21 1	19 5	22 8	20 2	27 3	18 3	27 1	20 7	30 3	27 4	27 6	24 2
July	29.2	29.6	26 6	33 9	15 9	21.1	18.6	19.8	19 4	19 7	22 3	20 2	27 3	18 3	27 7	20 7	24 2	19 9	26 3	23 7
Combined Systems of Steam and Hydro Plants.																				
January	45.3	53 5	45.3	53.5	43 5	45 8	43.5	45.8	39.5	38.6	39.5	38 6	38.6	46 6	38.6	46.6	35.2	45 5	35.2	45 5
February	44.3	60 0	44.7	58 8	41.8	41.9	42.6	43 8	42.4	49 8	41.9	48 2	41.7	39.6	40.5	42.0	39.6	43 8	37.4	44.7
March	49.7	53 8	47.3	56.0	39 7	47.3	42.0	45.3	41.5	46.0	41.8	47.3	38.6	39 2	40.2	41.2	36.4	39.7	36 9	43.0
April	46.6	48 5	47 1	53 5	42 9	43.9	41.9	44 8	45.0	48 3	42.7	47 5	43.6	48 6	40 7	42.8	37.0	36 8	37.0	41.[illegible]
May	49.2	48 5	47.6	52.3	39.8	44 2	41.4	44 7	47 0	52 8	43 7	48 8	40 7	39.6	40 6	42 2	35.0	38.3	36 4	40 3
June	58 5	56 5	49 6	53 2	42 3	45 8	41 6	44 9	50 1	62 2	45 0	51 6	45 1	44 8	41 3	42 7	38 8	44 3	37 0	41.1
July	56 1	63 2	50 5	54 7	42 6	51 3	41 7	45 8	51 6	64 4	46 0	53 9	53.6	45 3	41 4	42.8	35 4	43 1	36 8	41 5

Switzerland Wants Better Prices for Exported Energy

According to a cablegram to the New York *Times*, Switzerland has discovered that she exports to Germany and France, but chiefly to Germany, electric power which saves those countries 450,000 tons of coal annually, worth 18,000,000 gold francs, whereas the sales bring Switzerland only 5,000,000 gold francs annually. In 1920 about 350,000,000 kw.-hr. was, the dispatch says, exported by Switzerland to neighboring countries. The production of 1 kw.-hr. of electricity requires fully 1 kg. of coal, which costs in Germany 40 pfennigs. Now, on the average, the Swiss have been selling electricity to the Germans and French at 2 centimes or less per kilowatt-hour, whereas the price of electricity on the world's market is from 6 to 8 centimes per kilowatt-hour. In some parts of Switzerland factories must pay for electric power 45 centimes per kilowatt-hour; but German manufacturers, who are mostly competing seriously with Swiss industry, contrive to get it thirty times cheaper than the Swiss themselves.

Electric Trucks Show Superiority Over Gasoline Trucks and Horses

They Have Proved Themselves Cheaper, Cleaner and Easier to Operate on 15-Mile to 45-Mile Delivery Trips—One-Ton Truck Costs 32 Cents per Mile, Including All Fixed and Operating Charges—Repairs Are Made More Quickly



PART OF A FLEET OF ½-TON ELECTRIC TRUCKS WHICH HAS PROVED SUPERIOR TO HORSES AND GASOLINE TRUCKS IN MAKING DELIVERIES

ELECTRIC street trucks in their wide field of application have proved their superiority over all other means of transportation. A case which well illustrates this superiority is that of Cushman's Sons, Inc., bakery, New York City. This company has found by careful studies that for deliveries requiring round trips of 15 miles to 45 miles (24 km. to 72 km.) the electric truck is cheaper, cleaner and more easily taken care of than any other type of conveyance. This conclusion was reached after six years' experience with electric trucks, gasoline-engine trucks and horse-drawn vehicles.

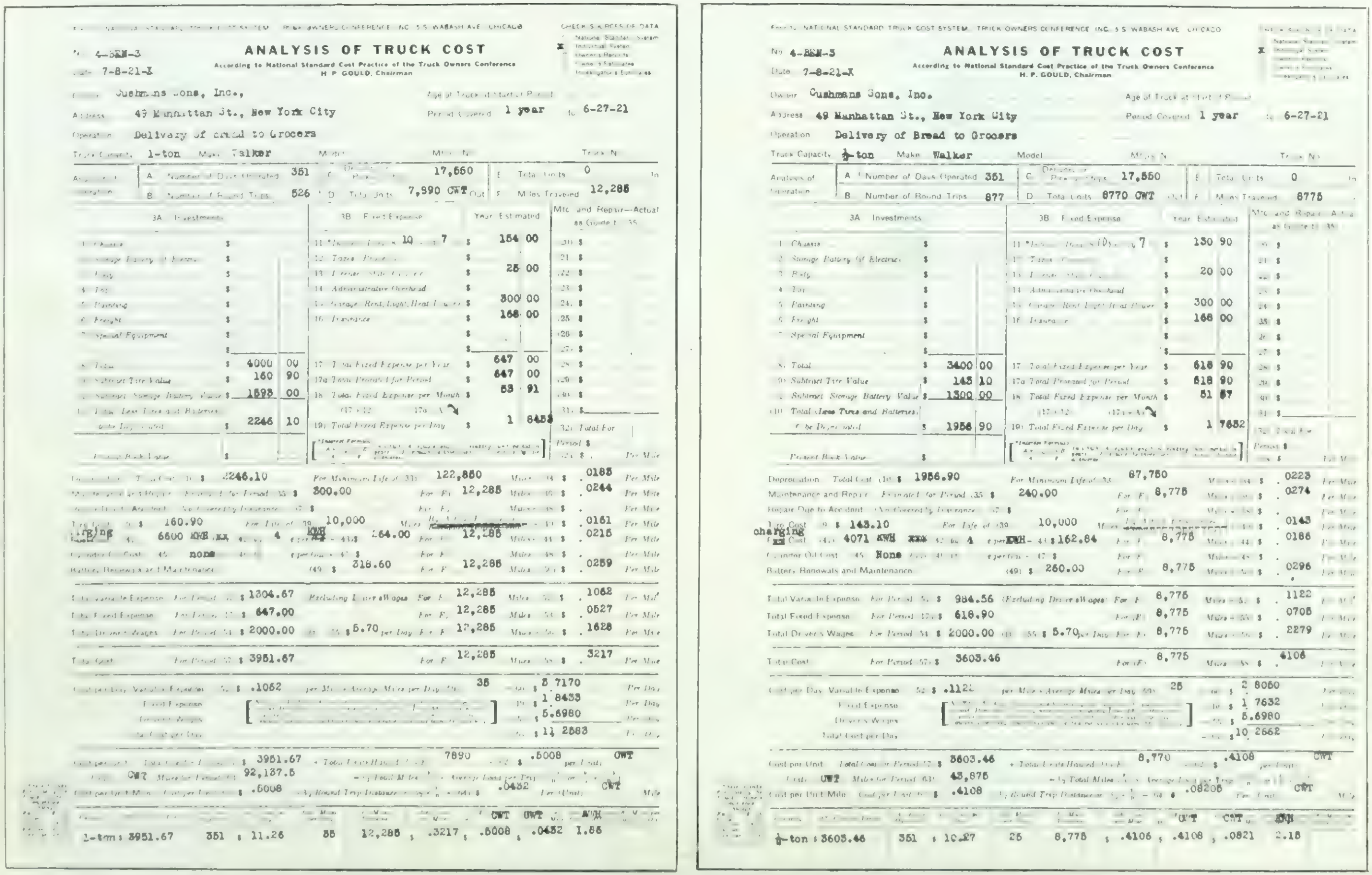
The company operates an electric fleet of 149 trucks, of which 105 are 1-ton trucks, forty are ½-ton trucks and four are 5-ton trucks. Twenty more 1-ton trucks are on order. All the electric trucks are of the same make, Walker. The 1-ton and ½-ton sizes are equipped with large, high-grade, closed bodies, designed for carrying loaves of bread. The 5-ton size is equipped for hauling flour to bakeries. Deliveries are made seven days a week to grocers all over Greater New York and vicinity. Six of the 1-ton machines average 40 miles (64 km.) a day each.

In the baking business the margin of profit is small and the delivery cost is an important item. For this reason an especially careful study of the transportation end of the business was made with the object of reducing the delivery cost to a minimum. Undoubtedly the most important single factor in effecting this reduction is the choice of the proper vehicle. Experience proved that horses, electric trucks and gas trucks all have a place in this company's system.

It was determined that for round trips up to about 15 miles horses are best; for round trips between 15 miles and 45 miles, electrics, and for round trips over 45 miles, gas trucks. The "electrics" average between 20 miles and 40 miles (32 km. and 64 km.) a day, depending on the nature of the routes. The accompanying table shows actual costs on typical ½-ton and 1-ton trucks, both of which are equipped with Edison

FIVE-TON ELECTRIC TRUCKS ARE MOST ECONOMICAL MEANS FOR HAULING HEAVIER LOADS

THIS 1-TON ELECTRIC TRUCK AVERAGES 35 MILES PER DAY, MAKING FIFTY STOPS, AT TOTAL COST OF $11.26



NATIONAL STANDARD TRUCK COST SYSTEM TRUCK OWNERS CONFERENCE INC 5 S WABASH AVE CHICAGO

CHECK SOURCES OF DATA
National Standard System
x Individual System
Owner's Records
Owner's Estimates
Investigator's Estimates

ANALYSIS OF TRUCK COST
According to National Standard Cost Practice of the Truck Owners Conference
H. P. GOULD, Chairman

No 4-BEM-3
Date 7-8-21-X
Owner Cushmans Sons, Inc.,
Address 49 Manhattan St., New York City
Age of Truck at Start of Period
Period Covered 1 year to 6-27-21
Operation Delivery of Bread to Grocers
Truck Capacity 1-ton Make Walker Model Motor No. Truck No.

A Number of Days Operated	351	C Deliveries or Pick-up Stops	17,550	E Total Units	0 In
B Number of Round Trips	526	D Total Units	7,990 CWT Out	F Miles Traveled	12,285

3A Investments		3B Fixed Expense	Year Estimated	Mtc. and Repair—Actual as Guide to (35)
1 Chassis	$	11 *Interest ... 10 ... 7	$ 154 00	20 $
2 Storage Battery (if Electric)	$	12 Taxes	$	21 $
3 Body	$	13 License	$ 25 00	22 $
4 Top	$	14 Administrative Overhead	$	23 $
5 Painting	$	15 Garage Rent, Light, Heat, Power	$ 300 00	24 $
6 Freight	$	16 Insurance	$ 168 00	25 $
7 Special Equipment	$		$	26 $
	$		$	27 $
8 Total	$ 4000 00	17 Total Fixed Expense per Year	$ 647 00	28 $
9 Subtract Tire Value	$ 160 90	17a Total Prorated for Period	$ 647 00	29 $
Subtract Storage Battery Value	$ 1593 00	18 Total Fixed Expense per Month (17 ÷ 12)	$ 53 91	30 $
10 Total (Less Tires and Batteries) to be Depreciated	$ 2246 10	19 Total Fixed Expense per Day (17a ÷ A)	$ 1 8433	31 $
Present Book Value	$			32 Total For Period $

Depreciation Total Cost (10) $ 2246.10 For Minimum Life of (33) 122,880 Miles (34) $ .0183 Per Mile
Maintenance and Repair Estimated for Period (35) $ 300.00 For (F) 12,285 Miles (36) $ .0244 Per Mile
Repair Due to Accident (Not Covered by Insurance) (37) $ For (F) Miles (38) $. Per Mile
Tire Cost (9) $ 160.90 For Life of (39) 10,000 Miles (40) $ .0161 Per Mile
charging Cost (41) 6600 KWH 4 ¢ per KWH (43) $ 264.00 For (F) 12,285 Miles (44) $ .0215 Per Mile
Cylinder Oil Cost (45) none (47) $ For (F) Miles (48) $. Per Mile
Battery Renewals and Maintenance (49) $ 318.60 For (F) 12,285 Miles (50) $ .0259 Per Mile

Total Variable Expense For Period (51) $ 1304.67 (Excluding Driver's Wages) For (F) 12,285 Miles (52) $ .1062 Per Mile
Total Fixed Expense For Period (17a) $ 647.00 For (F) 12,285 Miles (53) $ .0527 Per Mile
Total Driver's Wages For Period (54) $ 2000.00 (55) $ 5.70 per Day For (F) 12,285 Miles (56) $ .1628 Per Mile

Total Cost For Period (57) $ 3951.67 For (F) 12,285 Miles (58) $ .3217 Per Mile

Cost per Day Variable Expense (52) $ .1062 per Mile × Average Miles per Day (59) 35 = (60) $ 3.7170 Per Day
Fixed Expense (19) $ 1.8433 Per Day
Driver's Wages (55) $ 5.6980 Per Day
Total Cost per Day (61) $ 11.2583 Per Day

Cost per Unit Total Cost for Period (57) $ 3951.67 ÷ Total Units Hauled (D) 7890 = (62) $ .5008 per Unit CWT
Units CWT Miles for Period (63) 92,137.5
Cost per Unit Mile Cost per Unit (62) $ .5008 ÷ ½ Round Trip Distance = (64) $ .0432 Per Unit CWT Mile

1-ton	$ 3951.67	351	$ 11.26	35	12,285	$ .3217	$ .5008	$ .0432	1.88

NATIONAL STANDARD TRUCK COST SYSTEM TRUCK OWNERS CONFERENCE INC 5 S WABASH AVE CHICAGO

x

ANALYSIS OF TRUCK COST
According to National Standard Cost Practice of the Truck Owners Conference
H. P. GOULD, Chairman

No 4-BEM-5
Date 7-8-21-X
Owner Cushmans Sons, Inc.
Address 49 Manhattan St., New York City
Age of Truck at Start of Period
Period Covered 1 year to 6-27-21
Operation Delivery of Bread to Grocers
Truck Capacity ½-ton Make Walker Model Motor No. Truck No.

A Number of Days Operated	351	C Deliveries or Pick-up Stops	17,550	E Total Units	0 In
B Number of Round Trips	877	D Total Units	8770 CWT Out	F Miles Traveled	8775

3A Investments		3B Fixed Expense	Year Estimated	Mtc. and Repair—Actual as Guide to (35)
1 Chassis	$	11 *Interest ... 10 ... 7	$ 130 90	20 $
2 Storage Battery (if Electric)	$	12 Taxes	$	21 $
3 Body	$	13 License	$ 20 00	22 $
4 Top	$	14 Administrative Overhead	$	23 $
5 Painting	$	15 Garage Rent, Light, Heat, Power	$ 300 00	24 $
6 Freight	$	16 Insurance	$ 168 00	25 $
7 Special Equipment	$		$	26 $
	$		$	27 $
8 Total	$ 3400 00	17 Total Fixed Expense per Year	$ 618 90	28 $
9 Subtract Tire Value	$ 143 10	17a Total Prorated for Period	$ 618 90	29 $
Subtract Storage Battery Value	$ 1300 00	18 Total Fixed Expense per Month (17 ÷ 12)	$ 51 57	30 $
10 Total (Less Tires and Batteries) to be Depreciated	$ 1956 90	19 Total Fixed Expense per Day (17a ÷ A)	$ 1 7632	31 $
Present Book Value	$			32 Total For Period $

Depreciation Total Cost (10) $ 1956.90 For Minimum Life of (33) 87,750 Miles (34) $ .0223 Per Mile
Maintenance and Repair Estimated for Period (35) $ 240.00 For (F) 8,775 Miles (36) $ .0274 Per Mile
Repair Due to Accident (Not Covered by Insurance) (37) $ For (F) Miles (38) $. Per Mile
Tire Cost (9) $ 143.10 For Life of (39) 10,000 Miles (40) $ .0143 Per Mile
charging Cost (41) 4071 KWH 4 ¢ per KWH (43) $ 162.84 For (F) 8,775 Miles (44) $ .0186 Per Mile
Cylinder Oil Cost (45) None (47) $ For (F) Miles (48) $. Per Mile
Battery Renewals and Maintenance (49) $ 260.00 For (F) 8,775 Miles (50) $ .0296 Per Mile

Total Variable Expense For Period (51) $ 984.56 (Excluding Driver's Wages) For (F) 8,775 Miles (52) $ .1122 Per Mile
Total Fixed Expense For Period (17a) $ 618.90 For (F) 8,775 Miles (53) $ .0705 Per Mile
Total Driver's Wages For Period (54) $ 2000.00 (55) $ 5.70 per Day For (F) 8,775 Miles (56) $ .2279 Per Mile

Total Cost For Period (57) $ 3603.46 For (F) 8,775 Miles (58) $ .4106 Per Mile

Cost per Day Variable Expense (52) $ .1122 per Mile × Average Miles per Day (59) 25 = (60) $ 2.8050 Per Day
Fixed Expense (19) $ 1.7632 Per Day
Driver's Wages (55) $ 5.6980 Per Day
Total Cost per Day (61) $ 10.2662 Per Day

Cost per Unit Total Cost for Period (57) $ 3603.46 ÷ Total Units Hauled (D) 8,770 = (62) $ .4108 per Unit CWT
Units CWT Miles for Period (63) 43,875
Cost per Unit Mile Cost per Unit (62) $ .4108 ÷ ½ Round Trip Distance = (64) $ .08206 Per Unit CWT Mile

½-ton	$ 3603.46	351	$ 10.27	25	8,775	$ .4106	$ .4108	$ .0821	2.15

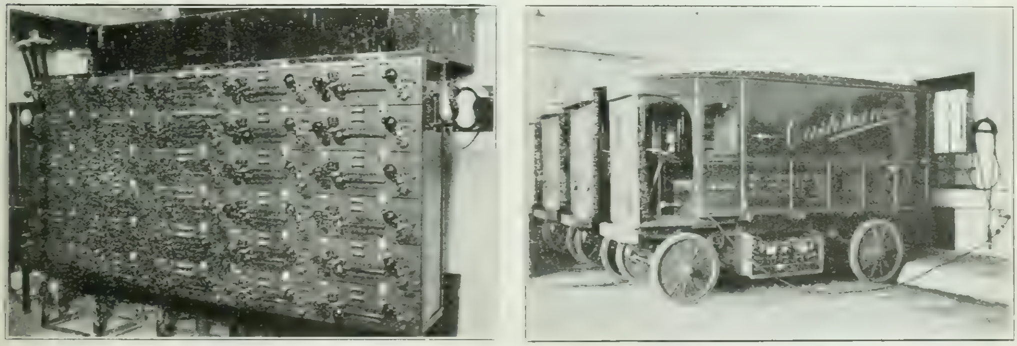
Complete Analyses of Costs of Deliveries by 1-Ton and ½-Ton Electric Trucks

Such forms as these allow an accurate account of truck costs to be kept. In a logical way costs are divided into variable, fixed and driver expenses and these and their component items are reduced to costs per mile. The cost per day of the three main costs is also determined.

batteries. The average 1-ton electric truck runs 35 miles (56 km.) a day, making one or two trips and about fifty deliveries. Its average load is 1,500 lb. (680 kg.). An allowance is made for two weeks' lay-up per year. As work is done on Sundays, this leaves 351 days on which it is operated.

It is known from experience that these trucks will last ten years, and depreciation is figured on that basis. Repairs and maintenance on the truck average $300 a year. This includes oil and grease and washing daily, as well as repairs and maintenance on the batteries. Charging amounts to $22 a month, at 4 cents per kilowatt-hour. The company does its own charging. Depreciation on the Edison battery is calculated on a five-year basis. Figuring on the "National Standard Truck Cost System," the total operating cost is $11.26 per day, 50.08 cents per 100 lb. (45 kg.) and 4.32 cents per hundredweight-mile.

The ½-ton "electrics" are used for small loads where two or three trips are required daily. These trucks average 25 miles (40 kg.) a day and fifty delivery stops. The average load is 1,000 lb. (450 kg.). They are depreciated on a ten-year basis, and repairs and maintenance come to $240 a year. Charging averages $13.57 per month, and the Edison battery is depreciated on a five-year basis. The driver's wage is the same as for the 1-ton machine. Figured on the "National Standard Truck Cost System," the ½-ton electric costs $10.27 per day, 41.08 cents per 100 lb. and 8.21 cents per hundredweight-mile. These are the bare trucking costs and do not include overhead on delivery service.



ONE-TON AND ½-TON DELIVERY TRUCKS ARE CHARGED AT A COST OF 2.2 AND 1.9 CENTS PER MILE RESPECTIVELY

COSTS OF DELIVERIES BY ELECTRIC TRUCKS

Each truck worked 351 days per year delivering bread to grocers, making about 17,550 stops per year

	½-Ton Truck		1-Ton Truck	
Miles Traveled per Year	8,775		12,285	
	Per Mile	Per Day	Per Mile	Per Day
Depreciation	$0.022	$0.557	$0.018	$0.640
Maintenance and repair	0.027	0.685	0.024	0.839
Tire cost	0.014	0.358	0.016	0.560
Charging cost	0.019	0.465	0.022	0.769
Battery renewals and maintenance	0.030	0.740	0.026	0.909
Total variable expense	$0.112	$2.805	$0.106	$3.717
Total fixed expense..............	0.071	1.763	0.053	1.843
Drivers' wages	0.228	5.698	0.163	5.698
Total cost	$0.411	$10.266	$0.322	$11.258

Costs on the 5-ton "electrics" are not available at this time, but it is known that they have proved cheaper than horses or gas trucks for hauling flour.

As soon as the sphere of electric trucks was determined the company began to displace the horses and light gas trucks which were operating in the electrics' zone. The "electrics" proved cheaper than either horses or gas trucks, but they saved more as compared with the gas trucks than as compared with the horses. It is estimated conservatively that the electric trucks have saved $100,000 in two years as compared with what the delivery cost would have been if they had displaced only light gas trucks. The actual saving is somewhat less than this because some of the "electrics" displaced horses.

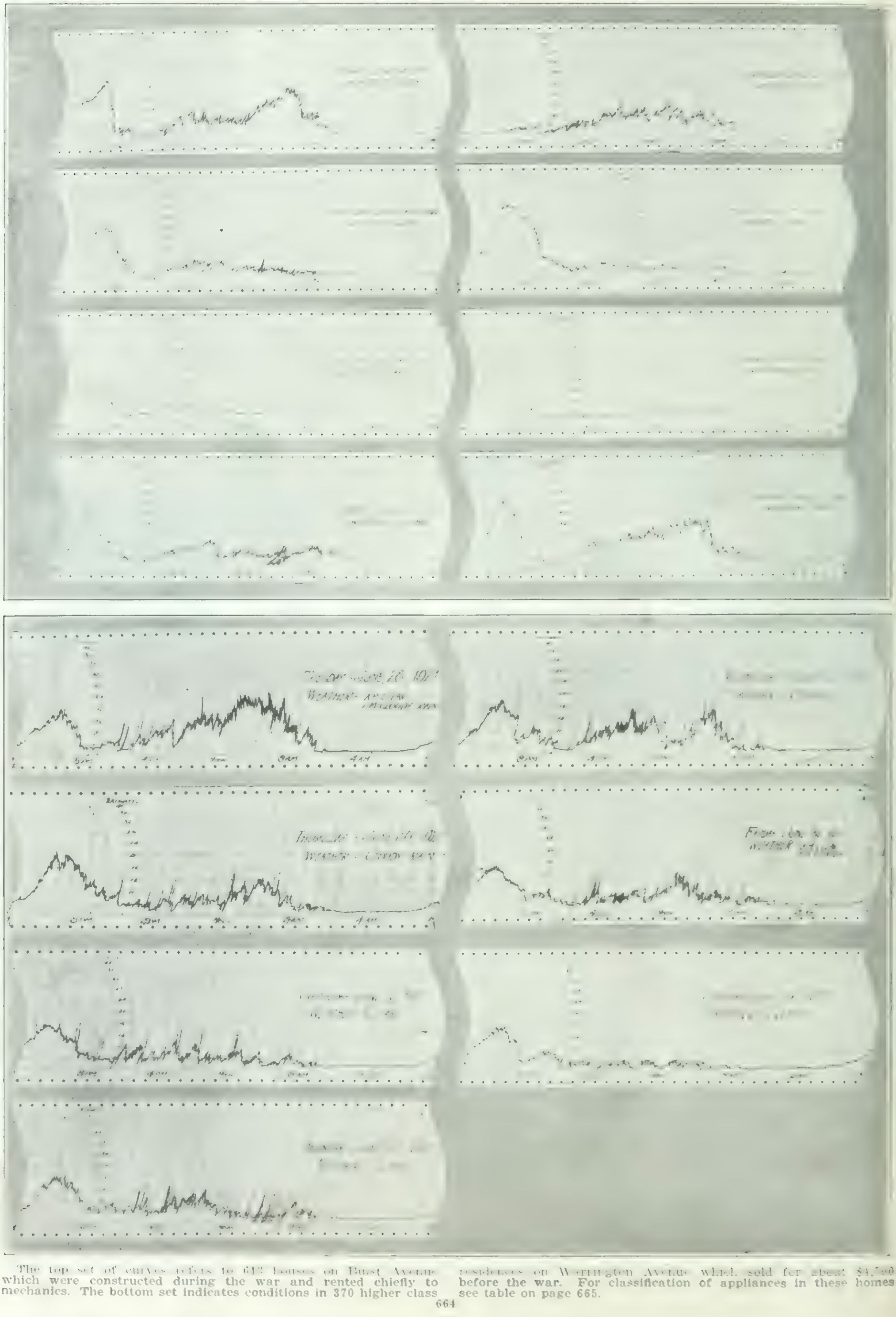
At present the hauls made by the "electrics" are considerably longer than those made by horses, yet the cost per unit delivered is only 2 per cent or 3 per cent greater for the electric trucks than for the horses. As a result of six years' experience, the company is fully satisfied that the electric vehicles are the most economical hauling unit for the range in which operated.

Electric trucks are also more satisfactory for other reasons. They are easier to operate and take care of, and their cleanliness is a great advantage in this class of work. The driver who delivers the bread to the customer does not get grease on his hands, and the trucks give out no odor of gasoline and oil to contaminate the bread or flour. Repairs on the electric trucks are very light, averaging only half the cost of repairs for a gasoline truck. Repairs can be made more quickly, too.

The fact that the speed is limited to 14 miles (22 km.) per hour is really an advantage, for it results in lower repairs and tire cost and fewer accidents. With gas trucks the accidents are easily twice as many. The life of an "electric" is double that of a gas truck because of its low speed and simplicity of construction.

The choice of the proper storage battery for electric trucks is very important. More than half of the batteries are nickel-iron type, and the same make is specified for fifteen of the twenty trucks now on order. This make of battery is used for two reasons—first, because they have a very long life, and, second, because they weigh about 600 lb. (270 kg.) less than others for the size of trucks used. It is found that other makes of battery last about three and one-half years. The oldest nickel-iron cells have been in service only two years, so their life cannot be prophesied from past experience. Their low weight naturally adds to the carrying capacity of the trucks. A 600-lb. load saved on a truck rated at 2,000 lb. (900 kg.) increases its capacity 30 per cent.

Analysis of Residence Loads Shows Effect of Domestic Appliances



The top set of curves refers to 612 houses on Buist Avenue which were constructed during the war and rented chiefly to mechanics. The bottom set indicates conditions in 370 higher class residences on Warrington Avenue which sold for about $4,500 before the war. For classification of appliances in these homes see table on page 665.

Residence Load Factor Doubled by Use of Household Appliances

Survey of the Appliance Load in More than 1,300 Dwellings in Philadelphia Indicates that the Day Load Can Be Appreciably Increased Without Additional Expenses in the Way of Investment for Poles, Lines and Transformers by Intelligent and Energetic Promotion of Electrical Merchandise Sales

THE amount of electricity consumed by labor-saving appliances in the household has always been the subject of considerable speculation, so that the survey recently conducted in Philadelphia and reported before the fortieth convention of the Association of Edison Illuminating Companies by C. J. Russell and P. W. Berger should be of considerable interest to all executives and business men engaged in central-station work. In this survey comprehensive figures were collected on the relation of the electric appliance consumption to the electricity consumed by lamps in the homes of more than 1,300 average families. Great care was exercised in conducting the tests so that the results would be indicative of average conditions and not of a selected class. As a result of the investigation the authors of the reports have concluded that not much increase in revenue can be expected from residences already on the circuit because of greater use of energy for illumination and that improvement of the load factor and increase in revenue will have to come from the general introduction of domestic appliances.

ENERGY CONSUMPTION BY APPLIANCES APPROACHING THAT BY LIGHTING

The logic of the conclusion is fairly well proved by the fact that the Philadelphia Electric Company has apparently doubled the energy consumption of its residences during the summer months by intelligent and energetic promotion of electrical merchandise sales. The increase in load factor has been obtained without additional expense in the way of investment for equipment such as poles, lines and transformers, so that it has cost virtually nothing to get this daylight load aside from the sales promotion expense. Such results could never have been had, the author concluded, by placing heavy-duty devices on the residence lines, since they would require reinforcing distribution lines, transformers and other apparatus. The time is rapidly approaching, they contend, when the consumption of household appliances will be more than 50 per cent of the residence load.

In order that the survey should be representative of average conditions four groups of residences, which were served from transformers carrying no power loads, were selected. Six hundred and thirteen of these homes, which were on Buist Avenue, were constructed during the war and were sold or rented to mechanics, most of whom worked at the Hog Island shipyard. The second group, consisting of 370 homes, was on Warrington Avenue and involved homes that sold for approximately $4,500 just prior to the war. These homes are occupied by people in moderate circumstances. The third block was selected on Wyoming Avenue and consisted of 269 of the oldest modern homes in the city, most of which were erected about ten or twelve years ago and have been wired for that length of time. The last group consisted of eighty-eight homes of well-to-do persons on Lincoln Drive.

By actual count it was found that there were 728, 522, 655 and 321 appliances in these groups respectively, making a total of 2,226. The classification of appliances is given in the table. From this tabulation it will be noted that 41.2 per cent of the appliances are flatirons, 28.7 per cent vacuum cleaners, 8.4 per cent washing machines, 7 per cent toasters, 4.2 per cent fans, 2.6 per cent sewing machines and an equal percentage percolators. The average numbers of appliances in the Buist, Warrington, Wyoming and Lincoln groups were respectively 1.21, 1.4, 2.43 and 3.73.

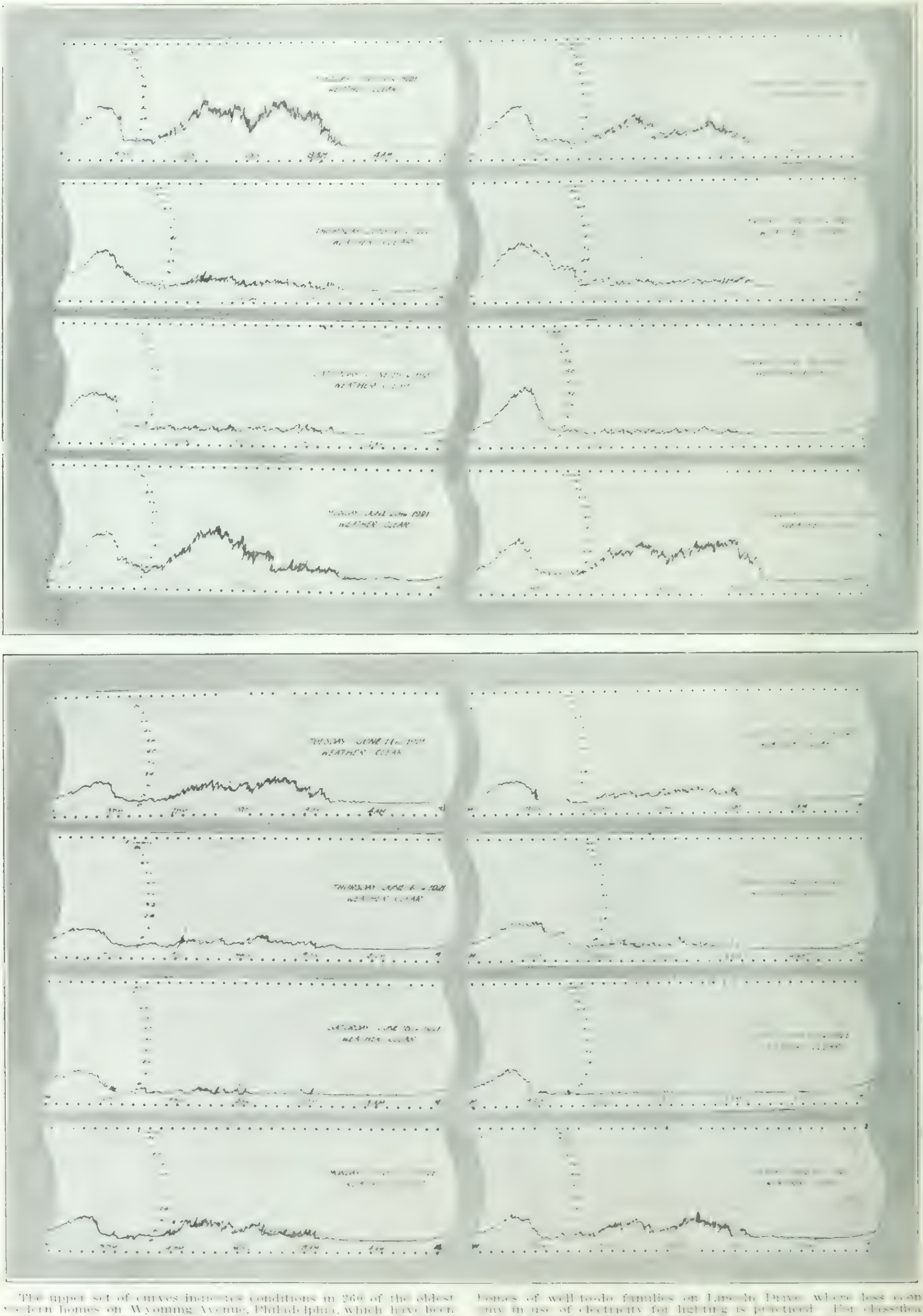
Since each group of residences is supplied by a single-phase transformer, it was possible to study the load variations each day of the week by connecting graphic instruments in the transformer circuit. Records from these instruments for each of the groups are shown on pages 664 and 666.

CLASSIFICATION OF APPLIANCES IN ACTIVE USE IN RESIDENCES SURVEYED

	Location of Residence					
Kind of Appliance	Lincoln Drive	Wyoming Avenue	Warrington Avenue	Buist Avenue	Total No. of Appliances	Per Cent of Total
Irons	79	233	222	384	918	41.2
Cleaners	74	221	148	196	639	28.7
Washing machines	28	74	19	66	187	8.4
Toasters	36	44	52	25	157	7.1
Fans	32	26	23	12	93	4.2
Percolators	17	17	16	7	57	2.6
Sewing-machine motors	13	11	13	20	57	2.6
Heaters	6	14	2	4	26	1.2
Waffle irons	4	4	9	2	19	0.85
Curling irons	8	0	5	3	16	0.72
Vibrators	2	5	7	1	15	0.67
Heating pads	6	1	0	1	8	0.36
Mangles	5	0	0	1	6	0.27
Chafing dishes	0	3	1	0	4	0.18
Piano motors	2	0	1	1	4	0.18
Disk stoves	3	0	0	0	3	0.13
Grills	0	1	0	2	3	0.13
Victrola motors	2	1	0	0	3	0.13
Meat grinders	0	0	2	0	2	0.09
Bottle warmers	2	0	0	0	2	0.09
Violet ray	1	0	1	0	2	0.09
Hair dryers	0	0	0	1	1	0.04
Boilers	0	0	1	0	1	0.04
Fireless cookers	0	0	0	1	1	0.04
Plate warmers	1	0	0	0	1	0.04
Soda pumps	0	0	0	1	1	0.04
Totals	321	655	522	728	2,226	100.00

From the Buist Avenue chart it will be observed that the appliance load started at 8 a.m. and reached its high point about the middle of the forenoon, tapering off after noon but still holding a fairly high line up to 4 p.m., when it broke off rather sharply. At 8 p.m. the lighting load is at its peak but is not much higher than the peak of the day appliance load, and its duration is not nearly so long. Between 7 a.m. and 7 p.m. on Tuesday there was a total of 291 kw.-hr. consumed, and from

Comparison of Weekday and Sunday Loads Indicates Appliance Load



The upper set of curves indicates conditions in 260 of the oldest modern homes on Wyoming Avenue, Philadelphia, which have been wired for ten to twelve years. The lower set refers to eighty-eight homes of well-to-do families on Lincoln Drive where less economy in use of electricity for lighting is practiced. For classification of appliances in these homes see table on page 66

7 p.m. to 7 a.m. the consumption was only 131 kw.-hr. It may be observed that the day load gradually decreased during the week after reaching its peak on Tuesday.

Monday is the day on which comparatively few appliances are used in the home, the total output for this group being only 79 kw.-hr. during the day, as compared with 159 kw.-hr. at night. This confirms the theory upon which the survey was based, namely, that the daily energy consumption in excess of the Sunday consumption can be safely assumed to be due only to the appliance load. Taking a whole week into consideration, the total day consumption is 907 kw.-hr., as compared with 949 kw.-hr. at night.

The survey of the Warrington Avenue group indicated similar conditions to those on Buist Avenue. On Tuesday the day load was 119 kw.-hr., as compared with 52 kw.-hr. at night, whereas on Sunday the day load was 33 kw.-hr. and the night load 59 kw.-hr. The total for the week figured 455 kw.-hr. during the day and 408 kw.-hr. during the evening.

Somewhat different conditions existed in the Wyoming Avenue group, for the Tuesday day load there was 209 kw.-hr. as compared with 119 kw.-hr. at night. On Wednesday the day output was about 146 kw.-hr., against 111 kw.-hr. at night. On Monday the day output was 208 kw.-hr. and the night output 122 kw.-hr., bringing the total figures up to the point where the day load was 941 kw.-hr., which overbalanced the night load of 865 kw.-hr. for the whole week.

The conditions found in the Lincoln Drive residences were different from those in the rest of the homes, as would be expected, owing to the fact that servants are employed largely in these houses and hence there is less economy in the use of energy for illumination than in the other homes. The lighting load, therefore, is relatively a greater portion of the total than in the other groups. This accounts for the kilowatt-hour consumption during the day being somewhat less than that at night.

TUESDAY HAS HEAVIEST DAY LOAD

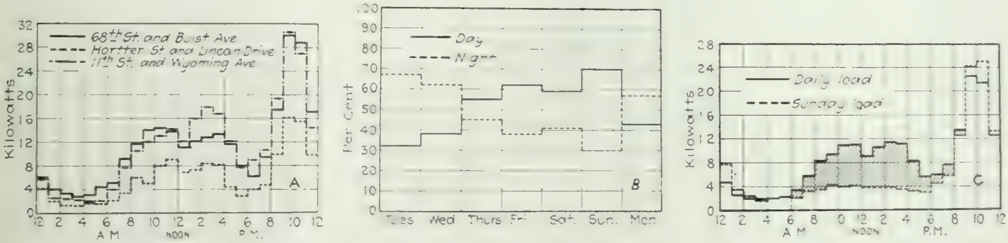
A comparison of the average daily load in the districts appears in the above curves. In studying this survey it should be remembered that the Buist Avenue homes were relatively poorly equipped with appliances and that the Lincoln Drive homes were much better equipped.

Composite curves showing the relation of the load on each day during the week to the Sunday load and to the average weekday load were presented in the original papers by C. J. Russell and T. W. Berger, but they cannot be reproduced here for lack of space. However, it might be pointed out that the general observation would be that Tuesday is the day of largest appliance-load consumption, the peak occurring slightly after 10 a.m. Monday is next in magnitude, with a peak slightly after 2 p.m. Wednesday, Thursday, Friday and Saturday are very similar in many respects, the day load being relatively flat-topped, with a slight valley immediately after noon. On Saturday the day load is at its lowest ebb for any weekday, but even on Saturday it is higher than on Sunday.

DAY LOAD GREATER THAN NIGHT LOAD

One of the most interesting relationships is shown by the composite curves at the center showing percentage of kilowatt-hours used during day hours and night hours for each day during the test in the four locations. Commencing with Tuesday, which shows the highest day load, owing to its being the universal ironing day, it may be observed that 67 per cent of the total energy consumed was used during the day. On Wednesday the daylight load was 62 per cent of the total; on Thursday 45 per cent, on Friday 38 per cent, on Saturday 48 per cent and on Sunday 30 per cent, while on Monday it was 57 per cent.

In summing up the whole survey, it was found that in more than 1,300 average homes in Philadelphia 51.1 per cent of the total output of energy was consumed from 7 o'clock in the morning until 7 at night and 49.9 per cent from 7 at night to 7 in the morning. To determine how much of the daylight consumption is due to appliance load, it was assumed that the daylight load on Sunday is due to illumination. Although this is not actually true, it was nevertheless taken as a basis in order that the conclusions should not be too favorable to the value of the appliance load. On this basis the average daily load for the four districts was plotted in comparison with the average Sunday load for the same district, as shown on the right. On the basis of the assumption made, the cross-hatched area represents the net appliance load, which comes to 33.5 per cent of the total. Owing to the nature of the assumption, the authors of the report believe that this should show conclusively the minimum amount of energy consumed by appliances in the houses covered by the test. From this survey it was concluded that the load factor of the four locations combined was virtually doubled by the use of household appliances.



COMPARISON OF AVERAGE DAILY LOAD AND ENERGY CONSUMPTION FOR GROUPS OF RESIDENCES STUDIED

A—Indicates the average daily loads (Sunday excluded) in three of the residence groups referred to in this article. It may be observed that the daylight-energy consumption is a considerable portion of entire consumption. B—Composite curves showing relation of average daylight consumption to average night consumption for each day of test at four locations. C—Superposition of average day load curves on Sunday curve indicates energy consumption (cross-hatched area) fairly attributed to appliance load.

Bearing of Illumination Intensity Upon Efficiency of Visual Operations

For Such an Operation as Reading the Average Observer Chose a Greater Intensity of Light When Using the Mercury Arc than When Using Tungsten Lamps Results Indicate the Value of Higher Illumination Values than Are Ordinarily Used

By M. LUCKIESH, A. H. TAYLOR and R. H. SINDEN

SOME investigations that should be of considerable interest to industrial-plant engineers and all who specify or recommend lighting equipment have been carried out recently at the Laboratory of Applied Science, National Lamp Works, Nela Park, Cleveland. The tests* indicate the relation between intensity of illumination and efficiency of visual operations and hence have an important bearing on the effect of illumination on industrial production. The effect of spectral distribution upon desired illumination has also been investigated.

Lest some one who has not closely followed the literature on the subject should get the impression from the foregoing that intensity is everything in illumination, the writers wish to emphasize that many other factors must be taken into account. For instance, contrast, distribution of illumination, spectral character and color of light, specular reflection, etc., must have equal consideration.

Recently particular attention has been directed to various psycho-physiological factors, such as the speed of discrimination, the influence of color of light and the general effect of higher intensities. While it has been definitely established by Ferree and Rand† that increase in light intensity above the minimum required has considerable influence on speed of discrimination, ability to sustain clear seeing, etc., the Laboratory of Applied Science desired to obtain definite data on the relation between spectral character, intensity and efficiency of operations. The method of conducting the tests to determine this information and the results obtained are presented briefly in this article.

In general it has been found: (1) That the speed of visual discrimination for reading matter of high and of low contrast increased with an increase in illumination intensity; (2) that for such a visual operation as that of reading the average observer chose a greater intensity of light from the mercury arc than of light from the tungsten lamp, and (3) that the chosen intensity increased with an increase in the maximum intensity available. The results indicate the value of illumination intensities of higher value than those ordinarily used. They also show that for most visual operations the light from the mercury arc does not have the advantages indicated by former tests with details so small as to be at the threshold of discrimination.

The central idea in the development of the apparatus for the investigation was the evolution of a test which would be closely related to the conditions encountered in practice and which would give a direct reading of the change of efficiency resulting from a change in illuminating intensity. The arrangement of the apparatus for the study of speed of discrimination is shown in Fig. 1. The test material (reading matter) was placed around a cylindrical drum driven by a small motor. In front of the drum was a screen having approximately the same reflection factor as the background of the material on the drum. This screen had a narrow horizontal slit which exposed about three lines of type. The light-source, which consisted essentially of a 75-watt gas-filled tungsten lamp back of a diffusing glass screen, was so arranged that the intensity of illumination on the test object and the screen could be controlled without change of color of the light and with no lack of uniformity.

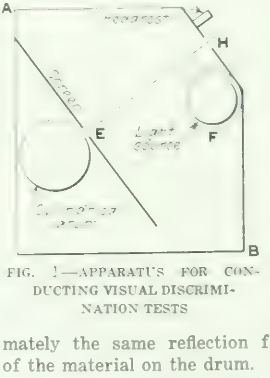


FIG. 1—APPARATUS FOR CONDUCTING VISUAL DISCRIMINATION TESTS

The observer viewed the test material on the drum through opening *H*, resting his forehead against the headrest. Extraneous light was kept out by black metal shields. The distance from the eyes to drum was approximately 16 in. (40 cm.). The speed of the drum was regulated by two rheostats in series, one of which was under control of the observer. Speeds were

TABLE I—READING TESTS SHOW [illegible] PER CENT HIGHER INTENSITY REQUIRED WITH MERCURY ARC THAN WITH GAS-FILLED TUNGSTEN

Test No.*	No. of Observer	[illegible]	Mercury Arc Means	Mercury Arc Medians	Tungsten Means	Tungsten Medians	Ratio Means	Ratio of Medians	Ratios	[illegible]	[illegible]
1..	22†	14	6.3	6.5	5.3	5.6	1.19	1.16	1.20	1.2[illegible]	[illegible]
2	33	30	14.2	13.5	12.7	12.3	1.12	1.1[illegible]	1.175	1.14	[illegible]
2	24	30	11.8	[illegible]	10.6	[illegible]	1.115	1.09[illegible]	[illegible]	1.15	0.012
3	26	30	18.0	17.8	17.4	16.0	1.035	1.11	1.065	[illegible]	[illegible]
4	24	45	16.9	16.2	16.1	14.7	1.05	1.10	1.10	1.04	[illegible]

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*The complete report of these researches will appear in an early issue of the *Journal of the Franklin Institute*.

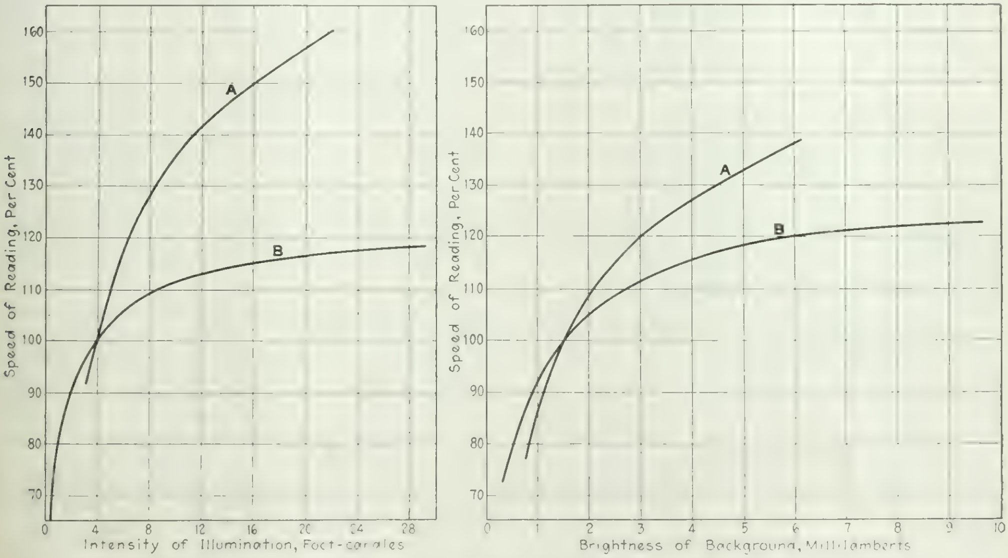
†*Transactions Illuminating Engineering Society*, Vol. XV, page 769, 1920.

* The reading material [illegible]

† Fifteen of these observers repeated, and to their second observations the same weight has been given as to the observations of different observers. The same observers were used in Tests 2a and 4. Results of Test 2a are included in Test 2.

measured by an automobile speedometer out of sight of the observer.

Many test materials were tried, but the most satisfactory was found to be Old English type. Unfamiliarity with this type makes it especially suitable, as discriminability plays a more important part in reading it and close inspection is necessary for recognition of words. Photographic copies of such material, reduced to approximately 8-point type size, were made. Columns were 1¼ in. (3.13 cm.) wide, and two columns of such material were pasted onto the drum. In many industrial processes brightness contrasts encountered are fairly low; hence to approximate this condition the prints were made on fogged paper, resulting in a background having a reflection factor of about 22.5 per cent. A later test was made with the same material on a white background having a reflection factor of approximately 80 per cent. These are hereafter referred to as "low" and "high" contrast material respectively.



FIGS. 2 AND 3—SPEED OF DISCERNMENT AT DIFFERENT LIGHT INTENSITIES AND BRIGHTNESS OF BACKGROUND

A—Using low-contrast material; averaged for forty-nine observers. B—Using high-contrast paper; averaged for thirty-seven observers.

Observations were made at four different intensities of illumination. For the low-contrast test object these were 3.12, 6.25, 12.5 and 25 foot-candles, and for the high-contrast they were 0.39, 1.56, 6.25 and 25 foot-candles. Each observer started the observation with the lowest illumination and adjusted the speed so that when reading the material aloud neither edge of the slot intercepted the line being read. After reading for several minutes until the rate of reading became constant, the speed of the drum was observed; then the illumination was increased to the next step and a new setting made. To avoid prejudice in the speed regulation a second person changed the other rheostat in a haphazard manner between observations. Each observer went through the cycle from low to high and then back to low illumination, and the two observations at each illumination were averaged to correct for the effect of increasing familiarity with Old English type.

Individual observers varied in speed of reading over a wide range. For convenience in combining results each observer's speed at an illumination of 4 foot-candles has been rated at 100 per cent, and the combined results for forty-nine observers for the low-contrast material are shown in curve A, Fig. 2. The results for thirty-seven observers with the high-contrast material are shown by curve B, Fig. 2. The same data are shown in another way in Fig. 3, where percentage speed is plotted against brightness of the background; the speed at a brightness of 1.5 millilamberts is taken as 100 per cent.

The second research was carried out to determine the effect of spectral character of the light on the intensities chosen by different observers for reading. The researches of Bell[‡] and of Luckiesh[§] have shown that visual acuity in monochromatic or nearly monochromatic light is higher than in light having an extended spectral distribution. These results are most noticeable for small details at low illumination. In ordinary operations, such as reading, the eyes are seldom called upon to distinguish very fine details at the limit of discrimination. In reading it has been shown that the eyes progress along the line of type by successive jumps and pauses and that the eyes see words as a whole rather than notice individual letters.

In view of these and other facts it appeared desirable to carry out further tests to determine whether visual acuity is an important factor in the illumination intensities required by various observers for reading, since this is a very important and representative application of vision.

The nearest approach to monochromatism in any commercial illumination is obtained in the mercury-vapor arc; hence the logical choice of illuminants for such a test would be mercury arcs and gas-filled tungsten lamps.

[‡] ELECTRICAL WORLD, May 11, 1911; Sept. 9, 1911.

[§] ELECTRICAL WORLD, Aug. 19, 1911; Nov. 18, 1911; Vol. 62, 1913, page 1150. *Transactions I.E.S.*, Vol. VII, 1912, page 135.

In order to obtain uniform illumination on the reading matter a glass-tube mercury arc with reflector and gas-filled tungsten lamps in a white-lined container were prepared. In the earlier tests these were mounted in an office room with light ceiling and buff walls. They were placed behind and to the left of the observer, who was seated at a table. The reading matter was placed on an inclined rest in front of the observer. The illumination from each source could be varied by the observer by means of strings attached to shutters in front of the cabinets containing the lamps. Variation of the illumination on the reading matter was accompanied by a similar variation in the general illumination of the room received from the same source.

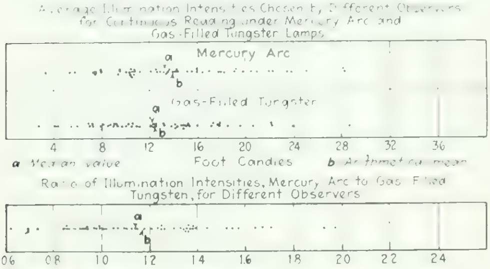


FIG. 4—RESULTS OF TYPICAL TEST (NO. 2A) PLOTTED

In this test (referred to in the tables as Test 1) each observer when seated at the table was instructed to adjust the illumination to an intensity which he would consider comfortable and desirable if he were to continue reading without eye strain for a period of several hours. The intent of the instruction was that the observer should not use the minimum possible intensity, but neither should he be wasteful of the light. The observer readjusted the illumination at the end of every five minutes for a period of thirty minutes. Later in the day observations were repeated with the other source.

For the larger portion of the later work the mercury source was a 50-in. (125-cm.) glass tube arc with reflector. Ten gas-filled tungsten lamps were placed in a white-lined box, 15 in. x 36 in. x 9½ in. (45 cm. x 90 cm. x 23.8 cm.) in size, with opal-glass front. This made the sources more nearly comparable as regards diffusion. These units were suspended about 5 ft. (1.5 m.) above a table placed near one corner of a large room. Control of illumination was obtained by means of two roller curtains on each source, which cut off the light by unrolling from both ends of the illuminant, this control being in the hands of the observer as before. Data on the reading matter used in each test are given in Table II. In order that all observers should receive identical instructions, written directions as follows were given to each:

TABLE II—DATA ON READING MATERIALS USED IN TESTS

Test No.	Reading Material	Apparent Diffuse Reflection Factor (Per Cent)	Size of Type (Points)	Lines per Inch
1	*Transactions I.E.S.*	84	11	6
	"Life of Edison"......	89.5	12	5.6
2 or 2a and 4	*Scientific American Monthly*....	80.5	9	7.2
3	*Saturday Evening Post* (dyed)* *Saturday Evening Post* (dyed)	41	9	9

*The dye used in dyeing the *Saturday Evening Post* was somewhat bluish, which accounts for the higher reflection factor obtained for illumination by the mercury-vapor lamp. If this correction were applied to the results in Table I all ratios for test No. 3 would be raised about 4 per cent (42) for mercury-vapor light.

INSTRUCTIONS FOR READING TEST

> The object of this test is to measure the intensity of illumination most satisfactory for continued use in reading. This does not mean an intensity with which it is just possible to get along, but rather one which seems comfortable and desirable.
>
> In commencing the test the observer will read for a period of four minutes under a selected intensity of illumination. He will then be instructed to adjust the light to suit his own taste, and in doing so will bear in mind the above-mentioned objective. At the end of each four-minute period the observer will be instructed to readjust the light.

The selected intensity referred to was 4 foot-candles. Observations under each source continued for sixteen minutes, and observations under one followed immediately after those under the other. The order of the illuminants was reversed for successive observers.

Photometric measurements were made by two or three observers. A calibration curve relating shutter position and illumination was determined for each illuminant. Frequent checks of the calibrations were made.

The results of the various tests, with data on the reading materials, are given in Tables I and II. A plot of the results of Test 2, which is typical of all tests, is given in Fig. 4.

In every test the maximum illumination obtainable was kept approximately the same for the two sources. It appears from Tests 2a and 4 that the intensity chosen by an observer is influenced to some extent by the maximum intensity available. Intensities higher than 45 foot-candles could not be obtained with the mercury arc used; hence it was not possible to investigate the effect of maximum intensities greater than this.

These tests seem to show conclusively that visual acuity is not the determining factor in choosing an illumination intensity for reading. On the contrary, in all of the tests the average intensity chosen under the mercury arc exceeded the average tungsten-lamp intensity by 4 to 20 per cent, whereas it has been shown that at lower intensities about 75 to 95 per cent more tungsten light than mercury light was required for equal visual acuity; that is, where the details are so small as to be just distinguishable. The actual intensity which would be chosen by the average observer if the available intensity were unlimited is unknown, but where intensities of the order of 30 to 45 foot-candles are available an intensity of 10 to 17 foot-candles seems to be satisfactory.

Hydro-Electric Power in Ceylon

RAILROAD electrification, street-railway construction and lighting important towns would, the authorities of Ceylon estimate, afford ample use for development of the hydro-electric resources of the island, and surveying and other preliminary work is now under way. There are also tea, rubber and other factories which would probably become consumers of energy, and electrochemical works are within the possibilities. The consulting engineers have advised the government to develop the power as a public enterprise but to intrust the distribution of the energy to private interests.

Readers' Views and Comments

This is a readers' forum. Comments on questions before the electrical industry presenting economic, financial, engineering or commercial aspects and new or supplementary viewpoints on published articles are cordially invited

Need for Popular Enlightenment in the Contest Between Light and Illumination

To the Editors of the ELECTRICAL WORLD:

A battle is being waged in the electric industry over light versus illumination. The average layman has a growing desire for the former and a hazy idea of the latter. In my locality this is exemplified in a marked manner. Lamps rated as high as 150 watts are hung over store counters in the direct line of vision of clerk and customer. A customer passing from such a store to one filled with soft illumination will often criticise the lighting of the second store and contrast it with the other man's "bright light." It is safe to say that ignorance is the direct cause for this everyday remark—the ignorance of the average layman on the fundamentals of illumination coupled with the psychological effect produced on his mind by seeing the burning filament.

Electrical men have educated the layman to see the advantage of electric light in comparison with oil and gas. Yet is he not ignorant of the power of the illuminant he is now employing? Is he not, in fact, often guilty of "running a good thing into the ground"? Should not electrical men, having proved the superiority of electricity to other forms of light, discourage this mad rush after glare and strive to show that correct lighting—illumination—is that happy medium where light is present in the right amount but vision is not impaired?

J. B. FICKLEN, III.

Rappahannock Electric Light & Power Company,
Rappahannock, Va.

Disputes Industrial Court's Idea of Coal Mining Operations in Kansas

To the Editors of the ELECTRICAL WORLD:

In your issue of Aug. 27 appears an article under the heading "Kansas Industrial Court Declares Mining Methods Wasteful." I wish to say that I have been in a number of mines that are fully equipped electrically, some that are partly equipped and a number that have no electrical equipment. My observation covers a period of more than three years and I cannot agree with the opinion of the Kansas court. In the mines that are electrically equipped the men are surprisingly quick to pick up the handling of electrical equipment, locomotives, electric shot-firing machines, mining machines, pumps, hoists, drills, etc., and quite efficiently, too. In this field the coal is 2 ft. 6 in. to 3 ft. 6 in. and very hard shooting. It is full of sulphur, "horsebacks," "faults" and "rash," which causes dirty coal that is either loaded out or "gobbed." This time is lost to the company and has to be paid for. The companies are not operating mines for their health, and unless they were very efficiently operated they could not be run at anything but a loss.

The statement that a miner or any one else can by simply drilling a hole in the face of the coal and putting in a stick of dynamite blow out several tons of coal is erroneous—in the first place because such a method would likely not shoot down a dinner-pail-full of coal, but would simply spring the hole. It would probably be a "windy" shot, and the method is against the law. The shot firers, as a rule, are quite intelligent or they would not live to fire many shots; so, needless to say, they would not fire that kind of a shot. When shooting off the "solid," a cutting is made by the miner to give the shots a chance. Usually a 3-ft. cutting is put in, or the shot firers would not light the shot. After a man drills two or three holes, which requires considerable labor, he wants some coal to load out the next day. He uses black powder or a permissible explosive. The holes could be loaded as the court states and fired the next day with smaller results than he got the first day.

The Sheridan Coal Company,
Mulberry, Kan.

CHARLES LELAND.

Rating-Plate Material

To the Editors of the ELECTRICAL WORLD:

Until the last few years the rating plates on motors, generators, transformers and other electrical equipment, which carry the information recommended by the American Institute of Electrical Engineers for record in this way, have been made of brass or copper. Of late a few manufacturers have been using steel rating plates. The object of the rating plate is to provide a permanent record of certain information regarding the apparatus to which it is attached, otherwise a cardboard tag tied to the machine would be sufficient. A thin sheet of steel may last longer than a paper tag in some locations, but there are many others where it is not so durable.

In a plant having in operation 1,000 or 1,200 motors, many of which look much alike, it is a pretty hard matter at times to identify one when the frame bears a rectangular patch of rust for a rating plate. If all electrical manufacturers will again return to the use of non-ferrous nameplates on their products, their action will be appreciated by their customers.

Jones & Laughlin Steel Co.,
Pittsburgh, Pa.

D. W. BLAKESLEE,
Electrical Engineer.

A Correction

To the Editors of the ELECTRICAL WORLD:

The table for 25 cycles on page 419 of the Aug. 27 issue of the ELECTRICAL WORLD in the writer's article on "Quick Line Calculation Without Charts or Tables" is in error as will be obvious to any one who checks up the calculations. The table should read as follows:

For 25 cycles:

No. 8 .... = 130 − (13 × 8) = 26
No. 7 .... = 130 − (14 × 7) = 32
No. 6 .... = 130 − (15 × 6) = 40
No. 0 .... = 130 − (15 × 0) = 130
No. 00 .... = 130 + (30 × 1) = 160
No. 000 .... = 130 + (30 × 2) = 190
No. 0000 .... = 130 + (30 × 3) = 220

Correction of this error will prevent confusion on the part of any one who may use the method.

Citizens' Gas & Electric Company,
Waterloo, Iowa.

AUSTIN BURT,
Manager.

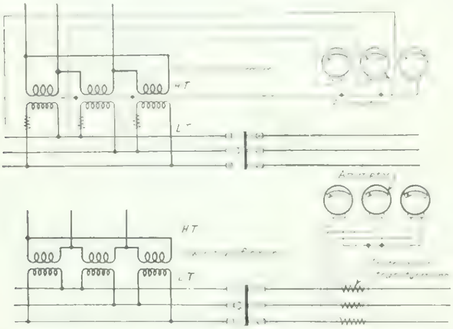
Industrial and Station Practice

Installation, Operation and Maintenance of
Generating and Distribution Equipment and Economical Utilization of Electrical Energy
in Mills and Factories, Including Testing and Repair Methods

Instrument Transformer Connections Should Have Been Different

A RATHER interesting case of trouble occurred some time ago which would not have gone undetected as long as it did if the instrument transformers had been connected differently. The trouble occurred in a bank of delta-delta-connected transformers one of which developed an open circuit in the high-tension side. The bank continued to operate in this condition for some time no doubt before being detected. As it happened, the transformers were not operating up to their rating and by running open-delta were quite capable of carrying the load without undue heating. The transformers had ammeters connected in each phase as shown in lower drawing. Had they been connected as shown in upper portion the condition described would have been readily detected as soon as the open-circuited transformer had lost its load. R. H. N. LOCKYER.

Bonnington Falls, B. C.



DESIRABLE AND UNDESIRABLE WAYS OF CONNECTING INSTRUMENTS TO TRANSFORMERS

Rules to Follow When Operating Disconnecting Switches

BECAUSE opening or closing disconnecting switches without taking proper precautions may damage apparatus and cause injury to workmen a set of instructions on the proper method of handling each switch has been issued to operators of the Pennsylvania Water & Power Company. As a guide to operators in other companies the rules are reprinted here:

(a) Switch sticks must be kept in good repair and should be occasionally wiped with a dry rag, particularly on damp days. A place is provided for every switch stick and every switch stick when not in use must be in its place.

(b) Never open or close a disconnecting switch unless the corresponding oil switch is open; that is, never use a disconnecting switch to break or make a power circuit.

(c) Every disconnector has an official designation and every order in connection with disconnector operation must use the official designations.

(d) When an operator orders an assistant operator to operate certain disconnectors, he will simultaneously point to that disconnector on the mimic bus and the assistant operator will repeat the order and throw the mimic disconnector on the board into the half-way position. The operator will verify the assistant operator's repetition and mimic bus indications and if correct say, "Right." The assistant operator will then proceed to execute the order.

(e) An order to open certain disconnectors shall be executed as follows:

1. Go to the corresponding oil switch. Stand in front of it. Read its sign. Make sure that it is the right one. Make sure that it is open.
2. Go to the disconnectors. Stand in front of the middle phase. Read the sign. Make sure that you have the right set of disconnectors. Note the location of the red stripes on the barriers between circuits.
3. Sidestep to the compartment farthest to the left, next to the red stripe. Again make sure that you are on the right circuit.
4. Pull the disconnector. Turn the face when doing so to prevent flashing in the eyes in case through some mistake the disconnector is loaded. Pull each disconnector, from left to right, in the same manner. Stop when you have pulled three switches to the red stripe.

Similar procedure should be used when closing disconnectors. In the case of high-tension switching it is not necessary to go to the oil switch as called for in the first step. The pilot lights on the barriers must be observed in this case.

(f) When the assistant operator has executed his order he will report the same to the operator, specifically mentioning the names of switches he has opened or closed and throwing the mimic disconnectors on the benchboard to the proper position. The operator shall repeat the report and note that the proper mimic disconnectors have been operated.

(g) If one disconnector of a set of three has been opened under load and this is at once noticed, it may be immediately closed again if not badly burned. If two disconnectors have been opened, do not close again.

(h) Do not open bus section disconnectors, even if the ammeters show no flow of current, if the opening of these disconnectors separates two systems which then fall out of phase with each other or if any considerable difference in voltage is created on these two systems, even though they be held in parallel by some other switch. A comparatively small arc caused by this difference in voltage when opening the switch may be sufficient to start a flashover across the buses.

(i) Bus reactor short-circuiting disconnectors should be opened with caution for the same reason. Decrease the current from one section of the bus to the other to a value less than 250 amp. before opening such bus reactor disconnectors.

(j) Before closing any bus section disconnectors be sure that the supposedly clear section of the bus on one side of the switch is really clear and if the disconnector is between two sections carrying load be sure that they are in parallel through some other switch and that there will be no excessive flow of current through this switch when it is closed and also that the switch closes and makes good contact at once, so that whatever interchange of current there may be will not cause an arc which might develop into a flashover.

(k) Disconnecting switches must not be slammed in unnecessarily hard, as doing so cracks the insulating supports.

There should, however, be no hesitation when opening or closing disconnectors. In pulling high-tension disconnectors they should be hooked in such a manner that they do not fall away from the switch hook.

(l) Any signs of disconnector clips or hinges cutting or running hot should be corrected at the earliest opportunity. A piece of paraffin on the end of a switchstick can be used for detecting hot switches.

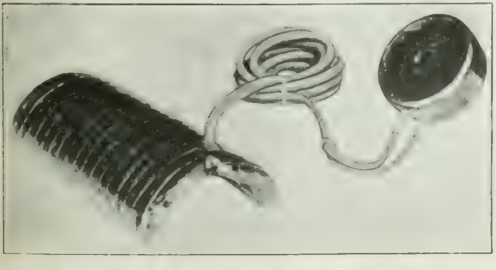
Pennsylvania Water & Power Co., Baltimore, Md.
A. E. BAUHAN, Superintendent of Stations.

Improved Practices Make Cable-Fault Location More Certain

AN EXTENDED description of fault location by the interrupter and telephonic method was published in the ELECTRICAL WORLD of Sept. 11 and 18 and Oct. 9, 1915. Since then this method has become widely popularized and a number of improvements have been made. Of late the vacuum tube has been pressed into service with great success and further refinements in exploring-coil design have been achieved.

A new exploring coil of the sector type has lately been developed to furnish a powerful signal, and this is usable on either single-conductor or multiple-conductor cable. With this type of coil applied to a multiple-conductor cable it is found on going around the sheath that the signal in the telephone is louder in spots. That is, there are "humps" in the field from the current in the faulty conductor in case a ground exists or in the field around the conductors in case there is a short circuit. Where there is considerable return current on the sheath beyond the fault this becomes apparent, because there are no "humps" in the field and the signal due to the sheath is the same all around it. This type of coil, illustrated herewith, gives a louder signal than the earlier forms developed, especially in the case of cement-covered cables.

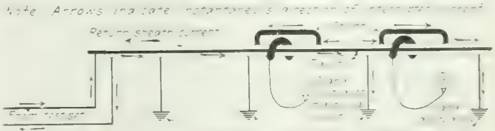
To do away with the need of making so-called test cuts on cable sheaths a shunt is now employed on the sheath of single-conductor cables when testing for faults by the interrupter method. The shunt is used as shown in the accompanying diagram, with an exploring coil between its ends. It consists of a piece of No. 0000 copper bent U-shaped, 10 in. long and 4 in. high. It must make good contact with the sheath. When the shunt contact is made the intensity of the interrupter signal in the portable telephone will increase if the burn-out is ahead of the point of application. The intensity will decrease if the fault is behind the point of application. In practice it has been found that, while the increase is not always discernible, the decrease is usually sufficiently marked to permit accurate location. This apparatus is very convenient in locating the exact trouble spot in cables after removing them from the ducts in case the burn-out does not show through the sheath.



SECTOR TYPE OF EXPLORING COIL FOR LOCATING FAULTS IN CABLES

The vacuum-tube amplifier has been applied with great advantage to cable-fault location within the past year or so. Equipment is now available for use with the various types of exploring coils provided in fault-locating apparatus, and the quick and accurate location of trouble in both overhead and underground lines has been facilitated. With the amplifier a particular signal can now be heard about three times as far away as before, or a signal of a certain value can be made three times as strong. In hunting trouble on overhead lines this means far less pole climbing and in cable work many less openings of manholes.

In tracing an "open" or a ground overhead it is no longer even necessary to stop the motor of a trouble hunter's automobile. In underground work signals can be heard above ground with the triangle (see previous articles) that could not possibly be heard without the amplifier. About the only kind of faults that give much trouble in practice are burn-outs in fresh water. As these high-resistance faults are not capable of being carbonized, they do not allow sufficient signaling current to pass through the fault to give a loud indication. While hitherto in multiple-conductor faults it has been possible to neutralize the charging currents, the signal due to the fault current was usually very weak and hard to trace. A new method of handling high-resistance faults, such as those submerged in fresh water, has just been developed. The details of this method are not quite ready for publication at this time. By its use high-resistance faults may be located with the same speed and accuracy as those of low resistance. The amplifier overcomes much of this difficulty. The amplifier is also useful in locating leaky insulators of the pin type.



COPPER SHUNT HELPS TO LOCATE CABLE FAULTS BY EXPLORING COIL METHOD

The filament current of the amplifier tube is supplied by two ordinary flashlamp batteries. In case a 6-volt storage battery is available, it can of course be used instead of the dry cells.
J. F. BEEDLE.

Lundin Electric & Manufacturing Company,
Boston, Mass.

Testing for Phase Sequence in Three-Phase Circuits

IN THE article by H. J. Blakeslee on "Testing for Phase Sequence in Three-Phase Circuits" published in the July 23 issue of the ELECTRICAL WORLD, page 177, the connection diagram fluxes A and B should be interchanged to correspond to the vector diagrams. Flux A in the vector diagram should be the flux in the portion of the core surrounded by the high reactance, and Flux B should be in that portion of the core surrounded by the coil of low reactance. The vectors are substantially correct and correspond to the core and coils in the connection diagram and the descriptive matter.

Field Winding Diagram Prevents Mistakes

When the field coils of a motor are taken out of the frame during overhauling or when damaged coils are being replaced it is very important to put them back in the frame properly, with the leads so connected as to give the correct relative polarity. In order to prevent wrong connections and to aid the operating man in connecting the field coils a standard winding diagram should be drawn up. Such a diagram showing a modern commutating-pole series-wound railway motor with four commutating-field coils is shown in the accompanying cut. This diagram should be drawn before any fields are removed. To make sure that the coils are put back in the same position a tag such as that shown at the right in the drawing is tied in position on each coil before removal. Then after the coils are replaced a polarity test is made on shunt, series and commutating poles.

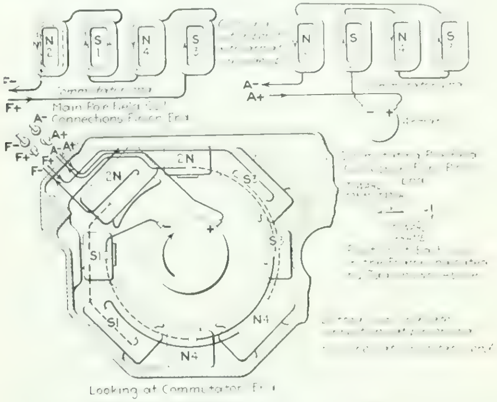


DIAGRAM FOR ASSURING CORRECT CONNECTION AND POSITION OF FIELD COILS

While overhauling or repairing field windings the following points are well worth attention:

Coils and frame should be cleaned and painted.

Coils should be placed on poles properly.

Clean the surface of the pole and pole seats, to insure a good close fit when the bolts are drawn up tightly.

Do not pound the pole in place with a sledge; use a block of wood or a piece of soft metal, such as copper.

Be sure that the pole bolts are drawn up tightly and that lock washers are under each nut. Add some white lead over the nuts after tightening to prevent entrance of water.

Sound the assembled poles, using a small hammer, to insure that the poles are drawn up tightly.

Connections should be made as shown on the winding diagram supplied by the manufacturer.

Check the polarity of each coil.

Dip and bake the individual coils. To secure best results, dip and bake the entire frame after the coils are in place and all connections are made.

The motor leads where they come out of the frame should be well protected by insulating bushings.

Where a motor is subjected to much vibration coils should be spring-supported, and, where necessary, backed up by washers of either metal or fibrous material, well painted. In replacing coils, temporarily tape the spring and washers to the coil to keep them from working out of place and getting in between the pole and the pole seat when assembled.

When the coils have terminals the ends of the cable connected to the terminal should have a metal sleeve soldered to the wire, which is held in the terminal by screws securely tightened and locked. It is considered best practice in connection with railway motors to use cables coming out of the body of the coil instead of the heavy brass terminals, to make the wiring around the frame connections. The main objection to the use of terminals is that they are more likely to break off under vibration, or to develop a loose connection and burn off the lead. Another disadvantage is the difficulty of properly insulating the terminals after the connection is made.

The connections between coils with cable leads should be made by butting the ends together, covering the joint by a copper sleeve and soldering well.

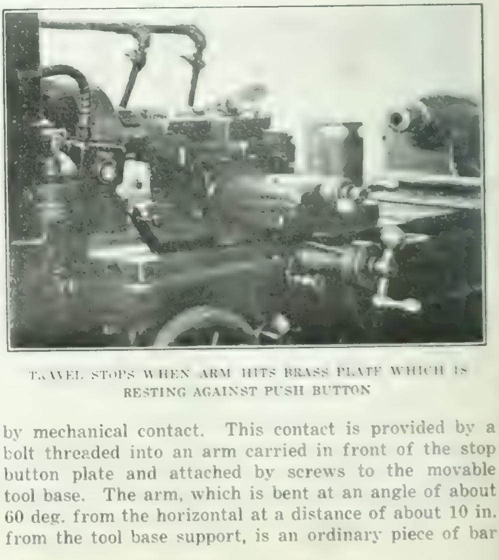
The ends of the cables connected to the brush-holders should be provided with metal sleeves or terminals that are to be securely clamped and locked to the brush-holder casting.

All wiring around the frame should be securely anchored to the frame and tied down, to prevent vibration and to keep the insulation from being rubbed or cut by parts of the rotating armature.

John S. Dean,
Motor Engineering Department.
Westinghouse Electric & Manufacturing Company,
East Pittsburgh, Pa.

Adjustable Cut-Off Switch Prevents Over-Run of Lathe

In a Massachusetts factory equipped with many motor-driven machine tools it has been found convenient to apply an automatic cut-off switch on certain equipments which can thereby be handled more readily by employees. One of these, illustrated herewith, is an 18-in. Chard lathe driven by a Westinghouse motor with push-button control. In an earlier type the automatic cut-off to prevent the tool from traveling too far toward the lathe axis was secured by attaching a ¼-in. iron rod to the movable tool base and fitting the end of this rod with a set screw which would depress the stop button when the end of the travel was reached. A more satisfactory arrangement is the one shown, in which the stop button is covered by a thin piece of brass plate bent at right angles to the button box and sufficiently flexible to actuate the stop button when pushed inward by mechanical contact. This contact is provided by a bolt threaded into an arm carried in front of the stop button plate and attached by screws to the movable tool base. The arm, which is bent at an angle of about 60 deg. from the horizontal at a distance of about 10 in. from the tool base support, is an ordinary piece of bar

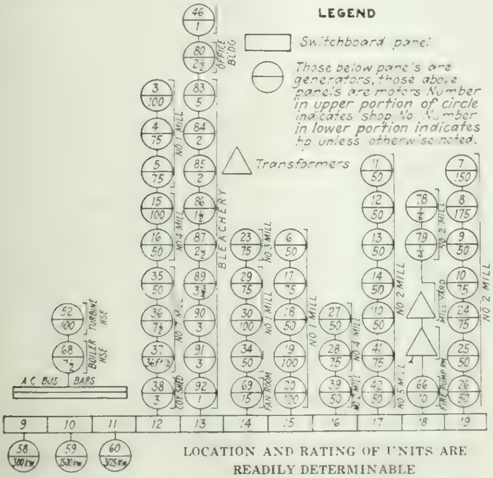


TRAVEL STOPS WHEN ARM HITS BRASS PLATE WHICH IS RESTING AGAINST PUSH BUTTON iron about ⅜ in. thick. With this arm a better adjustment is obtained than in the earlier arrangement, with corresponding increase in accuracy of motor cut-off as the cutting tool feeds in.

Boston, Mass. FIELD EDITOR ELECTRICAL WORLD.

Flat Chart Indicates Location and Rating of Each Unit

IN MANY industrial plants which generate their own power, and also in plants which distribute central-station power through a main switchboard, a graphical representation of the numerous power circuits is oftentimes of considerable value to the attendant in determining the number of motors which are connected to a certain panel of the switchboard and their size and location.



LOCATION AND RATING OF UNITS ARE READILY DETERMINABLE

To meet this requirement the writer has devised a chart (part of which is illustrated herewith) which has proved its value in a number of instances. In this case oblongs have been used to represent the various panels of the switchboard, an oil switch being mounted on each panel to control the feeder circuit. Current is generated at 440 volts for power service and is stepped down to 110 volts for lighting.

Circles have been used to denote electrical machinery, those below the switchboard representing generating machinery, while those above represent motors. Transformers are indicated by triangles and motors operating at 110 volts are shown connected to the transformers. The circles are divided into halves by a horizontal line; the numbers appearing in the upper portion indicating the "shop" number, while those in the lower portion indicate horsepower unless otherwise noted.

The chart has been made self-explanatory as far as possible and clearly shows the number of motors connected to each feeder circuit, together with their horsepower, shop number and location.

The original tracing is kept on file, and when new motor installations are completed, they are drawn in on the tracing and new blueprints are made, thus keeping the chart up to date.

LEROY A. FRANCIS,
Chief Electrician.
Utica Steam Cotton Mills,
Utica, N. Y.

Accidents Avoided Through Knowledge and Obeying Rules

DISSEMINATION of knowledge is the first important step in the work of reducing electrical hazards, and practice of the moral obligation to comply strictly with known requirements is the most important step. As an example it may be pointed out that since bad results do not always follow overfusing or blocking circuit breakers to permit of carrying overloads, this encourages many operators who do not understand the hazard involved to indulge in these bad practices in disregard of instructions. The contact points of blades of operating controllers can be made to stick whether or not distant control is employed, and damage frequently results before the circuit can be broken by any other means that have been provided. Could operators realize that overfusing or blocking circuit breakers is the same in effect as rendering inoperative a safety valve or an open throttle valve on an engine, the practice would not be followed. The damage it can do is limited in extent only by the other protection, if any is provided, for the branch system, and sometimes the damage extends back to the generators, with consequent opportunity for accidents.

Because switch blades or control contacts can be made to stick by overheating, none should be so arranged that they cannot be made visible for inspection while the current is on.

Overloading equipment is probably responsible for as many accidents as any other single cause. It results in breakage that may be immediately followed by injury to persons, or an impairment that later results in breakage. Overloading sometimes results through the ignorance of persons authorized to decide what a piece of equipment shall do, regardless of protests that may be made by operators or other employees connected with the work of caring for and maintaining it.

While none would attempt to minimize the importance of insulation, the limits imposed by lack of capital must be recognized. However, this should not abate the insistence of demand for it. A rather common kind of accident is for a person on a metal structure to touch a high-tension wire and thus intercept the current. If a structure were so perfectly insulated that current could not go through it to ground, no injury would result from contact with a conductor while on the structure. Persons may frequently have been in contact with dead metallic parts and current-carrying parts without receiving injury, and this leads them to ignore the principle, if they have ever understood it, that if such metallic parts are grounded they will complete a path through which current can travel to ground. Assuming that the structures or metal parts are not grounded and that contact is made between them and current-carrying parts, then also a person brought in contact with the structure would complete a path to ground. Therefore it is best practice to make electrical grounds to all dead parts.

Maintenance of equipment in a proper condition is largely the responsibility of inspectors. Breakage of parts weakened by wear and failure to keep parts properly keyed, bolted and lubricated have been responsible for many accidents. Lack of ruggedness in equipment is responsible for many accidents as breakage occurs when haste and unusual exposure to hazard must follow in order to prevent loss and sometimes disaster. It is difficult to control the handling of equipment so perfectly that unusual and excessive stress will not be put on it, and such excessive stress many times impairs the parts that necessarily are delicate but can fail only because of failure of more rugged parts caused by abuse. In many cases the matter of locating and repairing failure of delicate parts exposes some one to high hazard.

Standardization of parts of equipment and of the methods that should be followed in construction is important because it includes ruggedness, which lessens breakage; interchangeability and easy access, which shorten delays, lessening the number of men exposed and the length of time of exposure to hazard; simplicity of operation, which lessens the strain on the minds of operators with resulting failure to observe and act with promptness, and uniformity of arrangements; as an instance, arrangement of controllers so that operators changed from one piece of equipment to a similar one will not be liable through habit to operate the wrong controller.

Abuse of equipment is responsible for a high hazard. Machinery cannot be so ruggedly constructed that abuse will not impair it, and inspection cannot be so closely followed that parts weakened by abuse will not fail at a time when the results may be serious.

Operation of equipment by persons not authorized or qualified is dangerous. If not authorized, they may endanger some one through lack of information as to surrounding conditions. If not qualified, they may be the cause of an accident because they do not know that control of an apparatus is sometimes dependent on other factors than operating controllers, as, for instance, filling an air tank to operate brakes. They may be ignorant of operating requirements and may fail to do any of the many things that should be done to avoid accident.

Failure of employees to co-operate is responsible for many accidents. This particularly applies to operators, inspectors, repairmen and others who should notify one another of their intended actions in order that one may not endanger another.

This information was embodied in a talk by Walter Greenwood, safety engineer Carnegie Steel Company, at a meeting this week of the Metals Section of the National Safety Council, Boston, Mass.

Simple Multipliers for Measuring Current with a Millivoltmeter

IT IS OFTEN desired to measure the current in a circuit which for some reason or other it is impossible or inconvenient to open to permit of the insertion on an ammeter. In such a case it is the usual custom to measure the drop of potential along a certain measured distance on the wire or cable with a millivoltmeter and then, knowing the cross-section of the wire and therefore its resistance per foot and the drop between the voltmeter contacts, to estimate the current flowing in the wire by the use of Ohm's law. However, the contacts are often driven or screwed into the wire before the distance between them is measured, or else some arbitrary distance is taken. The result is that considerable calculation is necessary before the correct amount of current can be arrived at. A much simpler way is to place the contacts at fixed distances apart, these distances being chosen so that the millivoltmeter readings can be multiplied by some constant which will quickly and easily give the answer. As the most convenient distance apart for attaching the contacts will generally be found to be between 5 ft. and 10 ft., the accompanying table has been made with the idea of using easy multipliers for the voltmeter readings when the contacts are placed between those limits.

LENGTHS OF CONDUCTOR THAT GIVE SIMPLE MULTIPLIER FOR MILLIVOLT READINGS WHEN MEASURING CURRENT

[illegible] 79 deg. Fahr.

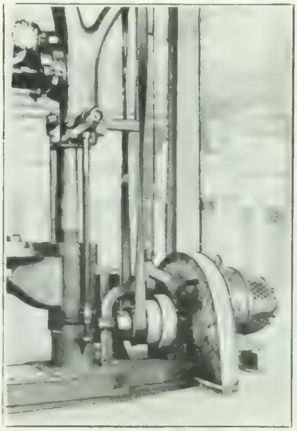
Size of Wire [illegible]	[illegible]	Distance Apart of [illegible] (Ft. and In.)	
1,000,000	[illegible]	9	6½
950,000	10.0	[illegible]	[illegible]
900,000	10.0	[illegible]	[illegible]
850,000	10.0	[illegible]	1
800,000	10.0	7	7
750,000	10.0	7	1
700,000	10.0	[illegible]	[illegible]
650,000	10.0	[illegible]	2
600,000	[illegible]	[illegible]	8
550,000	10.0	[illegible]	3
500,000	5.0	[illegible]	[illegible]
450,000	5.0	[illegible]	[illegible]
400,000	[illegible]	7	7
350,000	[illegible]	[illegible]	8
300,000	5.0	5	8
250,000	2.5	[illegible]	[illegible]
0000	[illegible]	[illegible]	1
000	[illegible]	[illegible]	5
00	2.5	5	1
0	1.0	10	[illegible]
1	1.0	7	11
2	1.0	[illegible]	[illegible]
3	0.5	10	[illegible]
4	0.5	7	11

Brooklyn Rapid Transit Co.,
Brooklyn, N. Y.

G. H. McKELWAY,
Engineer of Distribution.

Individual Motor Drive Adapted to a Column Drill

AN EXAMPLE of a changeover from group drive to individual drive of a Superior column drill is shown in the accompanying photograph, which was taken in a Massachusetts industrial plant. This installation demonstrates the ease with which a motor can be placed at the proper height above the floor when the main driving pulley is near the machine base. A variable-speed direct-current motor (740 to 220 r.p.m.) is used, in this case with a gear drive, the motor being mounted upon 4-in. I-beams. Push-button control with solenoid-type switches is provided. The design of the drill frame with the open space about it made it inconvenient to mount the motor directly on the frame. Therefore, it was mounted on the I-beams which rest on the floor. Some floor space was sacrificed by the motor mounting and the gear guard, but they are located on the side of the machine away from the working table.



MOTOR MOUNTED ON I-BEAM ON FLOOR

Boston, Mass. **FIELD EDITOR ELECTRICAL WORLD.**

Management and Policy

Embracing Central Station Commercial Organization and Management,
Customer and Trade Relationships, Public and Financial Policies, Advertising,
Selling and Service Methods

Industrial Information Spread Nationally by Georgia Railway & Power Company

THE Georgia Railway & Power Company has recently inaugurated a service of industrial information which is being sent out periodically by the company's publicity department to about 800 of the larger Northern and Western newspapers and other interested agencies. Each month an industrial and agricultural survey of Georgia is prepared by this department setting forth the industrial and agricultural conditions and business outlook in the state. The information is gathered from all available and reliable sources and is then condensed and published in a four-page digest. The company believes that this kind of news about Georgia is of sufficient general interest to attract the editors throughout the country and lead to considerable widely distributed newspaper comment that cannot but be beneficial to the state.

In the industrial letter of Sept. 13, for instance, some intimate facts are given as to the effect on the planters of the recent spectacular rise in the price of cotton and the reaction on the retail shops and banks. Figures and facts are given on results from the Georgia peach and watermelon crops, with a word about construction and general business activities. It is a brief, newsy, readable communication that is sure to spread confidence in Georgia and contribute an impulse to the industrial activity of the state.

Utica (N. Y.) Gas & Electric Company to "Service" Domestic Refrigerators

THE Utica (N. Y.) Gas & Electric Company has adopted an interesting plan by agreeing with local domestic refrigerator dealers to send electric service men to the refrigerator factories to train for "servicing" domestic refrigerators. All complaints or trouble calls concerning refrigerators will be handled by the Utica Gas & Electric Company, and its men who have qualified along refrigerating lines will take care of all service and inspection on these machines in the same way that the usual trouble calls regarding electrical appliances are handled. The refrigerator dealers have agreed to carry the necessary repair parts in their stock and to pay to the electric company one-half of the actual expense of labor for "servicing" these machines.

This plan gives the consumer ample assurance when he buys a domestic refrigerator of reputable make that the central-station company stands ready twenty-four hours each day to give the same attention to the electrically driven refrigerator as it would to the washing machine, flatiron, vacuum cleaner or any other electrical appliance.

The company is conducting tests on various types of household refrigerating machines. Data are obtained relative to energy consumption, load curve, water consumption, sustained temperatures of room, brine compartment, storage compartment and rise in circulating water, pressures of refrigerant, ice-making capacity and total cost of operation. As a result of these tests the company can determine for itself what machines it can recommend to its customers, its indorsement being based upon economical operation and efficiency for the customer, desirability of load and the probable requirements of service on the part of the company.

The domestic refrigerator will demand some attention, and the plan adopted by the Utica Gas & Electric Company seems to fulfill all service requirements until the refrigerating companies shall have sold a sufficient number of machines in one locality to justify establishing their own service stations.

A Standardized Equipment for the Tea Wagon Developed in Boston

SOME interesting experiments in the wiring of tea wagons have resulted in the adoption of a standard equipment by the appliance department of the Boston Edison Company. C. E. Greenwood, the department superintendent, says: "The tea table which we have fitted up has the extension cord permanently attached, the cord entering a long metal box containing the equipment. We had a special long plate made, the width of the framework under the table top, containing two double-T receptacles, with a push-button switch and a pilot light between the two receptacles. The 25-ft. cord is No. 14 heater cord. This is bulky, but it can be folded compactly and hung neatly on a small hook underneath the table top. We are working on the development of a self-contained unit that can be applied to the different

THE BOSTON WIRED TEA WAGON WITH ITS STANDARD EQUIPMENT pieces of furniture that should be wired and the question arises whether it would be best to have the cord permanently attached to the tea table or separable. We are arranging to have prongs extending from the outlet box so that the extension cord can be made in any length with a split plug on one end and a female plug on the other. The cord can then be detached from the table while still connected to the baseboard receptacle with no possibility of any one getting a shock from exposed terminals of the plug."

Population Increases 15 per Cent, Electric Customers 250 per Cent

AN INTERESTING comparison can be made from the recent census figures which show that the population of the United States increased slightly less than 15 per cent in the ten years 1910 to 1920. In the same ten-year period the number of customers of electric light and power companies increased more than 250 per cent and the amount of electrical energy sold increased over 350 per cent. The expansion was not confined to any particular section of the country, but was distributed about equally throughout all parts of the United States.

Business Men of All Communities Served Meet to Consider Utility Financing

ABOUT fifty leading citizens of Charleston, W. Va., and a dozen or more other smaller communities served by the Virginia-Western Power Company gathered recently at White Sulphur Springs to attend a meeting called to consider the general subject of utility financing. The fact that these men were selected on invitation as representing the most prominent banks, newspapers and business interests of these Virginia and West Virginia border-line towns made it a notable gathering. For it expressed an active feeling of responsibility on the part of the leading business men of the territory served by the power company in the welfare of the utility on which they all depend for a vital service.

The party was entertained at luncheon as guests of General Manager A. H. Grimsby, and a meeting followed at which W. T. Dabney, business manager of the Richmond Chamber of Commerce, spoke on "Community Co-operation and the Importance of Supporting Local Utilities," Judge G. R. C. Wiles of the West Virginia Utility Commission on "The Advantages and Advisability of Financing Utilities Locally," A. Bliss McCrum, secretary of the Public Utilities Association of West Virginia, on "Eliminating Utility Securities from the Speculative Class by Commission Regulation of Rates," and M. H. Aylesworth, executive manager of the National Electric Light Association, on "Taking Our Customers Into Partnership." This meeting was followed by golf and motoring and then by a dinner at which there was a free general discussion of the broad subject of customer ownership of utility securities. The deepest interest was shown and a thorough recognition that every business man is directly concerned in the prosperity and protection of the local electric company. Resolutions were passed and published in the newspapers throughout the different communities indorsing the plans of the power company for the sale of securities direct to the consumer.

What Other Companies Are Doing

San Francisco, Cal.—So much interest has been shown throughout the country in California's electrical homes that the California Electrical Co-operative Campaign, 710 Humboldt Bank Building, San Francisco, has prepared a complete booklet explaining and summarizing the purposes, organization and results of its work along these lines. The booklet is liberally illustrated with exterior and interior views of each home, with samples of the newspaper stories published and the advertising done, with sample folders and announcements distributed, and with wiring plans.

Salt Lake City, Utah.—The Utah Power & Light Company has engaged the services of Mrs. Louise Palmer Weber, a lecturer on home economics and dietetics, for a series of ten free lectures, for the benefit of the housewives. These began on Sept. 9 at the Commercial Club in Salt Lake City and are to be held every Tuesday and Friday afternoon for a period of five weeks from that date. Mrs. Weber will conduct a campaign of education, not only in the use of electricity for cooking, but also in furnishing expert advice and instruction on home economics.

Dallas, Tex.—The Texas Power & Light Company has issued and is distributing to its customers and the public an interesting booklet entitled "My Business, Your Business and Our Business." It is intended to answer the questions commonly asked regarding the public utilities. Some of the items discussed are the functions of the utilities, relationship to community and national prosperity, investment in utility services, rates for service—how fixed, watered stock an impossibility, state commission regulation, constitutional protection of utilities, and the future of public service.

Pittsfield, Mass.—To celebrate the installation of a new 5,000-kw. steam turbine unit at its Silver Lake Station, the Pittsfield Electric Company recently invited its stockholders to hold their annual meeting, with a dinner, at the plant. About 100 stockholders accepted the invitation and were taken to the station in autobuses. Guides showed the party about the station upon arrival. Long tables decorated with flowers were placed in available spaces in the electrical bay on the turbine-room floor and a full "shore dinner" was served. The chief engineer of the station officiated as cook, superheated steam from the company's 520-hp. boilers doing the cooking. Young women employees from the company's offices served as waitresses.

New York.—Sales of household electrical appliances have increased from 100 to about 155 per cent between 1914 and 1921, according to John F. Kelly, manager of showroom sales for the New York Edison Company. Records of sales for the months of June and July, 1921, are 8 per cent and 33 per cent above those for the corresponding periods of 1920. During May, 1914, household appliances disposed of totaled 916 articles, compared with 1,564 for the same month in 1921. In July, 1914, sales were 641, against 1,643 pieces for the same month this year, showing that within the past seven years a steady increase in sales took place. Mr. Kelly asserted that when the fiscal year of 1921 is over he expects business will be from 25 to 50 per cent better than that of last year.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
of the World

Generators, Motors and Transformers

Automatic Brush-Shifting Motor for Driving Draft Fan.—R. A. JONES.—This article describes the forced-draft fan equipment recently put into operation at the Springdale station of the West Penn Power Company, which includes a comparatively new type of polyphase alternating-current, variable-speed, brush-shifting motor, designed to eliminate the objectionable poor efficiency and limited number of speed points inherent with slip-ring induction motors. The induced-draft fan equipment for each boiler consists of two centrifugal fans coupled together and driven from one end through a flexible coupling by a 175-hp., 514-r.p.m., 2,200-volt, three-phase, 60-cycle slip-ring induction motor and from the other end through a magnetic clutch by a 400-hp., 720-r.p.m. slip-ring motor. Secondary resistance is provided to give a speed range from 514 to 450 r.p.m. with the larger motor and from 450 to 255 r.p.m. with the smaller motor.—*General Electric Review*, September, 1921.

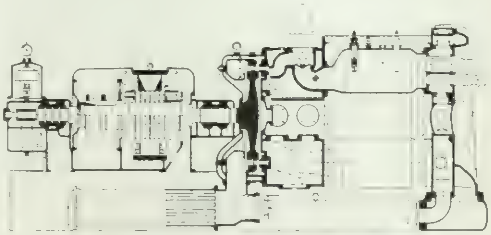
Variable-Speed Induction-Motor Sets.—C. W. KINCAID.—A description of obtaining variable speed in induction motors by several methods, among which are the Kramer system, the Scherbius system and the frequency converter system. A fuller description of the last method is given.—*Electrical Journal*, September, 1921.

Lamps and Lighting

Industrial Lighting with Mercury-Vapor Lamps.—E. L. ELLIOTT.—This paper gives the characteristics of the light suitable for the successful illumination of industrial plants and describes installations of mercury-vapor lamps used in automobile factories and for similar service. Higher lighting standards are advocated.—*Electrical Review*, Sept. 10, 1921.

Generation, Transmission and Distribution

The Gas and Oil Turbine.—W. SCHÜLE.—Much has been written, innumerable patents have been granted, and several books have been published on the subject of gas turbines during the last ten years. Yet there is nowhere a gas turbine in actual use. A French designer, Armengand-Lemale, went further than all his contemporaries and actually built a gas turbine, but it proved a failure. The Thyssen Works (Mülheim) succeeded finally, after years of research work, in developing the Holzwarth patents into a very serviceable machine, operating either with gas or with fuel oil. Their first gas turbine was used in 1913, and ever since then the development of this new type of prime mover has been pushed vigorously, until today a 10,000-kw., 1,500-r.p.m. machine gives results thermally superior to those obtained with an up-to-date steam turbine. Some of the greatest difficulties in the design of a gas turbine are (1) the very high temperature of the burning gas mixture which drives the turbine wheel or wheels (1,500 deg. to 2,000 deg. C.), (2) the choice of a turbine-wheel material withstanding this high temperature, and (3) the proper cooling of the explosion chambers. The author proves by actual test and operating results that all these problems have been solved and that the gas or the oil turbine represents today a serious competitor with the steam turbine for either stationary, railway or ship propulsion purposes. The article contains a number of drawings and photographs of gas turbines of from 500 kw. to 10,000 kw. output actually built and in operation. Contrary to steam turbine practice, only two stationary and one running bucket wheel are used. The exhaust heats a small steam boiler, which furnishes steam for the steam-turbine drive of auxiliary machines, such as an air blower for the main turbines. The experimental gas turbine first built was arranged with a vertical shaft, but further experience proved that a horizontal shaft is preferable. Some test data of the 500-kw. oil turbine will be of interest: The speed attained was 2,700 r.p.m. There were six explosion chambers operating fifty to sixty times per minute each. Owing to the speed with which the burning oil-gas mixture is blown out through the runner (0.1 second) and the consequent inrush of fresh air to the explosion chamber, the average temperature in the chambers is only about 470 deg. C. Only about 9 per cent of the combustion heat is lost in the cooling water of the cast-steel explosion chambers, the walls of which are 15 mm. thick.—*Elektrotechnische Zeitschrift*, July 21 and 28, 1921.



SECTION THROUGH A 500-HP. OIL TURBO-GENERATOR

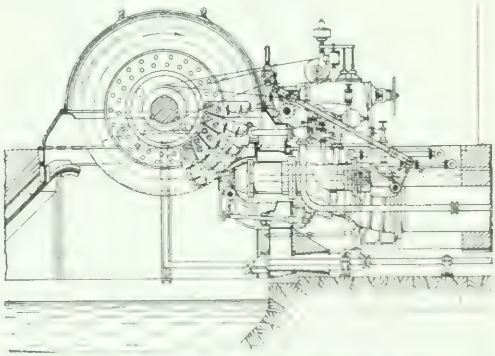
Vector Processes for the Calculation of Electrical Networks. — M. MUSYCK. — First part of a paper devoted to the calculation of currents and voltages in electrical networks, the author basing his method upon the representation of current intensities by vectors. "The introduction of the vector," he says, "in a problem involving continuous currents has no correspondence to the well-known employment of the same geometrical element for the study of alternating currents. When in the latter case there are properties pertaining to sinusoidal functions which render the adaptation of the vector possible, its employment is justified by considerations based simply on Ohm's law. To an addition of electric currents one can make a geometrical addition of vectors to correspond. This principle established, there can be developed without difficulty a method permitting easy solution of the problems of electrical networks."—*Bulletin de l'Association des Ingénieurs Electriciens sortis de Institut Electrotechnique Montefiore*, July-August, 1921.

Traction

Study of Pantagraphs and Overhead-Line Construction of Electric Main Roads.—P. LE BOUCHER.—The author gives first a theoretical study of the most desirable properties of a pantagraph current collector, such as (1) steady pressure, irrespective of height of wire; (2) great lateral steadiness; (3) small air resistance, and (4) small inertia, so as to follow easily any change in height of the overhead wire. About sixty different pantagraph constructions have been tested by the author, and the results are given in tabulations and curves. While it is American practice to maintain an average pressure of 11 kg. per square centimeter of the pantagraph against the wire, French railways use only 4 kg. to 8 kg. per square centimeter. The second part of the paper describes a number of catenary wire suspension systems, as used in Europe and in America. Several pages contain valuable construction details with exact drawings of overhead constructions of French 12,000-volt alternating-current lines.—*Revue Générale de l'Electricité*, Aug. 6, 13 and 20, 1921.

Installations, Systems and Appliances

The Hydro-Electric Plant on the Glomfjord.—G. TROELTSCH.—Situated 20 miles beyond the Arctic Circle on the Glomfjord, in Norway, a water-driven power plant of more than 75,000 hp. has recently been finished which supplies energy for metallurgical purposes. Two, and later three, steel pipes, 2,000 mm. down to 1,400 mm. in diameter, carry each 5.72 cu.m. of water per second to the power house under a useful head of 442 m. The station contains two 25,000-hp. and one 27,500-hp. turbine, with room for one more of the latter capacity. The article deals only with the hydraulic part of the plant, describing in particular the design of the waterwheels, which are adapted for the largest turbines used in Europe, built by J. M. Voith. The turbines are of the double-runner Pelton type, each runner being actuated by a single jet of water 260 mm. in diameter. The wheels have a diameter of 3.4 m. and are equipped with twenty-two buckets each. Of special interest is the novel double-action regulator, which actuates the customary needle in each nozzle and also a jet deflector. In case of a sudden decrease of the load the regulator first partly deflects the jets, then advances the needles, and after the jets have been thus adjusted to the proper volume the deflectors are swung back again, resulting in a great economy of water. The regulator is driven by a belt from the main shaft. If, for some reason, the belt should break or slip off the pulley, a small auxiliary Pelton turbine is automatically started up to maintain the drive of the regulator. Another novel feature is a hydraulic brake on the wheels, enabling the operator to stop the turbine quickly. This consists of two small water jets which can be directed against the backs of the buckets. Tests on the turbines in place showed a highest efficiency of 88.2 per cent. A sudden decrease of the load from 27,500 hp. to 4,500 hp. caused an increase in speed of only 8.8 per cent.—*Zeitschrift des Vereines Deutscher Ingenieure*, July 2, 1921.



ELEVATION AND PLAN OF HYDRO-ELECTRIC PLANT IN ARCTIC CIRCLE

Electrochemistry and Batteries

Regeneration of Manganese-Dioxide Dry-Battery Electrodes.—A method of reclaiming the electrodes of dry cells instead of discarding them. Experiments tend to show that the cleaning of the electrodes and the removing of the deposits clogging the pores of the bag and of the depolarizer are more important than the actual reoxidation of the maganese. This is fortunate, for the reoxidation cannot be effected by the simple chemical means.—London *Engineering*, Sept. 2, 1921.

Electrophysics and Magnetism

The Magnetic Electron.—ARTHUR H. COMPTON.—The author reviews the different lines of evidence from which information concerning the nature of the elementary magnet has been gained. He concludes that the electron itself, spinning like a tiny gyroscope, is probably the ultimate magnetic particle.—*Journal Franklin Institute*, August, 1921.

Units, Measurements and Instruments

Innovations in Electric Measuring Instruments.—G. KEINATH.—As a consequence of the present large increase in cost of all electrical apparatus a great number of very poorly built measuring instruments were thrown on the German market, which forced the German electrotechnical association to establish certain standards of accuracy and to designate visibly every instrument which met these requirements. The author describes in detail the latest designs of short-circuit-proof current transformers up to 100,000 amp., high-frequency ammeters as used in radio work of the iron type, and the hot-wire-type electrostatic voltmeters with compressed nitrogen insulation and with series air condensers, multiple-phase wattmeters, frequency meters, instruments with two movements to register the relation between two variables, and finally instruments for remote indication and registration of pressure temperature and the flow of gases.—*Elektrotechnische Zeitschrift*, Aug. 18, 1921.

Telegraphy, Telephony and Signals

A High-Frequency Machine of Greater Specific Power and Higher Efficiency.—MARIUS LATOUR.—A machine marketed by the Société Française Radio-Electrique is described which is a homoplar machine with a reduced number of stator slots. In the case of this machine it is possible to minimize the iron losses in the stator by not utilizing entirely the available space for the copper and by increasing the cross-section of the teeth at the bottom of the slots in such a manner as to decrease the magnetic induction.—*Radio Review*, August, 1921.

News of the Industry

Chronicle of Important Events and General Activities in the
Technical, Commercial and Manufacturing Fields With Announcements and
Reports of Association Meetings and Conventions

Co-operative Study of California Water Powers May Be Made

IF A SATISFACTORY arrangement can be made, the Federal Power Commission will co-operate with California in the study of the water-power resources of that state. The executive secretary was authorized to expend $15,000 to cover the expenses of the Federal Power Commission's participation in this work. The State of California has appropriated $200,000 for the study.

Unemployment Conference Under Way This Week

THE "unemployment conference" called by President Harding got under way in Washington on Monday. The meeting, which was under the direction of Secretary Hoover, was told by the President that he had little enthusiasm for any proposed relief in the way of charity from the national treasury. The conference rather is to seek the causes of lack of employment and suggest some constructive means whereby it can be lessened.

Secretary Hoover stated that the questions before the conference fell under the following broad phases:

A determination of the volume and distribution of non-employment.

A determination of what emergency measures should be undertaken to provide employment and to mitigate the suffering that may arise during the next winter and the method of organization for their application.

A consideration and a statement of what measures must be taken to restore our commerce and employment to normal, or, to put it in another way, what obstacles need to be removed to promote business recovery.

In opening the conference President Harding was most optimistic over the outcome, saying:

"There are no problems affecting our national life and the welfare of the American people which we cannot and will not solve. If we fail today, we will try again tomorrow. There has been vast unemployment before and will be again. There will be depression after inflation, just as surely as the tides ebb and flow, but we can mitigate, we can shorten duration, we can commit all America to relief, and all America has never failed when committed to a common cause. If out of your councils there comes a remedy which all America helpfully may apply today, it may be helpfully employed some time again when similar conditions are encountered.

"It is fair to say that you are not asked to solve the long controverted problems of our special system. We have builded the America of today on the fundamentals of economic, industrial and political life which made us what we are, and the temple requires no remaking now. We are incontestably sound. We are constitutionally strong. We are merely depressed after the fever, and we want to know the way to speediest and dependable convalescence. When we know the way, everybody in America, capital and labor, employer and employee, captains of industry and the privates in the trenches, will go over the top in the advance drive of peace. Frankly, it is difficult to know whether we have reached that bedrock to which reaction runs before the upward course begins, but here are representatives of the forces which make for all we are or ever can be, and your soundings ought to be reliable.

"I would have little enthusiasm for any proposed relief which seeks either palliation or tonic from the public treasury. The excess of stimulation from that source is to be reckoned a cause of trouble rather than a source of cure. We should achieve but little in a remedial way if we continued to excite a contributing cause."

The initial efforts of the conference were directed to meeting emergency needs of the employment situation, after which were to come recommendations for permanent measures for holding non-employment at a minimum. The sechedule called for public hearings throughout the week.

Pacific Coast Division of N. E. L. A. to Change Name

A GENERAL meeting of the Pacific Coast Division of the National Electric Light Association is to be held in November to consider a change in the name of the division. It is proposed that the new name be "Pacific Coast Electrical Association." It is not the intention to change the present relations of the section with the national organization, but merely to use a name which, it is said, will be more indicative of the character of the division and less cumbersome. Other matters affecting the general scope of the division are also to be decided at the forthcoming meeting, which is to be held in Del Monte, Cal.

Hearing on Accounting Rules Before Federal Power Commission

THE Federal Power Commission gives notice that on Monday, Oct. 17, at 10 a.m., a hearing will be held in room 2220, Interior Building, Eighteenth and F Streets, N. W., Washington, before O. C. Merrill, executive secretary, on the adoption of rules and regulations for the establishment and maintenance of a system of accounts for licensees under the federal water-power act. A tentative draft of proposed accounting rules and regulations was printed and circulated, for purposes of discussion only, under date of June 7, 1921. Any one desiring to offer criticisms or suggestions concerning the proposals contained in this draft or to make a statement or argument with respect to the matters to be considered at the hearing will be given an opportunity to be heard.

Great Lakes Section Discusses the Electric Range

THE effect of the electric range on the investment in service facilities was inquired into during the discussions at the convention of the Great Lakes Section of the National Electric Light Association at French Lick Springs, Ind., last week from the standpoint of the plant and distribution-line equipment as separate units. This is because it was recognized that the problem presented by a plant having its maximum load during the hours of the day when lighting is necessary and the one presented by the plant with a maximum load during the daylight hours because of industrial operations is decidedly different. The discussion brought out that it is necessary to analyze the situation in any given case and consider the effect on the two parts of the system before a correct conclusion as to the cost of service and proper rates can be arrived at. Although station capacities may be increased owing to the imposition of the cooking and appliance loads on the peak, the residential distribution system is less frequently affected. The discussion also laid emphasis on the tendency observable in the station-load curves of so many stations to reflect the effect of washing and ironing in the development of a marked peak in the residential load on Tuesdays, with a gradual fall in the magnitude of the peak during the following days until the arrival of the next Tuesday.

That investment in the training of employees of public utilities for public service must not be considered as an expense was the view of Fred R. Jenkins in discussing the training of employees. It is a necessary part of the business and must have the unqualified support of the executives.

Class Legislation Denounced

George M. Barnard of the Public Utilities Commission of Indiana on Thursday morning spoke on "Public Service," strongly denouncing the tendencies toward class legislation that have been displayed in legislative bodies and asserting that government will always be just what the people make it. A strong plea for every man to do his duty in public affairs was made. The poor policy of going before a commission without first going before the public interested and trying to obtain approval of policies it is desired to inaugurate was dwelt on by Martin J. Insull in discussing the public relations work of the N. E. L. A.

The Consumers' Power Company in Michigan as a pioneer in the development of high-voltage transmission was the theme of H. J. Burton, who gave the date of the first use of 110 kv. on that system as 1907 and said the construction of the present 140-kv. system began in 1910, the lines at that voltage being put in operation in 1912. At present the company has in operation more than 1,300 miles of high-voltage lines, of which 526 miles is operated at 140 kv. The system is divided into two parts, the western part being operated at 30 cycles and the eastern at 60 cycles. The system extends from a point north of Saginaw Bay on the east to Manistee on the west, the form being that of a U with the southern limits at Jackson and Kalamazoo. The two parts are tied together through a 15,000-kva. frequency changer at the Battle Creek plant.

J. M. Gilchrist called attention to the need of watching the water powers of the Middle West to prevent their falling into the hands of visionaries and "blue sky artists." Such sites as are possible of development should be developed with a view to including them in the existing systems, and all the existing systems should be developed with a view to an ultimate scheme of tying the systems together with the least loss of investment and the least cost of reconstruction necessary to make them effective parts of the combined system.

F. A. Bryan pointed to the danger that exists from public overconfidence in the use of water power to reduce the cost of service, pointing to cases in which promoters have been able to sell large amounts of securities on projects that cannot be developed at all. E. J. Condon cited one instance in which $175,000 in worthless securities had been sold to the farmers and other local people on a proposition that was not worth development. Misleading ideas as to the cost of developing water-power projects also received attention and were cited as the cause of financial embarrassment to the utilities that had undertaken their development in the belief that they were commercially feasible, only to find that they cost more than it is possible to earn on them.

Mail Order Method Favored

Mail-order methods rather than the methods of the investment banker were favored by F. H. Scheel in the sale of securities to customers. This is because the data on financial affairs that appeal to the customer of the investment banker are not understood by the man to whom the salesman handling utility securities in small lots makes his sales. The methods adopted must be based more on human interest than on purely financial appeal. The talk and discussion on customer ownership included a strong warning against the sale of any securities that were in any way subject to doubt. Mr. Scheel said that there had been no difficulties encountered with the partial-payment plan despite the presence on the books of the Insull properties, which he represents, of nearly 45,000 such accounts. Steps toward making the junior securities of utilities the most popular form of securities were urged, and the possibility of using these sales as a means of bridging the gap between the first-mortgage securities that can be taken down and the cost of construction was shown by J. M. Gilchrist and also by President Bump of the National Electric Light Association.

W. J. Canada outlined the progress in the inductive-interference work of the National Electric Light Association, and R. F. Schuchardt described the work and organization of the technical section.

President Bump and Executive Manager Aylesworth of the National Electric Light Association were the principal speakers at the annual banquet on Friday evening. President Bump pointed out the present strong position of the central-station companies in that they are undeveloped while other industries as a whole are overdeveloped. He spoke against the optimism that leads to "playing safe" at the expense of future development as a policy that will prevent meeting and solving the future problems of the industry as they must be solved if other industries progress as they should. The electrical industry was viewed by Mr. Bump as the key industry of the industrial world that must lead because it is so placed that it is capable of guiding the others.

Probabilities of Permanent Tariff Waning

THERE is every indication that the federal administration is rather lukewarm toward the enactment of a permanent tariff this year. In official circles the opinion is freely expressed that conditions throughout the world are too chaotic to make it possible to foretell exactly what is needed. The basic condition on which a tariff is built—cost of manufacturing elsewhere as compared with manufacturing costs in this country—fluctuates because of exchange conditions, and little can be foretold as to the future. Therefore it is held that no dependable and permanent tariff can be built on such an unstable foundation.

With reference to the American valuation plan, against which opposition has developed, the administration is moving cautiously. The sum of $100,000 has been appropriated to investigate this device and otherwise determine what might be done to help toward writing a permanent tariff. It is hoped that some of the difficulties will be removed after the disarmament conference has taken place and when peace with Germany has been declared. Surface indications are, however, that the President views tariff legislation at this time as a detriment instead of a help to the nation. The change in the make-up of the tariff commission is also indicative of lack of harmony on principles and policy.

Municipal Electricians Urged to Uphold National Electrical Code

THE twenty-sixth annual convention of the International Association of Municipal Electricians, held at Colorado Springs, Sept. 6 to 9, was one of the most interesting, from the standpoint of papers discussed, held in several years. Several amendments were adopted for presentation to the National Board of Fire Underwriters with regard to fire-alarm installation rules. This was in continuation of a discussion held in the 1920 convention.

Among the important papers read was one on "Paper Insulation Versus Rubber Insulation for Fire and Police Underground Cables," by T. P. Sandiford, city electrician, Savannah, Ga. It was the general opinion that local conditions have much to do with the proper kind of insulation and that in some cases paper insulation can be used successfully, especially in police signal systems, although many prefer rubber-insulated fire-alarm cables.

W. S. Boyd, secretary of the Western Association of Electrical Inspectors, in a paper entitled "The Relation of the National Electrical Code to the Electrical Industry," deplored the action of the engineering press in giving voice to any arraignment of the code and urged the upholding of the code by every means. Upon his suggestion a resolution was adopted in which the association pledged itself to recognize the National Electrical Code as the standard for electric wiring.

Other papers related to street lighting, traffic signals, fire-alarm and police-telegraph systems.

The election of officers resulted as follows: President, W. R. Arbuckle, superintendent fire and police telegraph, Bayonne, N. J.; first vice-president, Charles P. Steinmetz, Schenectady, N. Y.; second vice-president, J. L. Caldwell, superintendent fire alarm, Colorado Springs; third vice-president, D. R. Snyder, superintendent electrical department, Augusta, Ga.; fourth vice-president, John Southwell, superintendent fire alarm, Beaumont, Tex.; secretary, Clarence R. George, Houston, Tex. (re-elected for twelfth consecutive term); treasurer, William Crane, city electrician, Erie, Pa.

New York's Electrical Show Emphasizes Electric Home Appeal

WITH emphasis on household use rather than industrial application, the fourteenth annual New York Electrical Show opened Wednesday evening in the Seventy-first Regiment Armory to run for ten days. Approximately 450 appliances are being demonstrated in the eighty exhibits that compose the exposition. As usual, the management has arranged a number of special features which attract considerable attention, not the least of which is the "home electric" with the electrified furniture wired under the direction of Joseph F. Becker, commercial manager of the United Electric Light & Power Company, and who is chairman of the new N. E. L. A. committee that is developing this idea.

The elimination tournament for the American open wireless championship was held this week, and other wireless features helped to stimulate public interest in the show.

Electric trucks have a prominent place at the show, as might be expected, since New York City is the greatest single electric transportation market.

The management of the show is particularly pleased over the interest shown this year. Never before, it is stated, was the demand for space so insistent. As a result all of the available space was disposed of at an early date.

Iron and Steel Men Discuss Development in Electric Main-Roll Drive

DECIDED economies were claimed for the electric motor as applied to main-roll drive in steel mills when compared with steam drive, in the report of the electrical development committee of the Association of Iron and Steel Electrical Engineers submitted at the convention of that body in Chicago last week. It is perfectly feasible to operate an electrically driven blooming mill with two men in the pulpit as compared with the minimum of three required by steam operation, the committee declared, and several instances were cited to back the statement. One 40-in. mill at Sparrows Point, Md., has been successfully operated since last April without slowing up the work of the mill in any respect. In the case of a 60-in. reversing plate mill two operators handle the mill as against a minimum of four for the steam-operated mills at other plants.

An important event noted by the committee is the replacement this year of a twin-tandem reversing engine driving the first finishing stand of the Lackawanna rail mill by an 8,000-hp., 50-deg. motor which, it is said, has the highest continuous horsepower capacity of any electric reversing drive in the world. It was designed to roll the first four of the last five passes on a 150-lb. rail section at the rate of 240 gross tons per hour. The maximum production so far has been at the rate of 198 gross tons per hour, exceeding all previous tonnage records on this mill. The last pass is made in an adjacent mill driven by a separate engine, but the record was made with the last finishing stand disconnected from its engine and connected to the first finishing stand so that the motor was rolling five instead of four passes.

The committee also noted the tapping of the first heats from two 40-ton Heroult furnaces at the government armor plant, Charleston, W. Va., on Feb. 2 of this year. These furnaces take molten steel from basic open-hearth furnaces and complete the refining, producing a very high-class steel. A new design of contactor with which some plants have experienced a life of fifteen to twenty times that of the older designs is noted in control equipment. The committee stated as its opinion that probably the greatest single opportunity for electrical development in the steel industry at the present time lies in the steel-plant railroad field. Thus far this field has gone little beyond the investigation stage.

Induction-Motor Starting

In dealing with the induction-motor starting developments Millard C. Spencer described a form of compensator in which the second rush of current experienced with the ordinary form of compensator is reduced. A certain percentage of the line voltage is applied to the motor terminals by means of two auto-transformers connected in open delta in the usual way. The second step is to disconnect a portion of the auto-transformer windings, leaving the remainder connected as choke coils, which in turn are short-circuited and finally disconnected from the line entirely. The method has the advantage of keeping power on the motor during the entire sequence of operations, considerably reducing the sparking at the switch contacts, as the entire circuit is never opened. Another means is a signal device by which the operator may know when the current drawn by the motor has reached a low enough value to make it safe to throw the starter from the starting to the running position. Mr. Spencer said that recent developments in induction-motor starting designs seem to be toward strict interchangeability throughout, simplification of the wiring, complete accessibility of all parts and the design of overload relays as temperature-operated devices, rather than mechanical time-limit devices for protecting motors against injury due to overheating.

A saving of 23 per cent in fixed costs, a return of 10.5 per cent on the investment in battery locomotives and a saving of 41 per cent, with a return on the investment of 16.9 per cent on straight electric locomotives as compared with steam locomotives, was shown in the paper by R. B. Gebhardt, electrical superintendent of the Bethlehem Steel Company at the Sparrows Point plant, in his study of the electrification of a steel-plant railroad having a total trackage of 57 miles and using a total of twenty-seven steam locomotives ranging from 75 tons in size to 25 tons. Twenty-seven battery or twenty-three straight electric locomotives were assumed as necessary to do the work. For standardization purposes and flexibility of operation the author assumed that the locomotives would be of either 40-ton or 80-ton size, the latter being made up of two 40-ton locomotives.

With the yard electrified, Mr. Gebhardt indicated the next step as the electrification of the locomotive cranes. The greatest item of saving in this case would be in the additional amount of work that would be done, since experience shows that the general average of lost time due to the cranes having to drop their work and go for water is 50 per cent of the total. The author reached the conclusion that the third rail is the most satisfactory system, owing to the elimination of the interference from overhead trolley wires in the yard. He prefers the underneath-contact type of third rail because of the ease with which it can be guarded and points to a record of many years' use of this construction without accidents on blast furnace trestles. He regards 250 volts direct current as the rating most suitable for use with yard locomotives. The use of a higher voltage would introduce hazards that would be considerably more difficult to handle. Where the third rail may be objectionable for special reasons, Mr. Gebhardt proposes the use of reels on the locomotives to carry 500 ft. or less of service cable.

The educational committee presented a "Crane Operators' Manual" as a result of its year of work. In addition to instructions in operating matters and inspection, the manual includes some elementary theory of electric operation and operating instructions for knife, magnetic and limit switches, fuses and overhead relays.

The committee on electric furnaces concluded that just as good steel can be made using dual voltages as with one voltage, provided that the melting voltage is not too high. It also held that better economies can be secured electrically and from refractories with dual voltages. A total of 356 electric steel furnaces was reported for this country on Jan. 1, 1921, and the committee believed that the number had not been increased up to the date of the report. The committee stated its belief that, owing to conditions in the industrial field, the year 1921 will go down in history as the low-water mark in the growth of the electric furnace since the beginning of its advance more than ten years ago.

Specifications of Standardization Committee

The standardization committee presented specifications for electric overhead traveling cranes and also the reports of the sub-committees on motors and illumination. There was some criticism of the crane specifications as too liberal, the committee having made them general to permit of all possible leeway in purchasing and still insure that the builders would conform to standard specifications and put the bids on a competitive basis. The report of the sub-committee on motors showed that the general specifications for alternating-current motors have been revised and further revision will not be necessary until there are further developments in the art. Uniform dimensions for direct-current mill-type auxiliary motors were suggested, and also a reduction in the number of sizes to eight, ranging from 10 hp. to 150 hp. The discussion favored seven sizes ranging from 6 hp., a size frequently large enough for crane operation, to 175 hp. The 50-deg. motor rating for alternating-current auxiliary-service motors with the 40-deg. rating shown on the nameplate was recommended. For direct-current motors other than the standard mill type used in the auxiliary service the 40-deg. rating for motors using class A insulation was indorsed.

The officers elected were: President, W. S. Hall, Illinois Steel Company; first vice-president, R. B. Gebhardt, Bethlehem Steel Company; second vice-president, L. F. Galbraith, West Penn Steel Company; treasurer, James Parrington, La Belle Iron Works; secretary, J. F. Kelly, Pittsburgh. The new directors will be R. R. Sheppard, Steel & Tube Company of America; I. N. Tull, McKinney Steel Company; F. H. Woodhull, Lukens Steel Company, and W. H. Gilbert, Tennessee Coal, Iron & Railroad Company.

Society for Electrical Development Announces Christmas Campaign

With the mailing to the trade of a folder describing plans and selling helps the Society for Electrical Development is about to launch its seventh annual campaign to help the electrical industry promote the buying of electrical Christmas gifts. The first page of the announcement will carry a greeting and a few comments from William L. Goodwin.

The three major selling helps offered by the society this year are, according to its announcement: (1) An elaborate set of window display cut-outs; (2) a set of store and window display cards including one large card with eight smaller price or suggestion cards; (3) an eight-page folder including an invitation to visit the dealer's store together with many illustrated gift suggestions. This is designed to be mailed to prospective customers, to be inclosed with letters or distributed at the store.

The keynote of the campaign is expressed by the slogan, "Bring back business by getting busy selling."

Progress in Lighting Told at I. E. S. Convention

The outstanding features of the fifteenth annual convention of the Illuminating Engineering Society, held in Rochester, N. Y., this week, were a brief report on the Paris meeting of the International Commission on Illumination, the presentation of an amplified lighting code, the announcement of a new light source, and the report on progress in lighting. Among other valuable contributions to the literature of illumination there were a classical report on the effect of light intensity and composition on ocular functions and some valuable statistics on the relation between illumination and traffic accidents. In all, twenty-six papers, for the most part of a scientific nature, were presented.

The International Commission on Illumination, which was attended by delegates from Great Britain, France, Switzerland, Spain and Italy, decided on the definitions of three of the fundamental ideas of illumination and the corresponding units, namely, the lumen, the lux and the international candle. This decision is considered by the Illuminating Engineering Society as a long step toward general international concordance on technical ideas. The addition of tables for classifying light sources from the standpoint of glare was considered the greatest single contribution to the revised code of lighting.

The new light source which was announced is called the neon-tungsten arc-incandescent lamp and consists of two slightly separated helical tungsten electrodes inclosed by a bulb containing neon gas. The lamp is self-starting, commencing with a reddish corona discharge which gradually develops into an intense white light.

In the report on progress in lighting, which contained seventy-three pages, it was pointed out that while developments in light sources have not been marked, considerable improvement of searchlamps is going on. Some cities have proceeded with street-lighting improvements despite business conditions, two new types of street lighting having been reported. A big step forward has been made by standardization of fixture accessories.

Among the social functions of the convention were the president's reception and dance on Monday evening in the ballroom of the Rochester Club, automobile trips to various places of civic and engineering interest, a banquet at the Powers Hotel, where the convention was held, on Wednesday evening, and the induction of the president-elect, Dr. George S. Crampton. Between 150 and 200 persons attended the convention.

September Financing Shows Indications of Easier Money

During the month of September the total amount of stocks and bonds of the electric light and power companies offered to investors equaled $40,560,000, the figure denoting almost twice the total reported for August and an increase of more than $14,000,000 over September of last year. Attention is called to the low yield on several of the issues. For example, on an issue of $13,500,000 offered by the Toledo Edison Company the per cent yield was only 7.33. The month's flotation is again characterized for the most part by long-term investments and also by two unusually high single issues—the issue of $13,500,000 just referred to and a nine-million-dollar issue offered by the Consolidated Gas, Electric Light & Power Company of Baltimore, yielding 7.35 per cent. An issue of a quarter of a million of ten-year 8 per cent bonds of the Pacific Power & Light Company sold at a premium.

Name of Company	Amount of Issue	Period	Class of Security	Purpose of Issue	Rate of Interest	Per Cent Yield	Offered At
Standard Gas & Electric Co	$3,500,000	20-yr	Secured sinking-fund gold bonds	Payment of notes	7½	8.10	94
Pacific Power & Light Co	250,000	10-yr	First lien and general mortgage gold bonds of 1920		8	7.90	100
Nevada California Electric Corp	100,000	10-yr	Convertible debentures of 1916		6	8.55	90
Appalachian Power Co	2,500,000	15-yr	Secured gold bonds	To retire maturing notes	7	8.15	90
Puget Sound Power & Light Co	1,000,000	5-yr	Gold coupon notes	Expansion and development	8		
Toledo Traction, Light & Power Co	2,500,000	1½-yr	First lien gold bonds		7	8.40	98
Consumers' Power Co. (Michigan).....	1,500,000	15-yr.	General and refunding mortgage gold bonds, series B		7	7.50	95
Midland Counties Public Service Corp	800,000	35-yr.	General and refunding mortgage gold bonds	Refund floating debt	7½	7½	Par
Northern States Power Co. (Minnesota)	1,500,000	20½-yr	First and refunding mortgage bonds of 1916		6	6.75	92
Toledo Edison Co....................	13,500,000	20-yr.	First mortgage gold bonds		7	7.33	96
	2,500,000		Prior preferred stock cumulative, series A		8	8.15	98
Western States Gas & Electric Co. (California).....................	600,000	6½-yr.	Gold notes of 1917	Retire floating debt and extensions and additions	6	8.30	90
El Paso Electric Co	750,000	4-yr	Gold notes, series A of 1920		7	8	96
Lexington Utilities Co	560,000	15-yr	First lien and refunding gold bonds, series B	Extensions and improvements to property	6	8	83
Consolidated Gas, Electric Light & Power Co. of Baltimore........	9,000,000	10-yr	First refunding mortgage sinking fund gold bonds, series [illegible] convertible	New construction	7	7.35	97
Total	$40,560,000						

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest

"Brighter Brooklyn" Movement Inaugurated.—Municipal authorities and other prominent citizens of the borough of Brooklyn, in New York City, are promoting a movement for better illumination. As a first step in this "Brighter Brooklyn" project there was held a week or two ago a celebration on the occasion of floodlighting the tower of the Borough Hall. Addresses were made by officials of the borough as well as by G. H. Stickney, representing the Edison Lamp Works.

Electricity Comes to the Aid of Motion-Picture Patrons.—The difficulty of finding a seat in a dark and well-filled motion-picture house has been done away with in a large Los Angeles theater by a master electrical board situated in the lobby containing a small light bulb for each seat in the auditorium, arranged according to rows. Each of these bulbs is connected with its corresponding seat by a wire. When a pressure greater than thirty pounds is brought to bear on the seat, the electrical contact is broken and the light on the board goes out.

Electric Vehicles Gaining Popularity in Italy.—The great hydro-electric development going on in Italy has led to a marked cheapening of electrical power in that country, and this in turn has resulted in a distinct increase in the number of electrically driven vehicles, particularly for heavy traffic. Electric vehicles are, according to the London *Engineer*, especially popular in Milan, where several electric garages have been established which operate electric omnibuses for most of the large hotels and conduct a regular express trucking service between Milan and Bergamo. A company has been formed, with a capital of 3,000,000 lire, to manufacture and sell electric vehicles.

Electrical Energy from Wind Power.—An interesting method of tackling the problem set by the small wind-power electric generating plant has, according to *Engineering*, been developed by a British manufacturing company. In place of the usual fan or wind wheel of fairly large diameter set at the top of a latticed tower and driving a dynamo through gearing, a number of small dynamos with impellers mounted directly on their spindles are employed. The dynamos are carried at the top of the tower, which consists simply of a tubular pole with a tubular cross-bar on which the machinery is mounted. The dynamos are each rated at 40 watts and are self-regulating for battery charging, which is commenced with a wind of 15 miles an hour. Output increases with an increase in the velocity of the wind, and it is claimed that power may be obtained during high winds and gales that would make it necessary to disconnect the ordinary apparatus. A feature of the system is an automatic cut-out which breaks the connection when the wind falls below the desired velocity and establishes it again when the velocity increases.

Hydro-Electricity in Finland.—Details of the hydro-electric possibilities of the Imatra group of rapids in Finland reported by a British vice-consul say that these water-power sources are among the most important in the country. They are on the Vucksen River between Lakes Saima and Ladoga. The Saima system has a water area of about 60,000 sq.km., and the difference in level between Lake Saima and Lake Ladoga is more than 65 m., nearly all of which falls in a distance of 24 km., where there are ten different rapids. Of all the potential power a very small part is yet developed.

Denver's First Electrical Home.—Through the efforts of the Electrical Co-operative League of Denver a desirable boulevard building site 2½ miles from the business center was purchased and construction of the city's first electrical home started early in September. It is planned to have the house completed and furnished so as to be ready for exhibition about Thanksgiving time. S. W. Bishop, executive manager of the league, was elected secretary and treasurer of the twenty-five-thousand-dollar corporation that is erecting the seven-room house, which is of Spanish architecture and will have more than a hundred outlets.

Some Ancient Electrical History.—Few electrical men think of the electric light as going further back than Edison's first experiments in the "seventies," but here comes an antiquarian who, writing for the *Electrical Times* of London, recounts some striking experiments made in the "thirties" and "forties" with no better equipment than primary batteries. The real début of the electric light, he says, was in 1836, when it was employed to produce the effect of the rising sun at the Paris opera house. The first really important results were produced in 1843, when four or five thousand persons saw an illumination in the Place de la Concorde, Paris, that dimmed the surrounding gaslights and made it possible to read moderate-sized print at a distance of a hundred yards from the light source. Four years later "the evening gazers in London were astonished by the occasional flashes of intense light thrown out upon them from elevated spots. At one time it was the National Gallery, at another the north tower of Hungerford Bridge, at another the Duke of York's column, at another the Polytechnic Institution, which was made the theater for the exhibition of these results, and for a time the talk of the town was the electric light and its marvels."

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

American Association of Operating Engineers.—The second regular meeting of this association will be held with the Alabama Power Company, Oct. 6, 7 and 8, at Birmingham, Ala.

Institute of Radio Engineers. — The Institute of Radio Engineers will meet on Wednesday, Oct. 5, at 8:15 p.m., in the Engineering Societies Building, New York City. A paper on "A New Rectifier" will be presented by V. Bush and C. G. Smith.

A. I. E. E., Providence Section.—S. O. Hayes, electrical engineer with the Westinghouse Electric & Manufacturing Company, will discuss "European Practice in Electrical Switch Gear and Transmission" before this section of the Institute on Friday, Oct. 7, at 8 p.m.

American Electric Railway Association Convention.—The program of the A. E. R. A. convention to be held at Atlantic City next week from Monday to Friday is divided between general sessions and sessions of the Engineering Association, the Claims Association, the Transportation and Traffic Association and the Accountants' Association. Among the engineering features will be the reports of the committees on heavy electric traction, power generation and power distribution. Of these three committees the chairmen are respectively Sidney Withington, electrical engineer New York, New Haven & Hartford Railroad; A. B. Stitzer, chief engineer Republic Engineers, Inc., New York City, and Charles R. Harte, construction engineer Connecticut Company, New Haven, Conn. George B. Muldaur, general agent Underwriters' Laboratories, New York City, will present a paper on the work of the laboratories. Secretary of Commerce Hoover has been invited to address the convention on the use of electric railways in improving industrial efficiency.

Coming Meetings of Electrical and Other Technical Societies

American Electric Railway Association—Atlantic City, N. J., Oct. 3-7.

Indiana State Association of Electrical Contractors and Dealers—Indianapolis, Oct. 5 and 6.

Empire State Gas and Electric Association—Lake Placid, N. Y., Oct. 6 and 7.

National Association of Railway and Utilities Commissioners—Atlanta, Ga., Oct. 11-14.

N. E. L. A., Southeastern Section—Chattanooga, Tenn., Oct. 17-19.

A. I. E. E., New York Section—New York. Oct 19.

Electrical Supply Jobbers' Association, Atlantic Division—Philadelphia, Oct. 2[illegible]

A. I. and S. E. E., Philadelphia Section—Philadelphia, Nov. 5.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies

Unless Constitutional Question Is Clearly Raised Supreme Court Cannot Consider It.—An allegation that a certain statute was "unconstitutional and void," made in a personal injury suit (Johnson vs. Kansas City Electric Light Company), indicates nothing, according to the Kansas City Court of Appeals and does not give the State Supreme Court jurisdiction over an appeal from judgment, the rule being that a party attempting to raise a constitutional question must put his finger on the specific provision of the Constitution that he asserts to have been injured. (232 S. W. 1094.)*

Findings of Commission Not Res Judicata.—In annulling water rates fixed by the California Railroad Commission and appealed against in Stratton vs. that body, the Supreme Court of California said: "The Railroad Commission is essentially an administrative and legislative tribunal, and not a judicial tribunal in a strict sense, though many of its functions are quasi-judicial, so that its orders are not judgments and its findings of fact are not adjudications, and the facts found by it are not res judicata and as such finally and conclusively established between the parties for all purposes." (198 Pac. 1051.)

Powers of Pennsylvania Commission.—The Public Service Commission may, according to the decision of the Supreme Court of Pennsylvania in Coplay Cement Manufacturing Company vs. Public Service Commission of Pennsylvania, increase rates prior to the effective date of a previous increase pending the determination by the commission of a complaint against such prior increase, the commission having the power in such case to consolidate the several schedules of rate increases and to cause the complaint, the record and the evidence to be taken as a complaint, record and evidence in connection with the new rate. (114 At. 649.)

Liability for Lawful Act of Employee Causing Accident.—In a suit (Barva vs. United Telephone Company) brought against a telephone company to recover damages for injuries caused by a horse running away, the horse having been frightened when a telephone lineman tossed a glass insulator to another lineman on a pole, the Indiana Appellate Court held that the act of the lineman was a lawful one and that negligence could not be predicated upon it in the absence of evidence that the time, circumstances or manner of doing it manifested failure to exercise due care for the safety of others. (131 N. E. 794.)

Company Not Responsible for Death of Boy "Unlawfully" at Place Where He Was Killed.—In Roberts vs. Key West Electric Company damages were awarded in the trial court because of the death of a young boy who while climing on a shed belonging to the house where a playmate lived was killed by electricity escaping along a tin roof from an electric light wire from which insulation had been worn away. The Supreme Court of Florida reversed the verdict, holding that, the wires carrying only 110 volts and no complaint having been made, the company had been held to too high a degree of care, and also that the boy was not "lawfully" in the place where he was killed inasmuch as he had climbed the shed without invitation and after having been ordered away by his playmate, with whom he had quarreled. (89 So. 123.)

Responsibility for Contact Between Electric Lighting and Telephone Wires.—In Johnson vs. Kansas City Electric Light Company, damages awarded for injuries sustained by a builder who while in a vacant house came into contact with an uninsulated telephone wire against which a transmission line carrying 2,300 volts had sagged were sustained by the Kansas City (Mo.) Court of Appeals, which held that whether the electric company knew or should have known of the danger was a question for the jury, that it was not necessary to defendant's liability that it should have apprehended the particular injury which happened, that it was proper to instruct the jury on the company's duty of inspection, and that testimony introduced in rebuttal of medical testimony attributing plaintiff's condition in part to another cause was admissible and pertinent. (232 S. W. 1094.)

Commission Without Jurisdiction Over Lessor Companies.—The Supreme Court of Pennsylvania, in Philadelphia City Passenger Railway Company vs. Public Service Commission of Pennsylvania, found that the commission has no jurisdiction over a public service company which under legislative authority has leased its franchise and property to another corporation, since such a company has no rates to make or collect, no service to render the public and no facilities to furnish or extend. The commission has no jurisdiction over leases of public service property by one corporation to another or over the rate of rentals reserved thereby, since it is concerned only with the rendition of service by the operating company at reasonable rates, and it is immaterial if the operating company under its lease must pay an unreasonable rental to the lessor and is thereby prevented from earning a reasonable rate of return on its investment. (114 At. 142.)

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities

Extension of Service to Unprofitable Customers.—The Idaho Public Utilities Commission has refused to compel the Wood River Power Company to extend service to certain would-be customers at Ketchum, a summer resort which has only about 100 year-around residents. The complainants objected to the company's requiring prepayments and five-year contracts, but desired, on their own part, that cooking and heating service should be rendered them. This demand the commission found unreasonable, inasmuch as to meet it the company would have had to change its transmission system from single-phase to three-phase at an expense which the additional revenue would not justify. The commission found that cooking and heating service could not reasonably be required under present conditions.

Importance of Company Credit.—These observations on the desirability of a public utility's having a revenue sufficient to maintain its credit were made by the Maine Public Utilities Commission: "The matter of credit is of just as much importance to the customer as it is to the company. The company has no place to go for money except to its customers. If because of impaired credit a particular company is unable to obtain necessary funds except at an exorbitant rate of interest, the customers of that company must in some way contribute the income necessary to produce this interest, or else be willing to accept the kind of service capable of being rendered with impaired and more or less useless facilities. Under normal conditions the company whose credit and standing are good will be able to obtain necessary funds on better terms than a company whose standing is such that investors have need to be fearful not only of the payment of interest or dividends but also for the security of the principal. It follows that a company in good standing saves in interest charges or in the discount upon the sale of its securities a considerable sum each year. This means a saving to the customers; hence it is of advantage to each customer to have the company serving him in such a financial condition that that part of the operating expense which represents interest charges is as low as possible. It is also a fact that the employees of a company that is reasonably prosperous and is functioning properly have more heart and courage in their work than do the employees of a company that is just hanging on the ragged edge."

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*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel—Responsibilities and Association Appointments of Men Engaged in Professional, Executive, Operating and Commercial Branches of the Industry

James T. Hutchings, formerly president and general manager of the Rochester (N. Y.) Gas & Electric Company and now general manager of the United Gas Improvement Company of Philadelphia, was the subject of a biographical sketch in last week's "Men of the Industry." By an unfortunate error the portrait printed with the sketch of Mr. Hutchings was not his, but that of C. B. Hutchinson of the Southern California Edison Company. The ELECTRICAL WORLD prints herewith the picture that should have accompanied its notice of Mr. Hutchings and in the opposite column reproduces Mr. Hutchinson's picture with the sketch that had been prepared to accompany it. The editors tender to both gentlemen their apology for the mistake—one of the kind that even eternal vigilance cannot always prevent in the hurried and complicated processes of modern newspaper making.

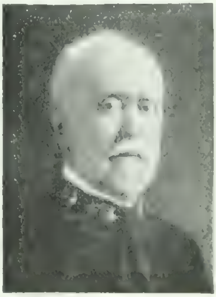
J. T. HUTCHINGS

J. C. Festerly, formerly of Canton, Ohio, has been appointed manager of the United Electric Company at Bucyrus, Ohio.

Hugh S. Riddell, who has been connected with the Greenfield (Mass.) Electric Light & Power Company for eleven years, for the greater part of the time as manager, has resigned on account of ill health.

George Shortmeier, formerly New York manager for the Madison Rubber Company and later district manager at New York for the Sinclair Oil Company, has been placed in charge of the New York office of the American Bosch Magneto Corporation, succeeding O. S. Stanley.

Robert Stanislaus Griffin, for more than eight years the head of the Bureau of Engineering of the Navy Department and engineer-in-chief of the United States Navy, terminated his long period of active service on Sept. 22 and retired to private life. Among the noteworthy accomplishments of Admiral Griffin is his introduction of electric propulsion on battleships, which was put into effect many years earlier than would have been the case had he been a less determined champion of that type of drive. In reviewing the work of the Bureau of Engineering under his administration Admiral Griffin subordinates everything else to the accomplishments of his organization during the war. The engineering features of the maintenance of an enormous fleet were carried out with a success which has called forth the highest praise from the British and the French. Among other developments of which Admiral Griffin can be justly proud is the work done by his bureau on radio. Under his direction high-powered stations have been built on the Isthmus, at San Diego, at Pearl Harbor, at Cavite and at Annapolis. The greatest achievement of all, however, was the erection of the world's most powerful station at Bordeaux. This great project was carried to satisfactory completion, despite the feverish haste which characterized every step of the work. Throughout his more than forty years in the naval service Admiral Griffin has been an active contender for an increased proportion of engineering talent in the navy personnel. He was born in Fredericksburg, Va., Sept. 27, 1857, and was graduated from the Naval Academy in 1878. He holds the degrees of doctor of engineering from the Stevens Institute of Technology and doctor of science from Columbia University. For his services during the war a distinguished service medal was awarded to him, he was made a commander of the Legion of Honor of France and was elected an honorary member of the American Society of Mechanical Engineers.



Harris & Ewing, Washington, D. C.

R. S. GRIFFIN

C. B. Hutchinson has recently been transferred from the San Pedro district of the Southern California Edison Company to its newly organized Fullerton district, where he will be the district manager. Mr. Hutchinson has spent almost his entire life in southern California, where he was formerly connected with the Salt Lake Railway Company in the operating and traffic departments. He resigned his position with that company in 1916 to enter the employ of the Southern California Edison Company, where he has served successively as salesman, assistant district manager and district manager.

C. B. HUTCHINSON

J. H. Sundmaker, for eight years chief engineer and director of all subsidiaries of the Ohio Electric Railway, with headquarters at Springfield, Ohio, has resigned and opened an office in Cincinnati as a consulting engineer.

Carl K. Chapin, formerly general manager of the Brady Utility Company, Memphis, Tenn., has been appointed Southwestern representative of the *Journal of Electricity and Western Industry*, with headquarters at Pasadena, Cal.

R. L. Ellis, formerly general manager of the Selma (Ala.) Lighting Company, is now manager of the Miami (Fla.) Beach Electric Company, which operates a small plant and furnishes power and street-railway service in Miami. Between the time Mr. Ellis resigned from the Selma Lighting Company and the taking up of his new duties he was engaged in war work and for about two and a half years was with the Semet Solvay Company.

Miss Olive A. Bursiel, secretary of the New England Division, National Electric Light Association, has been appointed a member of the woman's public information committee of the Public Relations National Section of the association, the object of which is to formulate and apply plans for the education of the women of the country in the fundamental economic principles of the electric light and power business and the interdependence of the public and the industry. Miss Bursiel is a native of Bedford, N. H., and is a graduate of the secretarial course of the Bryant & Stratton School, Boston. She entered the electrical industry about thirteen years ago as a stenographer for the New England Telephone & Telegraph Company in the engineering department at Boston and shortly afterward joined the staff of the Edison Electric Illuminating Company of Boston, almost immediately serving as secretary to the superintendent of the advertising department. In 1910 she became assistant secretary of the recently formed New England Section of the N. E. L. A. and in 1911 was appointed its secretary. The membership has since increased from 272 to 1,334, and there are now about twenty divisional committees, in the work of which Miss Bursiel is closely absorbed as well as in the general work of the division. To her loyalty, reliability, boundless and unflagging energy is due in no small measure the successful growth of the New England Division from small beginnings to its present influential status in national and regional electrical affairs. Miss Bursiel is a member of the Commonwealth Country Club and Woman's City Club of Boston, and of The Durant, Inc.

MISS OLIVE A. BURSILL

Carl F. Dietz, vice-president and sales manager of the Norton Company, Worcester, Mass., has resigned to become president and general manager of the Bridgeport (Conn.) Brass Company. He succeeds as president Fred J. Kingsbury of New Haven, who becomes chairman of the board of directors. Mr. Dietz has been connected with the Norton Company for ten years, first as plant engineer, then as assistant sales manager, and afterward as sales manager of the wheel division of the business. Two years ago, when the Norton Company and the Norton Grinding Company were consolidated, he was made vice-president and sales manager. He was born in New York, Feb. 12, 1880, was graduated from Stevens Institute of Technology in 1901, and subsequently took post-graduate courses in the Royal Technical College, Berlin, in sciences, metallurgy and mining. Early in his career he was employed for three years at plants of the United States Steel Corporation, largely in blast-furnace operation and large gas-engine installations. In 1905 he engaged in the development of zinc-smelting processes and later operated a mining lease in Utah, installing a dry method for concentrating lead-silver ores. He designed and built modern ore-milling plants for the American Glue Company as a part of its sandpaper factory at East Walpole Mass.; for the Grosselli Chemical Company, Park City, Utah, where the separation of iron and zinc sulphides was the problem, and for the Ozark Smelting & Mining Company, Magdalena, N. M., where zinc ore required concentration for paint making. In 1908 he joined the Minerals Separation, Ltd., London, as consulting engineer and in the interest of this company developed treatment methods at the Dunderland iron-ore deposits in Norway, north of the Arctic Circle, and studied ore treatment methods for properties in Russia, Bolivia, Australia and Africa. He put into operation the San Francisco del Oro mines in Mexico, yielding complex lead and silver ores. He is a member of the American Society of Mechanical Engineers and the American Institute of Mining and Metallurgical Engineers.

J. C. Van Duyne, who has not been in good health for some time, has resigned as auditor of the Brooklyn Edison Company and is taking a much-needed rest. Mr. Van Duyne was chairman of the Accounting Section of the N. E. L. A. during the last administration. He had been auditor of the Brooklyn Edison Company since Dec. 1, 1912. For seventeen years prior to that he was employed by the New York Edison Company, during the last nine years of which he was chief of the company's collection bureau.

J. C. VAN DUYNE

L. R. Wallis, newly appointed chairman of the Lighting Sales Bureau of the National Electric Light Association, is widely known in the central-station industry as a commercial executive and close student of service economics. He is a native of Beverly, Mass., and first entered the electrical business in January, 1888, at that time being associated with the Bernstein Electric Company of Boston. Later he was New England agent for the Buckeye Electric Company of Cleveland. In 1891 Mr. Wallis entered the electric light and power field as manager of the Wakefield (Mass.) Gas & Electric Company. Three years later the company sold its plant to the town, and Mr. Wallis, with others who had been interested in the development of the Wakefield property, built a new gas plant at Laconia, N. H. In 1897 he returned to Massachusetts as manager and treasurer of the Woburn Light, Heat & Power Company and was personally in charge of the building of its generating plant. In 1903 this property was purchased by the Edison Electric Illuminating Company of Boston, and in 1906 Mr. Wallis became associated with that organization. For the past eleven years he has been superintendent of the sales department. He has been interested in the development of the New England Division, N. E. L. A., since its organization and has been active in the work of the national body. Last year he was chairman of the committee on the compensation of salesmen and vice-chairman of the Lighting Sales Bureau. He is a member of the Illuminating Engineering Society, the Boston City Club, and also of the committee on industrial lighting of the Association of Edison Electric Illuminating Companies.

L. R. WALLIS

Arthur J. Carpenter has become manager of the Westchester Electric Supply Company at Tarrytown, N. Y.

Trade and Market Conditions

Business Reviews, Together with Market Letters
from Important Trade Centers, on the Supply, Demand and Prevailing Prices of
Electrical Apparatus and Supplies

Westinghouse Business Estimated at 65 per Cent of Last Year's Rate

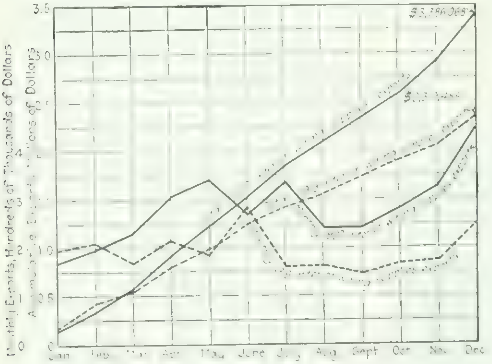
WESTINGHOUSE Electric & Manufacturing Company for its fiscal year ended March 31, 1921, showed billings of just under $151,000,000. Estimates of incoming business for the present year place business at the rate of $100,000,000, indicating that orders are running at the rate of almost 67 per cent of last year's business. The opinions expressed by the men of this company in the field show an evenly divided feeling that the bottom of the buying trend has been reached and that the fall business will show improvement.

A further reduction in pay roll has been announced to take effect Oct. 1. This will take the form of a reduction in salaries to a maximum of 10 per cent based on a sliding scale recognizing length of service and rate of increase during the last five years. A 10 per cent reduction will be placed on ordinary labor. On March 11 last a wage reduction of 15 per cent became effective.

Wiring-Device Exports of 1920 Were 46 per Cent Above 1919

AN ANALYSIS of the exports of interior wiring supplies, including fixtures, for the calendar year 1920 shows some interesting figures in regard to the markets for this class of electrical equipment. In the first place, the value of these exports in 1920 was $3,386,068, an increase of 46 per cent over the exports of the year 1919, when they amounted to $2,319,485. In 1918 the value was $1,428,615, a figure which was surpassed in 1920 by 113 per cent.

The general trend of the curves of monthly exports for the two years of 1920 and 1919 is virtually the same over the last six months of each year, except that the monthly values of the last three months in 1920 increased more rapidly than over the same period of 1919.



SIMILAR MONTHS FOLLOW SAME GENERAL TREND DURING MOST OF YEAR

In the accompanying table, figures for which were compiled by the ELECTRICAL WORLD from data received from the Bureau of Foreign and Domestic Commerce, it is shown that in the year 1920 twenty-three countries imported American-made interior wiring devices and fixtures in amounts over $25,000. These countries took virtually 90 per cent of the American exports, while the 10 per cent remaining were divided up between fifty-four other countries totaling less than $25,000.

The North American continent, including Panama and Cuba, imported $1,589,697 worth, 47 per cent of the total exports. Canada was the highest importing country, with $956,739 worth, the next country being Cuba, a very poor second. The remainder of the list are separated by only relatively small amounts. Mexico, in this commodity as in others, is ranking high in imports.

EXPORTS OF INTERIOR WIRING DEVICES IN 1920

Canada	$956,739	Spain	$47,655
Cuba	379,325	Panama	44,541
Brazil	253,193	Norway	43,268
Mexico	209,292	Uruguay	36,919
Argentina	148,398	Dutch East Indies	35,065
Philippine Islands	125,954	Italy	33,4[illegible]7
China	120,382	Hong Kong	32,531
England	115,878	Sweden	30,721
Australia	101,045	Belgium	26,998
France	76,938	Fifty-four other countries importing interior wiring supplies	342,4[illegible]3
Peru	63,246		
Colombia	57,398		
Japan	53,851		
Chile	51,011	Total	$3,386,068

South American countries took 18 per cent of all the exports, or $610,165 in value, embracing in the list six of the principal states on that continent—Argentina, Brazil, Chile, Colombia, Peru and Uruguay. The European states of England, France, Belgium, Spain, Italy, Norway and Sweden took a total value in wiring devices of $374,865, 11 per cent of the total. China, Japan and Hong Kong imported 6 per cent, and the Philippine Islands, Dutch East Indies and Australia took 7.7 per cent of the total.

Range Manufacturers Show Increasing Sales for 1921

FROM the expressions of several manufacturers of electric ranges, the sale of these ranges for the year 1921 is expected to surpass that of 1920 by a large margin. On the other hand, the expression is heard that 1921 sales will not even equal, much less exceed, those of last year. Representative opinions show that range sales over the first seven or eight months of this year have surpassed those of the same period of 1920 by from 25 to 200 per cent. The latter figure, however, is an extreme case, figures from 25 to 50 per cent being in the majority.

Different parts of the country are affected differently in this matter, depending to a large extent upon the attitude of central-station companies toward electric range business. Of course, with the help and backing of the utility it would be expected that the sales would increase, and some companies have been very active in this direction. On the other hand, where the utilities have discouraged the sales it is generally because their lines are already loaded and they have no additional capacity to turn into them.

One range manufacturer reports some utilities as refusing to be interested in any appliances that cannot be attached to lamp sockets. Another reports central-station companies generally active in making range sales, realizing the value of this load. Other reports balance one another in a somewhat similar way, showing the attitude manufacturers can be forced into because of varying local conditions. Still, it seems that more utilities are willing to push range sales this year than was the case last year

At the same time, the value of dealer education and dealer sales is being realized to a greater extent, whether there is co-operation with the central-station company or not.

In many quarters manufacturers, distributers and dealers came into this year with large stocks of ranges, and now that these are reported to be pretty well lowered, the manufacturers should come in for a little more business.

Let one case in point be used to illustrate the result of central-station activity in range sales. A leading Mid-Western utility reports that its range sales over the first six months of 1921 were 20 per cent greater than for the entire year of 1920, and that its range connections during that six-month period were 30 per cent greater than for all of 1920. The overlap was due to contractor-dealer sales. It is thought by this company that the contractor-dealers would not have sold 5 per cent of the ranges they did sell had it not been for the educational and sales work of the central-station company.

This fact must not be lost sight of, namely, that sales campaigns put on by central-station companies invariably lead to larger sales by the other branches of the trade. Consequently it would seem to be to the advantage of the range manufacturer to lend every bit of assistance possible to the electric light and power company in seeing that all range salesmen know their subject thoroughly, as it is felt that the crux of the whole situation is personal salesmanship and demonstration. At the same time, dealer salesmen in the same territory should get the same help.

August Electrical Exports Amount to $6,057,489

Although the value of August exports of electrical machinery and appliances was over a million dollars less than that of August, 1920, such figures as are available as to quantities indicate that there has been practically no decrease in the volume of exports. August, 1921, figures are $6,057,489, while August, 1920, returned $7,110,285. Exports for July, 1921, were valued at $6,417,336.

Since March of this year the value of electrical exports each succeeding month has declined only a relatively small amount. March was 28 per cent below February, April 7.8 per cent below March, May 4.8 per cent below April, and June 4.8 per cent below May. July exports fell off 14 per cent below those of June, but August has dropped again, the amount being 6 per cent. Apparently the low part of the curve is being reached.

	August		Eight Months Ended—August	
	1920	1921	1920	1921
Batteries	$444,859	$175,878	$4,277,326	$2,986,401
Carbons	174,910	27,110	966,598	304,904
Dynamos and generators	659,200	641,818	4,193,364	5,149,937
Fans	54,911	32,233	860,501	1,161,936
Heating and cooking apparatus	118,817	69,660	1,164,877	1,323,476
Insulating wire and cable	420,208	305,829	4,662,652	7,351,851
Interior wiring supplies	241,425	69,386	2,093,126	1,502,402
Arc lamps	711	184	16,324	8,698
Carbon-filament lamps	2,787	8,051	66,553	112,948
Metal-filament lamps	213,615	86,746	2,512,437	2,738,976
Magnetos, spark plugs, etc.	169,543	71,145	2,393,687	1,063,224
Meters and measuring instruments	152,696	116,820	1,677,969	2,156,510
Motors	845,839	959,773	7,668,715	12,935,073
Rheostats and controllers	30,818	64,456	1,128,295	841,324
Switches and accessories	283,900	184,555	2,766,189	3,510,355
Telegraph apparatus	31,903	26,697	443,341	820,610
Telephones	218,073	321,887	2,348,098	3,810,093
Transformers	721,507	796,292	2,771,693	6,626,943
All others	2,324,563	2,098,969	19,010,332	21,862,158
Total	$7,110,285	$6,057,489	$61,022,347	$76,293,819

A close comparison can be made between the months of July and August of this year. Exports increased in value in August over July on such items as heating and cooking apparatus, arc lamps, rheostats and controllers, telephones, transformers and miscellaneous equipment.

Taking the eight months of this year, the total value of exports comes to $76,293,819; the value over the same period of last year amounts to $61,022,347. Consequently to date this year the value of electrical exports is 25 per cent ahead of the same period of last year, and the rate of exporting for this year is at more than $9,000,000 per month, or about $114,440,000 for the whole year, an increase of over 11 per cent above 1920. But it is probable that during the next four months the value of exports will not increase sufficiently fast to attain this total, as not all the low prices have been represented in these exports. The volume of exports, however, is much further above that of last year than is represented in the figures for values.

Figures in the attached table have been received from the Bureau of Foreign and Domestic Commerce, Washington, D. C.

More No. 14 Rubber-Covered Wire Being Made

The demand for rubber-covered wire as such is still relatively low, but the demand for Nos. 10, 12 and 14 has been increasing of late. In the case of No. 14, the typical size for lighting-circuit work, the demand has increased not so much for use with rigid conduit or for open-wiring work but for use in flexible armored conductor. This material has been used in increasing amounts for house wiring this year, and in general it has made a larger call on the No. 14 wire, although the larger sizes too have been used.

The reason for the increased demand for Nos. 10 and 12 rubber-covered wire is that larger feeders and circuits are necessary owing to the increasing use of heating and motor-driven appliances.

Telephone extension work has been progressing at a high rate, and this in turn has increased the demand for the size of wire used for that purpose in making the run from the street to the premises.

Metal Market Situation

The main feature in the copper market is continued firmness of the metal and its general position is considered good. The ruling price in the producers' market has strengthened to 12.37½ cents a pound for electrolytic, delivered, for spot and early October. November is held at 12.50 cents and December at 12.75 cents.

Demand has improved considerably, one large consumer having taken about 5,000,000 lbs. early this week; he is in the market for still more. Consumers are more active in placing orders to take care of late fourth quarter deliveries. The outside market is not getting much of the business placed because of relatively low stocks in these hands.

The outside market likewise feels the strength of the metal and is quoting 12.25 cents at the refinery, which brings the delivered price to above 12.37½ cents for early October. That market is about on a level with the producers' market for the rest of the last quarter year.

Consumers are not satisfied that these prices should rule in October and are offering to buy at figures somewhat below those quoted, feeling that 12.25 cents is enough for October. They realize that there is a coming increase in demand for fall business and are quite desirous of making their own prices at this time.

Late last week the principal lead producer added another 5 points to the price, bringing New York spot to 4.70 cents.

NEW YORK METAL MARKET PRICES

	Sept. 20, 1921	Sept. 27, 1921
Copper		
London, standard spot	£ s d 67 15 0	£ s d 68 0 0
	Cents per Pound	Cents per Pound
Prime Lake	12 25	12 25
Electrolytic	12 25	12 37½
Casting	11 75	11 75
Wire base	13 75	13 75
Lead, Am. S. & R. Co. price	4 65	4 70
Antimony	4 45	4 60
Nickel, ingot	41 00	41 00
Sheet zinc, f. o. b. smelter	10 00	10 00
Zinc, spot	4 67½	4 87½
Tin, Straits	26 50	26 75
Aluminum, 98 to 99 per cent	24 50	24 50

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	9 62½ — 10 12½	9 75 — 10 50
Brass, heavy	4 75 — 4 00	4 75 — 5 00
Brass, light	4 00 — 4 25	4 25 — 4 50
Lead, heavy	3 37½ — 3 50	3 50 — 3 75
Zinc, old scrap	2 00 — 2 37½	2 00 — 2 37½

THE WEEK
IN TRADE

Prices When Quoted Are Those Prevailing at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for all Eastern Points

THE outlook for fall buying in the electrical trade is getting a little better each week. No reverses are noted this week, and most of the districts report better business. New York jobbers show a better flow of business, with special emphasis on wiring materials, heating devices and air heaters. Boston business is gradually improving, small orders to the jobbing trade being maintained. Textile, shoe, rubber and metal trades are improving. Motor inquiries are on a better plane in New England, and rubber-covered and weatherproof wires are reacting to a better demand.

Industrial business shows a little more activity in St. Louis, and pole-line equipment for short extensions is moving. Textile mills in the Atlanta district are running strong, farmers are purchasing for cash, and optimism for the fall is running strong.

The Northwest and West Coast States report bumper crops with shipments well under way. In California sales of air heaters, washing machines and electric ranges have been good, and in the Northwest States there has been an industrial revival to a slight degree. Lumber production has been better. The improvement has been noticeable in air heaters, lamps, reflectors and wiring materials for residential work. The Intermountain region has been active in home building, and much of this class of construction is just about ready to provide a market for electrical appliances.

NEW YORK

Jobbers are unanimous this week in reporting better business. As stated last week, orders not only continue to come through in greater numbers but individual orders are for larger quantities of material. Another encouraging sign is the statement by one jobber that he has found it necessary to increase the force in his shipping department to take care of additional business. Further sales of flexible armored conductor in large quantities have been reported, and buying all along the line is of a more confident nature. The demand for wiring materials of all kinds is more active.

Some further improvement was shown this week in heating appliances. Air heaters are beginning to move, and dealers are ordering for immediate and some future delivery. Other heating devices are moving better, with flatirons and toasters showing the most activity.

Most jobbers report collections fair to good, although some state that they still have a number of outstanding accounts. Credit is being extended with a great deal of caution and new accounts are watched very carefully.

Conduit.—Prices on this material remain virtually the same as last week, when new discounts amounting to about a 7 per cent price reduction were announced. Jobbers quoted the following prices: For ½-in. black pipe in 2,500-ft. lots, $54.23 to $55; ¾-in., $69.92 to $70.79, and 1-in., $99.96 to $101.42 per 1,000 ft. Galvanized pipe in the same sizes is quoted at $59.33 to $62, $76.82 to $81 and $110.16 to $116 per 1,000 ft. Demand is fair and jobbers report more activity than last week; however, there is little tendency to large orders. Stocks are fair to good.

Flexible Armored Conductor.—Buying of this material has increased, and several orders for large quantities have been placed, indicating that the trade believes present prices are as low as may be expected. No. 14, two-wire, single-strip, is quoted at $43 per 1,000 ft. in lots of that quantity, and double-strip at $44.50 per 1,000 ft. Jobbers' stocks for the most part are good.

Rubber-Covered Wire.—No change in the price of rubber-covered wire was noted this week, although there is a feeling among jobbers that prices will not go lower. No. 14 rubber-covered is quoted at $6 to $6.16 per 1,000 ft. in 5,000-ft. lots. Stocks are good to large in nearly all sizes.

Outlet Boxes.—New discounts have become effective on outlet boxes. Black boxes in lots of 1,000 are quoted at 57 per cent off list and galvanized boxes in the same quantity at 53 per cent off list. In lots of 100, black boxes are quoted at 55 per cent and galvanized at 50 per cent off list.

Loom.—So far no increase in the price of this material has been announced, although cotton has increased materially. In 1,000-ft. lots the $\frac{7}{32}$-in. size is quoted at $19.25 and the ¼-in. size at $21.

Heaters.—With the cooler weather of the past week there has been some activity in the sale of heaters. Jobbers report that dealers are placing orders for moderate stocks and the outlook is good in this line.

Heating Appliances.—Irons and toasters continue to furnish the most activity among the heating appliances. Other appliances are sluggish—dealers apparently holding off as long as possible before placing orders for holiday stocks. Jobbers' stocks of appliances, other than the two above named, are fair, but manufacturers' stocks are said to be low.

Tape.—Demand is moderate and in line with that for other wiring supplies. In 100-lb. lots friction tape sells for 36c. per lb. and rubber tape for 40c. per lb.

BOSTON

Business is gradually improving, notwithstanding sporadic labor difficulties in the building industry. New building and engineering contracts in New England for the week ended Sept. 20 totaled $2,487,900. Jobbers in the electrical supply field report a well-maintained flow of small orders and some improvement in larger orders placed. Collections are slower in the Connecticut territory but are holding up well at Boston when sharply watched. Jobbers' stocks are widely reduced in most lines. Textile mills in this region are more active and retail trade begins to respond to fall influences. Rubber manufacturers are active and the shoe industry is doing well. The metal-working industries still lag behind others in recuperation, but there is a tendency toward more activity not evident a few weeks ago.

Lamps.—Increased interest in portable lamps and fixtures is noticed and sign lighting is slightly more active. Stocks are ample and prices firm except where close competition in window displays exist.

Motors.—Inquiries are decidedly better this week and many propositions are being figured. One jobber lost a 50-hp. motor order recently because a four-weeks' delivery was quoted instead of a stock shipment. Small-order business prevails, but its diversification warrants close attention to prompt shipment possibilities.

Wire.—The demand is slightly better on weatherproof and rubber-covered, with some movement of bare after long dullness. No. 14 rubber-covered sells at $6.25 per 1,000 ft. in 5,000-ft. to 25,000-ft. lots, prices being open above the latter figure. Weatherproof is moving moderately around 15 cents base and bare is quoted about 14¼ cents base. A leading jobber closed a 34 000-lb. order for bare copper wire for central-station line work within a few days.

Flexible Armored Conductor.—In 2,500-ft. lots, No. 14 sells at $45 per 1,000 ft., with fair demand and stocks easily meeting present requirements.

Non-Metallic Flexible Conduit.—Increases in the cost of cotton have not as yet affected the quotations current on this material. Up-country business is fairly active, the $\frac{7}{32}$-in. size selling at $17.50 and the ½-in. size at $20 per 1,000 ft. in 5,000-ft. lots.

Washers.—The demand is good, but recent price changes downward have aroused some complaint that the jobber's margin of profit is less than it should be. The continued high cost of labor combined with vigorous sales effort is moving many machines this fall.

Rigid Conduit.—Prices are easier, and on orders over 5,000 lb. an open market prevails. Representative prices, with good stocks, are: Black conduit, 1-in., $100.58 per 1,000 ft.; ½-in., $54.53; galvanized, 1-in., $110.76; ½-in., $59.63—all under 5,000 lb. The demand is somewhat improved.

Conduit Fittings.—These are moving better. The new price sheets show as follows for representative sizes: Elbows, per 100, 1-in. black, $25.58; ½-in. black, $13.14; 1-in. galvanized, $27.80 per 100, and ½-in., galvanized, $14.28. The corresponding coupling prices are: Black, 1-in., $9 per $100, and ½-in., $4.84 per 100; galvanized, $9.77 for 1-in. and $5.26 for ½-in. per 100.

Transformers.—A more active market on small sizes is reported.

Porcelain Fittings.—Uneasy prices without much change from last week are reported. The market is absorbing larger quantities of this material owing to the moderate increase in building construction and active maintenance work in progress.

ATLANTA

Optimism as regards the outlook for the near future continues, though small-town merchants and bankers state that the money realized from the sale of cotton and other agricultural products is not being applied to any great extent on outstanding debts; rather, the farmers are making cash purchases with the proceeds available to date. The opinion is expressed, however, that this is a perfectly natural situation and that it is only a matter of a short time before the proceeds from cotton will be used extensively to cancel outstanding obligations and this will start a general revival of business in this section. All of the textile mills are back on full time with some operating double shift. Electrical supply jobbers report their business as showing a reasonable increase over the past two weeks, the increase, however, being spasmodic, each little peak being slightly in excess of its predecessor. Large numbers of small orders are being received daily, and the small purchasers, contrary to the usual custom, are asking for quotations before placing firm orders for material. Several very attractive orders have been received during the past week from industrials, and buying by industrials and municipal plants continues to increase, most of the purchases being for maintenance purposes. Collections are showing improvement, and jobbers report most of their credit sales on the sixty-day basis.

Meters.—The policy of the small plants in abolishing flat-rate service has caused a very brisk demand for the popular-size meters. One of the largest jobbers estimates that 90 to 95 per cent of orders received are for the two-wire, 5-amp. type. Stocks in this line are somewhat low but are being replenished by good shipments.

Lamp Cord.—Jobbers are placing comparatively heavy orders to replace depleted stocks. Retailers report the movement satisfactory with no change in price for the past two weeks.

Panelboards.—Several heavy orders were reported last week, most of the sales going to motion-picture houses and theaters that are nearing completion. Sales to apartment houses, office and commercial buildings, however, are slow.

Storage Batteries.—This line reflects the increased business in the rural districts and respectable orders are being received. The increase in number of automobiles throughout the section and the return to use of numbers of machines that have been laid up is strengthening the market. Some manufacturers have made sharp reductions in prices.

Oil Switches.—This line, together with equipment for industrial plants, has not shown any noticeable activity of late. Stocks are plentiful throughout the section.

Conduit.—The past thirty days have witnessed the best movement in this line for the last six months, the movement being particularly brisk in the smaller sizes, especially 1-in. galvanized and black. All sizes are on hand in quantity with the exception of 1-in., stocks of which have bcome depleted in some localities. A price reduction of 4 per cent was noted last week.

Schedule Material.—This seems to be on a little firmer basis than two weeks ago, though taken as a whole it is not showing the activity that should be expected of it. A slight price reduction in certain lines was announced last week.

Cross-Arms.—Carload lots are moving very satisfactorily, but there is a shortage of orders for less-than-carload lots. Pine arms show a price reduction of 5 per cent, but fir arms are steady. Heavy stocks are on hand.

Inter-Phones.—This line is rather sluggish, such orders as are being received calling for the cheaper class of material. No price change of recent date is to be noted and stocks are in good shape.

ST. LOUIS

Although a large number of factors tending to affect the development of electrical sales here have been noticed, the net result of last week's business was about the same as that for several weeks past. The buying by municipal plants, which was fairly active for some time, shows a tendency to slow down. Industrial business, on the other hand, shows improvement, particularly in St. Louis, where it has been very quiet for several months. Several sales of engine-generator sets to out-of-town plants have been made. The utility companies are purchasing rather large amounts of poles, transformers, lightning arresters and meters for use in short extensions. Appliances show steady increases in sales. Inquiries are becoming more numerous and for more attractive amounts, and it is generally believed that business will continue to show a steady, though slow, improvement.

The metal industry, which had been very stagnant, shows substantial improvement. Planing mills and furniture factories are running somewhat heavier. Owing to the better condition of credit, the principal buying is being done by Illinois, Missouri and Iowa. Some improvement is noticed in the South, particularly Kentucky, but no change can yet be directly attributed to the improved cotton market. Considerable attention is being given by the manufacturers to the development of the Mexican trade.

Conduit.—Following the four-point increase in discounts some concerns are making special prices on the ½-in. size, the black being priced at $51 per 1,000 ft. and the galvanized at $56, both in bundle lots of 100 ft. Sales are slightly better, and stocks, with a few exceptions, are in good shape.

Wire.—With the expectation of a stiffening in wire prices there has been some improvement in sales. No. 14 rubber-covered is slightly lower in 5,000-ft. lots, the price being $6.25 per 1,000 ft. The price remains at $6.10 in 10,000-ft. lots. No. 6 double-braid stranded is quoted at $33.66 per 1,000 ft. in 5,000-ft. lots. The base price on bare and weatherproof varies from 14½ cents to 15 cents per pound. Stocks are in satisfactory condition.

Street-Lighting Cable.—There has been a fair demand, but municipalities are somewhat slow in making extensions. No. 8 solid single-conductor, 3,500-volt, is quoted at $140 per 1,000 ft., f.o.b. factory.

Lighting Standards.—Inquiries are being received in sufficient volume to indicate a desire to expand lighting systems, but because of existing tax rates it is proving difficult to have the necessary bonded indebtedness voted.

Lamp Cord.—Very little improvement in demand is reported, though the stocks are getting more in line. No. 18 cotton-covered generally sells for about $13 per 1,000 ft. in 5,000-ft. lots, and silk-covered ranges from $23 to $25 per 1,000 ft.

Air Compressors.—Good sales for the garage type are reported, and there is an improving demand for all stationary motor-driven machines. The portable compressors, however, are moving slowly.

Hammers and Drills.—A substantial improvement in sales is reported, particularly in southern Illinois, due in part to more construction work and also to increasing demand around the mines.

Pole-Line Material.—Inquiries that are being made indicate some improvement in demand within the next thirty days, but there has been a slackening in sales for the past two weeks. Most of the inquiries are for comparatively small amounts.

Transformers.—Central-station companies are making larger purchases to take care of the coming lighting loads and, to a lesser extent, to serve new industrials. Orders for transformers to serve small outlying towns are being obtained from a number of the utilities.

Meters.—Coincident with the improved transformer business, the demand for meters shows steady improvement. The residential lighting type is finding a particularly good market.

Lightning Arresters.—Sales of compression-type arresters continue in good volume. Better sales are also reported for substation installations by the larger power companies.

SAN FRANCISCO

Conditions, especially in the coast and interior valleys, are very prosperous, and one of the hottest seasons ever known following a spring of good rainfall is producing bumper crops. Moreover, the crops which were left over from last year are now being sold. The usual series of county fairs is in progress, and electrical men have taken care to have good representation. An electrical feature of these fairs is the number of electric range booths with capable salesmen and demonstrator in attendance. Farm plants are also featured. The oil production is seriously threatened by a strike now in progress in the Kern County fields. San Francisco and Oakland are fast recovering from the sixteen-week builders' strike, which resulted in a victory for the American plan.

Fans.—With the fan season now virtually closed, jobbers and dealers report the best season in many years, the main factor being a summer which, while it did not break any high heat records, was yet unusually hot for a long period. Stocks of all kinds are reduced to a few odd left-overs.

Radiators.—A few days of cold rain gave considerable impetus to radiator sales, but as yet the season has not really started. Jobbers have placed their orders as a basis for manufacture, and so far these advance orders have run pretty close to last season's orders, notwithstanding considerable unsold stock from last season.

Heating Material.—Iron sales are rather slow, notwithstanding that some companies have guaranteed present prices until Jan. 1. The heaviest overstock item is percolators, and Christmas holdovers are still mostly unsold. There is a good call in proportion for complete percolator outfits.

Washers.—Dealers from all sections of the state are reporting a 300 or 400 per cent increase in washer sales. There is a tendency to decrease the number of types and makes carried by dealers, although hand in hand with this tendency is an apparent standardization of the practice of carrying at least two contrasting styles.

Ranges.—The range campaign of the Great Western Power Company, based upon sales virtually at cost, has resulted in a sale of more than 100 heavy-duty pieces in the last couple of months. The Pacific Gas & Electric campaign, which is to be based upon dealers' participation, is still in process of organization.

SEATTLE—PORTLAND—SPOKANE

There is a continued feeling of optimism over the general business outlook throughout the Northwest generally. This feeling prevails in the electrical industry as well on the part of manufacturer, jobber and dealer. Increased shipping movement of crops, renewed activity in the lumber industry and a slight industrial revival are pointed to as tangible evidence of better times. Lumber production in Oregon and Washington for the week ended Sept. 17 was 20 per cent below normal. New business booked was about 10 per cent in excess of the cut and about 30 per cent in excess of the shipment. More cargo is being offered at the port of Portland than can be handled, particularly in lumber and grain, and imports are on the increase.

Electrical jobbers of Portland report a reduction of about 5 per cent in conduit prices. Bare copper wire is now selling on a 15½-cent base. Wiring devices and material are the most active at the present time, although lamps, reflectors and air heaters are showing marked improvement. Seattle jobbers see some improvement in sales—September is better than August and money is a little easier. Credits have improved slightly, but collections are still difficult to make and stand at from fifty-five to sixty days as compared with a normal period of perhaps forty-five days. Residence wiring is holding up well, but industrial business is not so good.

Portland reports credits apparently loosening and collections somewhat improved. Long-standing accounts are still in bad shape, but new accounts are being handled in a very satisfactory manner. Jobbers of Spokane report continued better business and anticipate a good fall. Stocks are ample and shipments are prompt. A car of high-tension insulators, a car of farm-lighting plants and a car of ranges are on the road, with a second car of ranges to be shipped soon. The territory around Spokane is absorbing more than a carload of ranges a month. Residence construction is active, many homes being wired during construction for electric ranges.

Contractor-dealers of Portland report the number of orders taken as materially greater than a year ago, although the volume of business does not show such an increase. Contractors have been buying short for so long because of the fall in prices that stocks are in a very depleted condition at the present time, and they are more actively in the market than they have been for several months past.

Wire.—Seattle quotes No. 14 rubber covered at $6.50 and No. 12 at $8.80 per 1,000 ft. in 5,000-ft. lots, with demand fair and stocks heavy.

Flexible Armored Conductor.—Demand is fair and stocks are in good shape. No. 14, 2-wire single and double strip, sells at $56.33 per 1,000 ft. in 2,500-ft. lots.

Knobs and Tubes.—Nail-it knobs are $21.60 per 1,000 in barrel lots and 5/16-in. tubes are as follows: 2½- and 3-in.. $7.74, and 4-in. $10.08, all per thousand in barrel lots.

Tape.—Demand is fair and stocks ample. Friction tape is quoted at $21.70 per 100 rolls and rubber at $19.44 in 200-roll lots.

SALT LAKE CITY—DENVER

The fall weather thus far has proved ideal for builders, and contracts are being pushed rapidly to completion. Hundreds of residential buildings will soon be in the market for prospective home owners, and the housing problem will be far less acute this winter than last. Excessively high rents are in part responsible for the persistent lack of buying activity. A new three-million-dollar hotel is projected for construction in Denver in the near future. The tourist traffic has been a saving factor for the Intermountain West. Denver in particular has been able to exploit this passing trade to a very profitable degree. Retailers report that their summer volume of sales compares favorably with corresponding business for the season of 1920.

Aid which the War Finance Corporation will be able to give Western stock growers will enable them to preserve their herds intact for winter fattening on feed that is cheaper than it has been in years. With a favorable winter they should be able to liquidate next spring and summer to good advantage. Wire mills report a better demand for their product. It is believed that prices on wire have about hit the bottom, a small reduction having been made within the past month.

Lamps.—Lamps are showing the usual September activity. Householders are buying in a steadily larger volume. Stocks are ample.

Air Heaters.—From present interest shown dealers expect a fair trade in this item. They are ordering in better quantities.

Manufacturers' Activities

Devoted to the Business Side of Manufacturing, Distribution
and Sales, News from Jobbers and Foreign Fields and a
Record of New Devices and Trade Literature

Western Electric Sales Nearly Up to Last Year's

Charles G. Du Bois, president of the Western Electric Company, has issued the following statement in connection with the 1921 business of that company:

"The Western Electric Company reports sales for the eight months ended Aug. 31 as approximately $122,000,000, or almost the same as for the similar period of 1920. Since the beginning of the year the company has reduced its floating debt by $7,500,000 and has increased its cash balance by $6,000,000, an improvement of $13,500,000 in its financial position."

Electric Machinery Company Opens New York Office

Following its purchase and reorganization last April, the Electric Machinery Manufacturing Company, Minneapolis, Minn., has started again the expansion of its distribution. To this end a New York office was opened early in September in the Grand Central Palace, Forty-sixth Street and Lexington Avenue, in charge of A. B. King, who was sales manager for the old Electric Machinery Company. Plans are under way to open offices as soon as practicable in the same cities where representation was held before.

Under the new ownership Silas McClure is president, and in a recent announcement he states that his company's prices on electrical apparatus are now closely comparable with 1914 prices. "Whatever decline may occur to reach that level promises to cover an extended period," he continues. The company specializes in the manufacture of synchronous motors and vertical alternators.

Rapid Turnover Discussed in U. S. Chamber of Commerce Booklet

"Merchandise Turnover and Stock Control" is the title of a booklet being distributed by the Domestic Distribution Department of the United States Chamber of Commerce, Washington, D. C. Therein is brought out the advantages of rapid turnover in business, and this fundamental principle of merchandise is emphasized in connection with a suggested plan of stock control records designed to reduce waste and losses which are due to slow movement of goods.

The department calls attention to seven separate directions in which losses may occur when merchandise is not turned over as rapidly as it might be. These are investment, interest, markdown, salaries and wages, shelf and storage room, prestige and reputation, and inefficiency, all of which the booklet takes up in detail. Two graphs help to bring home the points made.

Apex Adds Gould Ironer to Its Appliance Line

The Apex Electrical Distributing Company, Cleveland, announces its purchase of the Gould ironer, which it will manufacture hereafter under a new name in connection with the Apex electric suction cleaner and the Rotapex electric clothes washer.

The Gould ironer was the product of the Gould Appliance Company, New York City, and Benjamin Gould, president of the Eastern company, has joined the Apex organization in Cleveland to supervise the sale of the ironer.

With better factory facilities this ironer, it is announced, will be a greatly improved product, and the Apex Electrical Distributing Company plans to push its sales vigorously.

William F. Clarke to Represent M. W. Dunton in New York

The William F. Clarke Company, Singer Building, New York City, has been appointed exclusive representative of the M. W. Dunton Company, Providence, R. I., in the metropolitan territory, handling its lines of soldering flux known as "Nokorode," which is put in three forms, paste, salts and liquid, and also its "Red Rope Paper" for armature winding. The Clarke company is also considering taking on other lines in the near future. Stocks will not be carried at this address unless at some future time conditions should warrant it.

Mr. Clarke previously represented the Square D Company in New York and in Baltimore territory. He started in the electrical field with the Manhattan Electrical Supply Company, where he spent five years as assistant manager at the Forty-Second Street branch, New York City.

Manufacturer Sought to Make Canadian Dishwasher

The "Cosmo" Electric Company, 60 Bedford Row, Halifax, N. S., in issuing a folder on its "Cosmo" electric dishwashing machine, adds a request to be placed in communication with manufacturers who are in a position to make this machine for Canada or the United States.

Enlarged Organization and Capitalization of Jewell Electrical Instrument Company

Following out its policy of working carefully, conservatively and progressively, the Jewell Electrical Instrument Company, 1640 Walnut Street, Chicago, last May came to the point of development where with the increased demand for its instruments the company found it to its advantage to increase capitalization and enlarge its organization. The capitalization was increased to $150,000, all subscribed and paid in.

For the past twelve years Orval Simpson, president of the company, and Ray Simpson have held all the stock in the company, but on its increase in capitalization, although they still retain a very substantial control of the stock, a small portion has been sold to a few of the company executives. A. F. Klink, president of the Bryant Zinc Company, Chicago, a stockholder has been elected a director and also the treasurer of the Jewell Electrical Instrument Company.

Orval Simpson states that while his production is not back to normal, he is encouraged in that each month of this year has shown a conservative and continued increase in the volume and number of orders booked, and he feels that conditions are improving on a healthy and substantial basis.

New Plant for the North American Electric Lamp Company

The North American Electric Lamp Company, St. Louis, is erecting a new one-story factory containing 20,000 sq.ft. of floor space for the manufacture of carbon lamps. The machinery, which is now being installed, is reported to be of the most modern design, and the filament-treating equipment was designed by the company's own electrical engineers. Special care has been taken to obtain unusual efficiency in the exhausting machinery. The plant when completed will give employment to about a hundred hands.

Manufacturers Talk to Wetmore-Savage Men

A vigorous and well-attended sales conference was held at Boston Sept. 22-24, under the auspices of the Wetmore-Savage Company, electrical supply jobbers. In addition to business sessions at the Exchange Club, the conference also attended the exhibit of the Bureau for Better Illumination, in one of the old Massachusetts Institute of Technology Buildings. Among the speakers at the sales conference were: E. L. Bradbury, Holophane Glass Company; H. C. Bingham, Diamond Holfast Rubber Company; J. S. Lapp, Lapp Insulator Company; A. G. Kimball and C. F. Smith, Landers, Frary & Clark; R. V. Bingay, Pittsburgh Transformer Company; Warren A. Myers, Chief Engineer Stewart and W. W. Mumma, Robbins & Myers Company; George A. Burnham, Condit Electrical Manufacturing Company; Warren M. Heim, Hubbard & Company; G. V. Ingham, Bryant Electric Company; N. B. Missel, American Ever Ready Works; J. R. Wilkins, Economy Fuse & Manufacturing Company; J. H. Trumbull and L. L. Brastow, Trumbull Electric Manufacturing Company; Bon Clark, Brokaw-Eden Company; F. V. Burton, Henry D. Sears; M. Corcoran, Stanley & Patterson; R. C. Lanphier, Sangamo Electric Company; C. S. Beardsley, Apex Electrcial Distributing Company; K. S. Byrd, Manhattan Electrical Supply Company; W. H. Talkes, National Carbon Company; J. Patrick and Messrs. Johnson and Jensen, the Benjamin Electric Manufacturing Company, and Mr. Sullivan, Bryan-Marsh Company. That good sales will reward continued hard work was the general view expressed.

Pacific Radio Trade Association Formed to Help Amateur

With a slogan of "Better service to the radio amateur," the Pacific Radio Trade Association has been organized, with headquarters at San Francisco. Membership includes radio manufacturers, jobbers, dealers and advertisers. The prime purpose of the association, it is declared, is a co-operative effort to popularize the use of radio, and the first step in this direction will be a joint exhibit and demonstration of radio equipment at the California Industries Exposition, Nov. 19 to Dec. 20.

Arthur H. Halloran, editor of *Radio*, is president; Ellery W. Stone, Pacific Radio Supplies Company, is vice-president; Max Lowenthal, Globe Commercial Company, is secretary-treasurer. District No. 1 of the association comprises the northern part of California and Nevada; district No. 2 takes in the southern part of California, which is now in the process of organization; district No. 3 comprises Oregon and Washington, and District No. 4 takes in Utah and Idaho. Organization of these last two districts will be completed in the near future.

Export Convention to Have Large Foreign Representation

Plans are about completed for the twelfth annual convention of the American Manufacturers' Export Association, which will be held on Oct. 5 and 6 at the Waldorf-Astoria in New York City. It is expected that several of the recently appointed chiefs of the commodity divisions of the Bureau of Foreign and Domestic Commerce will be in attendance with whom manufacturers may discuss the sale of their products in foreign countries. The general theme of the convention is "How to Retain and Increase Export Trade."

An interesting feature will be the opportunity manufacturers will have of meeting representatives of foreign countries, thirty-one of which have sent trade ambassadors to advise regarding trade possibilities in their respective lands. Among the nations which will be so represented are Argentina, Belgium, Brązil, Bulgaria, Canada, Chile, China, Colombia, Costa Rica, Cuba, Czecho-Slovakia, Dominican Republic, Ecuador, Finland, Great Britain, Greece, Italy, Netherlands, Netherlands Colonies, Nicaragua, Norway, Poland, Persia, Peru, Philippine Islands, Salvador, Spain, Uruguay, Venezuela, Guatemala and Mexico.

"Problems of Exchange" has been assigned to Allen Walker, manager foreign trade bureau of Guaranty Trust Company. W. S. Kies, chairman of the board, First Federal Foreign Banking Association, will discuss "Foreign Credits and Investments." W. F. H. Koelsch, president National Association of Credit Men; J. S. Lawrence of Lawrence & Company, Boston, and Benjamin M. Anderson, Jr., Chase National Bank, New York, will discuss "Our Relation to the Present European Situation."

John H. Fahey, Boston, will speak on the "International Chamber of Commerce." Julius Klein, director of the Bureau of Foreign and Domestic Commerce, will speak on the work of that bureau. Judge John F. Zoller, General Electric Company, and Thomas J. Doherty, National Council of American Importers and Traders, Inc., will discuss "The Effect of the Tariff on Export Trade." Lawrence Langner, patent and trade-mark counsel of the association, will speak on "Competing for Foreign Trade With Trademarks." The evening of Oct. 6 has been set aside for the annual banquet.

United Lamp Penalizes Maker of Defective Lamps

The United Lamp Manufacturers' Corporation, 44 West Eighteenth Street, New York City, which opened for business on Aug. 1, has adopted a policy not only of guaranteeing its lamps but also of penalizing the manufacturers whose defective lamps may get into circulation through oversight of inspectors. The corporation was formed by eleven independent lamp manufacturers as a selling, distributing, purchasing and manufacturing control organization, to supply a complete line of incandescent lamps in uniform packing and of uniform high quality.

At a meeting of the factory managers on Aug. 8 A. E. Wiest, president of the corporation, said that it would be necessary to have the product up to the standards adopted by the middle of September as the uniform line of cartons would be ready for use at that time. As a matter of fact those cartons will not be ready until early in October, owing to a delay in printing. "After that time," said Mr. Wiest, "no lamps will be permitted by our inspectors to be packed in 'United' cartons that do not meet the tests required to insure a 'quality lamp.' On any lamps that upon delivery to our customers do prove defective you will be penalized 10 per cent of their value. If we do not make quality, we will not make lamps. An extra allowance of 10 per cent will be made to our jobbers on all 'United' lamps returned which inspection shows were actually defective in manufacture."

The last clause seems to protect the jobber for his trouble in handling complaints on defective lamps.

Oil Circuit Breakers for 220,000-Volt P. G. & E. Line

Announcement is made of further orders of electrical equipment for use on the 220,000-volt lines of the Pacific Gas & Electric Company. The Westinghouse Electric & Manufacturing Co., East Pittsburgh, is to supply six high-tension oil circuit breakers for this solidly grounded system.

G. E. Announces Further Pay Roll Reduction

Another reduction of 10 per cent in wages and salaries affecting all employees has been announced by the General Electric Company to take effect on Oct. 31. The announcement by E. W. Rice, Jr., president of the company, follows:

"In accordance with an order of the board of directors, a reduction of 10 per cent will be made as of Oct. 31, 1921, in the salaries of all officers and employees of the company. Heads of departments are requested to notify all those affected."

The General Electric Company has made several reductions since last January. The first reduction became effective Feb. 1, when the wages of day workers at the Schenectady plant were reduced 10 per cent and the pay of piece workers 10 per cent. The bonus system was also dropped.

In July another reduction of 10 to 30 per cent was announced. The working forces have been reduced in line with the company's plan of retrenchment.

The Southern Electrolyte Battery Company, New Orleans, La., has acquired a local building which it will remodel and equip for the manufacture of electric storage batteries.

The Ojax Battery Company, Canaseraga, N. Y., is planning to erect the second unit of its new electric battery manufacturing plant. The first unit has been completed and machinery will be installed at an early date.

The Midstates Engineering Company, Westminster Building, Chicago, has the agency from the Brown-Boveri Company, Baden, Switzerland, for the United States.

The J. T. Pearson Company has taken new quarters at 624 Dime Savings Bank Building, Detroit, where it has more spacious quarters. The company represents the United States Rubber Company, wire division; Central Tube Company, National Electric Porcelain Company, and the Steel City Electric Company.

The Oregon Insurance Rating Bureau, Portland, Ore., has issued the fifth edition of "Wiring Data for Direct and Alternating Current Motors," which supersedes all previous editions.

Foreign Trade Notes

GENERAL ELECTRIFICATION OF ITALIAN RAILWAYS UNDER WAY.—Work is proceeding actively on the general electrification of the Italian railways. At the end of August, 1920, ten roads, comprising a total of 797 km., had been equipped for electrical operation. From Sept. 1, 1920, to June 30, 1921, five additional roads, comprising a total of 234 km., were electrified. During the current year 434 km. of road will be electrified. At the end of August, 1920, the sole electric generating plant operated by the railways of the state was that of Mordegno, with a capacity of 5,000 hp. and normally working with about 3,800 hp. Various works have now been started and are being carried on and finished by means of designs and contracts approved recently by the second section of the Superior Council of Waters, and these will soon be submitted for the financial approval of the Council of Administration of the railways.

ESTABLISHMENT OF HYDRO-ELECTRIC PLANTS IN MEXICO.—The Mexican authorities, according to reports from Commissioner R. M. Connell, have for some time offered inducements for the establishment of hydro-electric plants in or near the Federal District, the plant of the existing power company being inadequate for the needs of the territory. A decree has been issued reducing federal taxes on the use of water for power and irrigation, and the press announces that two Mexicans have submitted a proposal for the erection of such a plant.

H. R. FORBES MACKAY, general manager of the municipal electricity department of Sydney, New South Wales, Australia, according to the *Electrician*, has been instructed by the City Council to visit Great Britain and America for the purpose of making investigations of the latest developments in electric generating and distributing systems. Mr. Mackay expects to arrive in London about the middle of October, where he will make his headquarters at the office of Preece, Cardew & Rider, 8 Queen Anne's Gate. The Sydney electric power project is a large undertaking, the capital expenditure being already nearly £4,500,000. Mr. Mackay has reported to the City Council that the next generating unit to be installed should be of about 16,000 kw., that it will take all the space available in the present power house, and that by 1925 a new power house should be in operation. It is largely in connection with the design of this proposed power house that Mr. Mackay is making his visit to Great Britain and America. He is especially interested in pulverized coal as fuel, automatic protection of high-tension cables, the latest developments of automatic stokers, steam turbines, use of extra-high steam pressures in boilers and methods of disposing of ash and clinker where coal is burned in large quantities.

HYDRO-ELECTRIC PROJECTS IN NETHERLANDS EAST INDIES. — While good progress is being made on hydro-electric projects in the Netherlands East Indies, new projects for further development of water power, according to *Eastern Engineering*, continue to be launched. Work on a 37,500-kw. power project in the Residency of Batavia, it is stated, was started last year. It is proposed that power shall be supplied from this station for operating the Batavia railway and furnishing electricity for light and power to the towns which the railway serves, including Tandjong, Priok, Batavia, Meister Cornelis, Buitenzorg and Soekaboemi. A plant is under construction in the Preanger Regencies to have an initial capacity of 2,475 kw. An additional reservoir is to be constructed so that the output of this station may be doubled. A power station is to be erected on a tributary of the Tjisadane, to the west of Buitenzorg, to develop between 18,650 kw and 21,000 kw.

PROPOSED MANUFACTURING PLANTS IN AUSTRALIA.—The question of establishing plants for manufacturing electrical machinery in Australia is being actively discussed, according to information furnished by Vice-Consul Fox at Melbourne, Australia. In discussing the feasibility of establishing factories of this kind in Australia, the newspapers point out that during the month of July equipment in connection with the Morwell central-station distribution project, amounting to about £1,500,000, was ordered from America. One of the companies mentioned as intending to establish large works in Australia is the English Electric Company of Australia, Ltd., which announced plans some time ago. The Commonwealth General Electric Company, Ltd., has recently announced that it will erect large works immediately at Spotswood, in Melbourne, for the manufacture of electric line equipment and other equipment ranging from steam turbines to small switches and including magnetos, storage batteries, electric furnaces, radio equipment, etc.

New Apparatus and Publications

ELECTRIC WASHER. — A springless oscillating-type washing machine is being marketed by the United Engine Company, Lansing, Mich.

POLYPHASE INDUCTION MOTORS.—Bulletin No. 1,118 issued by the Allis-Chalmers Manufacturing Company, Milwaukee, describes its new line of continuous-rated polyphase induction motors, including the type AR squirrel-cage line, which is now on the market, and its new type R potential starter.

ELECTRICAL INSTRUMENTS. — The Jewell Electrical Instrument Company, 1640 Walnut Street, Chicago, is distributing two circulars, one covering instruments for use in garages, battery and automobile service stations, and the other showing a new line of electrical instruments especially applicable to radio apparatus and supplies.

HYDRAULIC TURBINES.—The Worthington Pump & Machinery Corporation, 115 Broadway, New York City, is distributing bulletin No. 1, series 1, describing its different types of hydraulic turbines.

ELECTRIC VEHICLES.—The Ward Motor Vehicle Company, South Fulton Avenue, Mount Vernon, New York, is distributing a booklet entitled "Are You Willing to Face the Facts on Delivery Costs to Save 20 per Cent to 35 per Cent?", covering the use of electric motor vehicles for delivery service.

WASHING MACHINES.—The Woodrow Manufacturing Company, Newton, Iowa, has issued a leaflet describing the improved "Woodrow" washing machine.

ELECTRIC WASHING MACHINE.—The Voss Brothers Manufacturing Company, Davenport, Iowa, is distributing a leaflet describing the new Voss "Sea Wave" model B washer.

TOGGLE SWITCHES.—Bulletin No. 17-3 issued by Harvey Hubbell, Inc., Bridgeport, Conn., describes the "Hubbell" toggle switches with luminous tips.

WEIGHT CARDS.—The American Sheet & Tin Plate Company, Frick Building, Pittsburgh, has issued a new and revised set of weight cards covering black sheets, galvanized sheets and formed products.

PLATINUM. — Baker & Company, Inc., Newark, N. J., has issued the fourteenth edition of "Data Concerning Platinum."

FUEL-OIL ENGINES. — The Hadfield-Penfield Steel Company, Bucyrus, Ohio, has issued two catalogs describing and illustrating its Diesel-type horizontal and vertical standard fuel-oil engines.

New Incorporations

THE SAYLORSBURG (PA.) LIGHT & POWER COMPANY has been chartered under the state laws with a capital stock of $20,000 to operate an electric light and power system in that vicinity. Frank D. Shupp, Saylorsburg, is treasurer.

THE SIMPSONVILLE (KY.) LIGHTING COMPANY has been incorporated with a capital of $3,000 by W. P. Johnson, A. S. Frazier and W. C. Lyons, all of Simpsonville.

THE MECHANICAL & ELECTRICAL MANUFACTURING COMPANY, Bethel, Me., has been incorporated with a capital stock of $100,000 to manufacture and deal in electric water heaters, electric wiring rosettes, other devices and appliances for heating, etc. The directors of the company are Theodore Morin, Berlin, N. H., president and treasurer, Charles D. McLean and Peter E. Lemieux, Berlin, N. H.

THE CITIZENS' LIGHT & POWER COMPANY, Chrisney, Ind., has been incorporated by J. F. [illegible], L. E. [illegible], S. F. Tower and B. F. Huffman, to furnish electricity for light, heat and power.

THE MARKOE & WALLACE ELECTRICAL COMPANY, New York, N. Y., has been chartered with a capital stock of $5,000 to manufacture and deal in electrical equipment. The incorporators are R. Markoe, H. W. Wallace and F. J. Ashley. The company is represented by A. Males, 366 Broadway.

THE SHAMOKIN, ELDRED, CAMERON, RALPHO and ZERBE ELECTRIC COMPANIES, Allentown, Pa., have been chartered under the state laws with a capital stock of $5,000 each, to install and operate electric systems in Northumberland County. The companies are all controlled by the same interests. Among the incorporators are C. M. Walter, J. S. Wise, Jr., and L. K. Bingaman, Allentown.

THE GAS-ELECTRIC APPLIANCE COMPANY, Brooklyn, N. Y., has been incorporated with a capital stock of $20,000 to manufacture electrical and gas equipment and appliances. The incorporators are E. J. and T. E. Byrne and L. P. Doyle. The company is represented by Cullen & Dykman, 177 Montague Street.

THE HOBOKEN (N. J.) LIGHTING FIXTURE & SUPPLY COMPANY, 614 Washington Street, has been organized to manufacture electric lighting fixtures and kindred equipment. Benjamin Johns heads the company.

THE ELECTRIC AMUSEMENT COMPANY, Trenton, N. J., has been incorporated by Lehman H. Garrison and William C. Matlack, Trenton, and Henry S. Wilson, Jr., Philadelphia, Pa. The company is capitalized at $125,000 and proposes to manufacture electrically operated amusement devices.

THE KING RADIO COMPANY, Pittsburgh, Pa., has been incorporated with a capital stock of $10,000 to manufacture radio apparatus. The incorporators are E. W. T. King and G. H. Sharman, Pittsburgh, and M. W. Palmer, Wilkinsburg.

THE MYRON BURGLAR ALARM COMPANY, Louisville, Ky., has been chartered with a capital stock of $10,000 by Louis Isaacs, Jacob Landau and S. J. Levy.

THE BETTERTON (MD.) ICE & POWER COMPANY has been organized with a capital of $200,000 to operate an electric light and power plant for commercial service in Betterton. The company also proposes to build an ice-manufacturing plant. John Brice is interested in the company.

THE HOLT POWER-LIGHT COMPANY has filed articles of incorporation under the laws of Delaware with a capital stock of $2,000,000 to manufacture farm-lighting power plants. The incorporators are M. L. Rogers, L. R. Wilson and M. M. Nichols, Wilmington, Del.

THE RADIO SERVICE LABORATORIES have been chartered under the laws of New Jersey with a capital stock of $50,000 to manufacture equipment. The incorporators are Hobart A. Simpson, Ocean Grove; Harold M. Lewis, Long Branch, and Melvin S. Moore, Manasquan.

THE EVERETT (MASS.) ELECTRICAL COMPANY has been incorporated with a capital stock of $50,000 to manufacture and deal in electric appliances. The incorporators are Roy C. Blackburn, Milton; Michael F. Culliney, Dorchester, and H. M. Clifford, Arlington.

THE QUID MANUFACTURING CORPORATION, Bay Shore, L. I., N. Y., has been incorporated by W. S. Johnson and M. J. Bunce to manufacture engines, motors and kindred products. The company is capitalized at $1,000,000.

THE TAYLORSVILLE (KY.) ELECTRIC COMPANY has been chartered with a capital stock of $16,000 to supply electricity for light and power in Taylorsville. The incorporators are H. W. and C. Mayfield, Ludlow, and F. S. Mayes, Springfield.

THE STAR MACHINE & NOVELTY COMPANY, Bloomfield, N. J., has been incorporated by John Brach, John Cionek and Anthony E. Zaga, 77 Mill Street. The company is capitalized at $100,000 and proposes to manufacture electric motors and parts and other machinery.

THE EXCELLIGHT COMPANY, Bristol, Conn., has been incorporated with a capital stock of $25,000 to manufacture electric lamps and kindred products. The incorporators are Rudolph Stern, F. N. Manross and [illegible] [illegible], [illegible] [illegible] Street.

THE ALMA ELECTRIC & SUPPLY COMPANY, Los Angeles, Cal., has been chartered with a capital stock of $75,000 to manufacture electrical products. The incorporators are A. E. Westphal, Iver J. McAllister and Joseph O. Poole.

Record of Electrical Patents

Notes on United States Patents

(Issued Aug. 30, 1921)

1,389,124. SUPPORT FOR THIRD RAIL; T. W. Casey, Yonkers, N. Y. App. filed June 6, 1917. Simple and inexpensive.

1,389,126. ELECTRICAL PRECIPITATING SYSTEM; Lewis W. Chubb, Edgewood Park, Pa. App. filed Jan. 5, 1917. For precipitating finely divided matter from gases of vapors.

1,389,134. MANUALLY OPERATED CIRCUIT-CLOSING SWITCH; John E. Grosswege, Wilkinsburg, Pa. App. filed Aug. 15, 1918. Electric coupler of the butt type.

1,389,137. CONTROLLING DEVICE FOR BRUSH-SHIFTING MECHANISMS; Max E. Gysel, Wilkinsburg, Pa. App. filed Nov. 7, 1917. Single-phase motors of commutator type.

1,389,147. AUTOMATICALLY CONTROLLED VAPOR-CONVERTER SUBSTATION; William V. Lovell, Wilkinsburg, Pa. App. filed Oct. 3, 1917. No operator required.

1,389,148. TRANSFORMER; William M. McConahey, Pittsburgh, Pa. App. filed June 8, 1917. Insulation subjected to uniformly distributed electric stresses.

1,389,149. INSULATING COIL AND METHOD OF MAKING SAME; Jesse E. Mateer, Wilkinsburg, Pa. App. filed Sept. 1, 1917. Good insulating properties and smooth external surfaces.

1,389,150. SYSTEM OF CONTROL; Harry R. Meyer, Wilkinsburg, Pa. App. filed Oct. 17, 1918. Railway system adapted for operation from two different supply voltages.

1,389,165. ELECTRIC HOT-AIR HEATER; O. P. Scott, Tacoma, Wash. App. filed Sept. 1, 1920. Installed beneath floor similar to radiator of an hot-air furnace.

1,389,166. WATER HEATER; Oliver P. Scott, Tacoma, Wash. App. filed Sept. 25, 1920. For use in domestic tank.

1,389,174. STORAGE BATTERY; Grant Wheat, Marlboro, Mass. App. filed Aug. 6, 1919. For lighting lamp on miner's cap.

1,389,192. HEATER AND HEAT INSULATION; William S. Hadaway, Jr., New Rochelle, N. Y. App. filed July 26, 1917. Vapor electric heaters.

1,389,230. THERMIC TELEPHONE; Robert Aernout Baron van Lynden, Utrecht, Netherlands. App. filed Oct. 12, 1917. Manufacture of heating conductors greatly facilitated.

1,389,235. ELECTRIC DEVICE; J. D. Zieley, Summit, N. J. App. filed Dec. 20, 1918. Heater adapted for use in connection with electric fan.

1,389,242. THERMIC TELEPHONE TRANSMITTER; Pieter de Lange and Robert Aernout Baron van Lynden, Utrecht, Netherlands. App. filed Feb. 29, 1921. Durable and able to stand great quantities of energy.

1,389,255. HIGH-FREQUENCY ELECTRICAL OSCILLATION APPARATUS; Leslie R. McDonald, Montreal, Quebec, Can. App. filed May 16, 1917. Oscillation apparatus for therapeutic use and for radio transmission.

1,389,306. PROTECTIVE ARRANGEMENT FOR ELECTRIC DISTRIBUTION SYSTEMS; Philip V. Hunter, Purley, England. App. filed March 1, 1919. Split-conductor system.

1,389,307. WATERPROOF ELECTRIC HEATER; Lee P. Hynes, Albany, N. Y. App. filed May 27, 1920. For car heating, etc.

1,389,312. ELECTRIC HEATER; Edwin M. Lightfoot, New York, N. Y. App. filed March 3, 1920. Flat electric heater having resistor mounted within but insulated from a sheet-metal casing.

1,389,326. SYSTEM OF ELECTRICAL DISTRIBUTION; William A. Turbayne, Niagara Falls, N. Y. App. filed June 15, 1916. Lighting of railway cars.

1,389,327 to 1,389,334 inclusive. SYSTEM OF ELECTRICAL DISTRIBUTION; Leonard A. Watson, Brooklyn, N. Y. App. filed Sept. 19, 1919. Improved railway-car lighting system.

1,389,342. PLANER AND SYSTEM OF MOTOR CONTROL THEREFOR; Harold L. Blood, Fairfield, N. J. App. filed March 1[illegible], 1917. Planers provided with reversing driving motor.

1,389,343. PANELBOARD STRUCTURE AND BRANCH-BLOCK UNITS; John Cuthbert and Julian J. Nielsen, Chicago, Ill. App. filed May 18, 1916. New and useful form of lamp receptacle.

1,389,351. MEANS FOR SUPPORTING ELECTRODES IN IONIC TUBES; Charles H. Harvey, London, England. App. filed May 27, 1918. Loop elastically supported by coiled spring.

1,389,354. METHOD OF AND MEANS FOR INCREASING POWER FACTOR; C. Hering, Philadelphia, Pa. App. filed June 18, 1914. For counteracting undesirable effects of inductance in an alternating-current circuit.

1,389,397. HEATER; Louis A. Tactikos; Greenwich, Conn. App. filed Jan. 23, 1920. For warming confection batches.

1,389,433. DRIVING MECHANISM FOR AUTOMATIC MACHINES; John P. Brophy, Cleveland, Ohio. App. filed Oct. 19, 1916. Machine in which number of operations can be carried on on a single piece of stock.

1,389,463. SYSTEM OF ELECTRICAL DISTRIBUTION; William A. Turbayne, Niagara Falls, N. Y. App. filed Nov. 15, 1915. Improved stone system of car lighting.

1,389,476. WELDING CAST IRON; Jack Churchward, New York, N. Y. App. filed Oct. 27, 1920. Welded joints which are adapted to be machined.

1,389,555. TARGET-FOLLOWING BOMB SIGHT; Bernard L. Smith, Washington, D. C. App. filed March 11, 1918. Carried by aircraft for co-operation between the pilot and the observer.

1,389,566. MAGNETIC FIRING MECHANISM FOR SUBMARINE MINES; Hudson Maxim, Hopatcong Borough, N. J. App. filed Dec. 7, 1917. Without contact between mine and vessel to be destroyed.

(Issued Sept. 6, 1921)

1,389,596. DESK OPERATOR'S CIRCUITS; William A. Rhodes, New York, N. Y. App. filed Dec. 5, 1918. For connecting subscriber's line with special position.

1,389,623. COMBINED SWITCHING AND PROTECTIVE UNIT FOR ELECTRICAL TRANSMISSION LINES; Russell T. Calloway, Chicago, Ill. App. filed March 29, 1920. For use in small pole-top installations.

1,389,625. ELECTRICAL SOLENOID; Alexander Churchward, New York, N. Y. App. filed June 24, 1919. Current-regulating apparatus for electric welding system.

1,389,628. BEVERAGE URN; Warren F. Clark, Cleveland, Ohio. App. filed Dec. 24, 1919. Electrically heated.

1,389,662. MEANS FOR TREATMENT OF PYORRHEA; John R. Irwin, Cobourg, Ontario, Canada. App. filed April 6, 1920. Electrochemical.

1,389,684. ELECTRIC HEATER; William A. Morrison and Frederick D. Lake St. Catharines, Ontario, Canada. App. filed Oct. 4, 1920. For use in hot-water boilers.

1,389,691. DRY-CELL ELECTRIC BATTERY; James E. Peavey, Cincinnati, Ohio. App. filed March 15, 1919. Absorbent packing between the anode forming casing of cell and the electrode

1,389,716. ELECTRIC GENERATING SYSTEM; Roy M. Van Vleet, Milwaukee, Wis. App. filed June 14, 1920. Isolated electric generating plant.

1,389,718. TYPEWRITING MACHINE; John Waldheim, Elizabeth, N. J. App. filed Sept. 18, 1919. Automatic return.

1,389,740. SOCKET FOR TUBULAR LAMPS; Marc Chalier, Paris, France. App. filed July 10, 1914. Footlights or floats.

1,389,750. ELECTROLYTE FOR STORAGE BATTERIES; William Gardiner, Chicago, Ill. App. filed Aug. 22, 1918. Substantially dry storage battery.

1,389,773. TROLLEY-WIRE SUPPORT; Henry L. Miller, Knoxville, Tenn. App. filed Dec. 5, 1919. Cast and finished with minimum amount of machine work.

1,389,806. RADIO-SIGNALING APPARATUS; Roy A. Weagant, New York, N. Y. App. filed Feb. 1, 1918. Signals received from different directions without material static interference.

1,389,811. VENDING MACHINE; Eugene F. Bowen and Ephraim J. Scott, Providence, R. I. App. filed Sept. 15, 1920. For feeding stamps, tickets, coupons, etc.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

BROOKLINE, MASS.—The town authorities have voted to appropriate $37,000 for improvements and alterations to the municipal lighting and heating plant and the installation of new equipment.

BRIDGEPORT, CONN.—The United Illuminating Company contemplates the installation of a machine shop in connection with its generating plant under construction at the foot of East Main Street. The shop will be equipped for electric machinery repairs, manufacture of parts, etc.

Middle Atlantic States

BUFFALO, N. Y.—The Niagara, Lockport & Ontario Power Company has filed a petition with the Public Service Commission by which the power company would acquire the stock holdings and interests of Almet and Sheldon N. Broadhead in the Jamestown Lighting & Power Company and the Western New York Electric Company. The Niagara company, it is understood, contemplates the erection of a transmission line from Dunkirk to Jamestown, subject to the approval of the above arrangement.

NEW YORK, N. Y.—Plans have been filed by the board of directors of the Mount Sinai Hospital, 110th Street and Fifth Avenue, for extensions and improvements to the power house at the institution.

NEW YORK, N. Y.—The Inwood Consumers' Ice Manufacturing Corporation, recently incorporated with a capital of $220,000 by N. F. Schmidt, 220 Broadway, and others, is contemplating the construction of an ice-manufacturing and refrigerating plant.

SILVER CREEK, N. Y.—The Silver Creek Electric Company has filed notice of an increase in capital stock from $20,000 to $40,000.

ELIZABETH, N. J.—Plans have been prepared for the erection of an addition to the power house in connection with an extension to the Battin High School.

OCEAN CITY, N. J.—The Board of Freeholders, Cape May, is considering extensions and improvements to its electric plant in Ocean City. M. D. Rice, Wildwood, is county engineer.

HAZLETON, PA.—Improvements to the street-lighting system in Hazelton are under consideration by the City Council. J. E Altmiller is superintendent of highways and public improvements.

PHILADELPHIA, PA.—Bids will be received at the Department of City Transit about Oct. 31 for the construction of two substations, one 40 ft. x 60 ft., at Cumberland and Kensington Avenues, and the other, [illegible] Avenues. H. H. Quimby, 1211 Chestnut Street, is engineer.

PITTSBURGH, PA.—Application has been made by the West Penn Power Company for [illegible] the proceeds to be used for extensions and improvements.

SAYRE, PA.—Application has been made to the State [illegible] to be used for extensions, etc.

SCRANTON, PA.—Application has been made by the Warren Light & Power Company [illegible] used for extensions, etc.

WEATHERLY, PA.—The Lehigh Valley Railroad Company, Wilkes-Barre, is considering replacing the steam power equipment of its shops in Weatherly with electrically operated machinery.

BALTIMORE, MD.—Bids will be asked by the Western Maryland Dairy Company, [illegible]

Oct. 1, for the installation of conveying equipment, transmission apparatus, etc., in its proposed new plant.

STEYER, MD.—Plans are under consideration by the Miners' Coal Company, recently organized with a capital of $500.000, for the installation of electrical and mechanical equipment at its properties. The company is also contemplating the erection of a power house and pumping plant. G. J. Lee is president.

BLUEFIELD, W. VA. — Arrangements have been made by the Appalachian Power Company for an issue of $2,500,000 in bonds, the proceeds to be used for extensions, improvements, etc. C. N. Mason is vice-president.

MORGANTOWN, W. VA. — The Star Glass Company has prepared plans for the construction of a plant to cost about $225,000 with machinery to replace its former works destroyed by fire. The present plans provide for main factory, 45 ft. x 500 ft., supplemented with a power house and other buildings. Louis Kauffield is manager.

MARION, VA.—Plans are under way for the construction of a new power house at the Southwestern State Hospital. Eubank & Caldwell, Express Building, Roanoke, are architects.

WASHINGTON, D. C.—The Bureau of Supplies and Accounts, Navy Department, Washington, D. C., will receive bids for furnishing the following: Until Oct. **11**, Boston, Schedule 8779—three electric heaters; Washington, Schedule 8812—20,000 **ft.** electric wire.

WASHINGTON, D. C.—Bids will be received by A. L. Flint, general purchasing officer of the Panama Canal, Washington, D. C., until Oct. 18, Circular 1459, for furnishing motion-picture projector, water meters, receptacles, reflectors, wire and cable, aero lightning switches, etc.

WASHINGTON, D. C.—Bids will be received at the office of the Chief Signal Officer, U. S. A., Washington, D. C., until Oct. 17, Circular PR 6840 A-1 CP, for furnishing 500 and 750 transmitters and receivers with loop, equipment box and battery cases f.o.b. to following destinations: 130 for South Brooklyn, N. Y.; 5 for Washington, D. C.; 10, Atlanta, Ga.; 75, Chicago, Ill.; 100, San Antonio, Tex.; 100, Fort Mason, Cal.; 20, South Brooklyn, packed for export; 35, Philadelphia, and 25 for Fort Mason, packed for export; also 250 for South Brooklyn. For further information address as above.

North Central States

GRAND RAPIDS, MICH. — Permission has been granted to the Wisconsin-Minnesota Light & Power Company by the Federal Power Commission for the construction of a hydro-electric power station on the Chippewa River, Sawyer County.

ASHTABULA, OHIO.—Plans are being prepared for the construction of a new municipal electric power plant in Ashtabula to cost about $400,000. Stone & Webster, 147 Milk Street, Boston, are engineers. M. H. Turner is city manager.

CINCINNATI, OHIO.—The Central Storage & Warehouse Company has acquired a building on Elm Street and plans to remodel it for a cold storage plant. The cost, with equipment, is estimated at $200,000.

CLEVELAND, OHIO. — The Cleveland Electric Illuminating Company has had plans prepared for the construction of a two-story addition, 26 ft. x 60 ft., to the substation on East Seventeenth Street. The cost is estimated at $10,000. M. S. Gallagher, Illuminating Building, is architect.

FREEPORT, OHIO.—The village authorities have granted a franchise to John F. Shreffler of Cleveland for the installation of an electric light and power station and ice plant in Freeport.

MIDDLETOWN, OHIO.—Bids, it is understood, will soon be received by City Clerk Kunz for the installation of an ornamental lighting system on East Third Street from Water Street to the Miami and Erie Canal.

CENTERTOWN, KY. — The installation of new equipment, including air compressors and other power apparatus, at the properties of the Blue Diamond Mining Company is under consideration. Robert A. Bridges is vice-president.

CORNISHVILLE, KY.—A company is being organized by Bishop Wash and associates to establish an electric light plant in Cornishville.

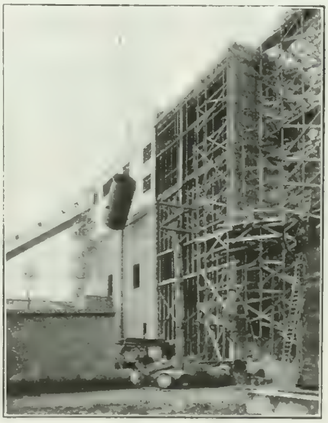
KENTENIA, KY.—The Banner Fork Coal Company is considering the construction of a power house at its properties and the installation of electric haulage and operating equipment at the mines.

KIEL, WIS. — The Kiel Woodenware Company, which supplies electricity to the city and industrial and domestic consumers, is contemplating an addition to its power plant. The company, it is understood, is in the market for additional generating transformer and other equipment.

NEENAH, WIS.—The City Council contemplates the installation of an ornamental lighting system on Wisconsin Avenue and Commercial Street to cost about $25,000. The present plans provide for 108 single-lamp standards and a two-circuit system. H. Zemlock is clerk.

SOLDIERS GROVE, WIS. — Plans are under consideration for rebuilding the hydro-electric generating plant and dam on the Kickapoo River, property of the Peterson Estate, to cost about $50,000. E. E. Dillon, Washington Building, Madison, is consulting and contracting engineer. Clarence Peterson is in charge of the estate.

KANSAS CITY, MO.—The Kansas City Power & Light Company is contemplating the installation of a substation at 1110-12 Baltimore Avenue. The machinery will cost about $250,000. The company also plans to install a substation at Fourteenth Street and Grand Avenue.


HOISTING STACK FOR NEW BOILER HOUSE OF FITCHBURG GAS & ELECTRIC COMPANY, JULY 2, 1921

MEMPHIS, MO.—Bonds have been voted for the installation of a unit in the municipal electric light plant.

NEODESHA, KAN.—At an election to be held Oct. 11 the proposal to issue $195,000 in bonds for extensions and improvements to the light and water plant will be submitted to the voters.

Southern States

ASHEVILLE, N. C.—The Asheville Power & Light Company is having plans prepared for extensions and improvements to its plant. W. H. Plummer is manager.

HENDERSONVILLE, N. C.—Application has been made by the Blue Ridge Power Company for a franchise to supply electricity in Hendersonville.

PILOT MOUNTAIN, N. C. — The City Council is considering issuing bonds for the construction of a municipal power plant.

WALNUT GROVE, N. C. — Plans are being prepared for rebuilding the municipal electric plant recently destroyed by fire. M. T. Chilton, city commissioner, is in charge.

McCORMICK, S. C.—The City Council has granted the Paul B. Wilson Electrical Machine Works a franchise to supply electricity to the city.

JACKSON, MISS.—The State Board of Improvement is considering purchasing sixteen lighting plants for the state prison farms.

GRAVETTE, ARK.—H. D. Jenkins, Eureka Springs and Harrison, Ark., and R. A. Wilson, Harrison, are contemplating the establishment of a power plant in Gravette.

STUTTGART, ARK.—The City Council is considering the construction of an electric light plant in Stuttgart.

EL RENO, OKLA.—The installation of an ornamental lighting system in El Reno is under consideration.

FAIRFAX, OKLA.—Bonds to the amount of $80,000 have been voted for improvements to the lighting system and pumping station and for extending the water and sewer systems into the Tall Chief addition.

EL PASO, TEX.—The El Paso Electric Company has arranged for an issue of $750,000 in bonds, the proceeds to be used for extensions and improvements.

HARLINGEN, TEX. — Plans are under consideration for the construction of a municipal electric lighting plant to cost about $32,000.

Pacific and Mountain States

PORT TOWNSEND, WASH.—Bids will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until Oct. 12 for the installation of a lighting plant, wiring, etc., at the U. S. Quarantine Station, Port Townsend, Wash. James A. Wetmore is acting supervising architect.

TACOMA, WASH.—The installation of a lighting system on South Eighth, Ninth and Tenth Streets has been authorized by the City Council.

TACOMA, WASH.—The installation of an ornamental lighting system on Sixth Avenue between State and Pine Streets, a distance of eight blocks, is under consideration by the City Council.

PORTLAND, ORE.—The Columbia Tire Corporation, it is reported, will soon award contract for the construction of a tire factory in the Kenton industrial district to cost about $100,000. The plant will be electrically operated, and motors of a total rating of from 600 hp. to 800 hp. will be required.

REEDSPORT, ORE.—The City Council is considering the establishment of a municipal lighting system in Reedsport.

LONG BEACH, CAL.—The Crystal Ice Company is planning the construction of a plant to cost about $45,000. C. H. Taylor is interested in the company.

LONG BEACH, CAL.—Plans are under way for the installation of an ornamental lighting system on Third Street between Pine and American Streets.

LOS ANGELES, CAL.—The installation of an ornamental lighting system in a section of Edgemont has been authorized by the Council.

TUJUNGA, CAL.—The formation of a street-lighting district in Tujunga has been authorized.

Canada

KINGSTON, ONT.—The construction of a power plant at the Kingston General Hospital is under consideration.

LONDON, ONT.—The rebuilding of the dam at Springbank is under consideration. E. V. Buchanan is manager of the Public Utilities Commission.

MERLIN, ONT.—The City Council is considering the establishment of an electric light and power system in Merlin to cost about $15,000. E. D. Lawler, 190 University Avenue, Toronto, is engineer.

NORTH TORONTO, ONT.—The Transportation Commission, Toronto, contemplates the construction of an automatic substation on Eglinton Avenue, North Toronto.

OTTAWA, ONT.—Bids, it is reported, will soon be received by the Board of Public Works, for the construction of a hydro-electric generating plant in the Fort Matachawan district. The plant will have an initial capacity of about 10,000 hp. The total cost is estimated at $[illegible].

WILKESPORT, ONT.—The installation of an electric light and power system in Sombra Township is under consideration. E. D. Lawler, 190 University Avenue, Toronto, is engineer.

Directory of Electrical Associations

Printed in the First Issue of Each Month

Alabama Light and Traction Association. Secretary-treasurer, J. P. Ross, Birmingham Railway, Light & Power Co., Birmingham, Ala.

American Association of Engineers. Secretary, C. E. Drayer, 63 East Adams St., Chicago, Ill.

American Electric Railway Association. Secretary, J. W. Welsh, 8 West 40th St., New York City. Annual convention, Atlantic City, N. J., Oct. 3-7.

American Electrochemical Society. Secretary, Prof. J. W. Richards, Lehigh University, Bethlehem, Pa.

American Engineering Standards Committee. Secretary, P. G. Agnew, 29 West 39th St., New York City.

American Institute of Consulting Engineers, Inc. Secretary, F. A. Molitor, 35 Nassau St., New York City.

American Institute of Electrical Engineers. Secretary, F. L. Hutchinson, 29 West 39th St., New York City. Board of directors meets monthly. Sections and branches in the principal electrical centers throughout the country.

American Physical Society. Secretary, Dayton C. Miller, Case School of Applied Science, Cleveland, Ohio.

American Society for Testing Materials. Secretary-treasurer, C. L. Warwick, 1315 Spruce St., Philadelphia, Pa.

American Welding Society. Secretary, H. C. Forbes, 29 West 39th St., New York City.

Arkansas Utilities Association. Secretary, S. E. Dillon, Hot Springs, Ark.

Associated Manufacturers of Electrical Supplies. General secretary, C. E. Dustin, 30 East 42d St., New York City.

Association of Edison Illuminating Companies. Secretary, Preston S. Millar, Electrical Testing Laboratories, New York.

Association of Iron and Steel Electrical Engineers. Secretary, John F. Kelly, Empire Building, Pittsburgh, Pa.

Association of Municipal Electrical Utilities of Ontario. Secretary, S. R. A. Clement, 190 University Ave., Toronto.

Association of Railway Electrical Engineers. Secretary-treasurer, Joseph A. Andreucetti, Chicago & Northwestern Railway, Chicago, Ill.

British Columbia Association of Electrical Contractors and Dealers. Secretary-treasurer, Capt. W. J. Conway, 406 Yorkshire Building, Vancouver, B. C.

Canadian Electrical Association, affiliated with N. E. L. A. Secretary-treasurer, Eugene Vinet, Shawinigan Water & Power Co., Montreal, Canada.

Colorado Electric Light, Power and Railway Association. Secretary-treasurer, M. B. W. Baker, Denver, Col.

Conference Club. Secretary, Sullivan W. Jones, 19 West 44th St., New York City.

Electric Hoist Manufacturers' Association. Secretary-treasurer, E. Donald Tolles, 52 Broadway, New York City.

Electric Furnace Association. Secretary, Dr. C. G. Schluederberg, Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.

Electrical Manufacturers' Club. Secretary, F. L. Bishop, Hartford Faience Co., Hartford, Conn.

Electrical Manufacturers' Council. Executive secretary, Frederic Nicholas, 522 5th Ave., New York City.

Electrical Safety Council. Secretary, Dana Pierce, 25 City Hall Place, New York City.

Electrical Supply Jobbers' Association. General secretary, Franklin Overbaugh, 411 South Clinton St., Chicago, Ill.

Electrical Supply Jobbers' Association, Atlantic Division. Secretary, E. Donald Tolles, 52 Broadway, New York City.

Electrical Supply Jobbers' Association Pacific Coast Division. Secretary, Albert H. Elliot, 502 Flatiron Building, San Francisco, Cal.

Electrical Trade Association of Canada. Secretary, William R. Stavely, Royal Insurance Building, Montreal, Canada.

Electric Power Club. Secretary, C. H. Roth, 1410 West Adams St., Chicago, Ill.

Empire State Gas and Electric Association. Secretary, Charles H. B. Chapin, Grand Central Terminal Building, New York City. Annual convention, Lake Placid, N. Y., Oct. 6-7.

Florida Engineering Society. Secretary, J. R. Benton, Gainesville, Fla.

Great Lakes Geographic Division, N. E. L. A. Secretary, R. V. Prather 305 De Witt Smith Bldg., Springfield, Ill.

Illinois State Electric Association. Secretary-treasurer, R. V. Prather, Springfield, Ill.

Illuminating Engineering Society. General Secretary, Clarence L. Law, 29 West 39th St., New York City. Sections in New York, Philadelphia, Pittsburgh, Cleveland, Chicago and Boston.

Indiana Electric Light Association. Secretary, Thomas Donohue, Lafayette, Ind.

Industrial Electric Heating Association. Secretary, Homer Kunz, Toledo Railways & Light Co., Toledo, Ohio.

Institute of Radio Engineers. Secretary, Alfred N. Goldsmith, College City of New York, New York.

International Association of Municipal Electricians. Secretary, C. R. George, Houston, Tex.

International Electrotechnical Commission (international body representing various national electrical engineering societies contributing to its support). General secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England.

Iowa Section, N. E. L. A. Secretary-treasurer, M. G. Linn, Des Moines, Iowa.

Kansas Public Service Association. Secretary-treasurer, W. W. Austin, Cottonwood Falls, Kan.

Michigan Section, N. E. L. A. Secretary, Herbert Silvester, Ann Arbor, Mich.

Mississippi Electric Association, affiliated with the N. E. L. A. Secretary, E. S. Myers, Vicksburg, Miss.

Missouri Association of Public Utilities. Secretary-treasurer, F. D. Beardslee, 315 North 12th St., St. Louis, Mo.

National Association of Electrical Contractors and Dealers. Secretary, Farquson Johnson, 15 West 37th St., New York City, N. Y. State associations in Alabama, Arkansas, Connecticut, Georgia, Kansas, Illinois, Indiana, Iowa, Louisiana, Maryland, Massachusetts, Michigan, Minnesota, Missouri, New Jersey, New York, Ohio, Oregon, Pennsylvania, Tennessee and Wisconsin.

National Council of Lighting Fixture Manufacturers. Secretary, C. W. Hoffrichter, 8410 Lake Ave., Cleveland, Ohio.

National Association of Electrical Inspectors. Secretary-treasurer, William L. Smith, Northeastern College, Boston, Mass.

National Association of Railway and Utilities Commissioners. Secretary, James B. Walker, New York Transit Commission, New York City. Annual convention Atlanta, Ga., Oct. 11-14.

National Electric Light Association. Executive manager, M. H. Aylesworth, 29 West 39th St., New York City.

National Electrical Credit Association. Secretary, Frederic P. Vose, 1350 Marquette Building, Chicago, Ill.

National Fire Protection Association. Secretary of electrical committee, Ralph Sweetland, 141 Milk St., Boston, Mass.

Nebraska Section, N. E. L. A. Secretary-treasurer, H. M. Davis, Brandeis Theater Bldg., Omaha, Neb.

New England Electrical Credit Association. Secretary, Alton F. Tupper, 1[illegible] State St., Boston, Mass.

New England Geographic Division, N. E. L. A. Secretary, Miss O. A. Bursiel, 149 Tremont St., Boston, Mass.

New Mexico Electrical Association. Secretary-treasurer, Charles E. Twogood, Albuquerque, N. M.

New York Electrical Credit Association. Secretary, W. J. Kreger, 47 West 34th St., New York City.

New York Electrical Society. Secretary, George H. Guy, 29 West 39th St., New York City.

North Central Geographic Division, N. E. L. A. Secretary, H. E. Young, Minneapolis General Electric Co., Minneapolis.

Northwest Geographic Division, N. E. L. A. Secretary-treasurer, Stacy Hamilton, Portland Railway Light & Power Co., Portland, Ore.

Ohio Electric Light Association. Secretary, D. L. Gaskill, Greenville, Ohio.

Ohio Society of Mechanical, Electrical and Steam Engineers. Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus.

Oklahoma Utilities Association. Secretary, H. A. Lane, 611 State National Bank Building, Oklahoma City.

Pacific Coast Geographic Division, N. E. L. A. Secretary, S. H. Taylor, Electric Railway & Manufacturers' Supply Co., San Francisco, Cal.

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Public Service Association of Virginia. Secretary, R. M. Booker, Newport News & Hampton Railway, Gas & Electric Co., Hampton, Va.

Public Utilities Association of West Virginia. Secretary, A. Bliss McCrum, Charleston, W. Va.

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Rocky Mountain Geographic Division, N. E. L. A. Secretary, A. C. Cornell, Denver, Col.

Society for Electrical Development, Inc. Assistant to the president, W. L. Goodwin, Guaranty Building, 522 5th Ave., New York City.

Society for the Promotion of Engineering Education. Secretary, Dean F. L. Bishop, University of Pittsburgh, Pittsburgh, Pa.

Southeastern Geographic Division N. E. L. A. Secretary-treasurer, Charles A. Collier, Georgia Railway & Power Co., Atlanta, Ga. Annual convention, Chattanooga, Tenn., Oct. 17, 18 and 19.

Southwestern Geographic Division, N. E. L. A. Secretary, H. A. Lane, Oklahoma Utilities Association, Oklahoma City, Okla.

Southern California Electrical Contractors and Dealers' Association. Secretary-treasurer, J. E. Wilson, 425 Consolidated Realty Building, Los Angeles, Cal.

Southwestern Electrical and Gas Association. Secretary, H. S. Cooper, 403-4 Slaughter Building, Dallas, Tex.

Southwestern Society of Engineers. Secretary, C. E. Barglebaugh, 721 First National Bank Building, El Paso, Tex.

Toronto Electrical Contractors' Association. Secretary, E. F. W. Salisbury, 615 Yonge St., Toronto, Ont.

Tri-State Water and Light Association. Secretary-treasurer, W. F. Steiglitz, Columbia, S. C.

Vermont Electrical Association. Secretary-treasurer, A. B. Marsden, Rutland, Vermont.

Western Association of Electrical Inspectors. Secretary, W. S. Boyd, 175 West Jackson Blvd., Chicago, Ill.

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Wyoming Utilities Association. Secretary, C. Luscombe, Cheyenne Light, Fuel & Power Co., Cheyenne, Wyo.

Electrical World

New York, Saturday, October 8, 1921

The Individual Responsibility that Will Follow the Unemployment Conference

OUT of the unemployment conference at Washington comes already real inspiration for the country. Committees are still at work. Results have not yet been announced. But the record of the opening session alone has brought new confidence.

When President Harding pointed out in his opening address that the task was not "to solve the long-controverted problems of our social system" he spoke to the entire nation. There has been too much time and talk thrown away here on theoretical discussion. His admonition that "tonic from the public treasury . . . would bring a new cause of trouble rather than a source of cure" was surely merited. We have become too prone to look to Washington to ease our troubles from the public funds. Secretary Hoover crystallized the thinking of the conference by his statement that "the only remedy for unemployment is employment."

It was soon found that the first estimate of 5,735,000 unemployed was an exaggerated figure. The actual number probably is 3,750,000, of whom 1,500,000 are but the normally unemployed in ordinary times. The emergency therefore presents something more than 2,000,000 idle men and women throughout the country for whom jobs must be sought to relieve the situation. And employers must realize that the straight road to the employment of this labor can only be through providing work, not in Washington, but across the country, in the factories, shops, stores, offices, homes, the farms, highways, railways and construction jobs.

The conference is bringing us decision and direction. We shall have practical suggestions for the acceleration of state, county and municipal work, for advancing production, for rotating labor, for distributing the burden of unemployment and for other measures of relief. And what then? Employers of labor throughout the land must accept the judgment of the conference and do the job they recommend. We have been waiting on Washington. When the report is in the time for local action will have come.

The problems of unemployment and the relationships between labor and capital are national issues only in their broader aspects. The points of contact are all local. The responsibility for constructive thinking, for fair dealing and for actual achievement in the working out of this great social and economic evolution rests not on the government but on the individual — employer and employee — and on the local leaders of them both.

The electrical industry must not delay in assuming its full share of obligation. We are both interested and involved. We must be ready when the conference points the way.

John Barnes Miller

President of one of the pioneer public service corporations whose scope of development and ideals of service have had a national influence on the engineering and business building phases of central-station work.

IN THE development of electric service in the West John B. Miller has been a leader for more than twenty-five years. When he became associated with the company which he now heads as president the present utilization of the water powers of California was a vision beyond the comprehension of all save a few, owing to the huge expenditures that were involved and the apparent lack of demand sufficient to earn the required return. Through sheer determination and undaunted faith in the future that would come to southern California from the application of brains and capital in the development of a rich virgin soil, he has in a short period of time been able to justify in a practical way the confidence that was placed in his business judgment. Today the Southern California Edison Company furnishes light and power to 250,000 customers throughout the southern section of the State and wholesales energy to numerous municipalities and other smaller corporations for redistribution. It has absorbed about thirty public service corporations and financed its developments on a vast partnership basis, more than 35,000 individuals being now owners of its securities.

As an executive Mr. Miller has a faculty for selecting and developing capable and loyal associates both in engineering and executive departments men who have not only contributed to the upbuilding of the company's affairs but are also able to extend their influence into the national affairs of the industry West and East. In the field of long-distance high-voltage transmission Southern California Edison engineers have done much pioneer work under physical difficulties that are [illegible] this country, work that in magnitude could only be accomplished with the full co-operation and confidence of the broad-minded leader under whom they have worked.

Mr. Miller was born at Port Huron, Mich., Oct. [illegible], 1869. He received his education at the Ann Arbor High School and the University of Michigan, and spent the first six years of his business career in Louisiana and Michigan. In 1896 he went to California and became associated with the electric light and power business on Feb. 1, 1897, in Los Angeles. A year before the West Side Lighting Company had purchased [illegible] plant then known as Los Angeles No. 1, with a generator rating of 100 kw., giving the entire system a generating capacity of 150 kw. In 1898 the directors of the company combined the West Side Lighting Company interests with the [illegible] Electric Light & Power Company under the new name of the Edison Electric Company and Mr. Miller was elected president in 1901. At this time the system of the new organization had a generating capacity of 4,000 kw., of which 3,850 kw. was water power. Plants were then built rapidly one after another, and in 1909, when the Edison Electric Company was reincorporated under the name of the Southern California Edison Company and the [illegible] of the present system—which had a [illegible] first of the year and an output for 1920 of 1,079,474,901 kw.-hr.—was well under way, Mr. Miller was elected president of the new organization. This position he held until 1918 when he was elected chairman of the board. Since March, 1920, he has carried the responsibilities of both president and chairman of the board. Mr. Miller is also connected with a number of other large business organizations.

Throughout his [illegible] career Mr. Miller has earned the esteem and confidence of other leaders in the electrical development of the West, where the spirit of co-operation and united effort in building for the future is a recognized constructive force in all branches of industry, irrespective of sectional lines or the limits of immediate interests.

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The Most Important Question About Utility Securities

UNDOUBTEDLY the most engrossing issue before the central-station company today is the sale of utility securities to the public. There is pressing need of funds, and these stock-selling campaigns to customers are opening up a vast new source of capital. This is good. But there is still another need, even more urgent, the need of friends for everything electrical, and customer ownership is massing an army of such supporters and defenders of the public service company. This is better. The development of this personal contact and this feeling of sympathetic responsibility among large numbers of the people offers perhaps the most important opportunity before the entire industry today.

But there is another important matter in this connection that is not being taken up. It involves a question that every electrical man should be expected to answer, and that question is: "How many electrical securities have *you* invested in?" For the sooner every central-station employee becomes a shareholder in his company the quicker shall we have an end to friction with the public and the easier will selling be. And the sooner contractors and dealers in every town buy stock in the local electric light and power company and electric light and power company men put money into contracting and dealer stores, the quicker will trade relationship be entirely happy.

So while the companies are selling stock they should sell some to themselves. There is no better slogan for us all than this: "Invest your money in the electrical business."

A Nebraska City Finds a Way Out

THE method by which a recent telephone franchise controversy at Alliance, Neb., was settled affords a ray of hope to those pessimists who can see only the dark side of the public relations problem. The company had been operating for two years without a franchise and had in at least one case been refused a franchise by vote of the people, after a bitter fight. With the appointment of a city manager a few months ago the question came up for settlement and the franchise was worked out and granted. The unusual thing about the proceeding was the frank and fearless way in which City Manager Kemmish in a public statement told the citizens the facts in a situation in which the city had no power to establish its own telephone service or regulate rates.

In that statement also Mr. Kemmish told the city that to establish competitive service would be futile even if the authorities could grant as many franchises as they saw fit. The folly of driving out a company with an established business was clearly set forth. This lack of effort to make political capital out of a situation of the sort that the politician ordinarily delights in is refreshing. Whatever may be the differences of opinion, controversies of this kind can be settled if both parties are willing to face all the facts and admit that there is a way of treating everybody fairly. "Where there is a will there is a way" is a trite observation, but none the less it is unfortunately the case that in too many instances impossible situations are caused by the lack of "will" on the part of one or both of the interested parties.

Reward for Efficient Operation of Utilities

WE HAVE commented now and then on the necessity for holding out some incentive to the management of electric public utilities as a reward for efficient operation. It is surely in the interest of both the consumer and the utility that energy be produced at the minimum of cost consistent with good service. If this is to be brought about, sufficient inducement should be given the management of public utilities to operate them as economically and as efficiently as possible; otherwise, with a regulated monopoly limited to a fixed rate of return, the tendency toward complacency would be as pronounced as it is in government and municipal work.

Without real incentive to give our best initiative is lacking and progress is dwarfed. It is of great moment, therefore, that the Transit Commission which is endeavoring to bring order out of chaos in the street-railway situation of New York City recognizes this principle and has incorporated it in its tentative report on the transit situation of that city. This should stiffen the backbone of some regulatory bodies which accept the idea but fear to make it effective. In essence it is the old "London sliding scale," and its revival and application to so important a public utility situation as that existing in the metropolis of the Western Hemisphere should give encouragement to public utility managers everywhere to do their utmost to bring down the cost of service, confident that their labors shall not go unrewarded. Although the report of the Transit Commission is applicable only to the street railways of New York City, the principle which it enunciates is not so restrictive. This is evident from the text, which reads as follows:

"In order to provide an incentive for efficient and economical management, there shall be set aside each year by the board of control out of the surplus earnings of the unified system, after the payment of all obligations and the maintenance of the barometer fund, a sum to be distributed or used for the joint benefit of the operating personnel of the unified system and the holders of the consolidated company's bonds. This fund, within the limits of the available surplus, shall, for the purpose of computing allotments prescribed, equal 3 per cent interest on the purchase-money bonds issued by the consolidated company. When the amount so available has been determined by the board of control it shall be allocated, one-half for the benefit of the operating personnel as hereinafter indicated and one-half for the payment of additional interest upon the outstanding purchase-money bonds, but subject to the condition that with any increase or decrease of fare above or below the rate of 5 cents, such funds shall be decreased or increased, as the case may be, on the basis of 1 per cent interest on the bonds with each cent of fare variation."

New Considerations in Peak-Load Discussions

CONSIDERABLE confusion is evident in many discussions on the floor of conventions when the subject of residence consumers' loads on the peak is discussed. This is sometimes due to the fact that we are in a transition period. Formerly the peak load was universally experienced in the evening hours and was due to lighting requirements. This is no longer true. The rapidly growing industrial and residence loads are shifting the peak to the daylight hours and very frequently to the morning hours. In a recent discussion revolving around the effect of the electric range on the peak load it developed that a plant concerned experienced its peak in the evening hours. As the range peak came at the same time, the coincidence was decidedly pertinent in the discussion but decidedly misleading to the man who has to provide for new conditions of growing daylight peaks.

The shifting of the peak hours to the daytime is playing havoc with many of the timeworn arguments about the effect of certain household equipment on the investment required to carry the consumers' demands. Some of the appliances, the flatiron and washing machine for example, are showing a decided peak load of their own in the early days of the week. These peaks coincide with the industrial load peak and help to make it a bigger factor in the investment required in the plant and distribution system. In many plants the range peaks in the evening are of little consequence in determining needed plant capacity because the resistance peak load does not now come at that time.

The problem is not the simple one of disregarding the range load as a peak load because the range peak does occur when the customers' lighting needs are greatest and therefore does affect the investment required in the distribution system. This is only one instance, but the problem presents itself in similar form when making plans to increase the load of motor-operated appliances in the home. It is becoming necessary, therefore, in discussions of the rate problem to guard more carefully against mistakes in the use of the term "peak load." It will also become increasingly necessary in the future to consider the effect of various peaks on various portions of the system as a whole and to watch the power factor of circuits serving large numbers of home devices driven by small, lightly loaded induction motors. The fast-growing loads of these motor-driven appliances in metropolitan residential centers emphasize the need for an extensive line of synchronous motors in the smaller range of sizes.

An Opportunity for the Electric Storage-Battery Bus

IN WORKING out the problem of city transportation by buses the manufacturers of gasoline vehicles have again invaded the field of the electrically propelled road vehicle in spite of the fact that in short-haul, frequent-stop service the storage-battery truck has more than demonstrated its economy and its engineering has reached a period of standardization that accommodates wide ranges of loads. In the handling of traffic over paved city streets or well-maintained main thoroughfares in areas of light traffic and in extensions of existing electric street railways no new problems are presented to the electric storage-battery truck. The main difficulty seems to center about that indeterminable factor in commercial exploitation which manufacturers of electric vehicles have been slow to learn even in the general haulage and delivery field. Electric railway men are still looking for a solution of the problems that have tended to disintegrate that industry, and for a time at least the bus seems to meet the emergency requirements in those communities where traffic is comparatively light and buses can be used as auxiliary feeders to existing lines.

Besides offering a new field for the electric bus, this situation presents a new opportunity to the light and power company that operates the railways to establish charging and maintenance facilities that will help to promote the more extensive use of the electric truck for general haulage by other businesses in the community. The lack of such service facilities manned with expert battery men has been the only serious drawback to the electric vehicle in the past, when only a few trucks have been required by any one concern and the establishing of individual maintenance stations has not seemed justifiable. If the local utility should take advantage of this situation, there is the business possibility of creating a revenue that would partially offset the expense of maintaining the electric buses used in a city transportation system and thus establish the electric vehicle within the electric industry from a public service standpoint.

Applied Illuminating Engineering Deserves More Consideration

FROM the opto-physical or purely scientific viewpoint of lighting and illumination the activities of the Illuminating Engineering Society are invaluable. If it were not for the classical researches reported before that organization, there would be no single place toward which to look for scientific guidance on the all-important problem of illumination. None the less, it is unfortunate that the valuable information presented audibly reaches so few ears and that it is then stored away in printed form on reference shelves which are consulted all too infrequently.

To us it seems that the remedy is to make the presentation of papers on commercial applications of illuminating engineering a more important part of the society's meetings and then arrange for joint meetings with other societies representing architects, contractors, fixture dealers and men of similar pursuits. Although this has been done spasmodically before, it could profitably be made a regular practice. By featuring the applied-engineering papers, which always have a wider appeal, and making an honest effort to interest the membership of other societies, a larger number of persons can be made to think in terms of lighting fundamentals and may even become interested in the more scientific discussions of the Illuminating Engineering Society.

The lighting code, the paper on relation of highway illumination to accidents and that on lighting public buildings, presented at the annual convention of the Illuminating Engineering Society last week in Rochester, N. Y., are examples of the type of information which has widespread interest.

Is Inductive-Interference Work Still Drifting?

ONE more step that will aid in the establishment of the California inductive-interference rules as the final answer to the problem they concern has been taken in the recent report of the inductive-interference committee of the telephone and telegraph section of the American Railway Association. The report is based on the work of the California committee, though it does not go to the extent of suggesting remedial measures. Constant reference is made to General Order No. 52 of the Railroad Commission of the State of California. On the committee that presented the report are two telephone representatives who had intimate contact with the California work. There was no representation from the National Electric Light Association except the presence of one manufacturers' representative who is a member of the inductive-interference committee of that association.

Unless the central-station executives awaken to the real situation and get back of the work of the National Electric Light Association more effectively than they have yet done the result of the present negotiations is a foregone conclusion. That this should be so is not strange. The American Bell telephone interests have carried on a consistent and increasingly intensive study of the subject until today they have not only a thoroughly competent research organization but have educated their operating organizations to a thorough appreciation of the problem they are facing.

The telephone interests are not to be criticised for this organization. On the contrary, they should be commended for the foresight that their executives have exercised in anticipating the problem and preparing to meet it.

The activities of the National Electric Light Association, during the last year particularly, are in the right direction and, considering the handicap under which the joint and inductive-interference committees and the small headquarters force have labored, the work accomplished has been far more than any one had a right to expect. This has been due to faithful and unselfish overwork on the part of individuals. The whole handicap is the product of the executive attitude that refused help to the California power interests when the California study was at its most critical point and left a few California companies to carry the burden as best they could. Unless the executive forces of the central-station interests can persuade themselves to back the work with something like the enthusiasm displayed by the executives of the telephone interests it is only a question of months until the men carrying the burden of the study for the National Electric Light Association will find themselves in the same position in which the association found itself in 1915 when it faced the safety code controversy.

Getting back of the work effectively means a much heavier expenditure than has yet been suggested. The organization constantly employed must be large enough to study all phases of the technical problems involved both from telephone and electric service standpoints. That force does not yet exist, and, worse than that, the men to make it up must be educated. The force must also undertake among the power men to a much greater degree the educational work that has already been largely done among the telephone operating force. It must be large enough to co-ordinate the work of the manufacturing and university research laboratories that are available for the studies. This is particularly important because it will result in throwing open the study to the general electrical engineering public and thus obviate the criticism that the knowledge needed in the solution of the problem is centralized in a few hands. It is not fair to the telephone interests to leave the entire burden with them. Much has been done, but a real task still remains for which sufficient funds from the power companies have not yet been made available.

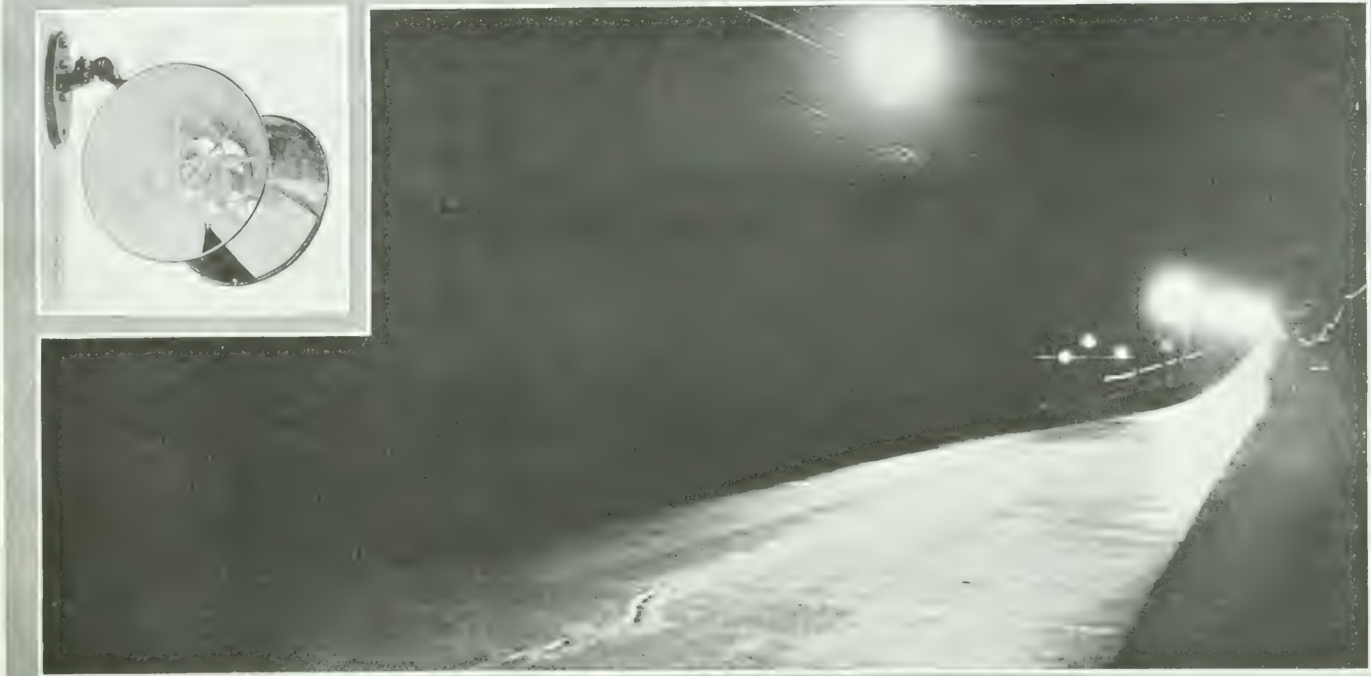
The present executive attitude of "let George do it" can lead only to delay in the ultimate solution of the inductive-interference problem and interminable controversy in arriving at the fundamentals on which it must be based.

Injustice of Large Cash Depreciation Fund

AT A RECENT hearing before the Oklahoma commission and now again before the District of Columbia commission the power companies have fought to get away from the timeworn practice of setting aside a depreciation fund based on probable life. Here is a cash fund growing yearly and remaining for the most part idle. If it earns any interest, it must be from the utility itself. From time to time replacements occur or a unit is taken out of service and the fund is drawn upon. The rest of the time the fund simply grows larger and larger each month out of earnings and earns nothing for itself. It assumes that a generator has a certain life and collects at that rate. It happens quite frequently that the generator at the end of its supposed life is running very efficiently and continues to do so for many more years. By this time the unit has been thoroughly depreciated and can be written off the books, although it is as hale and hearty as ever.

The evil of amassing such a large fund of idle cash and basing its collection on probable life has been apparent for some time. The alternative now advanced seems so sensible, practicable and fair that the wonder is it has not been put into practice before. It is proposed to set aside monthly a small sum, a little larger than the average maintenance account. This is to take care of recurring depreciation and maintenance and leave just enough over to absorb any undue charge that might come. In this way it is hoped to prevent severe fluctuation in operating expense due to this item.

It is hardly conceivable that the property of any company will depreciate all at once. Rather is it true that it will have a great spread. Why, then, have a fund large enough to take care of depreciation for the whole plant at once? Why not have a fund sufficient, with a factor of safety, to meet depreciation obligations as they occur?



Highway Illumination Is an Important and Relatively Untouched Field of Lighting

ANY ONE who has driven an automobile will appreciate the value of any form of road illumination which will eliminate the necessity of brilliant headlights and the usually attending glare, which are often the cause of night accidents. This function is remarkably well fulfilled by the installation shown, in which the light is so directed that the lamps produce the desired illumination without subjecting drivers to bewildering glare. (See the fixture employed in inset at left.) Several installations of this character have already been made for determining the advantages of this system and the experience is inducing other communities to install similar equipment. When it is considered that nearly 18 per cent of the night highway accidents can be attributed to improper or inadequate lighting, according to data presented before the Illuminating Engineering Society last week, it behooves each engineer to see that something is done to remedy local conditions. Some day it is hoped that the responsibility for providing highway light that will assure safety of traffic will be assumed by the state or municipality since it is just as important as a smooth road surface. Until then the necessity for good lighting must be constantly reiterated.

Problems that Central-Station Companies Are Studying

N. E. L. A. President Points to Essential Future Developments and Emphasizes the Need for Obtaining Capital Requirements from Small Investors and the Importance of Utilities Telling Their Own Story More Widely and Actively Pushing the Sale of Convenience Appliances

By **MILAN R. BUMP**
President National Electric Light Association and Chief Engineer Henry L Doherty & Company

MILAN R. BUMP

THE electric utilities of the country as a whole are having a generally satisfactory year from the standpoint of net earnings. Lower prices for materials, together with changes in load conditions, have in a large measure offset the temporary lessening of the revenue from industrial customers. In fact, some companies will undoubtedly have their best showing in 1921. The widespread development of the use of labor-saving appliances is having a marked effect in maintaining domestic consumption of electricity.

The field for electrical development is so great that there seems to be no possibility for overgrowth. The normal increase in the demand for service will require an expenditure of approximately $1,000,000,000 annually over the next few years to come.

When it is considered that the electrification of steam railroads has scarcely begun, that less than half of the homes in America are as yet wired, and that a large percentage of the industries of the country are still operated without the benefit of central-station power, it can be seen that the field for development is tremendous, even if general industrial conditions should be somewhat subnormal during that period.

The feeling is widespread in the industry that developments should continue. A possible drawback lies in the existing tax laws, which have removed for the present the large investor, who for self-protection must put his available funds into tax-free securities. It is the belief of many in our industry that the securities of public utility companies, on account of the fact that they are limited as to earnings, should enjoy tax-exemption privileges as do municipal securities.

Great Confidence in the Industry

My general feeling, based upon a survey of reports to National Electric Light Association headquarters, is one of great confidence in the industry. I sincerely believe that, through our good-will campaign and through the co-operation of all branches of the industry, the electric public utilities at least are coming to the position where their securities will be entitled to first rank among corporate issues. This will mean that if there is money available for any corporate use, the electric utilities can get at least their share of it and can continue the growth that is so essential to the welfare of the industry as a whole.

According to my best belief, the present state of development of the electrical industry covers not more than 10 per cent of its possible field. Any talk, therefore, of overbuilding as far as central stations are concerned is idle, and there is no utility in the country which in my opinion does not face the problem of more than doubling its capacity within the next ten years. This being the case, the fundamental duties of our association and of the industry seem to be, first, to build up the necessary good will to safeguard our investments and to make the sale of our securities possible, and, second, to continue the development of our facilities with the same aggressiveness that has prevailed in past years, with the knowledge and belief that the progress of the nation is in a large measure dependent upon the progress of the electrical industry.

Customers' Ownership Program

In my opinion, the most important new work of the year is embraced in the program undertaken by the new committee on customers' ownership activities. One of the outstanding contributions of Martin Insull's administration was the starting of the nation-wide good-will campaign. Our duty during the present administration lies in "carrying on" in this respect.

Until recently the cost of money has been too high to permit large expansion. Under the various regulatory laws, the return is usually limited to not more than 8 per cent, but it is my opinion that the cost of money is on the decline and will soon reach a figure which the average utility company can afford to pay. There are far too few definite data as to the actual cost of customers' ownership stock-selling campaigns, and one of the duties of the new committee will be to develop information along this line. Reports have reached me of campaigns where the cost has been as little as three points and of others where the cost has been as high as six points. In every instance, however, it has been conclusively shown that the cost of selling has been less than the discount which the bankers and brokers would have required to handle the same distribution of securities.

I believe our new committee will recommend certain fundamentals to be observed in all customers' ownership campaigns, the primary fundamental being the safety of the securities offered to the local stockholders. Great harm might be done where dividends were promised and the promise not fulfilled, and failures of this kind would naturally hurt the entire movement. In every instance the company should strive to sell securities to a maximum number of small holders rather than to continue to load up present holders with stock that is available. The wider the diversity the greater the success of the movement.

Our new work will center largely on customers' ownership activities as representing the most feasible and possible field for the securing of funds essential to the development of the industry. I feel that the various arguments in favor of this step are so well known that it would be mere reiteration to enumerate them here, but in my opinion the ELECTRICAL WORLD could perform no greater service than to continue in each issue to feature customers' ownership in some form and to urge further activity along these lines. The funds rendered available by these activities will be spent by the public utilities and will mean business for the manufacturers, jobbers and contractor-dealers. They are therefore vitally interested in the success of the movement as a movement to build up a volume of business in the various branches of the industry. From the standpoint of promoting proper public relations, no other step has ever approached customers' ownership in importance.

If the Interborough Rapid Transit Company in New York City had an army of 200,000 stockholders scattered over that great city today, its position would be very different from what it is. The same thing holds true of the small utilities in every hamlet in the country. I have heard recently of numerous very interesting customers' ownership campaigns in some of the smaller cities, such as South Bend, Ind.; Beloit, Wis.; Wausau, Wis.; Oklahoma City, etc. Stories of such campaigns give confidence to operators in other small cities. The feeling is widespread in the industry that the continued financing of needed developments by utility companies will also result in producing a satisfactory volume of business for the manufacturer, contractor-dealer and jobber.

PROMOTION AND SALE OF APPLIANCES

In my opinion, it is essential that central-station companies engage in the sale of appliances, but in doing so they should in every instance co-operate with the local contractor-dealers and jobbers and sell appliances on the basis of such a fair margin of profit as will enable the jobbers and contractor-dealers to live and prosper. There are altogether too few data as to what the actual cost of selling appliances is, but it is my opinion that the biggest need of today is a revamping of manufacturers' list prices, permitting a greater spread between list prices and net wholesale prices, because the margin today in many instances is entirely too small for the central-station company or dealer to work within, and it is almost impossible to sell appliances in big volumes at prices above manufacturers' lists.

The Russell-Berger data presented at the Spring Lake (N. J.) meeting of the Association of Edison Illuminating Companies and published in the ELECTRICAL WORLD last week is indeed most interesting, but it is not complete. I believe that it should awaken every company to the necessity for further study along this line, and I am going to recommend to the Commercial Section of the association that it endeavor to push these studies as rapidly as possible.

I am a firm believer in the necessity of the central-station companies' taking up and pioneering new appliances and assisting in promoting the use of such appliances. From a selfish standpoint they should, of course, promote such appliances as make the fullest use of their service, therefore yielding the greatest revenue to them. On the other hand, with a well-developed sales organization, any appliance that can be handled at a profit to help carry the overhead expense of the organization should, in my opinion, be handled. What we really need today is the further development of the long-hour use appliances, such as the small refrigerating machines. With reference to the sale of those appliances for which there is a popular demand for special rates, I am of the opinion that it never pays to establish rates lower than can assuredly be maintained as the load develops. In other words, it is entirely a mistake in policy to adopt a special range rate unless it is fixed at a basis which is profitable to the company and can be maintained as the load develops.

THE NEED FOR TELLING UTILITIES' OWN STORY

Committees on public information are being formed in the various states, and I believe this movement should extend into every state and section of the country. The results already attained by the Illinois committee and the work so capably carried on by other committees, notably the Oklahoma committee, amply justify the continuance of the effort. To my mind, the greatest failure chargeable to the utilities in the past has been their failure to tell their own story.

In all this work I am strongly committed to the elimination of a duplication of effort along either engineering or commercial lines, for I believe it is entirely practicable to work out a plan of co-operation with the engineering societies that will eliminate some of the present duplication that seems to exist between them and our Technical Section. Where publicity is involved the only danger of duplication lies in the failure to tell the same story. Repetition cannot hurt if the same objective is in sight.

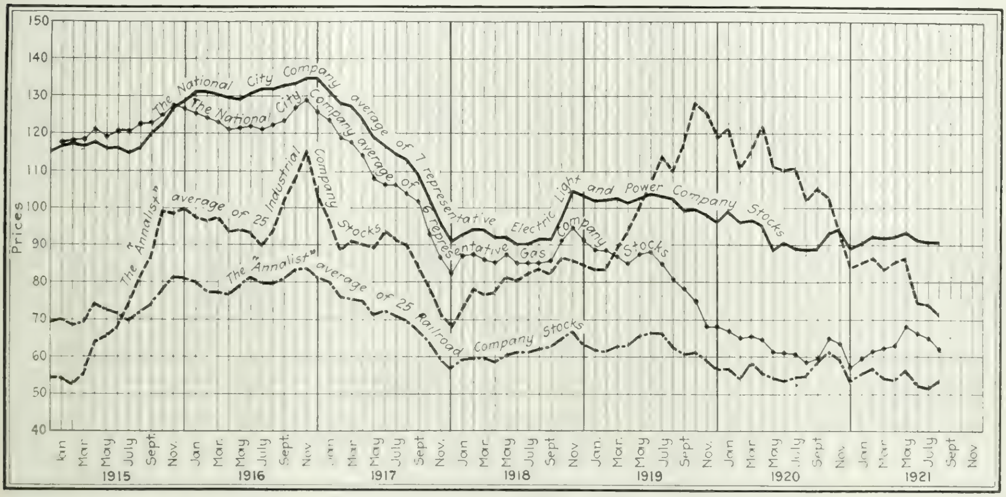
There is so much room for further development in the electrical industry that a knowledge of the facts cannot fail to make those who study them optimistic as to the future. We feel that the industry is sound, stable and safe; that it offers the world more toward making it better, brighter and more efficient than any other industry can offer.

There is underlying the entire electrical industry a feeling of quiet confidence, a belief in "carrying on," that we believe leads inevitably toward success.

Light and Power Securities Show Stability

Increasing Margin Between Gross Revenue and Expenses Reacts Favorably on the Price of Electric Light and Power Stocks

IN THIS season of reactionary tendencies exhibited by the stock market in general the securities of electric light and power companies have stood out in bold relief. These securities have, on the whole, maintained a much firmer tone than has been exhibited by any other class of securities. One of the principal causes for this stability of electric light and power stocks is the realization by the investing public of the large diversity factor in the industry and the recognition of the basic principle that conditions which operate to curtail one line of business may at the same time stimulate another line.



ELECTRIC LIGHT AND POWER STOCKS CONTINUE TO SHOW STABILITY WHILE INDUSTRIALS DROP

A second very pronounced reason for the comparatively high quotations for electric light and power securities is the fact that the margin between gross revenue received from the sale of energy and the operating and maintenance expenses is showing a material increase. Returns received by the ELECTRICAL WORLD indicate that while the operating expenses of the industry in general are practically the same as reported for last year, the gross revenue has increased by about 10 per cent. Similar relations hold true for every section of the country but are slightly exaggerated in the Atlantic States, where the gross revenue shows an increase of about 15.2 per cent over last year, though the operating expenses increased only 2 per cent over the same period. Such conditions cannot but induce a favorable attitude on the part of the careful investor.

Through the courtesy of the National City Company, the ELECTRICAL WORLD is able to continue its chart (published in the July 23 issue) showing the average prices of the common stock of seven representative electric light and power companies and of six representative gas companies. The curve showing the prices of twenty-five industrial and an equal number of railroad stocks has also been continued through August.

So far as possible the electric light and power stocks represented in the curves are of companies doing a purely electric lighting and power business. With one exception companies combining more than one utility have not been included in the tabulation. In order that the curves may be comparable, the values plotted have been obtained by averaging the high and low sales of each of the stocks which have occurred during each month.

Since the opening of the present year the electric light and power stocks have shown a remarkable stability. The greatest range during this intense reactionary period has been only 2.62 points, and in August the price was only two points above that quoted for January. During July and August the range was less than one-tenth of one point. Against this record of stability exhibited by the electric light and power stocks the variations shown by industrial stocks appear most unfavorably. Industrials showed a range of sixteen points during the first eight months of the year. These stocks have shown a decided drop since May, decreasing from 86 to 71 in August. During the period from October, 1919, to September, 1921, the stocks of twenty-five representative industrials have dropped from 128.5 to 71.5, a range of fifty-seven points. During this same period electric light and power stocks have decreased from 99.5 to 90.9, a drop of 8.6 and an extreme range of about ten points.

Electric light and power companies are beginning to reap the harvest resulting from the inherent stability of the industry and sound methods of financing. The confidence of the public has been obtained in large part, and the public's money is always available to those who hold its confidence. The electric light and power industry in general is returning real money to its stockholders in contradistinction to the suspended dividends now so prevalent among the industrials. Such a condition is bound to continue to react favorably upon electric light and power stocks.

Material Decrease in Operating Ratio

Survey of Systems of Electric Light and Power Companies Indicates Extent to Which Efficient Methods and Reduced Costs Have Decreased Cost of Operation and How Utility Dollar Is Increasing in Value to Stockholder

STARTING with January, 1921, the ELECTRICAL WORLD has been collecting monthly statistics on operating and maintenance expenses in addition to its usual monthly statistics on gross revenue and output of the electric light and power industry. These figures are reported for both 1920 and 1921 and show some interesting comparisons as to the trend of the operating ratio* of the industry.

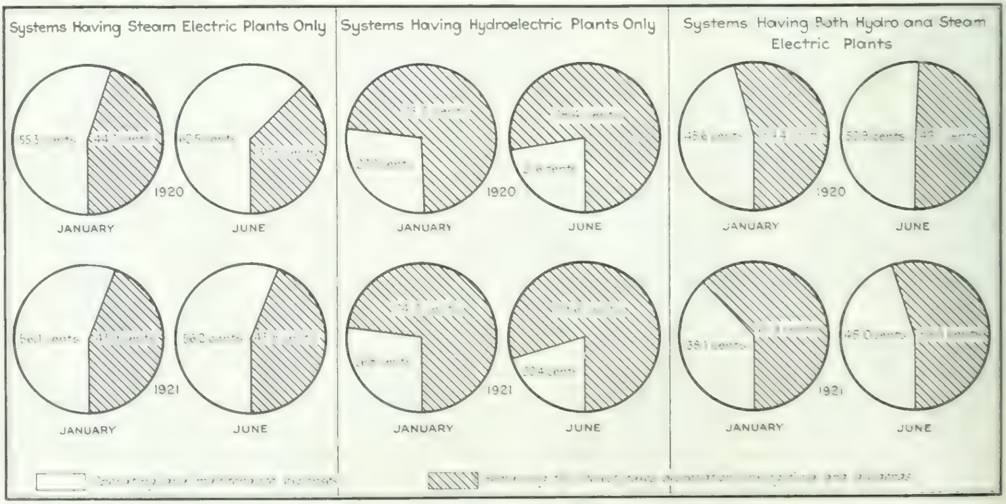
In order that a definite figure may be obtained, recording companies are requested to report only gross revenue from sale of energy, and under the item of "operating and maintenance expenses" not to include interest, taxes, depreciation or sinking fund. By the comparison of these two items it is believed that a dependable figure is obtained giving the aggregate operating ratio in the manufacture of electrical energy.

A study of the operating ratio figures for the first six months of 1920 and 1921 of electric light and power companies making regular monthly reports to the ELECTRICAL WORLD, as indicated in the accompanying tables, leads to some very pertinent conclusions as to the trend of the operating ratio where various types of generating units are employed. During the present year the operating ratio of generating companies operating steam plants only was, on an average, the same during June as during January, namely, about 56.2 per cent. During 1920, however, the operating ratio increased from 55.3 per cent in January, to 62.5 per cent in June. These comparisons can be fully explained by the rapid advance in the price of fuel during the spring of 1920 and the stability of fuel prices during the first six months of 1921.

Generating companies operating only hydro-electric plants reported a decrease in the operating ratio during the first six months of 1921 from 26.8 per cent to 20.4 per cent, and from 27.0 per cent to 21.6 per cent during a similar period in 1920. This decrease is, however, to a greater or less degree only apparent, for as the season advanced many companies operating small hydro-electric plants added steam auxiliaries to

TABLE I—AGGREGATE OPERATING RATIO OF COMPANIES REPORTING MONTHLY DATA TO "ELECTRICAL WORLD"

Month	Systems Having Steam Plants Only				Systems Having Hydro Plants Only				Systems Having Both Steam and Hydro Plants			
			Average for Year				Average for Year				Average for Year	
	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920
January	56.1	55.3	56.1	55.3	26.8	27.0	26.8	27.0	38.1	45.6	38.1	45.6
February	55.6	54.5	55.7	54.8	22.9	26.0	24.8	26.5	44.1	47.8	[illegible]	46.7
March	56.1	57.7	55.9	55.8	23.4	19.6	24.4	[illegible]	40.2	44.8	40.2	44.2
April	53.0	56.5	55.3	56.0	23.9	19.8	24.3	[illegible]	41.4	45.5	40.5	45.2
May	55.4	56.8	55.4	55.8	24.2	22.9	24.2	[illegible]	49.6	44.8	[illegible]	44.8
June	56.2	62.5	55.4	57.6	20.4	21.6	23.8	22.6	45.0	50.9	[illegible]	[illegible]



HOW THE ELECTRIC LIGHT AND POWER COMPANY DOLLAR HAS INCREASED IN VALUE TO STOCKHOLDERS their systems and their reports of operations were, therefore, transferred to "companies having both hydro and steam plants." This transfer left only the companies having the larger hydro plants, the operating ratio of which is, in general, below that of the smaller plants.

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*Operating ratio may be defined as the ratio between the "operating and maintenance expenses" and the "gross revenue from sale of energy" expressed as a percentage.

The operating ratio of companies having both hydro and steam plants follows more or less the high-water and low-water periods of the rivers of the country. As the amount of water available decreased with the spring and early summer months, these companies were forced to increase their steam-plant operation as the hydro-plant output decreased. The operating ratio gradually increased, therefore, from 38.1 per cent in January to 45.0 per cent in June during the present year and from 45.6 to 50.9 per cent during a similar period in 1920. In comparing June of 1921 with June of 1920, however, a large decrease in the operating ratio is shown. The operating ratio of generating companies operating only steam plants decreased during this period from 62.5 to 56.2 per cent, the companies with only hydro plants decreased from 21.6 to 20.4 per cent, and companies whose systems include both steam and hydro plants decreased from 50.9 to 45.0 per cent.

These figures for the country as a whole are even more significant when the fact is taken into consideration that the gross revenue of the electric light and power companies from the sale of energy during June, 1921, was almost 10 per cent greater than that reported in June, 1920. This increased revenue was realized during the period in which the cost of manufacturing electrical energy was decreasing, and this resulted in revenue above operating expenses greatly in excess of the amount possible had these two quantities increased proportionately.

Table II gives the aggregate operating ratio of electric light and power companies by sections of the country. Operating conditions vary materially in various parts of the country, depending upon proximity of fuel, size of streams and continuity of flow, concentration and density of population calling for a few large plants or many small plants, and distance of transmission. In all three classes of generating systems, however, a downward tendency in the operating ratio is noticeable in every section of the country except in the case of the hydro-electric plants. The expense of operating hydro-electric plants increased in every section of the country during the twelve-month period from June, 1920, to June, 1921, excepting the Atlantic States. This is probably due to increases in wages during that period. The gradual increase reported by systems having both hydro and steam electric generating plants is common to all sections during the first six months of both 1920 and 1921 and is attributed, as indicated above, to the decrease of the operation of hydro-electric plants and the substitution of additional steam plants as part of the system.

That the operating ratio has decreased materially during the past twelve months is certain, and it adds another argument to prove the progress of the electric light and power industry. Many industries through efficient methods and material cuts on every side can report a reduced operating ratio, but few can present figures such as the above, showing a reduced operating ratio and at the same time a high-record gross revenue.

TABLE II—AGGREGATE OPERATING RATIO OF ELECTRIC LIGHT AND POWER COMPANIES BY SECTIONS

Type of Generating Plant and Month	New England States				Atlantic States				North Central States				South Central States				Mountain and Pacific States			
			Average for Year				Average for Year				Average for Year				Average for Year				Average for Year	
	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920
Steam Plants:																				
January	54.0	60 8	54 0	60 8	53 5	50.9	53.5	50.9	61.2	61.8	61 2	61 8	53 1	53.7	53 1	53 7	69 0	60 5	69 0	60 5
February	54 3	59.5	54 2	60 3	52 3	53.0	52.7	52.1	63 0	57 9	62.1	59 8	59.1	51 2	56 2	52 3	60 2	60 3	64.3	60 3
March	64 0	70 0	56 7	62 5	54 5	56 7	53.3	53 7	58.4	59.7	60 8	59.8	53 3	50 9	55.0	51 9	68 4	62.5	65.9	61.2
April	59 4	63 5	57 3	62 7	50 9	54 3	52.8	53.8	54.8	61 2	59.3	60 2	54 1	52.8	54 7	52 1	53.7	53 7	61.8	58.6
May	63 2	69 1	58 3	63 8	56 2	58.6	53 4	54.5	54.7	63 3	58.5	60 8	53 3	56.0	54 4	53 0	55 0	57 0	59 9	58 3
June	60 1	71.2	58 7	64 9	55.8	59.5	53.8	55.3	56.6	68.3	58 3	61.8	55 3	60 0	54 6	53.8	53.4	56 2	58 6	57 8
Hydro Plants:																				
January	26.5	35.2	26 5	35.2	21 2	21 2	21.2	21.2	25.0	20.8	25.0	20.8	26.4	20.1	26 4	20 1	27.5	27.3	27 5	27 3
February	30.1	46 5	26 8	35.6	20 1	20.6	20.7	20.9	24.1	20.6	24.6	20.6	28.6	21.4	27 4	20 5	23 9	27 9	26 0	27 6
March	29.9	30 0	26 9	35 3	21 0	20 6	20.8	20.8	23.0	20 6	23.5	20.6	30 4	23.2	28 4	21.3	24 9	19 0	25 8	25 6
April	24.6	34 7	26.5	35.2	18 2	·18 8	20.2	20.3	24.8	20.8	24.2	20.7	22.4	25.0	26.8	21.2	27.3	19 2	26 0	24 2
May	26.5	25 6	26 5	34 3	15 5	17 4	19 2	19.7	21.5	20.1	22.5	20.5	27.9	21.2	27 1	21 2	29 8	22 9	26 6	24 0
June	29.2	21.5	26 6	33 8	17 6	18 8	19 0	19.6	21.1	19.5	22.8	20.2	27.3	18.3	27.1	20 7	30 3	27.4	27.6	24 2
Combined Systems of Steam and Hydro Plants:																				
January	45.3	53.5	45 3	53 5	43 5	45.8	43 5	45.8	39.5	38.6	39.5	38.6	38 6	46 6	38 6	46 6	35 2	45 6	35 2	45.5
February	44 3	60.0	44.7	58 8	41 8	41 9	42.6	43.8	42.4	49.8	41.9	48.2	41.7	39.6	40 5	42 0	39.6	43 8	37.4	44 7
March	49.7	53.8	47 3	56 0	39.7	47 3	42.0	45.3	41.5	46.0	41.8	47.3	38 6	39.2	40 2	41 2	36 4	39 7	36.9	43.0
April	46.6	48.5	47.1	53.5	42 9	43 9	41.9	44.8	45.0	48.3	42.7	47.5	43.6	48.6	40 7	42 8	37 0	36 8	37.0	41.0
May	49.2	48 5	47 6	52 3	39 8	44 2	41 4	44.7	47.0	52.8	43.7	48.8	40 7	39 6	40 6	42 2	35 0	38 3	36.4	40 3
June	58.5	56.5	49 6	53 2	42 3	45 8	41 6	44 9	50.1	62.2	45 0	51.6	45 1	44 8	41.3	42.7	38.8	44 3	37 0	41.1

Electric Steel Production in 1920 Totaled 747,724 Gross Tons

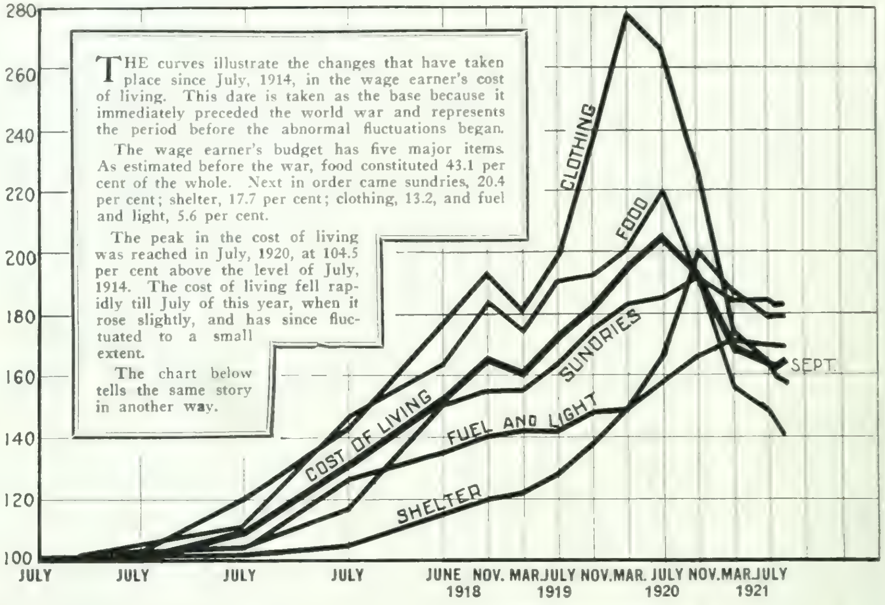
RECENT figures issued by the American Iron and Steel Institute indicate that the production of steel in the United States in 1920 reached a total of 43,793,226 gross tons. This is an increase of 21 per cent over 1919, but was 5.3 per cent below the output during the war rush of 1918. Electric steel output in 1920 totaled 747,724 gross tons, which was an increase over the 1919 production of 32 per cent. Electric steel ingots and castings totaled 502,152 gross tons in 1920 and electric steel alloys totaled 245,572 gross tons. Following is the 1919 and 1920 production:

	Gross Tons	
	1919	1920
Open-hearth	26,948,694	32,671,895
Bessemer	7,271,562	8,883,087
Crucible steel ingots and castings	63,572	72,265
Electric steel ingots and castings	384,452	502,152
Miscellaneous ingots and castings	2,352	5,535
Open-hearth alloy steels		
Bessemer alloy steels	1,299,536	1,414,720
Crucible alloy steels		
Electric alloy steels	181,637	245,572
Total production	[illegible]	43,793,226

The total production of electric ingots in 1919 was 448,517 tons, and in 1920 it was 580,818 tons. The total production of electric castings in 1919 was 117,567 tons, and in 1920 it was 166,906 tons.

INDEX NUMBERS OF THE COST OF LIVING IN THE UNITED STATES

100 = AVERAGE PRICES IN JULY, 1914



The curves illustrate the changes that have taken place since July, 1914, in the wage earner's cost of living. This date is taken as the base because it immediately preceded the world war and represents the period before the abnormal fluctuations began.

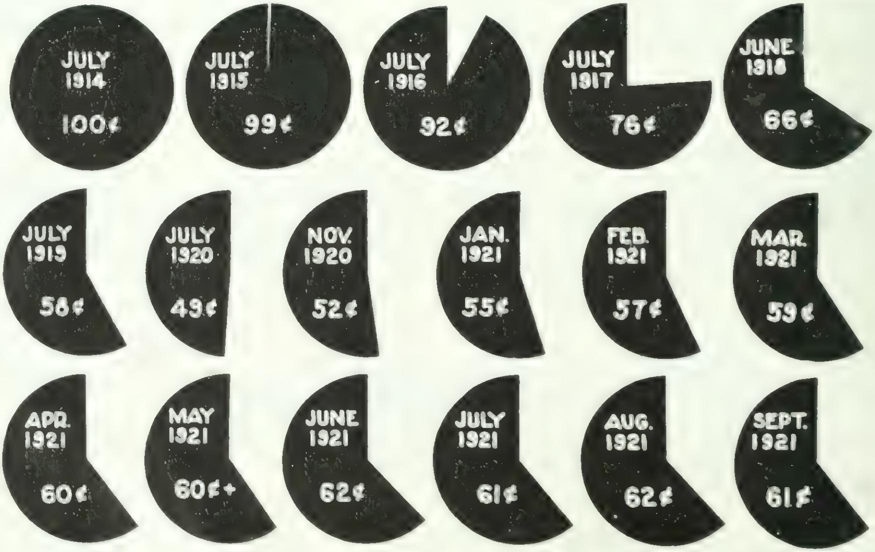
The wage earner's budget has five major items. As estimated before the war, food constituted 43.1 per cent of the whole. Next in order came sundries, 20.4 per cent; shelter, 17.7 per cent; clothing, 13.2, and fuel and light, 5.6 per cent.

The peak in the cost of living was reached in July, 1920, at 104.5 per cent above the level of July, 1914. The cost of living fell rapidly till July of this year, when it rose slightly, and has since fluctuated to a small extent.

The chart below tells the same story in another way.

PURCHASING VALUE OF THE DOLLAR

BASED ON RETAIL PRICES WEIGHTED ACCORDING TO IMPORTANCE IN AVERAGE FAMILY BUDGET



(NATIONAL INDUSTRIAL CONFERENCE BOARD)

The Plain Facts About the Business Outlook for Electrical Men

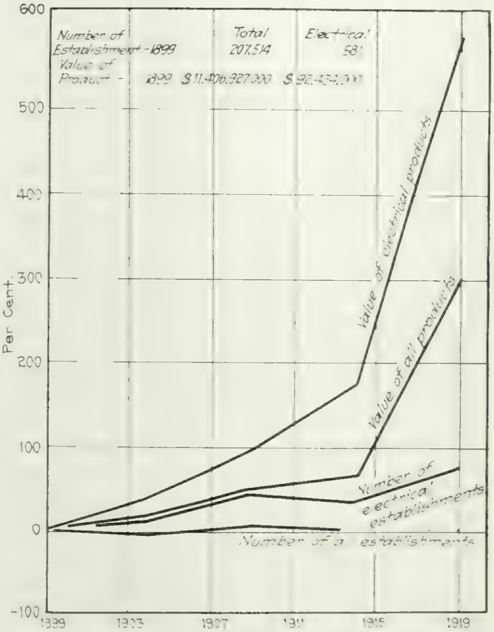
A Review of the Economic Influences Now Encouraging the Revival of Business, with Supporting Facts from Recent Experience in the Electrical Industry

By EARLE E. WHITEHORNE

GENERAL economic conditions continue to be the all-engrossing topic of discussion. But there is a new note growing stronger in it all. When two men meet each other on the corner today, after the greeting, one says: "Well, what do you think about business?" The answer comes: "Things seem to be looking up. I guess we've turned the corner all right." And the first man responds: "That's what everybody is saying. I guess it's so." In other words, what Thomas A. Edison has called the "fear load" is gradually lifting.

Confidence and optimism, or anxiety and mental depression, are ever a very large factor in the business situation of extremely good or unusually bad times. In a recent interview Mr. Edison expressed it graphically: "What we have been going through," he said, "is nothing but a period of depression, and nothing to worry over, provided we set ourselves resolutely to the task of overcoming it. These periods of depression come in recurring cycles. They are nothing new. The point to be driven home is that the country always recovers from them and goes forward with greater strides than ever before. We will get over this one, too. The tide already has begun to turn. Times are getting better now, slowly, of course, but surely. These periods of depression are caused by a faulty adjustment of our economic machine, or by it being thrown out of gear by some unusual force such as war. The machine is all right; it will work properly when the obstruction moves."

But better times cannot be built on theory alone, and it must be understood that it is on facts and figures of distinct improvement that the present swelling wave of economic restoration is feeding. In the ELECTRICAL WORLD of Sept. 10 statistics were given showing that while production among electrical manufacturers had declined from 73 to 52 per cent of capacity during the first half of this year, the situation was already beginning to stiffen on increase of orders and to show an actual upward trend. Moreover, these figures were, after all, calculated on the basis of war capacity, which is probably double that of the years preceding the war. We may have shown on July 1, 1921, operations of but 52 per cent of plant capacity, but comparisons with pre-war output would indicate a percentage far closer to our normal peace-time records, despite the fact that export business has been dissipated to such a degree. This must be reckoned in, for every calculation must embrace and estimate the influence of contributing conditions as well as mere reports of growing trade.

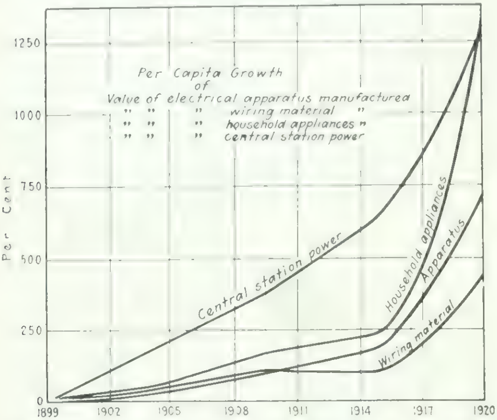


VALUE OF PER CAPITA GROWTH OF ELECTRICAL MANUFACTURED PRODUCTS COMPARED WITH ALL MANUFACTURED PRODUCTS

The business of the electrical man cannot be isolated from other business. The market for electrical products and the prosperity of the electrical industry are indissolubly compounded with the business of other men and the prosperity of other industries. The economic problems of the nation—which today have come to be the problems of the world—are the concern of every electrical manufacturer and jobber, every central-station-company executive, every contractor and dealer, because they directly influence his business. And so it becomes imperative with him that such affecting issues be widely guided and developed. What are these broad, economic conditions by which the business revival is being shaped? It is well for every man to have them classified in his mind so he shall be conscious of them and recognize and take advantage of their trend.

The Tax Situation.—The mind of the country is much engaged with the tax burden. People are tired of taxes that are hard to pay, so Congress is convened in extra session to frame a bill to provide some adequate measure of relief. Business men in general have come to a point where they despair of receiving immediate aid and are resolved to go ahead and do business in spite of it; but there is a widespread feeling that some relief must come before long, and this confidence is being expressed by more constructive activity. The yield of the tax is falling below the estimate, and a reduction in the rate can be expected to increase the revenue by stimulating business; therefore men believe that a reduction in income surtaxes and excess-profits taxes will surely come.

The Budget Situation.—The prospect of saving $350,000,000 in the expenses of the government through the institution of the budget system is bringing great encouragement not only to business but to the consuming public. The nation has confidence in Charles G. Dawes, Director-General of the Budget, and looks to him to put an end to the inordinate waste of money through duplication and inefficiency in government departments. Every one believes that such a vast saving must bring relief and have a good influence on business.



INCREASE IN VALUE OF ELECTRICAL APPLIANCES MANUFACTURED AND CENTRAL STATION POWER AS COMPARED WITH INCREASE IN WIRING MATERIAL AND HOUSEHOLD APPLIANCES

The Disarmament Situation.—The knowledge that 92 per cent of the revenues of our government go to pay the cost of past wars and preparation for possible future conflicts has been borne in on the consciousness of the people. Secretary of the Treasury Mellon has estimated federal expenditures for the year ending June 3, 1922, at $4,600,000,000. If the President, the Cabinet, Congress and all departments, including the mails and other services at home and abroad, were discontinued, it could effect an economy of but $400,000,000. The balance of $4,200,000,000, Mr. Mellon says, "represents burdens directly traceable to war" either past or prospective. Such a condition is unbelievable and not to be suffered, and the calling of the conference on the limitation of armaments has put hope in men's hearts that some help may be in sight. This conference will not disarm the world, but it does crystallize the demand of peoples and it is encouraging.

The Employment Situation.—It had been reported that there were 5,735,000 unemployed workers in the United States idle as a result of business depression. It appears now that the probable non-employment does not actually total much more than 3,750,000, or about two and a half times the 1,500,000 who are unemployed in this vast country in normal times. It is a bad condition in spite of that, but a national conference on unemployment has been at work in Washington, not theorizing on our social system, but endeavoring to find "a practical remedy for unemployment through employment," as Mr. Hoover expresses it. And the knowledge of this fact is stiffening the back of business.

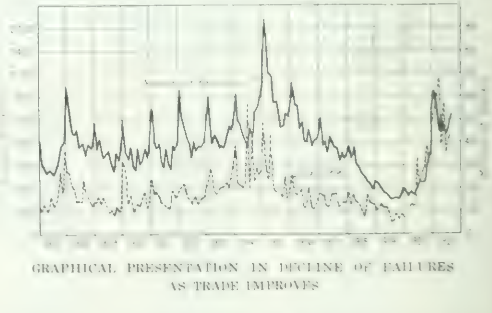
The Railroad Situation.—The problem of the railroads has not yet been solved, but the business of the railroads has been steadily improving. Freight-car loadings have been gradually increasing in the last six months. More money is being made. It is believed that the long-desired settlement with the government will be effected before very long, releasing funds for postponed construction and improvements and turning loose a flood of money into the channels of trade. Plans for a more efficient operation of the railways in group systems are being worked out, and there is a general feeling that the railroads are getting back on their feet.

The Crop Situation.—The rise in the price of cotton has brought renewed life and activity to the South. Higher prices for grain crops have made better feeling in the other rural sections. Farmers are marketing crops as they are harvesting, and spending money. General crop conditions are distinctly encouraging.

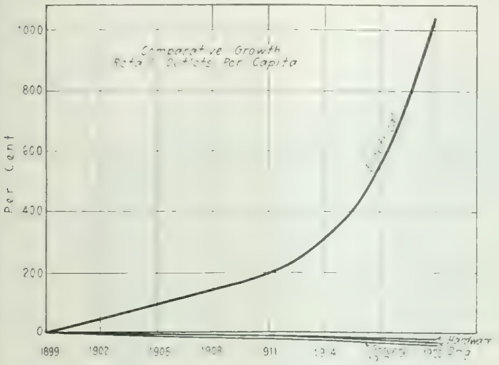
The Price Situation.—Prices have been gradually working down. Commodities in which the labor element is large are lagging because labor is naturally slow in its reaction. But it must and will give way before the general adjustment and every one realizes that conditions are improving. Prices are coming down.

The Foreign Trade Situation.—There is little progress to be seen in export trade. The European nations are apparently working out a measure of salvation and bettering their own conditions. Without a system of long time credits, however, there seems to be small opportunity for the development of export business from the United States, under present unbalanced rates of foreign exchange and the existing tariff. And no way is found to provide the credits. But business is making up its mind to go ahead without the export market until something turns up to make trade possible with foreign countries. The matter presses for settlement, but the general attitude is that domestic business must now be developed anyway. The influences of the export tangle are being discounted.

All these conditions listed here in briefest comment are factors in the market situation of every American business man—elements which will affect the plans of every member of the electrical industry. It is the expectation and consideration of these improving situations that are making men steadily more certain that conditions are improving and that the time has come to go ahead. And what is the result? Because business is stronger, the extreme financial restrictions have been materially eased, and in spite of the record-breaking drop in commodity prices, with consequent shrinkage in inventory values, the rate of business mortality is falling off. There have been fewer failures. The curve is working down again after the financial storm



GRAPHICAL PRESENTATION IN DECLINE OF FAILURES AS TRADE IMPROVES of last fall and winter. It is reacting to the fact that there is more general buying. People are beginning to spend money less fearfully. In the department stores of New York, for instance, there were 18.2 per cent more individual sales in August than for the same month last year, and this is general throughout the country. Chain-store systems report an increase and mail-order houses also show an advance. The reports of the Federal Reserve Bank, from the different districts, show a distinct general business improvement and a melting of the gloom. Inquiries and orders are both becoming more numerous. Buying is better and selling is better and so business is better. And buying is particularly better in the electrical industry.



COMPARATIVE GROWTH OF RETAIL OUTLETS PER CAPITA

There are two reasons why business is improving in the electrical industry, and one of them is largely the source of the other. In the first place, the light and power company is slowly and steadily gaining in popularity with the people, both as a public service and as an investment. Hundreds of thousands of dollars of central station securities have been marketed in the last few years direct to the local public. These security sales have been accomplished by active campaigns of information that have spread more light about utilities than ever has been seen before. Heaven knows that there remain enough companies that still have not made friendly peace with their customers and gained their understanding and appreciation and are not yet profiting by the benefits that popular sympathy will ever bring. But much progress has been made. To sell securities the people have been given the facts and the facts have spoken. And a better market has come for electrical appliances and the product of the generators.

All this has naturally reacted on the sale of electrical merchandise, and appliances are being sold this year in a volume far larger than many men appreciate. Many manufacturers report better appliance sales than last year. One of the largest producers has sold 50 per cent more heating appliances so far this year than in the like period in 1918 and 30 per cent more than in 1919. Others show similar gains, although the large stocks carried over from last year by jobbers and dealers affect some figures adversely. But the people are buying electrical devices because more and more they are becoming convinced of the comfort, the convenience and the practical economy they offer. Therefore the local sales are growing. Business may have been bad this year, but still the totals on appliance sales by central-station companies and contractor-dealers throughout the country swell to an impressive figure. A few examples taken at random may be cited:

Twenty-five central-station companies in Pennsylvania, not including any of the large cities, sold in the first seven months of this year 3,000 flatirons, 500 washers, 1,300 cleaners and small appliances to make a total of 6,200.

Twenty central-station companies in Texas, not including any large city, sold in the same period 1,200 flatirons, 230 washers, 700 cleaners and small appliances to make a total of 10,000.

Ten central-station companies in Kansas, including no large city, sold in the same period 810 flatirons, 450 washers, 415 cleaners and small devices to make a total of 2,850.

Twenty central-station companies in Utah, including one large city, sold in this same time 3,100 flatirons, 1,550 washers, 1,000 cleaners and enough other appliances to total 6,500.

Two central-station companies in Rhode Island, in small cities, have sold in eight months this year 1,485 flatirons, 200 washers, 435 cleaners and other devices to total 2,725.

A central-station company in a small city of Massachusetts has sold through August 2,690 flatirons, 63 washers, 487 cleaners and devices to total 4,777.

A central-station company in Maine has sold through August 2,534 flatirons, 209 washers, 413 cleaners and other appliances to aggregate 3,502.

One of the large Middle West utilities reports that range sales for the first six months this year were 20 per cent greater than for the entire year of 1920 and that range connections will be 30 per cent more.

Appliance sales by electrical contractor-dealers are aggregating a tremendous volume.

PROOF IN THE TREND OF GROWTH

In short, the electrical business, despite the closing era of bad times, has still been moving in large volume and with irresistible growth, because the idea of using electrical appliances is just beginning to be brought home to the great buying public. The recent survey in Philadelphia showed that in about 1,300 small houses there, where there is an average of but two appliances per house, the appliance load already has built a greater consumption of energy than the lighting load and on a summer test. What will the conditions be five years from now?

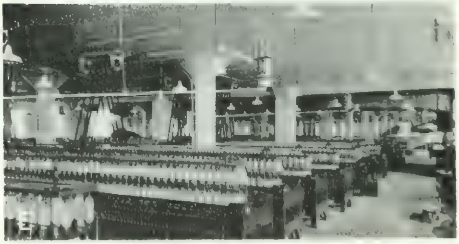
As a result of this increasing public interest in electrical appliances some interesting developments have been taking place, as shown graphically on these pages. Whereas the number of clothing stores, hardware stores and grocery stores has slightly fallen off in recent years, the number of electric shops has increased greatly. The percentage increase in value per capita of all the products of electrical manufacturers as compared with other manufacturers has shown enormous acceleration for the electrical industry. The comparative curves of the different electrical products show a tremendous swelling of the demand for appliances over and beyond a normal growth for other electrical materials and apparatus. It is not hard to picture how great a stimulus will come before very long when stabilized conditions begin to influence the more rapid building of homes and the demand sets in for electrical material.

In short, business is better. The electrical man is selling more. Substantial business is ahead and the "fear load" can be laid aside.

Some Industrial Installations of Recent Months

While industrial construction is below that of 1920 statistics show it has not stopped at any time

Rehabilitation, adaptation and new building will speed up as conditions continue to improve



A — Mississippi Glass Company, Floreffe, Pa. An extension involving $100,000 worth of mechanical and electrical equipment.

B — Corning (N. Y.) Glass Company, new boiler plant with $200,000 of mechanical equipment.

C — Great Falls Manufacturing Company, Somersworth, N. H. New building with 850 looms and 55,000 spindles built by Lockwood, Greene & Company.

D — Mutual Enamel Ware Company, Chattanooga, Tenn. About $100,000 in mechanical and electrical equipment.

E — Spinning room of Great Falls mill shown at C.

F — Westinghouse Lamp Company's plant at Indianapolis, Ind. Dwight P. Robinson & Company, Inc., installed mechanical and electrical equipment in all the factories shown except those of C and E.

Lower Prices Will Bring Better Business

Although It Is Apparent the Tide Has Turned, Improvement Will Be Gradual, Making Itself Strongly Felt Next Spring, with Full Recovery Well Advanced by 1923

By SHIRAS MORRIS

President Hart & Hegeman Manufacturing Company and Johns-Pratt Company, Hartford, Conn.

SHIRAS MORRIS

WITHIN the past six or eight weeks the sentiment of the electrical market has undergone a complete change for the better. Ever since last fall incoming business had been diminishing and buyers quite naturally had withheld orders. We had for some ten months or more been undergoing a reaction from the unbridled sellers' market of late 1919 and early 1920. The pendulum had swung upward to an alarming degree and there was no artificial force great enough to sustain it. Therefore it began to swing the other way.

Now it looks as though the reaction had gone almost too far for the present. This does not mean, however, that we are speedily on our way to another boom period. There will be no quick recovery of business. It will come as it is coming now, slowly and gradually. By next spring we should see the market well on its way to recovery. Before that time, however, there must be a further purging of business in the fire of lower costs.

Business and labor are becoming tired of inactivity, but neither can make any real progress forward—and they both know it—while shackled with the chains of high costs.

It is not a case of raw-material prices—these have hit pretty near low. Copper and cotton are probably as low as we shall see them for a good many years. In fact, both of these items are due for a substantial rise as soon as a buying market sets in. Some materials, like iron and steel and coal, depend on two items—labor and freight. The labor situation will probably be decided by next spring. The demand for lower freight rates is becoming more insistent each day, and while the railroads naturally are doing all they can to postpone any such action, it is impossible to see how they can hold out much longer.

In looking for better business, however, it must be remembered that the year 1920 was an unusual year, built up to a large degree on fictitious business. A buyer was apt to place his order in from two to six places in the hope of getting some kind of a delivery. When a slump seemed imminent cancellations were resorted to. The business was unsound and for that reason must be cast out of the business thinking of the electrical as well as every other industry.

Some manufacturers, it is true, misread the conditions and took the 1920 business mirage to be the real thing. On the strength of these beliefs they went ahead expanding. To them, of course, this period of depression has been unusually painful.

Still, the bottom has not dropped out of the market. The market has merely changed in character. From 1915, except perhaps for the early months of 1919, business went through a sellers' market. It was so tremendous that it ran away with itself. We forgot our awe of millions and became very familiar with the word billions. It all seemed so easy. Everybody got the spirit. Labor got it and worked less and asked for more. Salesmen no longer really worked. They took orders or explained why orders booked for some months hadn't been delivered. Factories didn't look for business, instead they turned it away.

In the five years of the biggest sellers' market in the history of the world the art of salesmanship was almost lost. Since then manufacturers and jobbers have been sitting back in their chairs feeling very blue and doing a lot of self-pitying. All they saw was a decreasing volume of bookings, and their answer almost invariably was to cut expenses. And it is good that they did. They are now on a better foundation to do business. Those who are left in the office or the shop realize that a full day's work is expected.

This method, however, of keeping gross income and expenses away from each other has a limit, and it is now time to work on the other end—increase the gross. We are in a buyers' market now and we must therefore seek the buyer. For five years we had a grand vacation from selling and it left us soft.

There are some electrical manufacturers who are doing a nice business today. These manufacturers recognized the changed conditions and quickly adapted themselves to them. They are selling their goods at prices based on present costs of labor and material regardless of the loss they may have to take on the inventory which is being used.

The buying public feels that the prices of such manufactures are as low as they probably will be in the immediate future and buys without restraint. The other kind of manufacturer, whose prices are not adapted to the present values of labor and material but who is attempting to sell on the basis the material cost him months ago, is retarding the revival of his business.

When a salesman is obliged to say frankly that prices on his line will probably be lower in the near future, he has not given a very good argument for receiving orders, and the buyer naturally buys nothing except his immediate urgent requirements. When the entire industry is back to normal and reasonable costs and selling prices, I look for a vigorous revival in business. The electrical material is not a very large percentage of building costs, but it is a factor, and lower building costs will unquestionably stimulate the whole general business situation.

Just now the South is in clover with high cotton prices. The crops of the Middle West have put the farmer in a better frame of mind. The water-power development of the West Coast means almost unthinkable electrical business of every description. The central station companies have now available capacity. They are not standing back calmly waiting for business. They are wiring old houses, extending lines and filling them with new business, pushing street lighting and generally getting back to the pre-war days when the central-station company was looked on by every one as the great developer and builder of the electrical business.

To sum up, business is not bad. It is getting better and by spring should be in very fair condition. It will not come up to the bloated 1920 period of pyramided orders. By 1923 we should have pretty well recovered our market equilibrium.

Jobbers See Steady Improvement Ahead

Although the Volume of Business Is About 50 per Cent What It Was Last Year. Stocks Are Lower and Wholesalers Are Entering the Winter with Optimistic Spirit and Feeling that Spring Business Will Be Good

STEADY improvement, slow but continued, with full activity coming somewhere between spring and fall next year, is the optimistic outlook on the electric supply jobbing situation. The long pull is here so far as the jobbers are concerned. Such is the sentiment revealed by a survey made by the ELECTRICAL WORLD, the conclusion being based on letters from more than eighty jobbers, representing every section of the country.

A questionnaire was sent to all electrical jobbers asking six questions, as follows:

1. How does your volume of sales compare with that (a) at the beginning of this year and (b) a year ago?
2. Were your stocks on Sept. 1 very low, moderate or large?
3. What is your present rate of turnover and how does this compare with the last quarter of 1920?
4. In what condition do you intend to maintain your stock for the remainder of the year?
5. Has the bottom been reached in your locality, and if so when? And if not, when, in your opinion, will it be?
6. What is your personal opinion of the outlook in the electrical industry locally?

The answers have been tabulated and will be found on the next page.

Sales volume is lower than it was last year by almost 50 per cent on the whole. Here and there a jobbing house is found that is doing a better business than it did a year ago. With the first of the year, however, the comparison is more favorable. Almost as many houses are handling a greater volume as are handling less. The strength, however, seems to lie for the most part in the Middle West.

In looking at these results on sales volume, however, it must be remembered that prices have materially declined in the past twelve months. Even with the same tonnage handled sales volume would be less on a dollars-and-cents basis. Not a few jobbers took pains to point this out and say that their sales tonnage shows a healthy increase while gross revenue continues to decline.

Stocks show a much healthier condition than they did last year, and the natural result has been to strengthen greatly the credit position of the jobbers. Last year almost every jobber was overstocked. He had to be if he were going to perform his logical function. Now only here and there is a large stock found. For the most part stocks are moderate and not a few have been consistently reduced until they are now quite low. There are, of course, a number of overstocks on miscellaneous items, but not enough to be at all a serious factor.

Moreover, the jobbers are going to maintain their practice of reducing stocks until they feel that prices have reached a reasonably steady basis. There is, however, a well-defined feeling that stocks should not be reduced beyond the point where service would suffer. Some of the jobbers are going to do a certain amount of stocking this fall, but principally in such items as wire, loom and pipe, which they feel have about run their course in price reduction.

TURNOVER SLOWER THAN A YEAR AGO

The general impression one gets in going over the replies to the question of turnover is that it is slower now than it was a year ago, in spite of lower stocks. The replies, however, were not satisfactory on the whole and showed a rather uncertain knowledge on the part of some as to their present turnover.

Has the bottom been reached? This seems to be the question of the hour. For the electrical jobbers the answer is yes. There are still quite a few doubters but on the whole jobbers feel that the corner has been turned. Where answers are given the time is placed as the months of July and August.

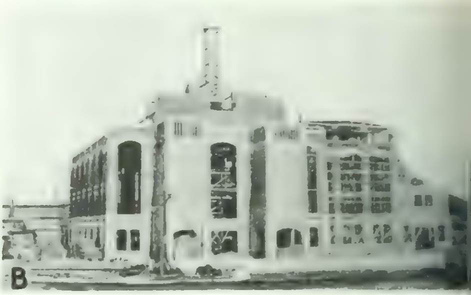
There are some who feel that it will be spring before the downward trend of business ceases. These concerns, however, are in regions dominated by a single industry. This industry must pick up before these jobbers can begin to enjoy improved business.

Jobbers approach the winter much more cheerfully than they did a year ago. The sun has risen and darkness is gone. They can now see ahead and the road is straight. A slow, gradual improvement is expected, with the time for full activity varying put between spring and fall 1922. A few, while looking for better fall business, foresee a reaction after the holidays lasting until March or April.

All predictions, however, are bound up with local conditions. Montana jobbers, for instance, are hopeful but state frankly that the copper demand is the governing feature. West Virginia jobbers can't see beyond April next year when the miners' wage agreements expire. Better building is looked for next spring—better buying by farmers—more industrial production. Lower prices are earnestly awaited, and one very shrewd jobber of the South even went so far as to say that there would not be any real improvement until prices began once more to advance.

Summary of Conditions in the Electrical Supply Jobbing Field as of Sept. 1, 1921

No. of Replies by Sections	Volume of Sales Compared with		Condition of Stocks on Sept. 1	Rate of Turnover		Stocks for Rest of the Year	Has Bottom Been Reached Yet?	Outlook
	Beginning of Year	Year Ago		Now	Year Ago			
New England—nine replies	1—50% less 1—17% less 1—10% less 1—smaller 1—same	2—50% less 2—40% less 1—33⅓% less 1—30% less 1—10-12% less 1—same	6—moderate 2—low 1—large	1—half last yr. 1— times 1—5½ times 1—5 times 1—6 to 7 mos. 1—7 times	2—same 1—8 times 1—3 mos.	1—moderate 5—low	6—yes 2—no 1—don't know	3—slow but gradual improvement 2—fair 2—good 1—better for two months, then slow until late spring. No good business for a year 1—improvement but will be a year before back to normal
Middle Atlantic—twenty-five replies	1—20% more 1—15% more 1—improved 2—same 1—10% less 1—11% less 1—13% less 1—17% less 1—33% less 1—40% less 1—53% less	3—increase 2—10% less 1—17% less 1—20% less 2—22% less 1—25% less 3—30% less 3—40% less 1—43% less 1—47% less 3—50% less 1—57% less 1—less	10—moderate 11—low 2—large	1—6 times 2—6 times 1—67 days 6—4 times 1—3-4 times 2—3 times 1—2 times	1—8 times 1—54 days 1—6.6 times 2—6 times 1—5 times 3—4 times 1—unchanged 3—slower than now 5—faster than now 1—20% greater than now 1—Twice as great as now	10—moderate 12—low 1—45 days 1—90 days	10—yes 6—no 2—partially 3—don't know	6—good 5—slow improvement 6—improvement to come in the spring 2—fair 3—improvement depending on local labor situation 1—bad
South Atlantic—five replies	1—11½% less 1—40% less 1—50% less	2—30% less 1—40% less 1—46½% less 1—60% less	3—moderate 2—low	1—same as last year 1—3 times 1—3½ times 1—2½ mos.	2—6 times 1—4 times	5—low	2—yes 2—no	4—gradual improvement with good spring demand 1—improvement with spring depression
East north central—fifteen replies	1—44% more 1—20% more 1—same 1—large 2—10% less 1—26% less 1—30% less 1—33% less	1—28% less 1—33⅓% less 2—35% less 3—40% less 1—50% less 1—56% less 2—60% less 1—62% less 1—67% less 1—smaller	9—moderate 5—low 1—large	2—10 times 2—6 times 2—4 times 2—3 times 1—moderate 1—slow 1—75% of a year ago	2—12 times 1—10 times 3—6 times 1—4 times 3—higher than now	3—moderate 10—low 1—on 1917 basis	6—yes 8—no 1—don't know	5—slow, gradual improvement 4—poor 3—better in spring 1—favorable 1—fair 1—no change
East south central—five replies	1—25% more 1—16% more 1—same	1—25% less 1—20% less 2—50% less	4—moderate 1—low	1—12 times 1—4 times 1—15% under normal	1—12 times 1—8 times 1—6 times 1—25% under normal	1—moderate 3—low	4—yes 1—don't know	3—steady increase 1—improvement shortly 1—fair to good
West north central thirteen replies	1—12% more 1—better 2—same 1—fair 1—14% less 1—20% less	1—same 1—25% less 1—30% less 2—40% less 1—42% less 1—40-50% less 3—50% less 1—53% less 1—less 1—poor	6—moderate 4—low 3—large	1—10 times 1—6 times 2—5 times 1—4½ times 3—4 times 1—2½ times 1—1½ to 2 times	1—10 times 1—8 times 1—6 times 1—5 times 1—4.8 times 1—4 times 1—1-1½ times 1—same as now 1—more than now	3—moderate 9—low 1—larger	10—yes 3—no	3—fair 4—slow increase 2—poor 1—good business until first quarter 1—good in 10 months 2—good business ahead
West south central—three replies	2—same	1—25% less 2—40% less	1—moderate 1—low 1—normal	1—7 times 1—2½ to 3 times	2—4 times	1—normal 1—low 1—60 to 90 days	2—yes 1—no	1—[illegible] favorable 1—good 1—no marked improvement until spring
Mountain—six replies	1—10 to 15% more 1—20% less 1—32% less	1—27% less 1—35 to 40% less 1—45% less 1—45% less 1—50% less	3—moderate 2—large 1—low	1—4 times 1—3 times 1—2½ times 1—2 times 1—60-90 days 1—5 months	1—6 times 2—4 times 1—3 times 1—60 to 90 days	2—moderate 2—low 1—60-90 days 1—50% less	6—yes	3—good 1—[illegible] 1—very poor 1—[illegible]
Pacific coast—three replies	1—10% less	1—better 1—40% less 1—50% less	2—moderate 1—large	1—7 times 1—3 times 1—133 days	1—5 times 1—3½ times 1—comparable with now	1—moderate 1—low 1—20% lower	2—yes 1—no	1—good 1—[illegible] a lull 1—better



Construction Has Never Stopped in the Central Station Field

NEW equipment must be installed to meet the fast growing demands for energy. Even during the last few months of so-called depression the energy consumption was only about 10 per cent lower than the consumption of 1920 and was higher than that of any other year. Among the more important stations under construction are:

A—The South Meadow station of the Hartford Electric Light Company. The first 20,000-kva. unit will probably be in operation by 1922; another will come

later. Stone & Webster are the designers.

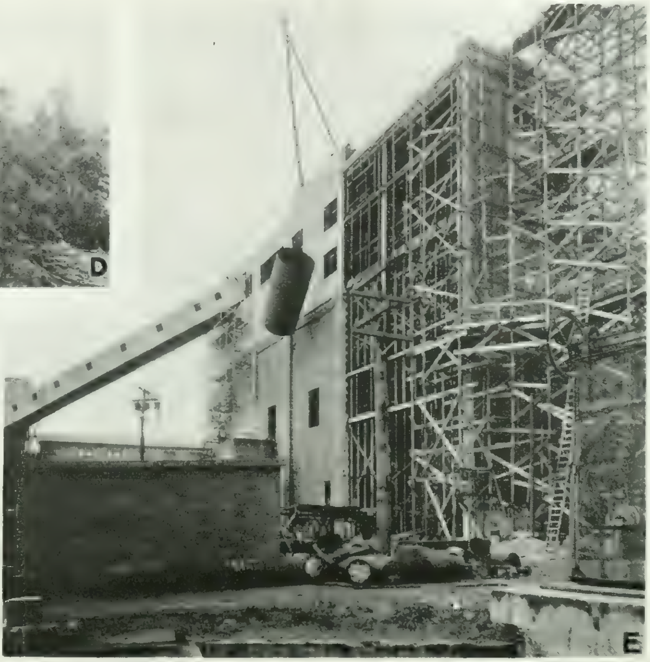
B—100,000-kw Steel Point station of United Illuminating Company, Bridgeport, Conn., Westcott & Mapes, designers.

C—Hell Gate station of the United Electric Light & Power Company, rated at 280,000 kw. Built by Thomas E. Murray, Inc.

D—Big Creek No. 8 plant of the Southern California Edison Company, 22,500 kw. Structure at rear is for 220,000-volt transformers, oil switches and buses.

E—Station of the Fitchburg (Mass.) Gas & Electric Company, built by Charles H. Tenney.

F—12,000-hp. plant of San Joaquin Light & Power Corporation on Kern River.



Encouraging Outlook for Construction

Unprecedented Requests for Estimates—Healthy Recovery of Business, However, Demands Equalization of Liquidation and Settlement of National and International Problems

HALF MILLION DOLLARS IN ELECTRICAL EQUIPMENT GOING INTO THIS PLANT[*]

GRADUAL increase of activity in consulting engineering and electrical construction is reported by various prominent engineering organizations interviewed by the ELECTRICAL WORLD recently, and most of them are of the opinion that resumption of business on a larger scale will set in as soon as there has been an equalization of liquidation and a settlement of certain national and international problems. Some of the large houses are handling close to a "normal" pre-war business, but 40 to 50 per cent of normal is more nearly the average. Much of the existing business is coming from New England and the Middle Atlantic States, but the Middle West holds forth great prospects.

Important investigations of industrial plant economy are under way, including rehabilitation work in diversified industries, improved power distribution and betterment work in old and inefficient hydraulic generating installations. The importance of improved illumination is also receiving broader consideration, and the transformation of industrial plants designed for war service and often built under great stress into layouts suitable for peace-time industries is occupying engineering attention. Little complaint of collection conditions is heard in engineering circles, payment within thirty to sixty days of invoice being common.

In most cases it appears that a general expansion of engineering work accompanied by the bringing to a head of many projects held in abeyance will take place as renewed confidence spreads throughout the country. California is cited by one engineer as an example of this. Not a few engineers hold that prices now warrant going ahead with long-deferred work, and some are thus advising clients. Opinions differ as to whether materials and labor will fall to any great extent below present levels. The importance of deflation is almost unanimously accepted. Low prices are essential to business recovery and marks-ups tend to chill buying interest.

One prominent engineer points out that unskilled labor on some inland construction work away from cities has now reached a 35-cent-per-hour rate—a very complete index of liquidation. Gradual further reductions in wages of skilled trades are expected by several engineers. Almost all agree that labor is far more efficient than a year or two ago and more disposed to appreciate changed conditions.

It should be encouraging to know that the value[†] of contracts let for construction, exclusive of industrial buildings and residences, has exceeded the 1920 figures in four of the eight months past. Furthermore, statistics show that federal, state and municipal construction is relatively strong. Most of the projects have been in the nature of institutions or public buildings, such as hotels, schools, hospitals and similar structures. It is this class of work on which electrical contractors are now chiefly engaged. While the building constructors will be the first to feel new activity, it should be only a short time before the electrical contractors, jobbers and manufacturers will benefit.

Although activity in the field of the central-station company may be spotty, very few are in the position of being overequipped, so that when the process of business recovery becomes more rapid the necessity for enforced extension, development and rehabilitation will be evident.

Another significant fact is that some of the leading consulting engineers in the country report that they are receiving an unprecedented number of requests for reports and estimates on new work. If business conditions continue to improve, which most observers believe is the tendency now, the estimates that consulting engineers are making should be followed by construction activity that will keep every one busy.

There is a great danger that these signs of reviving business will make many "sit tight" and cease the readjustment of business conditions that is still necessary if a permanent healthy growth is to be expected. The present situation demands a revised type of business thinking, more participation in the settlement of national and international problems, a recognition of some of the economic laws that have been overlooked in the past, and a willingness to take a loss right now before any more time passes if liquidation in the particular business conducted has not gone far enough.

An analysis of the figures and interviews which have been mentioned disclose some interesting facts. For example, the value of industrial construction contracts let for the last eight months is only about one-fifth of that for the same period of 1920, although the ratio has increased to nearly one-third recently (see Table I). Dormancy in industrial construction is not surprising because the enormous expansion of some plants during the war has left them overequipped for handling their product even were there no depression now. Furthermore, many industries which expanded only normally or which were handicapped in making necessary extensions during the war do not feel inclined to make additions now that demands for their products do not require it and since money rates are high. However, the latter may be expected to build as soon as business conditions improve a little more, and the overbuilt group, which were mostly equipped for special work like munitions manufacture, etc., will have to adapt their plants to new purposes.

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[*] This is the Fisher Body Works at Cleveland, Ohio. The Thompson-Starrett Company was the building contractor and L. K. Comstock installed the lighting.

[†] See Table I on page 723.

While the statistics on contracts let and the reports by consulting engineers of unprecedented calls for estimates indicate that better business is coming, certain conditions still exist which are delaying business recovery. If they are not generally recognized and adjusted, business recovery will be slow. If they are taken in hand, recovery will be rapid. Many will say that the principal factors are labor and materials expense, excessive money rates, freight rates, etc. These may be the immediate things involved, but they are so inextricably tied up with unchangeable economic laws and national and international affairs that they cannot be considered by themselves in looking for business stimulus. Only so soon as the majority of people in this country recognize this fact and compel others to do likewise will business recovery strike a healthy pace.

TABLE I—VALUE OF CONSTRUCTION CONTRACTS LET BETWEEN JAN. 1 AND SEPT. 1 FOR 1920 AND 1921*

(Only that class of construction in which electrical work will figure prominently has been included. Residence construction is not included.) Roman figures refer to 1920, boldface figures to 1921.

		Industrial	Ratio of 1921 to 1920 Per Cent	Buildings	Ratio of 1921 to 1920 Per Cent	Federal	Ratio of 1921 to 1920 Per Cent
January..		$56,041,047	23	$87,095,987	20	$4,980,945	40
		12,881,968		**17,455,673**		**2,071,141**	
February		63,262,290	7.5	52,200,466	61	2,282,373	69
		4,737,850		**31,902,608**		**1,574,927**	
March		48,861,832	31	47,541,078	120	1,483,605	242
		15,032,130		**56,520,231**		**3,590,617**	
April		65,879,005	15.3	90,776,835	57	4,124,269	28.8
		9,346,586		**51,647,900**		**1,186,403**	
May		39,661,869	19.7	70,946,738	68.3	1,167,045	155
		7,799,584		**48,442,471**		**1,809,588**	
June		40,455,500	15.1	31,271,042	180	2,625,739	158
		6,111,307		**56,576,768**		**4,158,430**	
July		30,968,900	22	38,947,190	117	4,431,976	76
		6,781,369		**45,452,153**		**3,382,964**	
August		25,941,292	27.8	33,442,290	150	1,678,499	80
		7,210,378		**56,475,001**		**1,355,545**	
Total....	1920	371,159,543	18.8	452,271,626	79	22,783,451	84
	1921	**69,901,172**		**358,472,805**		**19,729,615**	

*Based on data compiled by the *Engineering News-Record*.

Obviously prosperity requires that the average citizen shall have an income which will provide money for all his necessary requirements. This condition cannot exist if the earning power of any large group of people goes down or remains constant while the price of many required commodities goes up excessively or stays at a prohibitive level. In such a case, if the entire income of this group is being expended for necessities, those who compose it will cut down on the use of commodities which have increased excessively in price and the producer of those commodities will suffer.

Briefly, this is the situation today. If the prices of commodities, labor and money in a normal year (say 1913), are considered as 100 per cent and their fluctuations since that time are plotted, it will be found that they have not liquidated to within the same percentage of normal. By July 1, 1921, farm products had liquidated to within 8.9 per cent of normal (1913), food within 17.1 per cent, metals and metal products within 20.4 per cent, cloth and clothing within 31.3 per cent, and miscellaneous within 34.1 per cent, whereas lumber and building materials is only within 42.3 per cent of normal, chemicals and drugs within 43.5 per cent, fuel within 47.3 per cent, and household furnishings within only 55.3 per cent. Thus it may be observed that the farmer, who has liquidated the most, does not have the income required to buy commodities which have not liquidated so much. The producer of cloth and clothing is better off than the farmer, but he has liquidated more than the producers of chemicals and drugs, lumber and building materials and household furnishings, and so on.

If every person selling service, commodities or money will take the foregoing statement of conditions into consideration and adjust his prices accordingly, he will go a long way toward establishing better business for himself. This does not necessarily mean that all prices have to come down. Some may have liquidated enough already, in which case the others will have to come down to meet them, or it may be that some have liquidated too much and must raise prices to meet the others. It may mean that some must take a loss, but the man who knows when to take a loss and who acts on this knowledge will always be in a better situation than one who delays. In judging how much to liquidate it is considered a good business rule by engineers who have been interviewed in the preparation of this article to dispose of products on hand at a price which will net a fair profit above the present replacement value. The difference between this revised selling price and the one at which the producer would like to sell must be charged to profit and loss and forgotten. The quicker the better.

BUSINESS UNCERTAINTY DEMANDS SETTLEMENT OF NATIONAL QUESTIONS

Aside from involving the economic relations just set forth, better business requires that the existing uncertainty in the minds of all regarding business be eliminated. Uncertainty regarding risk is one cause of high money rates. It is the cause of people holding on to what money they have. It is the cause of delayed industrial building where the companies have the money available. In the opinion of men whom the ELECTRICAL WORLD has interviewed most of the uncertainty that exists could be eliminated if certain of our national and international problems could be settled.

For example, there is the tax problem. The excess-profits tax, income supertaxes and tax-free bonds are taking most of the money that was formerly available for reinvestment in engineering undertakings. Until taxes are modified considerably and fewer bonds are issued exempt from taxation, financial support in engineering undertakings cannot be expected from the capitalists who have and always must be depended on for the bulk of the money required for new undertakings.

Then there is the tariff situation. Despite the fact that many of the men interviewed have been affiliated with the Republican party for years, they were quite generally in favor of low enough import tariffs on foreign commodities which we need to enable debtor countries to sell goods here and in that way establish credit for buying our products. Only in this way can we expect to develop foreign trade.

Lack of decision on peace terms and armament and reckless and extravagant expenditure of money for government purposes are suggested by some engineers as other deterrents to better business. Railroads are also inextricably tied up in the prosperity of the country. If their executives' hands are unshackled from government restrictions the railroads can remedy their own troubles, most engineers believe. When they prosper, prosperity will be passed along to railroad equipment and steel producers; more labor will be employed and more money will be put into circulation to produce more wealth. Hence an endless chain of benefit results which will stimulate business as a whole.

Industrial and Public Utility Prosperity Must Coexist

Last but not least, the prosperity of electric service companies must be assured by allowing a more attractive return on the investment in order to allow them to pay the high security rates demanded. This does not necessarily mean higher rates. By allowing the companies to share in the savings effected through new economies there will be an incentive to seek new methods of economizing where there was no incentive before because of the limited rate allowed to be earned on the investment. Through increased earning power public utilities should be able to obtain capital more easily, and through an incentive for greater economy they should be able to pass part of the benefits to their customers who represent industry.

The foregoing outline of the fundamental requirements for better business is based on views expressed by engineering firms such as Sanderson & Porter, Hugh L. Cooper, the Thompson-Starrett Company, the J. G. White Engineering Corporation, Dwight P. Robinson & Company, Inc., L. K. Comstock, Lockwood-Greene & Company, Peet & Powers, H. W. Buck, Westcott & Mapes, Inc., John F. Vaughan, the Harry M. Hope Engineering Company, Charles H. Tenney & Company, French & Hubbard, Monks & Johnson, and Stone & Webster. Others will be quoted in the paragraphs that follow:

Utilities Must Be Ready for Business Recovery

W. S. Barstow, New York—You inquire as to what is the matter with the electrical industry. I cannot see that there is anything unusual happening. In the period of readjustment all industries must adjust themselves to normal conditions The electrical industry is perhaps the least affected because it has not been overdeveloped and its field is constantly expanding even in periods of depression. What concerns power companies at this time is to know what plans can be carried out to provide for the large demand upon the industry which will surely result when the period of readjustment has passed. Although the demand for power in some cases has fallen off, the customers are still connected and the gradual increase of the new business is slowly but surely using up spare capacity, so that when normal times come and general business revives, a period of very active power development must take place. It is well to make plans now to anticipate as far as financial conditions will permit future demands which are sure to come and should be economically supplied when the time arrives.

Col. H. M. Byllesby, Chicago.—I recently stated to a number of our executives and securities salesmen that the situation with respect to electric light and power companies was the best I had ever known in all of my forty years' connection with the electrical industry. By this I do not mean that these industries are reaping undue profits or enjoying a sudden flush of prosperity. They are simply coming into their rightful position as vital economic instrumentalities rendering indispensable service and providing the soundest kind of investment for the funds of capitalist and wage earner alike. The people generally realize these facts now as never before. A proper conception of our obligations and duties as public utility operators and skillful, common-sense management are all that are necessary to assure prosperity to the electrical industry for many years in the future.

Construction activities will proceed at a pace attuned to the relative cost of new money and the price of materials and labor. The growing demands for additional service make imperative a certain amount of extensions and improvements. Many of these cannot be postponed There is a vast quantity of work ahead for all connected with the electrical industry, and as interest rates and commodity prices more nearly approximate a long time average, the greater will be the new construction placed under way.

TABLE II—SOME EXAMPLES OF ELECTRICAL CONSTRUCTION UNDER WAY OR COMPLETED SINCE OCT. 1, 1920

POWER PLANTS:
500,000 hp., Chippewa-Queenston plant, Hydro-Electric Power Commission of Ontario
280,000 kw., Hell Gate station, United Electric Light & Power Company
270,000 kva. (ultimate) Ruby plant on Skagit River, city of Seattle
180,000 kw. Delaware, Philadelphia Electric Company
150,000 kw., Big Creek No. 3, Southern California Edison Company
120,000 kw., Westport, Consolidated Gas, Electric Light & Power Company
100,000 kw., Bridgeport, (Conn.) United Illuminating Company
100,000 kw., Extension, Niagara Falls Power Company
100,000 hp. Coosa River, Alabama Power Company
60,000 kw., (300,000 kw. ultimate) Colfax, Duquesne Light Company
60,000 kw., (180,000 kw. ultimate) Calumet, Commonwealth Edison
50,000 hp., Kerckhoff, San Joaquin Light & Power Corporation
45,000 kva., unit added, Detroit Edison Company
40,000 kw., Battle Creek, Consumers' Power Company
40,000 kw., Great Western Power Company
40,000 kva., Meadow Station, Hartford (Conn.) Electric Light Company
35,000 kva., city of Los Angeles
35,000 kw., $1,000,000 improvements raise rating to this value, Arkansas Valley Railway, Light & Power
32,000 kw., Kern River No. 3, Southern California Edison Company
30,000 kw., Dodge Brothers, cost $3,500,000
30,000 kw., unit added, Cincinnati Gas & Electric Company
22,500 kw., Big Creek No. 8, Southern California Edison
12,500 kw., Buttonwillow, Cal., San Joaquin Light & Power Corporation
14,500 hp., Washington Water Power Company
12,000 hp., Kern River, San Joaquin Light & Power Corporation
Columbus, Delaware & Marion Electric Company, $2,000,000 station
Penn Public Service Company, station at Seward, Pa.
Searsburg, Vt., plant of New England Power Company
20,000-kw. addition to plant of Edison Gas & Electric Company, New Bedford, Mass.
Salem, (Mass.) Electric Lighting Company enlarging plant
5,000 kva., addition, Eastern Texas Electric Company

SUBSTATIONS:
San Joaquin Light & Power Corporation
Duquesne Light Company, Pittsburgh, Pa.
2,400-kw. rotary-converter substation, United Railroads, San Francisco

TRANSMISSION LINES:
186-mile, 165,000-volt line, Great Western Power Company
195-mile, 220,000-volt line, Southern California Edison Company
20-mile, 33,000-volt line, Arkansas Light & Power Company

STREET AND PARK LIGHTING:
Street Lighting, Lima, Ohio, $130,000
Street lighting, Twin Falls, Idaho
Park lighting, Cleveland, Ohio

INDUSTRIAL PLANTS:
Great Falls Manufacturing Company, Somersworth, N. H., 840 looms and 55,000 spindles, Lockwood, Greene & Company
Westinghouse Lamp Company and factory, Indianapolis, Ind., Dwight P. Robinson & Company, Inc.
Fisher Body Plant, Cleveland, Ohio, $500,000 of electrical equipment, part of which was installed by L. K. Comstock
Kelley Tire & Rubber Company, New Haven, Conn., Monks & Johnson, Engineers
United Enameled Ware Company, Chattanooga, Tenn., $100,000 in mechanical and electrical equipment, Dwight P. Robinson & Company, Inc.
Mississippi Glass Company, Floreffe, Pa., extension with $100,000 in mechanical equipment installed by Dwight P. Robinson & Company, Inc.
Corning (N. Y.) Glass Company, $200,000 in mechanical equipment put in by Dwight P. Robinson & Company, Inc.

The further pronounced development of the electric light and power and gas companies which is now assured has been the result—and, to a far larger extent than the casual observer appreciates, the solution—of the equity financing of these corporations, which has been so markedly carried forward by the various subsidiaries of our general organization, and which is likewise, with equally marked success.

being carried forward by other large holding operating companies.

NORWOOD-NOONAN COMPANY, CHICAGO.—There are three classes of construction work that must be considered at the present time. General industries were subject to forced development during the war and to some extent at least suffered from overdevelopment. From these industries, with the possible exception of the cement industry, no construction work can be expected until the recovery in business conditions allows them to catch up with their development. The second class, including railroads, municipalities and industries not allied with war activities, suffered a stoppage of its normal development during the war. As a result it is short of facilities and will proceed with construction work as soon as prices reach a stable condition and in many cases even before that time, because facilities are now inadequate and the cost of construction will be a minor consideration. The third class is the purely speculative building project. This will probably not recover until prices have gone to the lowest possible level, since profits depend on the possibility of building at the lowest possible costs. Conditions are now at the point where there is a marked awakening of interest in the second class, and we look for a steady upward trend in the construction work to supply needed facilities. The price stabilization needed to start this movement is fairly well established, though there are many items that will have to drop in price and a new demand be created before a boom of the old-time type can be expected. As a consequence the recovery will be slow but all the more healthy because of its slowness.

TABLE III—WHERE SOME ENGINEERS CONSIDER FURTHER ADJUSTMENTS ARE NECESSARY

Remark	Opinion of
Retail and semi-retail prices in brick, lumber and cement, building trade labor and common labor should suffer a reduction of at least $2 per day. Cost of building still 30 per cent higher than in 1916	R. D. Coombs, New York
Labor is 33⅓ per cent too high yet	W. S. Berry, San Francisco
Skilled labor is 10 to 15 per cent too high	Barney & Ahlers, New York
Building materials and machinery	H. W. Buck, New York
Skilled mechanics and materials	Aberthaw Construction Co., Boston
Do not believe that prices of labor and material stand in way of development	Huntington & Guerry
Timber, cement and construction labor is 25 per cent too high	Holbrook, Cabot & Rollins, Boston
Electrical equipment, freight rates and attitude of labor	Scofield Engineering Company, Philadelphia
Cement and freight rates	J. W. Fraser & Co., Charlotte, N. C.
Cement and freight rates, but not at expense of service Skilled labor 25 per cent too high	C. A. Mees, Charlotte, N. C.
Skilled labor should get within 25 per cent of pre-war price	G. S. Williams, Ann Arbor, Mich.
Freight rates, labor, steam and hydraulic machinery	C. O. Lenz, New York

HUNTINGTON & GUERRY, GREENVILLE, S. C.—We have pending contracts awaiting improved conditions to the amount of possibly $80,000 or $100,000. We do not believe that prices of labor and material are at present standing in the way of the development of our business. Our industrial work, which comprises the larger part of our business, is almost entirely with the textile mills. These mills are, as most people know, one of the basic industries of the country, and further investment by them depends upon the improvement of their market. The improvement of our local business depends, of course, upon the improvement of local conditions, which down here is largely a matter of the price of cotton. Since cotton has advanced strongly in the last month, we have noticed an improvement, but we do not expect entirely satisfactory business conditions until more cotton is sold and the market therefor becomes stable.

We have no particular suggestion to make for helping the recovery of business by the electrical industry beyond joining in the efforts that are being made by all substantial business interests at the present time to bring about mutual confidence and stabilize market and labor conditions.

PIEDMONT ELECTRIC COMPANY, ASHEVILLE, N. C.—Frankly we don't believe there is any such animal as "normal business." What might be normal today would be abnormal next year or vice versa, and we have already had too much looking back when all of our business lies now ahead of us. Let us cut out this habit, which is so closely related to the trouble Lot's wife had, for, if persisted in, it will surely leave a salty taste with us.

The progress of electrical work is so interconnected with other businesses that the electrical business cannot separately and independently of those related businesses speed up on its own account. We have in mind general construction, building and increased housing facilities, all of which have a direct bearing on the speeding up of electrical business in general.

Through the section of the country we operate in, the Carolinas, the price of cotton has had a debilitating effect on all business, but with the advance in price on account of the short crop confidence will be restored, and that means a general speeding up of all business.

Your question as to what legislative action could help the electrical business causes me to suggest that our various states should enact laws that would conserve the use of electrical power in the state wherein it is developed, for nothing in our opinion will assist more in rapidly building up any state as hydro-electrical developments, making available a continuous source of power at a low rate.

To help the electrical business in general under present conditions, we could suggest nothing better than that we revise our ideas of selling; in other words, project our thoughts beyond the mere materials that we sell to the advantages that would be obtained by the purchase and assembling of those materials. We are confident that if every man in the electrical business or having any connection with it would at this time think how he could help his customer in his business by having him utilize electricity, there would be a revival of buying in many lines which are now uselessly waiting for the buyer to come and ask for service.

MEES & MEES, CHARLOTTE, N. C.—The following subjects need attention:

Financial.—The hoarding of gold and the consequent maintenance of high prices for money should be stopped. Confidence will not return as it should as long as business feels that the Federal Reserve Board may again at any time inflict its deflation policies on those who assume the legitimate risks without which no progress can be made. This is of paramount importance.

Legislative.—We have still too much government interference of the unintelligent variety. All competitive governmental activities should be stopped. Governmental economy is essential. Excess-profits taxes should be revoked.

Labor.—The restrictive practices of organized labor as to output and segregation of duties must be stopped. The open shop is the answer. This comes next in importance. Individual, efficient productivity alone will bring the world out of chaos.

Tariff.—A high protective tariff will help 80 per cent of the nation's business even though it reacts against the 20 per cent of export business.

Every member of Congress should be informed of these demands in language which he understands to the end that in self-preservation he will espouse these requests.

J. W. FRASER & COMPANY, CHARLOTTE, N. C. — About twelve mills, mostly new, have been completed in which motors, transformers, switches and motor-driven fire pumps are used. The owners of small water powers in a good many cases are considering development, and the owners of small powers which were developed a good many years ago are considering the advisability of rehabilitating these powers in such a way as to get the maximum power available. In old plants wheels of inefficient design are being replaced by new wheels of more efficient type

Our business is nearly all with cotton mills and power companies. Of course, we get perhaps 25 per cent from other sources, but when cotton-mill business is bad virtually everything else is inactive down here. If the price of cotton would stay steady, say, at about 20 cents, we believe that the business depression in this section of the country would be at an end. I feel sure that the cotton mills would soon start to make extensions and that quite a number of mills which have been under contemplation would be built immediately.

BUSINESS DEPRESSION HAS PASSED THE PEAK

FRANK F. FOWLE, CHICAGO—Appraisal of the present condition and trend of business as a whole is productive of an optimistic feeling that the worst phase of depression is probably over and from now on there are excellent prospects of a slow but healthy resumption of activity. The necessary liquidation in labor and materials which always succeeds a period of general inflation—in the last instance the most excessive by far we have ever known—is usually accompanied by the severe shocks to the general business structure that characterize every cycle of prosperity and depression. In most lines of business this dip in the cycle seems to be past, although the railroads and some of the building trades possibly constitute an exception. In other lines, particularly the steel industry, there are signs of returning demand and activity. The oil and automotive industries are also exhibiting signs of recuperation. High-grade bonds and notes are stiffening in price, and the accompanying decline of the recent exceptional interest yields is a very healthy sign. Non-employment continues to be prevalent, but can be reduced by a general return of labor to its pre-war occupations, as well as increased demand resulting from more normal wage scales and the renewed flow of capital into new enterprises and extensions. Public utilities will inevitably reflect the improved tone of business in general. What the country needs as almost never before is a stanch faith in the return of prosperity, such as perhaps we have lacked the courage to conceive, and a general willingness on all sides to make the temporary sacrifices in luxury or scale of living necessary to insure its early realization. No one can reasonably doubt that the worldwide destruction of man-power and wealth in the great war must be made up again by hard work and plenty of it, with generous reward for all who have the vision to comprehend the situation and do their part.

Actual 1921 Additions to Systems Will Total $214,818,000

"Electrical World" Survey Indicates that Actual Expenditures for System Extensions of Electric Light and Power Companies During 1921 Will Be 95.8 per Cent of the Aggregate Estimates Made at the Beginning of the Year

RESULTS of a survey just completed by the ELECTRICAL WORLD covering the electric light and power industry indicate that the system extensions proposed for the year 1921 will in the aggregate come within 4.8 per cent of realization. In the May 28 issue of the ELECTRICAL WORLD were published the results of a similar survey to ascertain the estimated or proposed extensions to generating plants and transmission and distribution systems during 1921. This survey indicated that $225,770,000 would be spent by the electric light and power industry if the new construction plans for the year were carried to completion. Since these estimates for the year were published the industries of the country have passed through the most severe depression on record. Proposed additions for 1921 have "gone by the board" and in their place have come curtailments of all kinds.

Although few central-station companies have reported that only a small proportion of their extensions contemplated for 1921 will materialize, the majority of others have reported expenditures considerably in excess of those estimated at the opening of the year. In the aggregate the returns indicated that the expenditures of the electric light and power companies for actual extensions to their systems during 1921 would fall about 4.8 per cent below the proposed expenditures.

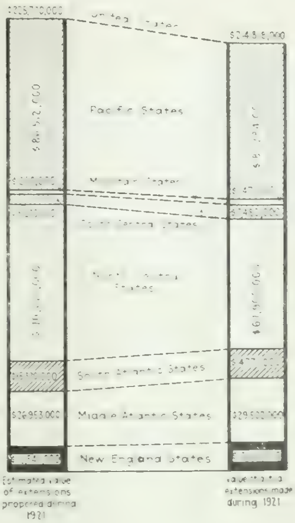
Taking the United States as a whole, the item of "transmission systems" shows an increase over the proposed expenditures for 1921 of 8 per cent. The total of $60,067,000 for transmission systems is $4,385,000 in excess of the value of the proposed extensions for the year. Steam-electric generating-plant extensions will total $49,858,000, or $528,000 below the value of the proposed extensions. Hydro-electric generating plant additions will amount to $45,808,000, which is a decrease of $7,941,000. The value of additions to all distribution systems is $59,077,000, or $6,875,000 below the proposed additions for the year.

Steam electric plant additions in the Middle Atlantic States will exceed the proposed additions by 62 per

VALUE OF PROPOSED AND ACTUAL ADDITIONS TO ALL CENTRAL GENERATING AND DISTRIBUTING SYSTEMS DURING 1921 AS ESTIMATED BY THE "ELECTRICAL WORLD"

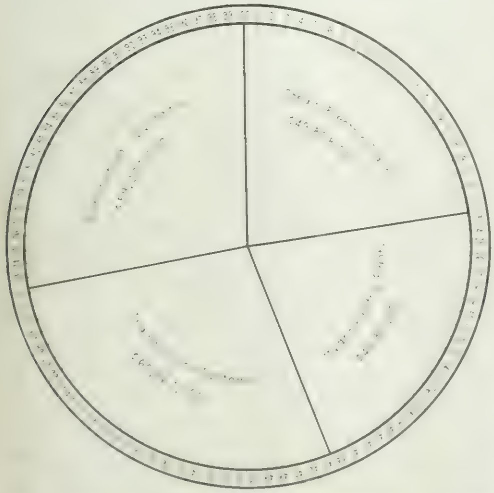
	Steam-Electric Generating Plants		Hydro-Electric Generating Plants		Transmission Systems		Distribution Systems		Total Value of All Additions Completed During 1921	
United States and Sections	Estimated Value of Additions Made in March, 1921	Value of Additions Completed During 1921	Estimated Value of Additions Made in March, 1921	Value of Additions Completed During 1921	Estimated Value of Additions Made in March, 1921	Value of Additions Completed During 1921	Estimated Value of Additions Made in March, 1921	Value of Additions Completed During 1921	Estimated in March, 1921	Additions Actually Completed During 1921
New England	$7,980,000	$8,085,000	$1,480,000	$1,480,000	$802,000	$1,440,000	$2,283,000	$2,629,000	$12,545,000	$13,634,000
Middle Atlantic	6,480,000	10,430,000	773,000	2,458,000	10,080,000	8,240,000	9,620,000	8,374,000	26,953,000	29,502,000
South Atlantic	5,110,000	5,004,000			6,650,000	6,197,000	3,560,000	3,570,000	15,320,000	14,771,000
North Central	27,000,000	22,020,000	2,340,000	2,680,000	21,950,000	20,510,000	27,720,000	22,690,000	79,010,000	67,900,000
South Central	1,030,000	1,920,000	1,110,000	1,110,000	1,800,000	2,230,000	1,290,000	2,220,000	5,230,000	7,480,000
Mountain	75,000	72,000	46,000	58,000			79,000	117,000	200,000	247,000
Pacific	2,712,000	2,327,000	48,000,000	38,030,000	14,400,000	21,450,000	21,400,000	19,477,000	86,512,000	81,284,000
United States	$50,387,000	$49,858,000	$53,749,000	$45,808,000	$55,682,000	$60,067,000	$65,952,000	$59,077,000	$225,770,000	$214,818,000

cent, while in the North Central States the actual additions will be 15 per cent below the proposed additions. In other sections of the country it appears that additions to steam-electric generating plants will be very close to the additions proposed at the beginning of the year. The large decrease below the proposed additions to hydro-electric plants is confined almost exclusively to the Pacific States and is due in large part to an over-estimate of the additions to be completed during the year by one of the larger companies of that section. In the Middle Atlantic States, on the other hand, the proposed additions will be exceeded by almost $2,000,000.



ACTUAL ADDITIONS ONLY SLIGHTLY BELOW PROPOSED ADDITIONS IN ALL SECTIONS

Actual additions to the transmission systems of the Pacific States during 1921 will exceed the proposed additions by $7,000,000, other sections keeping fairly close to that proposed at the opening of the year.



HOW THE ELECTRIC LIGHT AND POWER "EXTENSIONS DOLLAR" IS BEING DISTRIBUTED IN 1921

Large curtailments in the proposed additions to distribution systems were reported by several companies in both the North Central and the Pacific States, but these were partially overcome in the aggregate by expenditures in excess of those proposed by companies in some of the other sections.

Taken as a barometer of activity within the electric light and power industry, these figures point in no uncertain manner to much larger things in the future. The figure of $214,818,000 expended for system additions means that approximately $400,000,000 more will be called for in service appliances. If these things can be accomplished during a period of unprecedented industrial and business depression and a period of greatly restricted buying power, the future of electric public utilities when conditions return to normal cannot help to show a development exceeding by far that of any period in the past.

Proposed Plants Would Complete Development of Bear River

AN ANALYSIS of the data submitted by the Utah Power & Light Company in connection with its project on Bear River in Idaho has been made by the engineers of the Federal Power Commission. The Commission recently granted a preliminary permit to the company for the development of four power sites on Bear River. These sites when developed as proposed by the permittee will complete the utilization of Bear River for power purposes at all practicable points from Bear Lake to Great Salt Lake, into which the river empties. The river then will be one of the most completely utilized streams in the West for power purposes as well as irrigation.

The present power developments of the Utah Power & Light Company on Bear River are four in number—the Grace plant, about 12 miles below Soda Point, having a capacity of 35,000 kw.; immediately below this lies the Cove plant, with 7,500 kw., and joining this, just below, the Oneida plant, with an installed capacity of 30,000 kw., while further down the river and below the Logan Valley is the Wheelon plant, with 7,125 kw.

Of the four locations for which the company was granted preliminary permits two lie above the Grace plant and two below the Oneida plant. The two upper sites, Soda Point and Lava, will have effective heads of 75 ft. and 85 ft. respectively, and each will have a primary capacity of about 4,700 kw. The dams erected at these two points, and especially the one at Soda Point, will furnish storage facilities that will make it possible to regulate the daily fluctuations in power and irrigation demand. The other two locations under permit are the so-called Narrows and Mink sites, which lie immediately below the Oneida power plant and will utilize all the available fall between that plant and the head of the Logan Valley. These points will have a primary capacity of about 3,100 kw. and 4,200 kw. respectively. The reservoirs behind these dams will also be of sufficient capacity to supply the daily fluctuations in power and irrigation demand. Thus, within a short distance, Bear River will eventually have six small regulating reservoirs—the Grace and Oneida ponds in addition to the four above named.

The four new power sites will therefore add 21,500 hp. to the generating capacity of the company's system, which at the present time has a hydro-electric capacity of about 165,000 hp. They will be connected with the main transmission systems now operating at 130,000 volts, extending from the Grace plant in Idaho to Salt Lake City, Utah, a distance of 134 miles.

Readers' Views and Comments

This is a readers' forum. Comments on questions before the electrical industry presenting economic, financial, engineering or commercial aspects and new or supplementary viewpoints on published articles are cordially invited

Relation Between Street Lighting and Crime

To the Editors of the ELECTRICAL WORLD:

Early in the year 1916 a high-intensity ornamental lighting system was installed on the more important streets in the business section of Cleveland. This installation consisted of ornamental lanterns equipped with 1,000-cp. and 1,500-cp. tungsten lamps, spaced 80 ft. to 90 ft. apart on each side of the street. The original installation included approximately 600 posts and covered what came to be known as the "white way" district—a total of about 5 miles out of about 600 miles of paved street in the city.

There were two principal motives which led to the installation—first, the desire to benefit trade in the business district, and, second, to facilitate the handling of the increasingly dense vehicular traffic. The possible effect of the improved illumination in reducing crime was scarcely considered, for the existing system of lighting with arc lamps was as good as that which obtained in the rest of the city, and one seldom looks upon the business district as a crime center. However, the widespread increase in such crimes as assaults, hold-ups and automobile stealing in the past few years has focused attention upon these matters, and it was this that led to a survey of the street crime situation in Cleveland covering both the city as a whole and the "white way" district. More than 1,000 cases of hold-up, assault to rob, burglary (stores entered from front), automobile stealing, pocket picking, etc., were included in this study of the Police Department records.

The first important point brought out was that more than 90 per cent of all such crimes took place after dark; the second was that before the new lighting was installed seventeen out of every hundred of these street crimes were committed in the small downtown area designated as the "white way" district, which embraced less than 1 per cent of the street mileage of the city. Third, and most important, street crimes committed after dark during the months of October, November and December of the year 1916, after the new lighting was installed, were compared with the corresponding months of the previous year so that the possible effect of the increased lighting as a deterrent to crime might be determined. In this connection it will be recalled that 1916 saw the virtual beginning of the crime wave and that crime was increasing by leaps and bounds in all sections of the country. In Cleveland in the areas outside of the "white way" district street crimes committed after dark increased 54 per cent over 1915, while crimes on the "white way" actually decreased 8 per cent in comparison with 1915. The accompanying table giving a summary of the data obtained is of special interest, for it shows very clearly the trend toward bolder and more serious crimes during 1916. As a matter of fact, the minor offences—larceny and pocket picking, etc.—actually decreased during the period when the major crimes nearly doubled.

COMPARISON OF CRIMES COMMITTED IN "WHITE WAY" AND IN OUTSIDE DISTRICT

	All Street Crimes		Major Street Crimes	
	Outside "White Way" District	Inside "White Way" District	Outside "White Way" District	Inside "White Way" District
1915	350	73	222	32
1916	539	67	434	37

Per cent change, Increase 54, Decrease, 8, Increase, 95, Increase 15

Limiting the comparison to major crimes—burglary, assault to rob, hold-up and automobile stealing—the comparison between the "white way" and the outside district changes very little. These major crimes increased 95 per cent in all of the outside territory; they increased but 15 per cent in the downtown section. To put it another way, crimes in the business section of Cleveland in the year 1916 were little more than one-half—to be exact, 59 per cent—of what we might well have expected had no change been made in the lighting.

In connection with the survey the engineering department wishes to acknowledge its indebtedness to the police department of the city of Cleveland, and particularly to Chief Frank W. Smith, through whose courtesy this survey was made possible.

National Lamp Works of General Electric Company, Nela Park, Cleveland.

WARD HARRISON, Illuminating Engineer.

Electrical Engineering Cannot Be Learned in Ten Weeks

To the Editors of the ELECTRICAL WORLD:

I should like to call your attention to what I consider of utmost importance, namely, suppression of the "fakery" that has sprung into being, especially during the last two years, regarding electrical engineering. All electrical engineers, of course, know that their profession must be learned either in college, supplemented by practical experience, or, as many have learned it, by extensive practical experience alone. In either case it takes "years," not months, weeks or days, to become expert in any of the diversified forms of electrical engineering. None the less, many magazines, technical, farm or popular, usually contain one or more "ads," emblazoned with a picture of Niagara's turbine alternators or similar views, stating that wonderful salaries can be made in electrical engineering simply by taking So and so's "practical course" (minus mathematics) of a few weeks' duration.

The writer took a course in an Eastern school of engineering with all of the "hard stuff" that some advertisers say is omitted in their courses and has had over six years' field work besides. Still, he is not yet drawing down "$10,000 per" or anything near it, although such salaries are commonplace in the "Promised Land" portrayed to the innocent beginners. Men like Dr. C. P. Steinmetz of the General Electric Company and B. G. Lamme of the Westinghouse Electric & Manufacturing Company doubtless draw large salaries; but genius like theirs doesn't come from correspondence courses of ten weeks' duration. I have great respect for the courses of the I. C. S. and similar accredited institutions. I am only attacking the "get-rich-quick" variety.

FRANK E. WOOLEY.

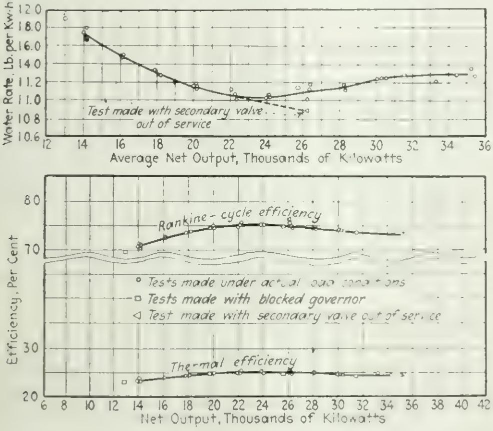
Fulton, N. Y.

Industrial and Station Practice

Installation, Operation and Maintenance of
Generating and Distribution Equipment and Economical Utilization of Electrical Energy
in Mills and Factories, Including Testing and Repair Methods

Tests on 30,000-Kw. Steam Turbines

SUMMARIES of tests made on three 30,000-kw. General Electric turbines installed during 1920 at the Fiftieth Street power station of the Interborough Rapid Transit Company, New York City, are shown in the accompanying table and curves. These turbines are of the straight Curtiss impulse type, having twenty pressure stages, each pressure stage consisting of one velocity stage. The normal steam pressure at the throttle is 225 lb. per square inch, absolute, the steam being superheated 150 deg. Fahr., and exhausted into a vacuum of 29 in. of mercury. The speed is 1,500 r.p.m. In addition to the primary steam inlet a secondary valve is provided which opens after the load reaches 24,000 kw. and which enables the turbines to carry a load of 35,000 kw. The highest water rate obtained during the tests while operating under normal conditions was 11.03 lb. per kilowatt-hour, while the highest Rankine-cycle and thermal efficiencies obtained were 75.5 per cent and 25 per cent respectively.



WATER RATE AND EFFICIENCY OF 30,000-KW. TURBINE

TESTS ON 30,000-KW. TURBINE SHOW LOW WATER RATE

Load, Average Net Kw.	Steam Pressures, Lb. per Sq.In. Throttle	Turbine Head	Overload Seventh Stage	Heat Balance Connection, Sixteenth Stage	Water Rate*, Lb. per Kw.-Hr.	Rankine-Cycle Efficiency*, per Cent	Thermal Efficiency*, per Cent
14,175	236	136	81	8.08	11.66	71.36	23.64
18,243	227	166	99	10.25	11.28	73.76	24.44
23,945	233	207	124	13.75	11.03	75.43	25.00
28,249	225	211	159	18.71	11.11	74.89	24.81
30,289	225	222	161	17.20	11.23	74.09	24.55
35,467	224	216	193	21.53	11.27	73.82	24.46

* Corrected to 225 lb. per square inch absolute pressure, 150 deg. Fahr. superheat, 29 in. of mercury vacuum referred to 30 in. barometer at 58.1 deg. Fahr.

The turbine tested was installed on a new structural-steel foundation cased in concrete. As no expansion joint was provided between the turbine and condenser, novel spring supports for the condenser were provided.

The tests were conducted under the supervision of Herbert B. Reynolds, mechanical research engineer Motive Power Department, Interborough Rapid Transit Company.

How Gap, Temperature, Etc., Affect Voltage Test on Oil

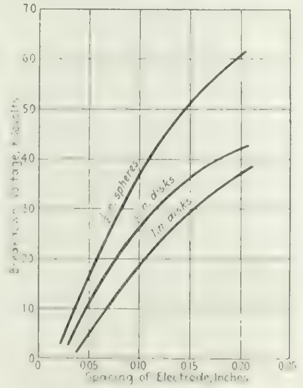
THE effect of various conditions when testing insulating oils was determined in some studies made recently by the American Society for Testing Materials. These conditions included the type of gap, the number of shots in one sample, circulation of oil and temperature. In brief the conclusions drawn were as follows:

1. The gap between 1-in. disks with horizontal axes is to be preferred because of the lower values of breakdown voltage and hence smaller testing equipment.

2. Spacings of less than 0.1 in. are undesirable because of the greater probable error of measurement made with such small gaps.

3. The results of measurements obtained with other forms of gap may be referred to the recommended standard gap by the factors given in the accompanying table.

4. The value of dielectric strength obtained from the first shot of each filling does not differ sufficiently from the values given by later shots in either its magnitude or repeatability to justify the practice of making only one shot on each filling.



DIELECTRIC STRENGTH OF TRANSFORMER OIL WITH DIFFERENT SHAPES OF ELECTRODES

5. A precision of approximately 3 per cent may be expected in the mean value of fifteen shots distributed over three fillings, provided no adjustment of length of gap is made. Uncertainties of 6 per cent may be introduced as a result of resetting the electrodes and from contamination introduced from day to day at a single laboratory. Differences as great as 12 per cent may arise even in careful work done at the different laboratories.

6. The circulation of oil past the electrodes does not appreciably affect the observed values of dielectric strength.

7. The temperature coefficient of the dielectric strength is approximately 0.13 kv. per degree C.

The bulk of the work consisted of parallel tests made at each of the three co-operating laboratories, namely, Vacuum Oil Company, Westinghouse Electric & Manufacturing Company, and the Bureau of Standards. A 5-gal. can of each of four grades of oil was sent to each of the three laboratories. Three styles of electrodes were used at each laboratory: (1) 1-in. disks placed with axes horizontal; (2) ½-in. disks with axes horizontal; (3) ½-in. spheres with axes vertical. With each type of electrode, four spacings, namely, 0.05-in.; 0.10-in. and 0.20-in., were used. With each gap, spacing and oil, three fillings of the cup were made, and five "shots" were made on each filling. In these tests the room temperature was kept as near 25 deg. C. as conveniently possible and the oil containers were not opened except when they were at a temperature at least as high as that of the room. A 60-cycle alternating voltage was applied and raised at an approximately uniform rate of 3,000 (effective) volts per second until breakdown occurred. The results are expressed in terms of the effective kilovolts of a sine wave having the same crest value as that at which breakdown occurred.

It is sometimes maintained that only a single shot should be made with each filling of the test vessel. However, the tests indicate quite strongly that the contamination of the oil by the products of carbonization resulting from the first shot is negligible in its effect upon the accuracy of the results. Although it was deduced theoretically that it is most economical of time to take as many as fifteen shots on a single filling, it is probable that the danger of contaminating a single filling is appreciable and that a smaller number, such as the five shots, is more desirable. To investigate any possible effect of circulation of oil upon the observed dielectric strength, observations were carried out. From these it was concluded that the presence of a velocity as great as 1 m. per second does not appreciably affect the dielectric strength.

To determine the temperature coefficient a sample of each of the four grades of oil was tested for dielectric strength at average temperature of 45, 20, 10, 6 and 0 deg. C. Decreases in dielectric strength followed decreases in temperature at a reasonably constant rate, although the plotted curves were not smooth. The conclusion from the series of tests is that about 0.13 kv. per degree is a reasonable correction for deviation from 25 deg. C., the correction being subtracted when the temperature is above 25 deg. C. and added when the temperature is below 25 deg.

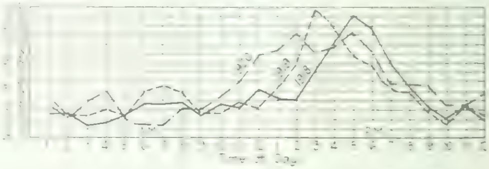
F. M. Farmer is chairman of the committee responsible for these tests.

Operation Helped by Curves Showing Time of Interruptions

IN ORDER to determine during what hours of the day the greatest vigilance of operators and troublemen must be exercised curves have been plotted showing the number of interruptions which occur each hour of the day on the system of the Georgia Railway & Power Company.

As will be seen in the accompanying drawings, these curves were plotted for the last three years, each curve showing the total number of interruptions in a year which occurred within a certain hour. These curves indicate clearly that during the time from 3 o'clock in the afternoon to 5 o'clock the interruptions are very much more frequent than at other times. Therefore, during these hours an attempt is made to increase the vigilance of all operators, dispatchers and repairmen.

The automobile trouble trucks are all held in reserve ready to answer any calls and the load dispatchers and operators are reinforced during the period of the day by extra men. If any equipment is out of service for repairs of a temporary nature an effort is made to get it back into operation by noon in order to anticipate the troublesome period occurring in the afternoon.



CURVES SHOW THAT GREATEST NUMBER OF INTERRUPTIONS OCCUR BETWEEN THE HOURS OF 3 AND 5 O'CLOCK IN THE AFTERNOON

The daily curve showing the total load carried by this company also has a peak at very nearly the same time that the interruptions are most frequent. This might be expected as at this time generating and distributing equipment is being loaded to its maximum and more equipment is in service. The fact, however, that a greater load is being carried at this time makes it all the more important that extra precautions should be taken to remove any trouble from the system as soon as possible.

G. A. Iler,
Superintendent of Operating Tests and Repairs.
Georgia Railway & Power Company,
Atlanta, Ga.

AVERAGE RATIOS OF BREAKDOWN VOLTAGES OF OIL IN VARIOUS GAPS

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[illegible]	[illegible]	0 05	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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	[illegible]		[illegible]	[illegible]	[illegible]	0 70	1 26	1 57	[illegible]	0 91	1 64	[illegible]	[illegible]
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ap indicated at the left side of the table.

Design of Lighting Secondaries

THE following method of designing lighting secondaries is an attempt to put the necessary calculations on as definite a basis as possible, at the same time standardizing computations and eliminating time-consuming details. The first step is the determination of the kilowatt demand of each consumer. Each pole from which services are run is then treated as a sub-center of distribution. In calculating voltage drops the "kilowatt span" is taken as the unit of measurement. One kilowatt-span equals the number of kilowatts which may be transmitted over one span (or the number of spans over which one kilowatt may be transmitted) at 2 volts drop between neutral and outer wire. In Table I are given the sizes of wire required for different values of kilowatt-span. For a drop of 1 volt the values in the kilowatt-span column should be reduced one-half.

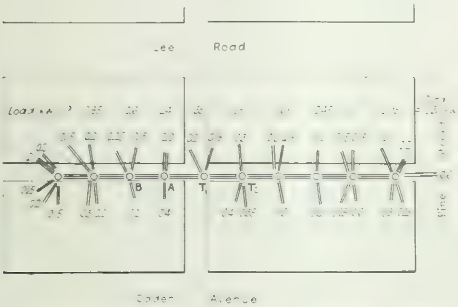


CHART TO CALCULATE SIZE OF WIRE FOR SECONDARY CIRCUIT FEEDING LIGHTING LOAD

Kilowatt spans are figured as below

TRANSFORMER AT T_1

West Kw.	Spans	Kw.-Spans	East Kw.	Spans	Kw.-Spans
1.9 ×	4 =	7.6	1.05 ×	1 =	1.05
0.85 ×	3 =	2.55	0.65 ×	2 =	1.30
0.6 ×	2 =	1.2	0.45 ×	3 =	1.35
2.4 ×	1 =	2.4	1.15 ×	4 =	4.60
			2.95 ×	5 =	14.75
		13.75			23.05

TRANSFORMER AT T_2

West Kw.	Spans	Kw.-Spans	East Kw.	Spans	Kw.-Spans
1.9 ×	5 =	9.5	0.65 ×	1 =	0.65
0.85 ×	4 =	3.4	0.45 ×	2 =	0.90
0.6 ×	3 =	1.8	1.15 ×	3 =	3.45
2.4 ×	2 =	4.8	2.95 ×	4 =	11.80
0.35 ×	1 =	0.35			
		19.85			16.80

In calculating residence loads a table similar to Table II may be computed, adjusting it as conditions warrant to the particular characteristics of a given community. This table shows the required transformer capacity for residences with different numbers of rooms. The demand figures do not represent the demand of the individual consumer at the service entrance, but rather the demand of the consumer at the transformer, taking into account all diversifying conditions. Where a considerable number of consumers are connected to a given secondary, this figure will, of course, be considerably below the demand at the individual consumer's service. For stores, shops and general commercial lighting an actual count of the connected load or a demand test will usually be required, as these loads are generally as incapable of standardizing as are residence loads. The demand of a store at the transformer will be from 10 per cent to 30 per cent, or 40 per cent less than demand at the service, unless the transformer provided is but little larger than such demand. Likewise single-phase motors connected to lighting mains will show a very low diversity factor unless an individual motor constitutes a large proportion of the total load connected to a given secondary. If several motors are combined on one secondary with a considerable amount of lighting, they may often be virtually neglected as far as providing transformer capacity is concerned, particularly if their period of operation is largely off the lighting peak.

TABLE I—SIZE OF WIRE FOR 110/220-VOLT SECONDARIES

Single-phase, 60-cycle, 98 per cent power factor, 12-in. spacing, 125-ft. spans, reactance included

Size Wire, B. & S. Gage	Voltage Loss per Ampere per 1,000 Ft.	Voltage Loss per Ampere per Span of 125 Ft.	Voltage Loss per Kilowatt per Span of 125 Ft.	Kilowatt-Spans for 2 Volts Loss (Working Values)
6	0.821	0.1027	0.467	9
4	0.533	0.0667	0.303	13
2	0.351	0.043	0.200	20
1	0.287	0.0359	0.163	25
1/0	0.236	0.0295	0.134	30
2/0	0.195	0.0244	0.111	36
4/0	0.136	0.0171	0.0775	52

The accompanying drawing shows a typical survey of a lighting load. In the block shown alley distribution is employed and thirty-three services are fed from the secondary, there being twenty-nine residences, two stores, a sixteen-family apartment and one church. The total load is 12.35 kw., which requires a 15-kva. transformer as the nearest standard size. Preliminary inspection indicates that the transformer should be located at T_1. Accordingly the kilowatt-spans are calculated on both sides of T_1. The kilowatt-spans due to the load fed from any one pole equal the number of kilowatts at the pole multiplied by the number of spans from the pole to the transformer. For instance, the kilowatt-spans due to pole *A* equal the load at *A* (2.4 kw.) multiplied by the distance to T_1 (one span). This means 2.4 kilowatt-spans. Likewise due to pole *B* there are 0.6 × 2 = 1.2 kilowatt-spans. This is carried out for all poles west of T_1 and the sum equals 13.75 kilowatt-spans. Likewise the sum for all poles to the east of T_1 equals 23.05 kilowatt-spans. As considerably more of the load is west of T_1, a similar calculation is made taking T_2 as the transformer pole. This calculation shows that the kilowatt spans on the west of T_2 (19.85) very closely balance the kilowatt-spans on the east (16.8). Therefore T_2 is chosen for the transformer pole. Referring to Table I, it is found that with 19.85 kilowatt-spans No. 2 wire is required to keep the drop within 2 volts from neutral to outer wire. As the load may be well balanced on each side of the 110/220-volt line, a No. 4 wire may be strung for the neutral. Accordingly two No. 2 wires and one No. 4 will carry the load satisfactorily.

TABLE II—REQUIRED TRANSFORMER CAPACITY FOR RESIDENCES

No. of Rooms in Residence	Kilowatt Demand Average Territory	High-Grade Territory
4 or less	0.15	
5—6	0.20	0.25
7—8	0.25	0.30
9—10	0.30	0.40
11—12	0.40	0.50
Over 12	.	0.60

L. C. PETERMAN.

Brooklyn, N. Y.

Starting an Induction Motor Without a Compensator

A METHOD of connecting a motor so that it may be started under heavy load without the use of a compensator has been worked out by the writer. This is accomplished by arranging the motor for starting with part of the windings in a star connection and part in a delta connection. For instance, by reference to the accompanying drawing B (Fig. 1) it will be seen that one part or unit of each phase is in delta and two units are in star. In C two units are in delta and one unit is in star for each phase. Starting at A with the line voltage applied to the extremities of the connection, a certain torque will be developed and a certain current will flow in the winding. In B a greater torque will be developed and more current will flow. This will increase successively in C and D.

To test this scheme a 50-hp. motor was connected up with the different combinations. This was a six-pole, 1,200-r.p.m., 440-volt, three-phase motor. A potential of 176 volts was impressed upon the motor while the rotor was blocked by being clamped to a lever 40 in. long, one end of which rested upon a scale. Thus the torque of the motor was determined for the different connections. These values and the values of current drawn from the line are given in the accompanying table. This table also shows the theoretical values which should be obtained under these conditions. In the lower part of the table are also given the values which would be obtained with the different taps of a compensator if the motor were connected in delta. This table shows that connection C gave about the same torque as a 75 per cent tap on a compensator would give. The current in the star part of the winding was 74 amp. while the current with the compensator for the same torque would be only 58 amp. This shows that the heating of the motor would be greater with the combination connection than with the compensator. However, the current in the delta portion of the combination winding would be only 43 amp., and as the delta winding embraces two-thirds of the coils in the motor this would allow the dissipation of a considerable amount of the heat into these coils, so that the heating would not be so great as indicated by the respective currents of 74 amp. and 58 amp. The B connection gave approximately the same torque as a 65 per cent compensator tap. In this case the current in the star part of the combination winding would be 57 amp., against 50 amp. if the motor started with a compensator. As before, the difference is lessened by the fact that one-third of the winding of the motor, the part connected in delta, carries only 33 amp.

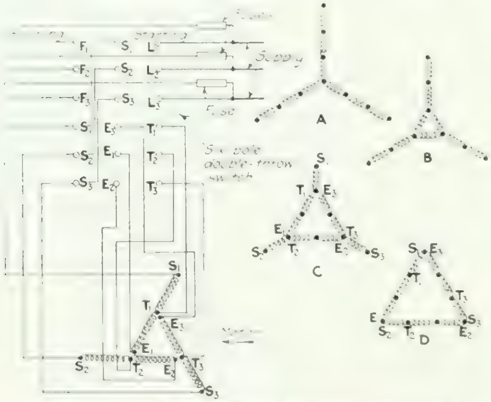


FIG. 1—MOTOR ARRANGED FOR STARTING WITHOUT A COMPENSATOR

The practical method of connecting this motor is as described in the following paragraphs. There were three coils per phase per pole in the motor. Instead of connecting these three coils under each pole in series directly, the first coil of the first phase under the first pole was connected in series with the first coil of the first phase under the second pole, and this was connected in series with the first coil of the first phase under the third pole, and so forth. On completion of this connection entirely around the motor one unit was formed of the six coils. The units are shown in the diagrams A, B, C, and D. As there were three coils per phase per pole, three of these units were formed for each of the phases, thus giving nine units.

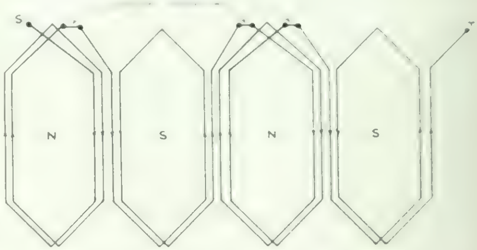


FIG. 2—COILS CONNECTED TO FORM "UNITS"

This method of connection was accomplished in the motor by inserting the coils as shown in Fig. 2, putting in first a lap-wound coil and then a wave-wound coil, and connecting the ends of the coils as indicated. All three units of one phase are then connected in series, but taps are brought out to a junction board from the ends of all units.

It is seen that in using the combination winding several arrangements giving different starting torques and drawing different currents are available. However, for a certain motor drive only one combination is employed in addition to the delta or running combination. The combination is chosen which will start the load and still draw the lowest current from the line. This means that altogether nine leads must be brought out and connected to the starting switch. This should preferably be a double-throw, six-pole knife or drum switch. Six poles allow changing from unprotected line leads for starting to fused or otherwise protected line leads for running. In starting the motor with the switch it is thrown first to the starting position and then when the motor has come to speed it is changed over to the running position. Should it be desired to change the starting torque of the motor, this may be done by changing the leads from the junction box to the switch. This is similar to the operation in changing the taps in the compensator.

To understand the connections and the theory the same motor has been laid out in Fig. 3, each heavy line representing a coil. There are fifty-four coils, nine in each pole, and nine units with six coils in each unit. The position of the coils in the motor is shown at *M*. The connection of the coils is shown at *P*, where the units are marked. In this connection there are two units in delta and one unit in star for each phase as at *C* (Fig. 1). The current in unit 1 is in phase with the line current and equal to it. For the sake of simplicity let it equal 1 amp. The current in unit 2 equals 0.58 times the current in unit 1 and is 150 deg. out of phase with the current in unit 1. Therefore the current in coil 2 is 150 deg. ahead of that in coil 1. However, this coil is connected reversed with respect to coil 1 and therefore the magnetic flux is 30 deg. out of phase with the flux from coil 1. This flux relation is clearly illustrated at Q, which shows the coils developed in a straight line. The flux in coil 3 is equal and of the same direction as the flux in coil 2. By similar reasoning the flux in coil 4 is equal to that in coil 1, but is 30 deg. ahead of the flux in coils 2 and 3. The flux in succeeding coils progresses similarly 30 deg. at coil 7, 30 deg. at coil 8. When coil 10 is reached the current is in the same direction as that in coil 1, but the coil is connected in the reverse direction and consequently where there was a north pole under coil 1 there is a south pole under coil 10. The flux has changed direction 30 deg. at a time from positive to negative. If this reasoning were carried out for all the coils, it would be seen that the motor had six poles changing in proper order and position as a trip is made around the motor.

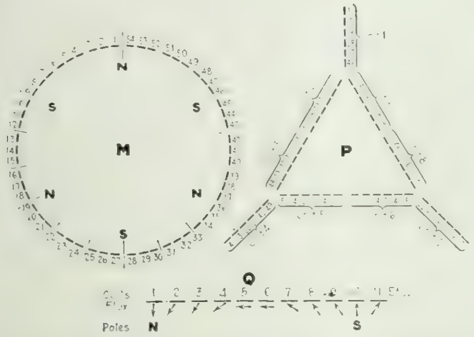


FIG. 3—EXPLANATION OF FLUX DIRECTIONS IN MOTOR STARTED WITHOUT COMPENSATOR

Six-pole, three-phase machine with fifty-four coils each represented by a short heavy line. *M* shows position of coils in machine. *P* shows sequence and arrangement of coils as they are connected with two units in delta and one in star per phase. *Q* is a development of the coils in their order of sequence in the motor. The short arrows represent magnetic flux.

STARTING CONDITIONS OF MOTOR

Fig. No.	Test No. Coils in Delta	Test No. Coils in Star	Line Volts	Line Amp.	Amp. in Delta Part of Winding (Calculated)	Amp. in Star Part of Winding	Torque (Lb.-Ft.)
With combination winding (from tests)							
D	3	0	176	133	77	0	233
C	2	1	176	74	43	74	123
B	1	2	176	57	33	57	113
A	0	3	176	43	0	43	[illegible]
With combination winding (calculated)							
D	3	0	176	133	77	0	233
C	2	1	176	80	46	80	140
B	1	2	176	57	33	57	97
A	0	3	176	44	0	44	78

With Compensator Straight Delta Connection with Compensator Tap of per Cent Indicated Below	Line Volts	Line Amp.	Amp. in Winding	Torque (Lb.-Ft.)
100	176	133	77	233
90	176	120	69	[illegible]
80	176	107	62	14
70	176	93	54	114
60	176	80	46	4
50	176	67	39	

The foregoing explains the connections for a motor having six poles and three coils per phase per pole. A similar connection might be worked out for any other motor which has more than one coil per phase per pole.

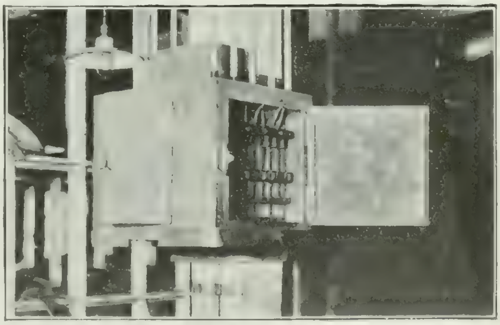
United Zinc Smelting Corp., Moundsville, W. Va.

J. W. MURRY, Electrical Engineer.

Switch Cabinet Made in Plant Occupies Little Space

A CONVENIENT home-made switch cabinet for low-voltage service in factory lighting and small power is employed at the plant of the Graton & Knight Manufacturing Company in Worcester, Mass. As illustrated, the cabinet consists of a set of two slate distributing panels mounted on opposite sides of a column, with a main switch mounted on cleats on the intermediate face of the post and the whole inclosed by a cast-iron and galvanized-iron housing with hinged doors. The doors are fastened by sash locks. The conduit carrying the feed wires to the main switch is set in the channel formed between the cleats. The distributing panels mounted on the other two faces are carried out beyond the post to form slate barriers at the side of the main switch, and the buses are run across the distributing panels to within 1 in. of the edge. Connecting studs passing through the busbars and slate permit connection to the main switch busbar on the back of the panels, which are made reversible by terminating the buses equidistant from the edge. Angles 1½ in. x 1½ in. x $\frac{3}{16}$ in. are used in attaching the panels to the post, and this makes the construction sufficiently rugged to withstand the rough usage to which cabinets are liable when set at the side of a passageway where trucking is done. Leather strips ⅛ in. thick have been riveted on the corners to avoid injury to passers-by.

The advantages of this construction, apart from minimizing the investment cost, are the radial central distribution, occupying a minimum of space and permitting higher mounting because all switches are in the same horizontal plane, and the convenient access to all connections. Unless the panels are so constructed that no live parts are exposed, this construction is adapted only to low-voltage service. The cost of such a cabinet is not over $2 per kilowatt of capacity.



SWITCH CABINET MADE TO FIT AROUND THREE SIDES OF BUILDING COLUMN

Graton & Knight Mfg. Co., Worcester, Mass.

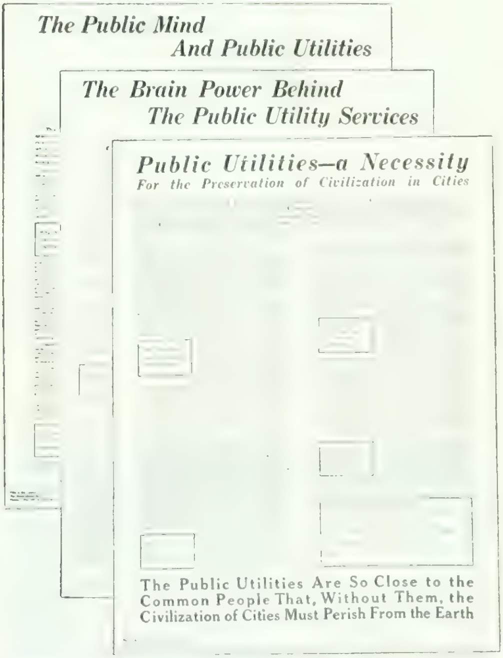
A. H. MAGNUSON, Electrical Engineer.

Management and Policy

Embracing Central Station Commercial Organization and Management, Customer and Trade Relationships, Public and Financial Policies, Advertising, Selling and Service Methods

Utilities Underwrite Clever Essays on Public Service Subjects

FULL-PAGE articles on the value of the public utility to the community are now appearing weekly in the New York *Globe* as the result of the enterprise of Darby Richardson of the *Globe's* financial staff. Mr. Richardson believes that there is a healthy growing interest on the part of the investing public in utility securities, but that most persons have a very small appreciation of the importance of the public service corporation in modern life and the scale on which their business has developed. He discussed the matter with a number of the larger central-station companies of the country and secured their co-operation in the underwriting of a series of twenty-five advertisements, which are really simple, forceful, interesting essays on the different human aspects of the public utility. These articles are now appearing each Wednesday with such titles as:



The Public Mind And Public Utilities

The Brain Power Behind The Public Utility Services

Public Utilities—a Necessity
For the Preservation of Civilization in Cities

The Public Utilities Are So Close to the Common People That, Without Them, the Civilization of Cities Must Perish From the Earth

TYPICAL ARTICLES APPEARING IN NEW YORK "GLOBE" SERIES

"The Brain Power Behind the Public Utility Service."
"The Average Person's View of the Electric Utilities."
"The Holding Company's Place in Public Utilities."
"Continuous Incomes for Public Utilities."
"The Romance of Electricity."
"The Dangers from M. O. to Public Utility Investments."

Each advertisement bears a return coupon by which the reader may ask the *Globe* financial department for information in regard to utility investments.

The publication of this series of essays is telling an invaluable story to a very large number of homes in the New York metropolitan district, but the effect is being extended still further through the distribution of reprints of the articles by a number of the underwriting utility interests, which are sending them to the local customers of the central-station companies. One company, for instance, plans to send a pamphlet containing the complete series to all the school teachers in one Western state, with the suggestion that it be used as the subject for an essay competition in the schools. In other cities the utilities purpose to interest the local bankers in co-operatively publishing these articles in the local press when the series is complete, for the benefit of the investing public. Each article before publication is being submitted to M. H. Aylesworth, executive manager of the National Electric Light Association, and receives his official approval.

A Traffic Count for the Information of Neighbors

VERY few of the neighbors of the electric light and power company in a city realize how great an influence the central-station office and salesroom exercises in attracting people to the neighborhood. To reduce this to approximate figures that might be brought to the attention of the surrounding merchants, J. E. Davidson, vice-president and general manager, had a tally kept over a recent twelve-month period of the number of persons who visited the office of the Nebraska Power Company in Omaha. On the completion of the count Mr. Davidson wrote this letter to fifteen retail merchants:

> DEAR NEIGHBOR: Some of the neighbors of the Nebraska Power Company told us when we moved into the Electric Building that they were glad to have us as neighbors as they thought we would bring more people into this part of the city.
>
> In our effort to better public relations we have kept close tab on transactions with customers whether in payment of bills, repairs, purchase of merchandise or adjustments, etc. For that reason it is very easy for us to segregate these records into almost any proposition that we desire.
>
> You will probably be interested in reading some of the figures as to the number of people who have come to our electric shop to pay bills only. I say only, because it does not include those who enter the shop to purchase merchandise, apply for service adjustments, etc. The smallest month's record was 13,843; the largest month's record was 21,791; the monthly average was 18,590, and the daily average was 715. Adding 30 per cent for sale of appliances and repairs would make a monthly average of 24,167, or a daily average of 930. Yours for more business, J. E. DAVIDSON.

The neighboring merchants were extremely pleased both with the concrete evidence of the increased sidewalk traffic which is now passing their windows on its way to the electric light office and also with the friendly spirit of the company. It was an act of courtesy that brought forth many expressions of appreciation and good will.

A Prepayment Meter to Collect Overdue Accounts

A METHOD of utilizing a prepayment meter to collect overdue accounts was shown at the New London convention of the New England Division, N. E. L. A., recently when the practice of the Union Light & Power Company, Franklin, Mass., was described. There have been several cases where for worthy reasons, such as sickness or non-employment of a customer who has in the past paid his account promptly, an account has run several months and finally reached an impasse. To meet this situation the company has used the prepayment meter, installed on the customer's premises and using the 25-cent gear. This means that for every 25 cents deposited the customer pays 14 cents each for the immediate kilowatt-hours used, and his back account is credited with the balance of 11 cents per kilowatt-hour. In this way the company has been able to close several accounts and retain the good will of the customer.

The prepayment meter is allowed to remain until a credit balance of $5 is shown on the customer's account, this being used as a deposit. A receipt is sent the customer and the prepayment meter is then replaced by one of the ordinary integrating type.

"7.37 per Cent" Makes Effective Feature of Securities Advertisements

EXPERIENCE has shown that an advertising program can be made doubly effective if it is centered around some one particular feature. In Evansville, Ind., the Southern Indiana Gas & Electric Company has done this very effectively by making an attractive design of the figures "7.37%," representing the rate of return on an investment in the company's preferred stock. The "7.37%" is prominently displayed in all advertisements, one of which is shown here. Another use made of the idea is a large red poster about 18 in. by 36 in. with "7.37%" in white figures. This is displayed in conspicuous places in the company's offices, on the fronts of street cars, on the company's trucks and wherever it will catch a prospective stockholder's eye. H. T. Sharpe, contract agent in charge of the sale, states that the advertising is producing highly satisfactory results.

FULL-PAGE ADVERTISEMENT FEATURES RATE OF RETURN

What Other Companies Are Doing

Northern Illinois.—An exemplification of the benefit that accrues to electrical contractor-dealers from sales campaigns of central-station companies is shown in the sales of electric ranges in the territory of the Public Service Company of Northern Illinois. During the first six months of this year the company's range sales have exceeded by 20 per cent the sales for the entire year of 1920. New connections of ranges for the same period have exceeded by 30 per cent the connections during the whole of last year. The increase in connections is due to contractor-dealer sales. It is believed that the contractor-dealers would not have sold 5 per cent of the ranges they did had it not been for the Public Service Company's educational and promotion work on these appliances.

Portland, Ore.—To stimulate the collection of delinquent accounts by its branch offices the Pacific Power & Light Company publishes each month in its "*Bulletin*" a chart showing the relative standing of the branches. By comparing the delinquent accounts to gross earnings the percentage of delinquency is ascertained and the branch offices thus rated. Keen rivalry among the eighteen branches has materially lowered the percentage of total outstanding accounts. W. A. Dunlap, statistician of the company, brings the chart up to date each month and calls attention to any change in standing of the different branch offices. For the past six months the best showing has been made by the White Salmon branch, which gained 26 points, followed by the Sunnyside branch, which made a gain of 18 points.

Chicago, Ill.—A new booklet entitled "Income Building on the Byllesby Ten-Payment Plan" has just been issued by H. M. Byllesby & Company. The booklet describes the company's partial payment plan for purchasing securities, and illustrates with tables and compilations in detail how the plan works. An interesting feature is a comparison of the rate of growth of money when compounded at various interest rates. Another is a graphic chart showing how the regular monthly saving of certain sums grows over a period of twenty-five years. A number of Byllesby securities are illustrated and described, and five booklets dealing with various phases of the company's operations, securities, etc., which are offered for distribution are illustrated. A copy of the new "Ten-Payment Plan" booklet will be sent to inquirers upon request.

Minneapolis, Minn.—The month of August in the Minneapolis General Electric Company was the busiest August ever experienced by the company and one of the busiest months in the company's history. The net gain in customers was 15 per cent greater than any other August, all classes of business showing good gains. In spite of power disconnections due to the shutting down or partial shutting down of industrial plants, a net gain of 852¾ hp. connected was shown for the month. Four hundred and ninety-two old houses were wired as compared with 479 for the same month last year. An idea of the volume of business transacted in the Minneapolis office may be gained from the fact that 3,288 contracts of various kinds were signed during the month as compared with 2,536 contracts during the same month the previous year.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
of the World

Generators, Motors and Transformers

Small Rotary Rectifier. — R. BARTHÉLEMY. — The article gives a detailed description of a rectifier of 60 watts to 80 watts direct-current output for charging of storage batteries of 6 volts to 24 volts. A synchronous motor with a Siemens double-T armature and a simple commutator, turning on ball bearings within a stationary field of either a permanent magnet or a magnet excited by the battery, is used. The motor is started by hand with a self-disengaging gear. The rotor consumes only 10 watts.—*Revue Générale de l'Electricité,* Sept. 10, 1921.

Balancing High-Speed Electric Machines.—H. H. WHEELER.—The article indicates several of the main causes of vibration in turbo-generators and similar machines and tells of methods employed to overcome it. This article describes methods of getting the static balance and also the centrifugal-force method for eliminating vibration at various speeds. Mention is also made of running machinery above "critical speeds." At speeds very much greater than the critical rotation becomes remarkably steady, and many machines have been designed to take advantage of this. Such a course is, however, hardly to be recommended for dynamos and motors ordinarily since the composite nature of their construction renders them liable to sustain serious strains while being run up to speed or being stopped.—London *Electrician,* July 29, 1921.

Lamps and Lighting

The Theory of the Beck Arc.—H. BECK.—The author gives an account of his theoretical investigations of very high-current arc phenomena such as occur in the Beck searchlamp. The character of the negative flame and the positive crater are studied both for slow and for fast vaporizing carbons. The question of pressure and vapor density is investigated, and an explanation is given for the deep crater formation. The much advertised Sperry high-intensity arc, the author claims, is an imitation of the antecedent Beck arc.—*Elektrotechnische Zeitschrift,* Sept. 8, 1921.

Types of Circuits Employed in Street Lighting. C. H. SHEPHERD.—A description of multiple and series circuits, with a number of intermediate combinations which are utilized for street-lighting purposes. The group system is favored as it combines many important advantages of other systems. A number of systems are described and distribution and control equipment is discussed.—*Electrical Review,* Sept 10, 1921.

Generation, Transmission and Distribution

Manufacture and Testing of High-Tension Porcelain Insulators.—A. D. ALLEN.—A practical description of the processes involved in making and the care essential in inspecting high-tension insulators. The materials are described and classified and the methods of working the material, making the molds, forming the porcelain and baking are described. Some of the defects which may be detected in inspecting are also mentioned.—*Electrical News,* Aug. 15, 1921.

Latticed Steel Poles for High-Tension Transmission. CARLO FASCETTI.—Calculations and formulas giving the weight of a steel pole in function of the span and size of conductors are given in this article. The portion of the tower set in the concrete and also the weight of the cross-arm are considered as constant, not being affected by the size of the conductors or the length of the span. Hence the weight of the pole depends on the degree of the wind pressure against the exposed area of the pole and of the line conductors and also on the height above the ground of the lowest wire. With reference to the transmission voltage the author shows that the increased distance between the wires does not materially change the height of the pole and does not affect the use of the formulas. Tabulated data and practical examples are given showing the application of the formulas.—*Elettrotecnica,* Aug. 5, 1921.

Practical Results of Higher Power Factor by the Use of Static Condensers.—CORRADO LANDI.—Among the various methods adopted to improve power factor the static condenser has come into use very recently. Heretofore it was found difficult to obtain for this purpose an apparatus convenient, durable and economical. The most recent type of static condenser, which embodies many valuable features, uses impregnated paper as a dielectric, the same as that used in submarine cable, thus permitting a compact structure of small dimensions and weight. Condensers rated up to 100 mf. are connected without special precaution, while those of larger capacity have a starting rheostat connected in series in order to reduce to a minimum the transients produced by switching. The author gives a tabulation of sizes and weights for condensers of different capacity; also tables of results obtained from tests on motors with and without condensers at no load and at 40 per cent load.—*Elettrotecnica.* Aug. 5, 1921.

Traction

New Electric Passenger Locomotives for the Silesian Mountains. — LOEWENTRAUT. — The Silesian Mountain railways present some of the most difficult traction problems in Europe. Steep and long grades, numerous small curves and a traffic system which imposes both passenger and freight service on the same locomotive are the handicaps. Fourteen "2-D-1" locomotives were ordered at the Bergmann works, to operate on 15,000 volt, single-phase alternating current at 16⅔ cycles and capable of pulling from 500-ton to 1,200-ton trains at top speeds of 90 km. to 55 km. per hour respectively. In 1917 the first of these engines was put in service on the line from Lauban to Königszelt, and it has given very good results. One motor only is used, transmitting its power by means of two 45-deg. inclined rods upon two jackshafts, from which the four drivers are actuated by horizontal coupling rods. The motor has an hour rating of 3,000 hp. and is said to be the largest railway motor in the world. The diameter of the motor is so large that the upper part of it extends through the roof of the engine. The complete locomotives weigh 108 tons and develop at the start a pull of 20,000 kg. at the circumference of the drivers. *Elektrische Kraftbetriebe und Bahnen*, Sept. 10, 1921.

Electrophysics and Magnetism

X-Ray Bulb with Liquid-Mercury Anticathode.—ALEX MÜLLER.—Experiments by the writer showed that it was easy to get fairly hard and intense X-rays using directly a liquid-mercury anticathode, a fact which led to the possibility of obtaining the X-ray spectrum of mercury. The experiments proved the fact that materials with fairly high vapor pressure can be used as anticathodes for X-rays.—*Philosophical Magazine*, September. 1921.

Variation of Resistance of Selenium with Temperature.—SNEHAMOY DATTA.—Though the light sensitiveness of selenium has been studied by a large number of workers, its heat sensitiveness has not been studied thoroughly, and it was therefore thought worth while to make tests with a view to decide how far the properties of selenium are attributable to changes caused by temperature variations. It was found that the resistance decreases with temperature according to the equation $R_t = (65.01 - 0.86t + 0.0029t^2)10^5$.—*Philosophical Magazine*, September, 1921.

Electrochemistry and Batteries

Influence of Electric Furnace on Metallurgy of Non-Ferrous Metals.—H. M. ST. JOHN.—As a result of its mechanical semi-automatic nature, electric melting, this paper states, is gradually doing away with the secretiveness which has characterized the non-ferrous industries and is replacing the experienced brass melter by a mechanic who needs only to understand his machine and its capabilities. By its use of large melting units, with closed chambers virtually free from oxygen and products of combustion, electric welding has revolutionized metal-handling methods and produces a more uniformly high quality of product, with less labor and less metal wastage, than have previously been possible. —Paper read before American Electrochemical Society, Sept. 29, 1921.

Units, Measurements and Instruments

A New Electric Hygrometer for Remote Indication.—J. CARTUS.—Knowledge of the degree of humidity of the air existing at any time is of great importance in cotton mills, refrigerating plants, breweries, storage rooms for tobacco, grain, paper, etc. The dry-and-wet-bulb thermometer method (psychrometer) has been used generally for these purposes. Hartmann & Braun have put on the market a new instrument which permits of the direct reading or permanent registering, in percentages of humidity at any distance from the room under control. Instead of a wet and a dry thermometer a very sensitive battery of thermocouples is used, one end of which is kept wet by a small wick of muslin hanging from a cup of distilled water. The ends of the couples lead to a millivoltmeter graduated directly in hundreds. To offset the influence of the varying room temperature a small mercury thermometer is installed next to the hygrometer. This has several platinum wires fused into the capillary tube and connected to the steps of a shunt to the millivoltmeter, so as to change its reading characteristics according to the changing room temperature.—*Zeitschrift des Vereines Deutscher Ingénieure*, July 16, 1921.

Apparatus for Measuring Ground Resistance—M. LESSALLE.—It is customary to measure the ohmic resistance of a ground connection by the Kohlrausch method bridge, using a small induction coil, a net of calibrated resistance units, a slide wire and a telephone. Three measurements must be made and three equations must be solved to obtain the desired result. The author has devised and patented a modified method whereby the bridge connections are made so that the slide wire is not calibrated, as is usual, according to its two parts, a/b, but according to $1 + (a/b)$. This reduces the method to only two measurements and the solution of only one or sometimes two equations.—*Revue Générale de l'Electricité*, Sept. 10, 1921.

Telegraphy, Telephony and Signals

Piloting Vessels by Electrically Energized Cables.—A. CROSSLEY.—This problem has been apparently met with the aural receiving equipment, but there is a demand for some kind of a visual device which will indicate directly the location of the cable. Work on such a device is now being undertaken by the New York Navy Yard. Arrangements have been considered by the International Communication Conference, meeting at Washington, whereby this aid to navigation will be internationalized and adopted by all countries having seaports. The New York Harbor installation will not cost more than $50,000, which is about equal to the cost of beacons and buoys now used in and about New York Harbor. Figuring the cost of receiving equipment for the audio piloting cable system at approximately $1,000 per vessel, it can be seen that the equipment will pay for itself within a period of a few hours, when steamships are detained outside of harbors at a cost of $500 to $4,000 per hour. The article contains a summary of historical developments.—*Proceedings Institute of Radio Engineers*, August, 1921.

A New Direction Finder.—G. M. WRIGHT AND S. B. SMITH.—A description of a new method of finding direction developed by the engineers of the Marconi company. The advantage claimed for this new method is that it is less seriously affected by the reflection and refraction phenomena which are usually known as night effect. The system consists of the well-known combination of the Bellini-Tosi aerial and an open aerial adjusted to give a heart-shaped diagram with a single zero. It is indicated that a receiver of this type may give very inaccurate results, but if the signals are so strong that the minimum is sharply defined there should be no difficulty.—*Radio Review*, August, 1921.

Miscellaneous

Small and Inexpensive Arc Furnace.—E. F. RUSS.—A very simple and cheap electric furnace of 500 kg. capacity with one or two electrodes suitable to be connected to any single or three-phase alternating-current power supply is described. An oil-cooled reactance coil in series with the furnace prevents short-circuiting when the arc is formed. The electrodes are advanced by hand operation. The energy consumption for one charge of 500 kg. is given to 550 kw.-hr. The furnace has been designed and is especially suitable for machine shops which produce their own small steel castings.—*Elektrotechnische Zeitschrift*, Sept. 8, 1921.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

Bankers Told Prosperity Cannot Be Halted

OPENING the annual convention of the American Bankers' Association, held in Los Angeles this week, John S. Drum, president of the association, declared that there is nothing in the domestic situation or in the international situation that can sustain a pessimistic outlook. Gradually, he said, influences preventing the restoration of stable conditions are disappearing as prices move toward stability on an equitable basis.

"The full purchasing power that is a necessary prerequisite of normal prosperity is being recovered steadily," he continued, "as social and political conditions abroad improve. The wealth wasted in war is being replaced, and foreign countries are working to rebuild the productive capacity that measures their ability to consume, and as foreign production increases world markets for American goods are being reopened. It is true that many problems, both domestic and foreign, are standing in the way of a restoration of stable conditions and normal domestic and world prosperity, but the forces that are working to solve these problems are irresistible."

Georgia Line Construction Regulation Law Fails to Pass

THE bill before the Georgia Legislature that aimed at the establishment of regulations by the Railroad Commission to govern overhead-line construction failed of passage in the House after being amended in the Senate. It was returned to the House too late for consideration. The bill as finally amended limited the scope of the rules to protection from physical hazards, though originally it was drawn to include inductive interference. Another amendment exempted from the provisions of the proposed law all utilities municipally owned. If the bill comes up for consideration next year, it will be necessary for both houses to pass it.

Chicago Building Trades Council Approves Landis Award

AFTER Judge Landis had declared himself "up in the air" and ordered a two weeks' continuance of the Chicago building controversy to "let things simmer down," the Chicago Building Trades Council on Friday night of last week expelled the hoisting engineers, who were the only defiant union organization remaining, and unanimously accepted the wage award made by Judge Landis about a month ago. The action came suddenly, after the situation had apparently reached a deadlock with little prospect of immediate progress in any direction. The approval of the council included that of the carpenters, who have been the principal disturbing element in the situation, they having refused to bind themselves at any time to take part in the proceedings under the direction of Judge Landis. The action of the council opens the way to the rehearings demanded by some of the trades that are dissatisfied with the wages awarded them. In some cases this will result in taking up again the matter of elimination of working rules that were the reason for a smaller wage being awarded than the trades in question would have otherwise received.

America Must Participate in European Restoration, Investigators Say

CONVICTION that the United States cannot refrain from active participation in the settlement of the economic and financial difficulties confronting the world is expressed by a special committee of the Chamber of Commerce of the United States just back from an extended trip through European countries where government officials and business leaders were interviewed and where in a close study on the ground the committee sought the views of various elements of the population. In a report to the board of directors of the Chamber of Commerce the committee declares:

"In every country visited the opinion was expressed that neither western nor central Europe can be restored to a condition which promises hope and progress for the future without our assistance. Every country desires our friendship and assistance, and it is apparent that we can participate in the restoration of commercial and industrial productivity on any reasonable and consistent terms, either by modification of the Versailles treaty to meet the policies of the United States or independently of it."

Westinghouse Receives $7,000,000 Railway Contract from Chile

THE Westinghouse Electric International Company announces that it has received final confirmation of the contract to supply the equipment to electrify the Chilean State Railroad between Valparaiso and Santiago and the Los Andes branch. This contract covers the largest railway electrification undertaken by an American firm outside of the United States.

The main line, which is 116 miles long, is now under steam operation and is the most important railway line in Chile. It connects the leading seaport (Valparaiso) with the capital (Santiago), while the line to Los Andes is 28 miles long and forms the Chilean State Railway section of the transcontinental line to Buenos Aires.

The contract, which has a total value of $7,000,000, was obtained despite keen competition from Germany and other European companies. The award was given to the American firm because of its more complete and correct engineering analysis of the situation as well as its low price.

The equipment to be furnished consists of eleven local passenger locomotives, fifteen road freight locomotives, six express locomotives, seven switching engines and five substations of 4,000 kw. rating each. All of these locomotives are to be of Baldwin-Westinghouse manufacture. The 3,000-volt direct-current system which will be used will be strictly American in character. The capacity of this equipment will be 50 per cent greater than present traffic demands, and the plans have been so drawn that an increase of traffic capacity reaching three times the present demands can readily be obtained.

This contract represents the third large order for electric railway supplies received by the Westinghouse Electric International Company from a foreign country in the past few months, the others being obtained from France and Japan. The Errazuriz-Simpson Company of Chile will build the overhead construction.

Portland Company to Finance Project with Preferred Stock

IN ORDER to provide capital for extensions and betterments, but primarily to finance the construction of a large hydro-electric project, the Portland (Ore.) Railway, Light & Power Company has authorized the sale of $10,000,000 of 7 per cent prior preferred stock, to be sold as needed. Much preliminary work has already been done on the Oak Grove project, which is capable of an ultimate development of 60,000 kw., and actual work will be started on the first unit of 20,000 kw. within the next year if adequate financing can be had. It is estimated that it will take three years to complete the first unit. Additional units will be added as required.

Prior to placing the stock on the market a financial reorganization of the company is being arranged. Supplementary articles of incorporation have been filed increasing the capitalization of the company from $35,000,000 to $42,500,000. A reduction of $5,000,000 is to be made in the common stock of the company. There will be issued $2,500,000 of first preferred stock that will not be offered for sale. There has been issued and paid in full $22,500,000 of the company's stock. Holders of the new $10,000,000 of prior-preferred stock will be first to receive dividends. As far as possible the same policy will govern the company in disposing of this new issue of stock as was followed recently when $1,000,000 of 8 per cent gold notes was offered locally.

Washington Contractor-Dealers Withdraw from National Association

DECISION was reached at the annual convention of the Washington Association of Electrical Contractor-Dealers, held in Yakima, Wash., Sept. 16, to follow the action of the California and Oregon state associations in withdrawing from the National Association of Electrical Contractors and Dealers. Similar action was taken at the Oregon state convention held June 12 and 13 at Eugene and at the California annual meeting held at Berkeley Aug. 27. A joint letter to the national association giving notice of withdrawal of the California, Oregon and Washington state divisions was signed by the presidents of the three associations at the Yakima meeting

Business Good in Southern California, Says S. M. Kennedy

BUSINESS in southern California is in a much better condition than it is in the East, according to S. M. Kennedy, vice-president Southern California Edison Company, largely because there was not the same extreme inflation and consequently there is not the necessity for deflation. Mr. Kennedy, who is a well known authority on public relations and central-station business building, while in New York recently on a business trip was asked by the ELECTRICAL WORLD to outline the conditions in the great territory served by his company, and he started out with a remark that undoubtedly has a much wider application than just to southern California.

S. M. KENNEDY

"Whatever depression has been felt in southern California," he said, "has been more sympathetic than anything else. We are a part of the nation and as such cannot escape altogether economic disturbances that are so widespread. Business with us, however, is really good and we are going ahead vigorously.

"In every town in southern California homes are being erected as fast as they can be built. There is a scarcity of homes, and now that building costs and labor's wages have decreased people are building. In fact, one of the greatest difficulties before the Southern California Edison Company today is to keep pace with the demand for service to new buildings, most of which are dwellings.

"Industrially and agriculturally we are operating at about the same level as a year ago. We are serving more irrigation stations and as many industrial plants, but the load of the latter is not quite so large as it was, say, twelve months ago.

"Gross revenue has been increasing satisfactorily month by month during the year in spite of an appreciable reduction in rates. The increase in business, in other words, more than offsets the lower rates.

"Labor seems more satisfied than at any time in the previous twelve months. Our company is not cutting salaries or wages of existing employees, but starting with last July the new employees for line and construction work have been taken on at a lower scale of wages. This seems to work out very well, and the new men seem well satisfied.

"In the oil fields of southern California, where about 10,000 men are employed, wages were reduced all along the line one dollar a day. While these men are now out on a strike, it is not a question of wages but rather one of recognition of the union.

"In certain classes of agricultural production conditions are somewhat unsatisfactory, but they are improving. During and immediately following the war fancy prices were obtained for many products. This incited the farmers to overproduction, and then came a poor market. This overproduction, which was stocked, has now been absorbed and the new product is being sold again at a favorable price. The same is true of the canning industry. There is now a decided improvement, and conditions are more hopeful than prevailed six months ago.

"These improved conditions are naturally being reflected in our sales of company securities locally. During the current year our company has sold more than $10,000,000 of stock to customers, and the total number of stockholders to date is 21,000. Our sales of stock locally are being made by a regular and permanent department that is operating every day and creating a steady demand for the company's securities. It is not only increasing the number of stockholders but is obtaining heavier investments from old stockholders.

"One of the big features of the company's stock-selling program is that two-thirds of our permanent employees are stockholders and the percentage is steadily increasing. We now have 3,000 employee stockholders. The customer-partnership plan is the ideal public ownership, and the Southern California Edison Company's eventual number of stockholders is limited only by the number of its customers."

A. R. A. Inductive-Interference Committee Reports

AT A SESSION of the telegraph and telephone section of the American Railway Association held in Cleveland week before last the inductive-interference committee submitted a report in which the theory of inductive interference was discussed and a description of its causes and effects included. The report was accepted for submission by letter ballot for inclusion in the A. R. A. manual. The description of causes and effects is confined to the "detrimental inductive effect on telegraph and telephone circuits caused by adjacent power circuits or systems." Inductive interference between telegraph and telephone circuits is mentioned, the remedy, it is said, consisting in transpositions in accordance with schemes worked out by the committee on maintenance of outside plant to reduce the effects of such interference. Three classes of interference are dealt with—interference with operation, which includes interruption of service; interference with telegraph communication, and interference with telephone signals. The classifications cover physical injury to plant from fire, damage to apparatus or protective apparatus and hazard to employees from electric or acoustic shock.

The report contains a fairly full discussion of the factors in the power circuits tending to create inductive interference, but aside from lack of balance in the communication circuits and those factors due to poor construction or maintenance no attention is given to the characteristics of communication circuits that render them unduly susceptible to the influence of paralleling power circuits. Except for the incidental mention of transpositions, there is no discussion of preventive or remedial measures.

A supplemental report contains the statement that the committee has learned through inquiry from the various state commissions that the subject of inductive interference is very much alive. A list of ten states in which rules have already been adopted or adoption of such rules is contemplated is given. Constant reference is made to California General Order No. 52 in this connection. This is the order by which the final recommendations of the California committee were put in force in that state. The American Railway Association through its secretary has been instrumental in furnishing copies of the order to the railroad and public service commissions of forty-three states.

It is interesting to note that in the make-up of the committee, in addition to the railroad representatives, the names of L. P. Ferris and R. W. Mastick, of the American Telephone & Telegraph Company and the Pacific Telephone & Telegraph Company respectively, appear. Both men were employed in the California inductive-interference study. One manufacturer's representative appears, but there is no direct representation of the power interests.

Indiana Association Considers Overhead Crossing Situation

ALTHOUGH the program of the thirteenth annual meeting of the Indiana Electric Light Association at French Lick Springs which was held recently was curtailed because of the consolidation of the meeting of the association with the meeting of the Great Lakes Geographic Section, N. E. L. A., the session was an interesting one. President DellPlain's address, delivered at the banquet on Friday night, called upon the members to center their thought on the improvement of the domestic life of their communities, to create good will by every possible means, and especially not to overlook the value of employees as a medium to this end. The establishment of a sound and active sales policy both as to product and merchandise was called for, and the members were especially warned against the hasty reduction of wages, Mr. DellPlain advocating a policy of non-interference with the present staffs and the limiting of adjustments, if any, to the newcomers.

The overhead-crossings committee reported that the law in Indiana was such that modern practice was difficult to adopt, because when the law was adopted a number of years ago the practices then current had been written into it. A committee was appointed to consider the drafting of new legislation that can be presented to the next Legislature to relieve the situation and permit the elimination of undesirable practices.

The discussion of the educational committee report centered around the meter course carried on at Purdue University and developed a strong sentiment for similar courses on overhead-line and distribution practice.

W. L. Goodwin, assistant to the president of the Society for Electrical Development, declared that electricity was not a necessity but a convenience and that the business should be developed on this basis. The difference indicated between the two is that profits must be lower on the necessities and the degree of control greater than on the conveniences.

No industry spends so little for aggressive and defensive work as the central-station company. This was the message that M. H. Aylesworth, executive manager of the N. E. L. A., left with the meeting in discussing the work of the national association. F. A. Bryan of South Bend made a heart-to-heart plea for a personal examination on the part of all the members to determine what may be wrong with their methods, their organizations and themselves, in order that the public relations and also the internal relations of the organizations may be improved.

E. M. Walker of Terre Haute was elected president for the coming year, Harry Reid vice-president and Thomas Donohue of Lafayette secretary and treasurer.

Dean Cooley to Head American Engineering Council

ALTHOUGH most of the time was taken up with matters of routine character, there were a number of definite accomplishments by the executive board of the American Engineering Council of the Federated American Engineering Societies at its meeting in Washington Sept. 30. Mortimer E. Cooley, dean of the colleges of engineering and architecture of the University of Michigan, was elected president of the American Engineering Council to fill the vacancy created by the resignation of Herbert C. Hoover when he became Secretary of Commerce. It is understood that Professor Cooley has made arrangements which will enable him to give one-fourth of his time to active work for the organization. The board adopted a number of recommendations by the committee on government contracts.

Most attention was given the report of the special committee on employment service. From the discussion a resolution grew which points out the pressing need for a unified employment service for engineers "national in scope, local in application and financed for adequate service." It having been found that the constituent societies are not able to provide a free service, the executive board indorsed the principle of a paid employment service, but with reduced fees for members of the organizations that support it. A joint committee will organize the employment bureau.

A resolution proposed by W. W. Varney of Baltimore provided for the publication of a journal by the federated societies. Most of the members of the board were not prepared to vote on such an important matter as is involved in embarking in a pretentious publication activity. The proposed resolution was referred to the committee on printing.

After listening to the report of the committee on licensing the board felt that further work must be done.

Success Attends Metermen's Conference at Yale University

AN electrical metermen's conference was held at the Dunham Laboratory of Electrical Engineering of Yale University, New Haven, Conn., from Sept. 13 to Sept. 15. The attendance was more than thirty, including representatives from sixteen of the electric utility companies of Connecticut. The principal meter and instrument manufacturers were represented by one or more meter experts, and they, in conjunction with two members of the departmental teaching staff, provided the lectures and answered the questions asked in the subsequent discussion.

State Information Committee Idea as Conceived by Insull Growing

PROGRESS is still being made in widening interest in State committees on public utility information. According to the latest information available there are now eleven such committees covering sixteen states, the New England States being grouped under one committee. There are five other states that are making progress in this matter and others which have given it consideration.

The first committee was formed in Illinois and this month marks two and a half years of service. The general scheme for this committee was erroneously attributed in ELECTRICAL WORLD for Sept. 24 to John F. Gilchrist. It was conceived by Samuel Insull, president of the Commonwealth Edison Company. Mr. Gilchrist was made chairman of the original committee.

New York Electrical Show Draws 100,000 Visitors

ON SATURDAY night the fourteenth annual New York Electrical Exposition came to a close after ten days of large and enthusiastic attendance. It was estimated that fully one hundred thousand people thronged the spacious armory of the 71st Regiment, where the show was held this year. While there was great interest manifest in the demonstration of the wireless telephone and the amateur wireless contest, still the predominant interest shown by the public was in the domestic electrical appliances for lightening the labor of the home.

Emergency Measures for Non-Employment Held to Be Essentially Local

THE first phase of the work of the national conference on non-employment, meeting at Washington—namely, consideration of emergency measures of relief—was completed on Sept. 30, and the conference adjourned to meet again next Monday, Oct. 10. At that time the program will deal with long-time and permanent measures to prevent excessive shortage of employment.

Emergency relief, it was held, is essentially local in character, and with that in mind the conference adopted the following summary of its recommendations "for an emergency program for immediate adoption and prosecution":

1. The conference finds that there are, variously estimated, from 3,500,000 to 5,500,000 persons unemployed, and there are a much greater number dependent upon them. There has been an improvement, but pending general trade revival this crisis cannot be met without definite and positive organization of the country.

2. The problem of meeting the emergency of non-employment is primarily a community problem. The responsibility for leadership is with the mayor and should be immediately assumed by him.

3. The basis of organization should be an emergency committee representing the various elements in the community. This committee should develop and carry through a community plan for meeting the emergency, using existing agencies and local groups as far as practicable. One immediate step should be to co-ordinate and establish efficient public employment agencies and to register all those desiring work. It should co-ordinate the work of the various charitable institutions. Registration for relief should be entirely separate from that for employment.

4. The personnel of the employment agencies should be selected with consideration of fitness only and should be directed to find the right job for the right man and should actively canvass and organize the community for opportunities for employment. The registry for employment should be surrounded with safeguards and should give priority in employment to residents. Employers should give preference to the emergency employment agencies.

5. The emergency committee should regularly publish the numbers dependent upon it for employment and relief, that the community may be apprized of its responsibility. Begging and unco-ordinated solicitation of funds should be prevented.

6. Private houses, hotels, offices, etc., can contribute to the situation by doing their repairs, cleaning and alterations during the winter instead of waiting until spring, when employment will be more plentiful.

7. Public construction is better than relief. The municipalities should expand their school, street, sewage, repair work and public buildings to the fullest possible volume compatible with the existing circumstances. That existing circumstances are favorable is indicated by the fact that more than $700,000,000 of municipal bonds, the largest amount in history, have been sold in 1921. Of these, $106,000,000 were sold by 333 municipalities in August. Municipalities should give short-time employment the same as other employers.

8. The governor should unite all state agencies for support of the mayors and, as the superior officer, should insist upon the responsibility of city officials. He should do everything compatible with circumstances in expedition of construction of roads, state buildings, etc.

9. The federal authorities, including the Federal Reserve banks, should expedite the construction of public buildings and public works covered by existing appropriations.

10. A congressional appropriation for roads, together with state appropriations amounting to many tens of millions of dollars already made in expectation of and dependence on federal aid, would make available a large amount of employment.

The conference under existing circumstances, notwithstanding various opinions as to the character of the legislation and the necessity for economy, recommends congressional action at the present session in order that work may go forward.

11. The greatest area for immediate relief is in the construction industry, which has been artificially restricted during and since the war. We are short more than a million homes. All kinds of building and construction are far behind national necessity. The Senate committee on reconstruction and production in March of this year estimated the total construction shortage in the country at between ten and twenty billion dollars. Considering all branches of the construction industries, more than two million people could be employed if construction were resumed. Undue cost and malignant combinations have made proper expansion impossible and contributed largely to this situation. In some places these matters have been cleaned up. In other places they have not and are an affront to public decency. In some places these things have not existed. In others costs have been adjusted. Some materials have been reduced in prices as much as can be expected. Where conditions have been righted, construction should proceed, but there is still a need of community action in provision of capital on terms that will encourage home building. Where the costs are still above the other economic levels of the community there should be searching inquiry and action in the situation. We recommend that the governors summon representative committees, with the co-operation of the mayors or otherwise as they may determine, to (a) determine facts; (b) to organize community action in securing adjustments in cost, including removal of freight discriminations, and clean out campaigns against combinations, restrictions of effort and unsound practices where they exist, to the end that building may be fully resumed.

Job Rotation

12. Manufacturers can contribute to relieve the present acute situation by (a) part-time work, through reduced time or rotation of jobs; (b) as far as possible manufacturing for stock; (c) taking advantage of the present opportunity to do as much plant construction, repairs and cleaning up as is possible, with the consequent transfer of many employees to other than their regular work; (d) reduction of the number of hours of labor per day; (e) the reduction of the work week to a lower number of days during the present period of industrial depression; (f) co-operation with employees in putting these recommendations into effect.

A large number of employers have already, in whole or in part, inaugurated the recommendations herein set forth, and for this they are to be commended; and it is earnestly urged upon those employers who have not done so to put same into use, wherever practicable, at the earliest possible opportunity.

Specific methods for solution of our economic problems will be effective only in so far as they are applied in a spirit of patriotic patience on the part of all our people.

During the period of drastic economic readjustment through which we are now passing the continued efforts of any one to profit beyond the requirements of safe business practice or economic consistency should be condemned. One of the important obstacles to a resumption of normal business activity will be removed as prices reach replacement values in terms of efficient producing and distributing cost plus reasonable profit.

We therefore strongly urge all manufacturers and wholesalers who may not yet have adopted this policy to do so; but it is essential to the success of these measures, when put into effect, that retail prices shall promptly and fairly reflect the price adjustment of the producer, the manufacturer and the wholesaler.

When these principles have been recognized and the recommendations complied with, we are confident that the public will increase their purchases, thereby increasing the operations of the mills, factories and transportation companies and consequently reducing the number of unemployed.

Southeastern Section, N. E. L. A., Issues Tentative Program

FOR the coming meeting of the Southeastern Geographic Section of the National Electric Light Association, which will be held at the Signal Mountain Inn, Chattanooga, Tenn., on Oct. 17, 18 and 19, the following tentative program has been issued. In addition to the speakers scheduled it is expected that B. S. Cooper of the Alabama Public Service Commission will address the convention.

MONDAY, OCT. 17

Morning.—Address of welcome, Mayor of Chattanooga; response, Judge Lindsey, Knoxville, Tenn.; president's address, S. O. Irelan; address, M. H. Aylesworth, executive manager N. E. L. A.; report of overhead systems committee, W. K. Vanderpoel.

TUESDAY, OCT. 18

Morning.—Address, Martin Insull, chairman Public Relations Section, N. E. L. A.; address, F. D. Mahoney, Birmingham, Ala.; paper, G. A. Sawin, Westinghouse Electric & Manufacturing Company; paper, Mr. Turner, Edison Lamp Works.

Evening.—Paper, W. L. Goodwin, Society for Electrical Development; discussion.

WEDNESDAY, OCT. 19

Morning.—Address, M. R. Bump, president N. E. L. A.; address, T. W. Martin, Birmingham, Ala.; report of meter committee; election of officers.

Western Electric Separates Telephone and Supply Business

THE separation between the telephone business for the Bell Companies and the electric supply jobbing business of the Western Electric Company which has been in progress for some time is now practically completed. The telephone distributing houses and the supply distributing houses now have separate offices and organizations. The supply distributing department will have as general manager O. D. Street, while F. H Leggett becomes general manager of the telephone distribution.

In announcing this separation in the current issue of the company's house organ, *Western Electric News*, Charles G. Du Bois, president of the company, said:

> Experience has shown that the natural territorial divisions for the two kinds of business are different and that the routines and methods best adapted to each are not at all the same. Moreover, in the personnel many have shown greater aptitude for one or the other kind of business and their natural tendency has been toward specialization in one or the other so far as was possible.
>
> During all these processes the advantages of the close combination have been decreasing and the disadvantages have been increasing, and in fact the two departments have been gradually separating themselves by reason of their increasingly distinctive functions.
>
> Fundamentally our telephone department is a service job for a relatively small number of companies. It calls for specialized knowledge in purchasing, warehousing, distributing, repairing (through the emergency shops maintained at the houses), disposing of returned material and other work peculiar to those companies' needs. It calls for a thorough knowledge of these telephone companies' requirements through an intimate contact with their operating officials. It demands also a familiarity with sources of supply, relationships with manufacturers, Hawthorne stocks and factory schedules, installation progress and many other details related to the continuous plant additions of the telephone companies.
>
> The electrical supply business calls for a different sort of training. It has thousands of customers and is highly competitive in character. It calls for selling experience, knowledge of conditions in the trade, and a specialized efficiency in warehousing and marketing.
>
> During the past twelve or fifteen years both divisions of our business have been steadily growing and our distributing facilities have been growing proportionately. These years have been naturally, too, a period for the development of men within our organization, and it has seemed clear that in dividing the business into its two logical parts better service could be rendered to both our associate telephone and our general supply customers by selecting at each distributing point a separate management specially equipped for each class of work.

Municipal Ownership Proposed for New York Railways

A "STATEMENT and outline" of its plan of readjustment for the New York City street railways, including subway and elevated lines, has been issued by the Transit Commission of that city, which has been working on the problem since its appointment by Governor Miller in accordance with the law reconstituting the public service commissions of the state that was passed at the last session of the Legislature. The following is a summary of its objectives:

(a) Municipal ownership of all railway lines in the city of New York.

(b) The surrender by the companies of all existing franchises, including perpetual franchises.

(c) The elimination of all existing agencies as factors in the transit situation.

(d) The unification of the entire transit system, with a board of control, three members to be appointed by the Mayor, three by the investors, and a chairman to be selected by the two groups.

(e) Operation to be carried on by three operating corporate agencies to be created for the purpose.

(f) Genuine home rule by the city in the administration of its transit affairs.

(g) The elimination of stock speculation in transit facilities by the elimination of stock.

(h) An honest valuation of all properties to be taken over by the city.

(i) Payment for such property to be made on the basis of such valuation, irrespective of present capitalization and book values.

(j) Municipal ownership to be acquired without outlay by the city, by retiring the purchase bonds out of revenues of operation.

(k) No increase of fare unless operation under the new conditions demonstrates its necessity.

(l) Rates of fare to be based on actual cost and automatically determined by the amount of a contingent reserve or "barometer" fund.

(m) Substantial economies in operation of the unified system through consolidation and the elimination of the numerous leasing and operating companies, with their unnecessary duplication of overhead, separate traction policies and independent purchases.

(n) Consolidation and unification of power facilities.

(o) The elimination of preferential payments to existing companies and the placing of the city's rights on the same footing with those of other interests.

(p) The assurance of a fair return on securities of the new system.

(q) The re-establishment of free transfers as rapidly as the financial condition of the new system will permit.

(r) The increase of the city's debt-incurring capacity so as to permit new subway construction.

(s) Proper and adequate service to the public.

(t) The rehabilitation of required lines, and the elimination of obsolete facilities.

(u) Participation by operating personnel, as well as new security holders, in surplus profits resulting from efficient management and operation.

(v) Useless or broken-down lines not needed in the public service not to be included in the system.

(w) Abolition of the Transit Commission upon the full establishment of the plan.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest

Tokyo Electric Company Donates 1,000,000 Yen to City.—A Japanese contemporary, *Denkinotomo*, says that at the last stockholders' meeting of the Tokyo Electric Light Company the president of the company announced, to the applause of the assembled security owners, that the company in commemoration of its twenty-fifth anniversary would donate 1,000,000 yen ($500,000 at normal exchange) to the city of Tokyo. The money will be expended for electrical research.

Venezuela Builds Wireless Stations.—Wireless stations which are expected to make up for the lack of adequate cable facilities between the United States and Venezuela are being erected in Caracas, Laguayra, Maracay, Valencia and other cities of the South American country. The Caracas station, it is said, is to have a long range and will be capable of communicating with similar stations in this country and Europe. The other Venezuelan stations, a number of which are already in operation, are to be employed in transmitting both official and private messages.

"Electrical" Fires Rage in England Also.—There was a great timber-yard blaze at Stratford, England, recently, and this fire, says the *Electrical Times*, "as every one might have anticipated, was probably due to 'the fusing of an electric wire.' That is what the evening papers said on the strength of a chance remark made by the proprietors. Whether or not there were any electric wires in the immediate vicinity of the outbreak matters nothing. If the point of origin was under the open sky, what of it? By a remarkable coincidence five thousand furious men had been hurling bricks through the office window that morning, a coincidence whereon it would be unworthy to dilate."

Electrification of the Most Northerly Railroad.—The most northerly railroad of the world—namely, that connecting the Bottnian Bay with the Atlantic Ocean—built for the transportation of iron ore, is now being electrified. The installation of this work is not an easy task, the average temperature at the town of Kiruna, the starting point of the road, being one degree above freezing and the lowest temperature 60 deg. Fahr. below zero. An order for eleven electric locomotives has been placed with the German Siemens-Schuckert company and the A. E. G. of Berlin. These locomotives will be the most powerful ever built in Europe. They will have to haul freight trains of 2,000 tons. The four motors of each of these engines have a total rating of 2,132 kw.

Quebec's Great Water Powers.—The vast hydro-electric potentialities of the Province of Quebec—estimated at from 6,000,000 hp. to 15,000,000 hp.—and the industries and activities that are served by the existing developments form the subject of a handsome special issue of the Toronto *Electrical News*, containing eighty pages of text and many illustrations. The Shawinigan Falls, Cedars Rapids and other plants serving the city of Montreal receive especial attention, and the statement is made on the authority of R. M. Wilson, chief engineer of the Montreal Light, Heat & Power Consolidated, that 750 kw.-hr. per capita per year is consumed in that city, as against 700 kw.-hr. in Toronto, 585 kw.-hr. in Buffalo, 450 kw.-hr. in New York and 250 kw.-hr. in Philadelphia.

Mr. Edison Investigates Hats.—Ascribing the industrial depression to a general spirit of timidity and unwarranted pessimism, Thomas A. Edison, talking to a New York *Times* reporter, said the other day: "We must get back to normal living and spending, forget our fears, our extravagances and our niggardliness, and live as if it were ordinary times. During the war America lost its head. Money was so plentiful, such high prices could be obtained for commodities, jobs paying such big wages so easily could be secured, that we fairly wallowed in extravagance. Then came the reaction, and we went to the other extreme. At the first cry of hard times, and as a token of rebellion against high prices, we went on a 'buyers' strike.' I attended a dinner last summer at which there were forty guests, all of them men of independent means. Noticing that the hats in the check room did not look particularly new, and having an inquisitive mind, I found out that twenty-nine of them were of last year's vintage. Naturally, the hat business has not been prosperous."

"Brown Coal" Versus "White Coal" in Australia.—Sir John Monash, chairman of the Electricity Commission of the State of Victoria, Australia, recently declared emphatically for the development of the "brown coal" mines at Morwell, in that state, as more economical than the alternative scheme of obtaining power by hydro-electricity. Brown coal, he said, could be produced at Morwell for about 5 shillings a ton and be available on railway sidings in Melbourne for 9 shillings. Briquettes would cost less than 20 shillings a ton, and electrical energy in the city would be obtainable at an average rate less than ½d. (1 cent) per kilowatt-hour. A capital expenditure of £3,500,000 on the scheme to develop water power at Kiewa was, he held, entirely unjustified, and it was sheer nonsense to speak of competition, which would mean the ruin of both schemes. The extent of the brown coal fields at Morwell, Sir John said, was 20 square miles, of which an area of one square mile had been selected containing sufficient fuel to last a hundred years.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

American Society for Testing Materials.—Important papers are, it is announced, to be read before this society on Oct. 28 and 29, when it will meet with the Providence Engineering Society at Providence, R. I.

Philadelphia Section, A. I. E. E.—This section will hold its first meeting for the new society year on Monday next, Oct. 10, at the Engineers' Club on Spruce Street. The speaker will be Frank B. Gilbreth, his subject being "One Best Way to Do Work."

Cincinnati Electric Club.—This club at its annual meeting elected the following officers: President, Leonard Trotter; first vice-president, Charles M. Beltzhoover; second vice-president, C. R. Eickelberger; secretary and treasurer, W. R. Keagy; directors, W. W. Freeman, J. A. Brett and W. J. Hanley. Reports of the retiring officers showed the progress the club has made in the last year in the promotion of the electrical industry, particularly in the field of industrial lighting.

New York Section, A. I. E. E.—In view of the success of the joint meetings held last year by the New York Section of the American Institute of Electrical Engineers and the Metropolitan Section of the American Society of Mechanical Engineers, it has been determined to continue and extend the idea in the coming Institute year. There will be six meetings of the electrical engineers. Four of these will be held jointly with the American Society of Civil Engineers, the American Institute of Mining and Metallurgical Engineers and the American Society of Mechanical Engineers, the dates being Oct. 19, Nov. 14, March 15 and April 19, and two with the A. S. M. E. only, on Dec. 14 and Jan. 27. The Oct. 19 meeting will have for its topic "Engineering Financing."

Coming Meetings of Electrical and Other Technical Societies

A. I. E. E., Philadelphia Section—Philadelphia, Oct. 10.

National Association of Railway and Utilities Commissioners—Atlanta, Ga., Oct. 11-14.

N. E. L. A., Southeastern Section—Chattanooga, Tenn., Oct. 17-19.

A. I. E. E., New York Section—New York, Oct. 19.

American Society for Testing Materials—Providence, Oct. 28 and 29.

A. I. and S. E. E., Philadelphia Section—Philadelphia, Nov. 5.

A. I. E. E. and Society of Naval Architects and Marine Engineers—New York, Nov. 17.

American Physical Society—Chicago, Nov. 25-26.

Electrical Supply Jobbers' Association, Atlantic Division—Philadelphia, date in November to be fixed.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities

Montana Commission's Powers.—The Public Service Commission of Montana has asserted its power to determine the jurisdictional fact of whether a business is rendering public service, notwithstanding that to do so involves judicial action or inquiry in the sense that the existence or non-existence of power is determined by the exercise of judgment on given facts.

Allocation of Property Between Towns Not Feasible.—In granting increased electric rates to the Missouri Gas & Electric Service Company, which serves seven small communities, the Missouri Public Service Commission declared that it was not feasible to allocate the property invested in transmission lines serving towns or cities of similar size and character and held that a unform rate in all the places involved was fair and not unduly discriminatory.

What Is Meant by "Historical Cost."—Finding fault with an estimate of $95,000,000 made by the Public Service Railway Company's engineers as representing the "historical cost" of the company's property, whereas it was the total cost of all the property ever constructed by the company for its use, much of which disappeared long ago, the New Jersey Board of Public Utility Commissioners defined "historical cost" as the cost shown by the records of so much of the property as is found in place at the time the valuation is made. In determining value based upon original cost it may be necessary to make certain deductions for accrued depreciation and certain additions for appreciation, but the result so obtained has reference to value and not at all to cost.

New York Commission Rules in Favor of Electric Company on Inductive-Interference Issue.—An application made to the New York Public Service Commission by the Hammond Light & Power Company for permission to construct a transmission line paralleling for 2½ miles the right-of-way of the New York Central Railroad was opposed by the railroad company on the ground of anticipated inductive interference and hazard from falling wires. It was shown that it was impossible for the light and power company to obtain a right-of-way further from the railroad, both sides of the adjacent highway being occupied by the railway's signal lines. These signal lines the proposed transmission line would parallel, but the commission authorized its construction, finding that "there will be little or no danger from inductive interference with the proposed voltage of 11,000 and the small amperage to be carried, and if the line is properly constructed, conforming with generally accepted standards, and properly maintained, there will be practically no danger from falling poles or wires."

Distance Factor as Affecting Rates.—In granting an increase of rates at Somerset, Wis., to the Interstate Light & Power Company, which supplies other communities also with energy developed by water power at the place named, the Wisconsin Railroad Commission said: "There does not appear to be any foundation supporting the contention that a city or village adjacent to a source of hydro-electric supply has a priority right over communities in more remote territory in the use of the electrical energy developed. It follows, then, that if a number of cities and villages can be connected at an expense not out of proportion to the revenues to be derived therefrom, every locality that is added will tend to reduce the unit cost of energy by apportioning the fixed costs over additional units sold. There is apparently no logical reason therefore why the power division should not be considered as a unit in determining the operating costs. While certain expenses can be definitely allocated to each community served by applicant, there are other joint costs which must be apportioned."

Basing Valuation on Investment.—The Public Utilities Commission of Maine in a recent utterance thus dealt with valuation principles: "Engineers, commissions and courts have been seeking a better method of valuation, and all of these agencies are now very seriously considering the ascertainment of an investment cost and using that as the foundation and perhaps the principal part of that which enters into the value. Otherwise stated, engineers seek to determine, either from records of the company or from records of prices and costs obtaining during the time when a particular plant was created, the amount which the company actually invested in the plant. The figure so obtained represents the investment which the company had originally in the property and the amount which it has since actually put in in money. It may be that to this amount should be added a certain sum in order to represent present value, but this method is regarded by many as more satisfactory than the reproduction method. If this method of valuation becomes the prevailing one, the public must understand that the return which the company is entitled to receive upon this value will vary, if figured in terms of per cent from year to year. If the public can be so educated that it will be assured that the value placed upon the property of the company is no greater than that which is fair and that the return figured in per cent must vary as the value of the dollar or the purchasing power of the dollar varies, then this method will probably be found the most satisfactory."

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies

Interpretation of Arkansas Commission Law.—The Arkansas Supreme Court has held that, in the absence of any action by the state commission suspending rates filed by a utility, such rates become effective in thirty days without the need for affirmative action upon them by the commission. It has found also that rates so put into effect do not impair a contract specifying other rates because there can be no valid contract as against the power of public control by the commission. (232 S.W. 932.)*

Company Owes No Duty to Insulate Wires as Regards Trespassers in Tree.—Reversing a verdict for the plaintiff in McCaffrey vs. Concord Electric Company, the Supreme Court of New Hampshire found that a boy had no right, as one of the public, to climb a tree by the roadside unless he was climbing it in the exercise of the proprietary right of the adjoining owner, by the owner's request or express or tacit permission, and that therefore the company owed to a boy injured by its uninsulated wires while climbing such a tree no duty to prevent his injury, because the company, as a lawful occupant of such trees, owes no duty to a trespasser or bare licensee greater than that owed by the owners of the trees, and it is not bound to anticipate casual trespass thereon. (114 At. 395.)

Court Will Set Aside Rates Fixed by Municipality Only When They Are Clearly Confiscatory.—That rates fixed by a municipal ordinance require a company to supply small consumers at a loss does not render them invalid, the United States District Court for the Northern District of California held in an action brought against the city and county of San Francisco by the Pacific Gas & Electric Company to annul gas rates, if as a whole they produce a fair return. In determining what are fair and reasonable rates to be charged by a company a city council exercised a discretionary power, and since there are necessarily many elements of uncertainty in the valuation of property and in respect to other items to be taken into consideration, a court is authorized to substitute its judgment and declare such rates invalid only when they are clearly confiscatory, taking into consideration the fact that what is a fair rate of return on the investment differs in accordance with the factors of time and locality. (273 Fed. 937.)

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*The left hand numbers refer to the volume and the right hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel—Responsibilities and Association Appointments of Men Engaged in Professional, Executive, Operating and Commercial Branches of the Industry

A. H. S. Cantlin, who was elected president of the Pennsylvania Electric Association at its annual convention at Bedford Springs, Pa., is general manager of the Pennsylvania Power & Light Company, Allentown, Pa. Mr. Cantlin is a graduate of the University of Pennsylvania in electrical engineering. Soon after graduation he became associated with the St. Louis Transit Company as assistant electrical engineer. Later he joined the sales organization of the Electric Storage Battery Company, traveling in the Southwest. He returned to the central-station field as tester for the Missouri Edison Electric Company at St. Louis, one of the constituent companies of the Union Electric Light & Power Company. He resigned from this company to become electrical engineer with E. W. Clark & Company in Columbus, Ohio, and was later transferred to various properties of this firm until 1909, when he accepted the position of manager of the Allentown Electric Light & Power Company and its subsidiaries. Since that time he has made a thorough study of the field served and developed through the various consolidations and undertakings of this company, which is twenty-five times larger than it was at the time that he became connected with it. Mr. Cantlin has been an active worker in all the divisions of the Pennsylvania Electric Association and was chairman last year of the national association's committee on bonus systems, a subject to which he has devoted considerable attention.

A. H. S. CANTLIN

Clark H. Minor, former manager of the China Electric Company of Pekin, has recently visited New York on his way to London, where he will become commercial manager of the Associated and Allied Companies of the International Western Electric Company in Europe.

H. Goodwin, Jr., who was associated with W. S. Murray in the Superpower Survey investigation during the past year, has opened an office in Philadelphia under the name of H. Goodwin, Jr. Associated with Mr. Goodwin in a partnership relation is E. M. Newlin, formerly also engaged in work of the Superpower Survey.

Dr. George Otis Smith, director of the United States Geological Survey, addressed the meeting of the New York State Oil Producers' Association at Olean on Sept. 21. His subject was the "Real Value of Oil." Dr. Smith also accepted an invitation to address the General Staff college of the army on Oct. 5 on the "Strategy of Minerals." Later in the course he will address the class on "Superpower."

Arthur H. Halloran, Pacific Coast representative of the McGraw-Hill Book Company, has resigned to become editor of the *Pacific Radio News* and president of the Pacific Radio Publishing Company of San Francisco. Mr. Halloran has had twenty-five years' experience in publishing work in both editorial and business capacities and was formerly managing editor of the *Journal of Electricity*.

D. W. Roper, who has recently been appointed chairman of the underground systems committee of the N. E. L. A., is superintendent of the street department of the Commonwealth Edison Company. Mr. Roper has for many years been identified with the work both of the N. E. L. A. and the A. I. E. E. He has been a member of the N. E. L. A. underground systems committee for several years and for two years has been chairman of the sub-committee on specifications and research, which was appointed jointly by the N. E. L. A. underground systems committee and the A. I. E. E. transmission and distribution committee.

Mr. Roper was born in Grafton, Ill., Oct. 18, 1869. He received his engineering education at Washington University and Cornell University, being graduated in the electrical course at the latter institute in 1893. His first connection with the electrical industry was with the National Electric Company, Eau Claire, Wis. He left that company to enter the students' course of the General Electric Company, Schenectady, and was associated with that company till the end of 1896, except for about six months during the winter of 1895-96, when he was a substation operator for the Niagara Falls Power Company soon after its first generator was installed. After leaving the General Electric Company, Mr. Roper entered the employ of the Missouri Edison Company in St. Louis, first in special testing work on arc lighting and single-phase motors, later as engineer of conduits. After about a year he received supervision of the underground-cable work and on completion of this work was made superintendent of electric apparatus. After four years with the Missouri Edison Company Mr. Roper resigned to take up consulting work. On May 1, 1903, he entered the employ of the Chicago Edison Company, and he has since been associated with that company and those which have succeeded it, making up the Commonwealth Edison Company.

D. W. ROPER

Mr. Roper's first connection with the Chicago Edison Company was in the engineering department. When W. G. Carlton resigned to become connected with the New York Central Railroad, Mr. Roper was appointed assistant to the chief operating engineer as his successor. The duties included supervision of the underground department, conduit and cable division, as well as the central district of the overhead division of the Commonwealth Electric Company. Beginning in the summer of 1907 and following the consolidation of the Chicago Edison Company and the Commonwealth Electric Company into the Commonwealth Edison Company, the district organization of the Commonwealth Electric Company was abolished and departmental organizations were substituted. To Mr. Roper supervision of the overhead work of the three other districts of the Commonwealth Electric Company was given. With the growth of the company and the increase in importance of the ununderground and overhead work his duties gradually changed, so that on July 1, 1915, his title was changed to correspond, making him superintendent of the street department.

Mr. Roper has been a member of the A. I. E. E. since June 6, 1893, and a fellow since June 25, 1914. For five years he was chairman of the protective devices committee of the A. I. E. E., and for several years he has been a member of the transmission and distribution committee and the protective devices committee. At the time of the organization of the American Committee on Electrolysis Mr. Roper was appointed one of the representatives of the N. E. L. A., which appointment he still holds.

Kenneth A. McIntyre, vice-president of Beattie-McIntyre, Ltd., of Toronto, Canada, has joined the staff of the Society for Electrical Development. In the United States Mr. McIntyre will devote his time to the problems of the contractor-dealer, while in Canada he will specialize on field work among all branches of the industry. Mr. McIntyre is well known on both sides of the border as an association worker. For more than nine years he has been engaged in the electrical business in Toronto. For the last three and a half years he has been vice-president of Beattie-McIntyre, Ltd., and has specialized in the contracting end of the business. His association activities have covered a period of more than five years. He was largely instrumental in organizing the Toronto Electrical Contractors' Association and was president of that organization before it expanded into the Ontario Association of Electrical Contractors and Dealers and became affiliated with the National Association of Electrical Contractors and Dealers. He still retains his chairmanship of the Ontario association as well as his financial interest in the firm of Beattie-McIntyre, Ltd., which company he continues to represent in association matters. For three years Mr. McIntyre has been the representative from eastern Canada on the national executive committee of the N. A. E. C. and D., and he is still a member of that committee. He is chairman of the architects' committee of the same association. He is also a member of the cost data committee of the national association and by means of a paper at the last Buffalo convention gave electrical contractors some exceedingly valuable data on installation costs.

K. A. MC INTYRE

E. J. Irish, manager T. J. Cope, Philadelphia, has resigned to go into business as a manufacturer of underground and overhead electrical supplies.

William McClellan, president of the American Institute of Electrical Engineers, has been appointed by Governor Sproul of Pennsylvania a member of the State Board for Licensing Engineers.

David C. Rosetahl, formerly general sales manager in the portable lamp department of the B. & K. Manufacturing Company, New Haven, Conn., has been appointed general sales manager of the Robert Findlay Manufacturing Company, New York City.

F. T. Whiting, manager of the engineering division of the Chicago office of the Westinghouse Electric & Manufacturing Company, has been appointed manager of the industrial division of that office, succeeding N. G. Symonds, who has been made manager of the office.

Charles E. Dustin, general secretary of the Associated Manufacturers of Electrical Supplies, New York City, is now able to return to his office. His friends are glad to know that he has recovered from the long siege of illness, lasting virtually ever since the last meeting of the association at New London.

Joseph B. Groce has been appointed director of the New England Bureau of Public Service Information and has established offices at 24 Milk Street, Boston. Mr. Groce was educated at Tufts College, graduating with the degree of A. B. in 1893. He engaged actively in newspaper work on the Boston *Transcript* and other publications for several years and later devoted about ten years to textbook publication work. For some time Mr. Groce was occupied in miscellaneous writing for newspapers and other periodicals. In 1918 he joined the staff of the Fore River Works, Bethlehem Shipbuilding Corporation, Ltd., and for two years served as general storekeeper in charge of supplies at the Quincy and Squantum plants. He then became attached to the office of the general manager and was in charge of industrial relations and service, during which time he established and edited the *Fore River Log*. He was later made vice-president of the industrial relations committee of the Atlantic Coast Shipbuilding Organizations. Last spring he left the company to engage in special writing for the Boston *Transcript*. The Bureau of Public Servce Information, as stated in the ELECTRICAL WORLD, represents leading electric, gas and telephone utilities in New England under the chairmanship of Howard T. Sands of Boston, and it is proposed through its activities to create and maintain the highest standards of mutual confidence between these utilities and the public of the New England territory.

J. B. GROCE

Obituary

Morris S. Wright, president and general manager of the Pneuvac Company, Worcester, Mass., and head of the M. S. Wright Company, manufacturer of vacuum cleaners, died recently at Worcester. Mr. Wright was very prominent in the appliance manufacturing field and was in every sense a self-made man. He was born in Janesville, Wis., in 1859 and at the age of nineteen went to Worcester and entered industrial life, where he devoted many years to the development and manufacture of piano and organ actions, pneumatic player-piano actions and allied products. It is said that he was the first to control piano playing successfully by means of an electric motor. About fourteen years ago Mr. Wright turned his attention to the vacuum-cleaning field and after a year's investigation, during which he shut himself away from all interrupting business, he began manufacture. The product developed rapidly, and Mr. Wright's application of the worm-gear principle in driving a brush in conjunction with a suction mechanism led to the expansion of the company and its recent location in a new factory, said to be the largest in the world in its type of output. Mr. Wright was prominent in the social and religious life of Worcester as well as active in its business concerns. The affairs of the M. S. Wright Company will be carried on by the present organization, which includes the four sons of the late founder and chief executive, all of whom have been closely identified with the business ever since its inception.

Trade and Market Conditions

Business Reviews, Together with Market Letters from Important Trade Centers, on the Supply, Demand and Prevailing Prices of Electrical Apparatus and Supplies

Are Further Steel Advances Warranted at This Time?

ALTHOUGH the steel market has shown a decided decline in prices this spring and summer, the month of September saw a turn upward in several items, starting on Sept. 10 with an advance in wire quotations; sheets were advanced about a week later $5 a ton, and just before the month closed steel bars, plates and structural shapes went to a higher level. At that rate certain portions of the trade are looking for advances on other steel products.

Some of the low points were on quotations only a relatively short time, hardly long enough for the market to settle at those figures, before the reaction started. It is felt in many circles, however, that there has not been sufficient liquidation in the steel industry to warrant any decided upward trend and that generally higher levels would be a decided hindrance to the efforts being made on all sides to bring business as a whole to a point a little nearer than at present to covering the nation's needs.

The steel industry has increased its operations to a large extent during the past month, and in some mills activity to the extent of up to 60 per cent of capacity has been reported as against 35 per cent a month ago. Much of this is caused by business taken just before the higher rates on certain steel products went into effect.

Electrical Exports to Brazil Increasing Over Last Year's Rate

THE Brazilian market for electrical goods is improving, say cable advices to the Bureau of Foreign and Domestic Commerce. The whole commercial situation in Brazil has been steadied by the upturn in the demand for her exportable commodities. At the same time the exchange situation has been improved by the action of the Banco de Brasil in drawing against the second installment of the American loan and by the increased coffee bills in the market.

ELECTRICAL EXPORTS TO BRAZIL

	Twelve Months 1920	Seven Months 1921
Batteries...	$189,582	$42,051
Carbons	23,963	6,220
Dynamos and generators	192,613	279,377
Fans..........	25,830	23,942
Heating and cooking apparatus	131,334	72,962
Insulated wire and cable	1,266,802	560,944
Interior wiring supplies	253,193	98,701
Arc lamps	117	
Carbon-filament lamps.....	6,571	10,698
Metal-filament lamps....	465,651	274,160
Magnetos, spark plugs, etc.	91,314	37,935
Meters and measuring instruments.......	131,621	84,775
Motors.........	448,131	519,057
Rheostats and controllers	21,395	49,006
Switches and accessories	207,275	108,714
Telegraph apparatus, including wireless. .	170,086	4,299
Telephones	407,768	219,850
Transformers	564,636	525,484
All other	1,353,245	1,072,034
Locomotives.	389,714	837,246
Total	$6,340,841	$4,827,455

Exports of electrical materials from the United States to Brazil over the first seven months of this year are running at a very favorable rate. During this period they have amounted to $4,827,455, as against total exports for the whole of 1920 of $6,340,841. At this rate Brazil should import more than $8,000,000 in electrical materials from the United States in the whole of 1921.

Last year's exports were highest in miscellaneous equipment, insulated wire and cable, transformers, metal-filament lamps, motors and telephone equipment. So far this year miscellaneous equipment leads, with electric locomotives, insulated wire and cable, transformers and motors following in order. This year dynamos and generators, motors, rheostats and controllers and locomotives are well ahead of 1920 figures. The accompanying table was compiled by the ELECTRICAL WORLD from data submitted by the Bureau of Foreign and Domestic Commerce.

Lower Prices Affect Many Gas-Filled Type Lamps

EFFECTIVE Oct. 1, there was a general readjustment downward in the prices of the gas-filled type of "Mazda" lamps and of the same type of lamp manufactured under the new "United" trademark of several independent manufacturers. No general change was made in the vacuum-type prices, but the gas-filled have been lowered from 5 cents to $1.10, or from about 6 per cent to about 13 per cent, this range covering the various kinds of lamp. At the same time, the design of lamp and shape of filament was changed somewhat for the "Mazda" mill-type lamps, and the filament shape of the gas-filled lamps for train lighting service, pear-shaped bulbs, and the 200-watt daylight "Mazda" lamp for general lighting service are shown in different form.

The white "Mazda C" lamp is 5 cents cheaper at 60 cents; the 15-watt and 25-watt decorative lamps with medium screw base are also 5 cents lower at 60 cents, and the gas-filled lamps for general lighting service, 110-120 volts, are lower in different amounts, ranging from 5 cents to 80 cents for the clear lamp and from 15 cents to 90 cents for the bowl enameled, 75 watts to 1,000 watts. The greater amounts are on the larger lamps and the bowl-enameled types suffered a slightly bigger drop. The same kind of lamps for 220-250-volt service were reduced from 10 cents to $1 for the clear and from 15 cents to $1.10 for bowl-enameled. These 1,000-watt lamps took the highest reduction of any in price, but the percentage reduction was not the highest.

Five cents was taken off the 25-watt vacuum lamp of tubular bulb. For series street-lighting service the 4,000-lumen and 6,000-lumen, 6.6-amp. lamps were cut 50 cents, and the 15-amp. and 20-amp. lamps were cut from 50 to 75 cents. The gas-filled pear-shaped train-lighting lamps were lowered 5 cents, and the locomotive headlight lamps were cut 15 cents on the 100-watt size and 40 cents on the 250-watt size, the 150-watt size not being shown. "Mazda" daylight lamps for general service are off from 5 cents to 45 cents. From 5 to 10 cents was taken off the 28-32-volt lamp for farm service, type C. Concentrated-filament floodlight lamps were lowered from 40 to 50 cents. Stereopticon lamps, round bulb, were reduced 15 to 40 cents.

The fall trade seems to be picking up a bit in lamps. Lamp manufacturers have large stocks in factory and district warehouses, but all through the summer the distributers have been trying to get their stocks down to a minimum and have been ordering very lightly. Dealer stocks are not very large, and it is felt that they must soon make their demands known to cover their winter requirements. Lamp production is still far from plant capacity. It is expected that lamps for household use will not fall behind in demand this winter, but unless industrial work picks up the demand for gas-filled types will lag.

Carbon Lamp Exports Increasing in 1921 to Date

EXPORTS of carbon-filament lamps during the year 1920 amounted to $114,542. This represents only 2.75 per cent of all carbon-filament and metal-filament lamps for that year. Through the first seven months of the year 1921 exports of carbon lamps have amounted to $102,856. From this it would seem that the exports for this present year would surpass those of last year to quite a large extent. Exports in the year 1919 amounted to $202,597, or 4.3 per cent of the total exports of all incandescent lamps. While sales of carbon lamps in the United States have shown a steady decline in the last few years, it does not necessarily follow that the same thing will take place in the export field.

EXPORTS OF CARBON LAMPS IN 1920 AND 1921

	1920	1919
Mexico	$24,581	$14,337
Cuba	13,419	18,902
Canada	11,888	60,025
Argentina	7,023	2,475
Brazil	6,371	5,475
Philippine Islands	4,063	5,140
China	25	37,008
Australia	989	27,004
New Zealand	542	6,817

From the accompanying table of all the countries taking more than $5,000 in carbon lamps in the years 1919 and 1920, it is shown that while Canada was high in 1919, that country had fallen off greatly in 1920. Mexico was high in 1920 but only fifth in 1919. China, Australia and New Zealand fell off heavily in 1920. What country provided their supply to the extent of $70,000? These figures were compiled by the ELECTRICAL WORLD from data provided by the Bureau of Foreign and Domestic Commerce.

Insulated-Wire Prices Show Advance in Some Quarters

FOR the last week or more there has been a feeling in the trade that copper-wire prices were due for a rise, and some wire mills have just added about 5 per cent to their prices. Buying of this commodity throughout this year, however, has not been such as to warrant any rise in price, but within the last six weeks cotton prices have almost doubled and copper prices have strengthened. Along with higher cotton have come higher yarn prices. Spot cotton in New York early this week was 21.35 cents per pound, as against about 12 cents in the middle of August. It was during the latter part of that month that raw cotton started up, and it has held around 20 to 21 cents since.

Two-ply Southern chain warp, No. 20, during this period rose from about 23 cents a pound to about 37 cents a pound at this writing, an increase of 14 cents. Allowing about 3.3 lb. of cotton yarn per 1,000 ft. of No. 14 rubber-covered wire would mean an increased cost of 46 cents per 1,000 ft. due to cotton only at today's price. Bare copper wire base during this same period has been quoted as low as 13.25 cents net at the mill and is today quoted ¾ cent to 1¼ cents higher. On about 12 lb. of copper wire to 1,000 ft. of No. 14 rubber-covered wire a 1-cent increase in wire would add 12 cents to the cost. These are replacement costs at present figures.

Rubber has had no remarkable advance during this time, although it is slightly higher now. With two main items of raw materials higher, there is an effect on the other materials. Manufacturers who buy of these on a rising market must consider the purchase of the allied materials at that time—rubber, compound, whiting, etc.

Not all insulated-wire mills have advanced their prices at this writing, and although some jobbers have not done so, many others throughout the country have placed a higher price on rubber-covered wire this week. At the same time in many quarters this rise was anticipated and contractors and jobbers alike have covered their near future needs by higher purchases during the last week.

Now a reaction is being felt in the flexible armored conductor field, and although no manufacturers have been found who have advanced their prices on this material, it would not be unexpected if a notification of higher prices should come in the near future. This action has also been anticipated in certain quarters.

Porcelain Insulator Prices Hold Firm in Quiet Market

ALTHOUGH prices on high-tension porcelain insulators of both the pin and strain types have been reduced only 10 per cent within the last year, there appears to be little likelihood of any further material reductions in the near future. Insulator manufacturers state that in their processes of manufacture it is essential that the personnel of the workmen be changed as little as possible in order to maintain a uniformly standard product. Reductions in labor costs have been very small, and these have been offset by increased charges for freight on both raw material and finished products. Comparison of present prices with those on a pre-war basis is difficult because of changes and developments in materials and design and the different requirements for both types of high-tension insulators.

The domestic market is fairly quiet. Most sales are small and appear to be for replacement and maintenance purposes. The electric light and power companies are making few long extensions, and this has naturally curtailed the demand. There is a market for high-tension strain insulators on the Pacific Coast, where some long-distance transmission lines are being built and others contemplated.

Foreign sales are holding up well, and manufacturers report that many European countries have a decided preference for American insulators because their serviceability has been demonstrated in actual practice here. In some countries German competition has appeared, but is not regarded as serious except in the case of insulators for the lower transmission voltages. One manufacturer reports a number of sales in Australia and Japan and states that European business is good. It is, of course, affected by adverse rates of exchange and other conditions abroad.

Metal Market Situation

CONTINUED strength still prevails in the copper market. Electrolytic is ¼ cent higher to 12.62½ cents a pound for spot, delivered, in the producers' market, and in the outside market it is ⅛ cent higher than this price. November shipment is quoted at 12.75 cents and December at 12.87½ to 13 cents where any producers at all have been found who are willing to quote for December. Some producers have no more October copper under 13 cents. The outside market is not overburdened with copper. Copper wire, net, at the mill has advanced to 14 cents to 14.50 cents.

Buying has been on a pretty good basis the last week and inquiries from consumers are showing more interest, particularly wire manufacturers and brass manufacturers. The latter have been buying better too.

NEW YORK METAL MARKET PRICES

	Sept. 27, 1921	Oct. 4, 1921
Copper	£ s d	£ s d
London, standard spot	68 0 0	68 12 6
	Cents per Pound	Cents per Pound
Prime Lake	12.25	12.50 — 12.75
Electrolytic	12.37½	13.62½
Casting	11.75	12.25
Wire base	13.75	14.00 — 14.50
Lead, Am. S. & R. Co. price	4.70	4.70
Antimony	4.60	5.00 — 5.25
Nickel, ingot	41.00	41.00
Sheet zinc, f.o.b. smelter	10.00	10.00
Zinc, spot	4.87½	5.05
Tin, Straits	26.75	26.87½
Aluminum, 98 to 99 per cent	24.50	24.50

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	9.75 10.50	10.00 — 10.62½
Brass, heavy	4.75 5.00	4.75 — 5.00
Brass, light	4.25 4.50	4.25 — 4.50
Lead, heavy	3.50 3.75	3.50 — 3.75
Zinc, old scrap	2.00 2.37½	2.25 2.37½

THE WEEK
IN TRADE

Prices When Quoted Are Those Prevailing at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for all Eastern Points

A SLOW but steady improvement is reported from virtually all sections of the country. Jobbers state that they are getting better orders from dealers and the industries are gradually getting back into better shape. Cotton mills in the South are running well and textile industries in New England are progressing. St. Louis reports better buying from the industrials in that territory than there has been in several months. Manufacturers in that territory report an increase in volume of their orders. Employment too is more satisfactory.

New York district jobbers have been taking larger orders and more of them this week, and there is better buying all around. Chicago is only about holding last week's activity, but with the acceptance by the Chicago Building Trades Council of the Landis award last Friday there is a more hopeful feeling for the fall months. Farm-lighting plants and farm high-tension switching equipment are reported moving well there.

Higher prices are being quoted on rubber-covered wire and on lamp cord in some quarters, while larger buying of this wire and of armored conductor has anticipated an advance in price.

NEW YORK

Larger orders, more of them and a generally firmer tone to buying marked conditions among the jobbers the past week. The increase in business from week to week has been gradual, and most jobbers feel that this is the best indication that a healthy improvement is well under way. The principal activity is seen in the standard items of wiring supplies, including conduit, wire, armored conductor and schedule material. In some lines it is believed that present prices are at the bottom, and there has been some large buying of wire and armored conductor.

With the return to standard time and longer evenings there has, of course, been a strong demand for lamps. At the same time, industrial lighting fixtures are moving, indicating some renewed industrial activity throughout this section. Among the heating appliances flatirons, toasters and air heaters are fairly active. The other appliances are moving slowly, although interest created by the Electrical Show has stimulated sales in the metropolitan district. Stocks of most lines are fair to good, but some shortage of curling irons and flatirons has been reported.

Collections have shown no change from last week. Jobbers report that most of their current credit sales are on a thirty-day to sixty-day basis.

Conduit.—No change in the price of this material was reported this week. The following prices were quoted by jobbers: For ½-in. black pipe in 2,500 ft. lots, $54.23 to $55; ¾-in., $69.92 to $70.79, and 1-in., $99.96 to $101.42 per 1,000 ft. Galvanized pipe in the same sizes was quoted at $59.33 to $62, $76.82 to $81 and $110.16 to $116 per 1,000 ft. Jobbers report that the demand is steady and orders have been for somewhat larger quantities but show no tendency on the part of contractors to lay in stocks. Most jobbers' stocks are good.

Flexible Armored Conductor.—Steady buying of this material continues and a number of sales of comparatively large quantities have been made. It is understood that in view of the increased cost of copper and cotton manufacturers of armored conductor are reluctant to accept orders at current prices for future delivery. No. 14, two-wire, single-strip, is quoted at $43 per 1,000 ft. in lots of that quantity and the double-strip at $44.50. Jobbers' stocks are fair.

Rubber-Covered Wire.—As a result of the rise in the prices of copper and cotton there was a noticeable stiffening in the quotations on rubber-covered wire this week. No. 14 in lots of 5,000 ft. is quoted at $6.35 to $6.60 per 1,000 ft. Demand is a little stronger, while jobbers' stocks generally are good.

Loom.—Prices remain as last quoted. In 1,000-ft. lots the 7/32-in. size sells for $19.25 and the ¼-in. size for $21 per 1,000 ft. It is thought possible that the recent increases in cotton may also affect this material.

Lamp Cord.—Demand is fair and jobbers report good to large stocks on hand. Prices this week are a little higher than those last reported. No. 18 cotton, twisted, is quoted at $12.30 per 1,000 ft. and No. 18 parallel at $14.90 per 1,000 ft.

Heaters.—Dealers are placing moderate orders for immediate delivery and jobbers report a fairly satisfactory activity on the heaters listing at $11.

Heating Appliances.—Flatirons and toasters still lead the heating devices in number of sales, although dealers find that the Electrical Show, which continues through this week, has increased their sales of other appliances. Jobbers report that buying is comparatively light.

CHICAGO

There has been little perceptible change during the past week. Although the disposition is still markedly in the direction of extreme caution and purchasing is largely confined to immediate requirements, more interest is being taken in future needs than at any time since the reaction set in last fall. The important event of last week was the acceptance on Friday night by the Chicago Building Trades Council of the Landis wage award. This was unanimous after the hoisting engineers had been expelled from the council for refusing to abide by the decision. The biggest obstacle in the building situation, it is felt, has thus been removed, though smooth sailing cannot be expected for some time to come.

The fall business in farm-lighting plants has started and is progressing fairly well. There is little fear of the stocks being depleted since dealers state they can supply all the demand calls for. There is also an increased demand for high-tension farm service equipment. Foreign inquiries for high-tension switching and protective equipment indicate that the American idea of standardized and interchangeable parts is appealing to purchasers. Lamps are beginning to move with their usual autumn speed.

Wire.—The market is a little firmer, with the base for bare wire still ranging from 15 to 15½ cents. The demand for rubber-covered wire is not very active. No. 14 is obtainable in 2,500-ft. quantities for $6 to $6.50 per 1,000 ft.

Flexible Armored Conductor. — This material has also strengthened a little, so that while stocks are fair the demand is unchanged. No. 14 two-wire double-strip is quoted at $50 per 1,000 ft. in lots of that quantity.

Rigid Conduit.—Quotations are unstable, a small price decrease being reported by some jobbers while others report no change. The demand continues fair and stocks are good in most sizes. The nominal quotation on the ½-in. black is $50 per 1,000 ft. in 2,500-ft. lots.

Lamp Cord.—This is quoted at $12 to $15 per 1,000 ft. for No. 18 cotton, twisted. Sales are keeping up fairly well and the demand is improving.

Lamps.—An increase of lamp sales to industrial companies and railroads has been reported. Dealers are ordering very little since their stocks are ample to meet demands.

Heating Devices.—Demand is increasing and excellent sales are recorded for air heaters. Stocks are ample to meet this demand.

Dry Cells.—The call for dry cells seems to be spotty. Several dealers report very little demand, while others report excellent sales, possibly because they handle radio materials. The regular cell is priced at 31 cents in barrel lots.

Poles.—Prices on poles are still holding and stocks are heavy. The entire undertone is stronger, however, so that better business can be expected along this line.

BOSTON

Further improvement is reported in trade this week by leading jobbers and manufacturers' representatives. Stocks are still meeting demands satisfactorily, but occasionally a temporary shortage is noted owing to transportation delays or other causes necessitating shopping around to fill an order requiring immediate delivery. More material is moving through jobbers' hands than of late and inquiries are very active. Prices are unsettled in wiring-material quotations, and an advance this week was expected in rubber-covered wire and flexible armored conductor. Rigid conduit and some types of incandescent lamps, on the other hand, are softer in price. New England industrial activities are very encouraging in some lines, notably in cotton and woolen manufacture, where 80 per cent of capacity production is reported. Building and engineering contracts have increased to more than $4,000,000 for the last week reported, compared with about half that for the previous week. Retail trade is improving and collections are holding their own well.

Flexible Armored Conductor.—Improved sales are noted, with considerable activity Monday, anticipating a price advance expected by midweek. Jobbers quoted $46 to $47 per 1,000 ft. on No. 14 double-strip in 5,000-ft. lots, with ample stocks.

Lamps.—Increased activity is evident with the advent of shorter days, and the demand for mill-type and bowl-enameled units is noteworthy this week. Prices on many type C lamps were reduced Oct. 1 by from 6 to 13 per cent. Stocks are meeting the demand, but there is little opportunity at the moment to increase holdings of industrial units.

Motors.—A spotty market is reported this week, with good volume of inquiries and fluctuating sales. New designs entering the market are arousing interest, and sales engineers are very busy in survey and quotation work. Smaller sizes constitute most of the business, and prices seem to be reasonably stable.

Wire.—Rubber-covered No. 14 wire sold around $6 per 1,000 ft. in 5,000-ft. lots the first of the week, with open prices on large quantities. Buyers were rushing to cover Monday in anticipation of an advance to $6.75 for the above quantity and size expected a day or two later. Weatherproof wire is moving fairly well around 14 to 16 cents base, depending on quantity. Bare copper wire was quoted around 13⅞ to 14 cents base the first of the week, with relatively dull demand.

Non Metallic Flexible Conduit.—Prices show considerable variation between Boston and southern New England points, the former running from $1 to $3 lower per 1,000 ft. in 5,000-ft. lots. Better sales are reported, but no striking demand has yet appeared. Boston was charging $18 per 1,000 ft. on ¼-in. loom Monday and $17.50 on 7/32-in., in 5,000-ft. lots. On "Nail-it" knobs, however, Boston was $18.50 per 1,000 in barrel lots, against $17.50 in southern New England.

Sockets.—Better building activity is moving these in greater volume. In case lots pulls are quoted 31½ to 33 cents net.

Lamp Cord.—Fair quantities are bringing $13 per 1,000 ft., quotations being made on a 15-cent base.

ATLANTA

Reports from jobbers on September business indicate a general improvement in the business tone throughout their line, orders being received from a constantly widening class of consumers. Christmas and holiday buying has just begun to make itself evident. Although industrials are still somewhat behind in their usual purchases, nevertheless very acceptable inquiries are being daily received and orders from textile mills that have been holding up on purchases for several months are reported as quite satisfactory. Bank clearings for the month of September in Atlanta amounted to $172,000,000, the largest in several months and approximately $30,000,000 over the clearings of June, July and August. Reports from manufacturers throughout the section show that cotton mills are back on full time with some operating on double time, while manufacturers of brick and clay products report a slight increase over prior months. A marked improvement is to be noted in the over-all manufacturing line, but other lines of manufacturers, while showing improvement over the past two months, state that their business is not up to conditions of a year ago. Building permits for September brought the number of new residences in Atlanta this year up to 982, which is the heaviest on record.

Schedule Material.—This line continues active, especially wiring devices required for the smaller stores and homes. Stocks are in good shape with no further change in price.

Lamps.—A price reduction of 6 to 13 per cent in type C was effectitve last Saturday. The 75-watt and 100-watt lamps of this type are particularly popular with industrials, and jobbers report a very satisfactory demand for the smaller sizes of the vacuum-type lamp, this demand being stimulated by the good movement in the fixture line. Heavy purchases by industrials for stocks are not yet in evidence.

Flexible Armored Conductor.—This has settled to a more even plane after the flurry of the past few weeks, and the movement has become less spasmodic, with resultant steadying in the price at $55 per 1,000 ft. Local stocks are in good shape.

Wire.—An increase of 10 per cent in the price of rubber-covered was effective last Saturday The movement of both weatherproof and rubber-covered has been exceptionally good during the last thirty days, nearly all sizes of rubber-covered being in considerable demand, while weatherproof in sizes No. 6 to No. 14 seem to be moving well. No change in the price of weatherproof is announced, though an increase would not be unexpected.

Flashlights.—The fall demand is beginning to show itself, and jobbers report an increasing movement in cases, batteries and lamps. No changes in prices are to be noted. Stocks are in excellent shape.

Heating Devices.—Orders are being received in increasing quantities from small dealers for hollow ware scheduled for delivery about Nov. 1. Flatirons continue to hold up well, and the entire line, air heaters excepted, seems to be getting into fairly satisfactory shape.

Vacuum Cleaners.—This line is showing a more satisfactory condition than any other specialties, sales having been very good for the past few weeks. Some orders are being received in anticipation of the holiday trade in this line.

Washing Machines.—Despite price reductions and campaigns, these continue dormant. In an attempt to stimulate sales several dealers undertook campaigns, but as yet they have met with little success. Heavy stocks are reported by all jobbers.

ST. LOUIS

Industrial buying of electrical goods is better now than it has been for some time. The entire industrial tone is improved. Stocks have been fairly well depleted, and with values liquidated to the point where they are remaining reasonably steady increased buying has resulted. Manufacturers in general report that the receipt of orders is more steady and that a good many calls are for rush shipment. For the first time in a number of months the labor situation in this district shows definite improvement, the percentage of employment being greater particularly in St. Louis, Louisville and Memphis. In St. Louis building shows some increase, but there remains the tendency to postpone construction until the costs are lowered. Railroad traffic is said to be increasing, but buying on the part of the railroads is still on a very reduced scale.

Returns indicate that the money situation in the agricultural districts will be good. The rapid advance in cotton has enormously helped the South and corn is maturing well, with the bulk of the crop beyond the danger of frost. The quality of oats that were threshed is disappointing, but the results were up to government estimates. While the prices obtained are low, the cost of this year's crops was much lower than it was last year. The report of the Federal Reserve Bank of St. Louis states that the advance in cotton prices alone has added $56,000,000 to the purchasing power of this district.

Jobbers are experiencing a steadier demand for goods, and the volume of sales is increasing. Much cooler weather prevails and a better business in portables, lamps and air heaters has resulted. Rubber-covered wire also is moving faster.

Wire.—A stiffening in prices is found, though there is considerable variation in the prices of the various jobbers. In 10,000-ft. lots No. 14 rubber-covered is being quoted from $6.10 to $6.50 per 1,000 ft., one jobber advancing the base price on all rubber-covered wire from 14 cents to 16 cents. The base on bare and weatherproof has been advanced to about 14½ cents. Fairly heavy sales in rubber-covered are being made.

Lamp Cord.—Higher prices obtain, No. 18 cotton-covered twisted-pair selling for about $16 per 1,000 ft. The No. 18 silk-covered is priced at about $26. The cotton cord is showing some improvement in demand, but the silk is moving very slowly. Stocks are inclined to be heavy.

Knobs and Tubes.—Easier prices are found, "Nail-it" knobs being priced at $14.60 per 1,000 in barrel lots, a reduction of about $2.40, while some stand as high as $16.50; 2½-in. tubes are priced at $4.72 per 1,000 in barrel lots, and 3-in. tubes are selling for $5.12. Moderate to low stocks are the rule and demand shows healthy improvement.

Loom.—The last price reduction has not as yet given stimulus to sales and stocks are on a conservative basis. The 7/32-in. size is quoted at $17.75 per 1,000 ft. in 5,000-ft. lots.

Air-Heaters.—The advent of chilly weather has started sales to dealer and consumer, although dealers are placing their orders very conservatively. The retail purchasing appears to be about normal for the beginning of the season.

Sewing Machines.—Slow sales and heavy stocks are the rule. The motors are selling somewhat better, but far from normal.

Ironers.—Retail sales have been helped some by a special campaign giving better time-payment terms. Jobbers, however, report a quiet business. Stocks have been maintained fairly low.

SAN FRANCISCO

Business conditions, especially retail sales, are improving continually. As for electrical construction, San Francisco building permits for September show 100 per cent increase in value over those of August, while Los Angeles maintains its tremendous pace.

Washers.—Washer business in many makes is generally good, and a standardized selling method through regular solicitors and intensive effort is reported bringing good business wherever followed.

Dishwashers.—The Western Electric table-top dishwasher is now selling for $105, a cut of $50 from the previous price, which is expected to add considerable impetus to the present increasing volume of sales.

Radiators.—A San Francisco September "Home Industry" week produced good displays and increased the sales of heaters. A couple of weeks of exceedingly warm weather nipped in the bud a retail sale started by a few previous days of cold rain. From all indications the approaching season will result in excellent business for all types.

Lamps.—New prices, making an average reduction of 10 per cent on the type C "Mazda" lamps, are expected to increase the proportionate volume of sales of this type as compared with type B. Local fixture campaigns and selling effort are popularizing the use of fixtures requiring the type C lamps, but the quantities of type B lamps still on the dealers' shelves will somewhat retard this work for the next few months.

Ranges.—The Pacific Gas & Electric Company recently placed an order for a carload of electric ranges, and about the same time the Great Western Power Company also ordered a carload of ranges. The power companies and the dealers are now conferring over the best method of promoting these range sales. At the present time a strong sentiment seems to favor a system of selling which, while popularizing electric ranges with the public at large, will still give the dealers a good margin of profit.

SALT LAKE CITY—DENVER

A slight advance in price of both insulated and bare wires is taken by jobbers to mean a coming revival of construction activities and an indication of a return to stabilized business. Hopeful comment is both universal and persistent in merchandising circles, notwithstanding that there is little actual improvement in general conditions recorded for the past month. Few sizable line construction jobs are under way, but many projects are certain to be launched within the next six months, it is felt. Home building is proceeding at a good rate during the open fall weather.

Jobbers' stocks are still heavy in most lines, and appeals to dealers for relief are falling on deaf ears. The retail merchant has not yet broken away from the retarding practice of ordering stocks in small consignments. Most jobbers believe they have passed the acute stage of the depression era and that things are perceptibly on the upgrade. With farmers rapidly liquidating their crops, more money seems to be in circulation and credits are a trifle easier, but collections are still the bane of every man's business. There is a concerted effort among managers of the industrials to absorb a large percentage of unemployed labor. Many idle men are getting back to work, but usually on a decidedly reduced wage scale. The coal mines are running almost to capacity, and the metal mines, excepting the coppers, are securing a fair output. Air heaters and lamps are moving satisfactorily. Dealers are ordering well in these lines and stocks are good.

SEATTLE—PORTLAND—SPOKANE

Indications of a gradual improvement in business continue to multiply and are reflected in increased sales in most lines. Conditions throughout the Northwest are most encouraging. Crops have been unusually good, and exports from both Seattle and Portland were unusually encouraging during the month of September. Apples and lumber are being shipped in large quantities. September was a bumper month for Portland in shipping, building and banking. Wheat exports were 150 per cent greater than for September of last year. More than 1,000,000 bushels of wheat cleared out of Portland on Sept. 29, which is believed to be the record for any port in the world.

Strengthening of prices of lumber and shingles and an improved demand are creating a more optimistic feeling among lumber men. Lumber exports from all Northwest ports are heavy. Building in all lines in Portland has been exceptionally good, although building activity in Seattle is confined mostly to residence construction. Builders' hardware, plumbing supplies and electrical wiring equipment are all experiencing considerable activity due to residence building. Labor conditions, all things considered, are good, with the open shop prevailing for the most part, including the mines and waterfront in the Puget Sound region.

Electrical jobbers of Seattle uniformly report business in their lines as gradually improving. This is evidenced by increased volume of sales. No change in either credits or collections is reported. Stocks in all lines are ample. Only two important price changes have been noted in the past two weeks. Sockets have dropped about 30 per cent and rigid conduit has been reduced about 5 per cent. Portland jobbers report that orders coming in for standard-package quantities now indicate confidence on the part of buyers. Demand for wire, wiring devices and conduit is good, and the seasonal business in lamps and air heaters is active at the present time. Range and water-heater sales are holding up well as the central-station companies are carrying on an active range campaign.

Manufacturers' Activities

Devoted to the Business Side of Manufacturing, Distribution and Sales, News fromJobbers and Foreign Fields and a Record of New Devices and Trade Literature

Atlantic Division Jobbers' Meeting Again Postponed

Announcement is made that the fall meeting of the Atlantic division of the Electrical Supply Jobbers' Association has been postponed from Oct. 22 to the week of Nov. 28, the exact date not having been determined upon at this writing. The meetings will convene at the Bellevue-Stratford in Philadelphia.

Fixture Dealers' Market and Convention at Milwaukee

The third annual convention and the second joint convention of the National Council of Lighting Fixture Manufacturers, the Lighting Fixture Dealers' Society of America and the Illuminating Glassware Guild will be held at the Auditorium in Milwaukee, Jan. 30 to Feb. 4, 1922. It is expected that the morning sessions will be devoted to convention meetings and the afternoons to the fixture market. A "better-lighting week" will be held at the same time. This will include demonstrations of better lighting methods for the home, office and industrial plants. Surveys and reports on improvements possible in existing lighting installations will be a feature of the week and a "pageant of light," showing the progress of lighting fixtures and methods from the torch to the present-day fixtures, will be included.

Sieben Manufacturing Company in Its New Plant

The Sieben Manufacturing Company, manufacturer of the Sieben "All-in-One" electric washing machine, dryer and ironer, is now occupying its new location at 914 Genesee Street, Kansas City, Mo., and production is under way. The building is of brick, three stories and basement, with ample room for manufacturing, assembling and storing. Henry Sieben is president of the company and H. F. Walker is sales and advertising manager. The general offices are at 418 Gumpel Building.

New Merchandising Plan for "Buss" Plug Fuses

The Bussman Manufacturing Company, St. Louis, in developing a new guaranteed clear-window plug fuse has also put into effect a new merchandising plan. Working on the general assumption that the average domestic user of electricity has little knowledge of the use and workings of a plug fuse and carries in general few if any extra fuses, this company is now putting out ten of these clear-window plug fuses in a single carton. On this carton there have been printed simple but complete instructions concerning what a fuse is, why it is put in a circuit, what causes a fuse to blow, why it should not be tampered with, and why neither a fuse of the wrong size nor a temporary substitute should be used, how to tell if the circuit is overloaded, the right fuse to use, etc. The growing use of electrical appliances is one of the reasons for the development of this new service.

New Books on Bolivia and Colombia Issued by Commerce Department

The Bureau of Foreign and Domestic Commerce has issued new handbooks on two South American countries, covering trade, manufactures, finance, markets, etc. "Bolivia, a Commercial and Industrial Handbook," and "Colombia, a Commercial Industrial Handbook," may be had for 65 cents and 70 cents respectively, on application to any office of the bureau.

Beaven Takes Weber Agency in Southern States

Arrangements have been concluded by Henry D. Sears, 80 Boylston Street, Boston, general sales agent for the Weber Electric Company, wiring devices, with W. H. Beaven, Jefferson County Bank Building, Birmingham, Ala., for the latter to act as representative of Weber wiring devices in North Carolina, South Carolina, Georgia, Florida, Tennessee, Alabama, Mississippi, Arkansas and Louisiana.

Extension of Sales Financing Service

New York Contract Purchase Corporation Admits House Wiring Contracts Within Its Service by Buying These Accounts from Contractors

The New York Contract Purchase Corporation, 120 Broadway, New York City, extended its service to a limited degree during the past month, but on the same terms and conditions, to include the purchase of accounts arising from house wiring when done on the partial-payment plan. This corporation is one unit of a national organization affiliated with the General Electric Company and certain allied companies and is the outgrowth of the Utilities Investment Company, which commenced operations in Cleveland on Jan. 1, 1920.

Six of these contract purchase corporations have been formed in the United States to stimulate the sale of the product of the above-mentioned manufacturers by financing dealers through the purchase of the installment accounts arising from such sales. The plan is all based on the fact that electrical merchandise sales increase through the employment of installment payments, but many dealers are unable to finance long-term payments themselves or are unwilling to enter into negotiations with outside banking institutions.

The affiliated manufacturers and the appliances covered are: General Electric Company—motors, Tungar rectifiers, compensarcs and other appliances that are marketed through dealers; Edison Electric Appliance Company—Hotpoint, Edison and Hughes line of ranges and appliances, motor-driven and otherwise; Electric Vacuum Cleaner Company—Premier, Liberty and all other types of vacuum cleaners, including private brands; Hurley Machine Company—Thor line of washing and ironing machines, all types.

The New York Contract Purchase Corporation will buy outright from the dealer the installment accounts arising from the sale of the product of the above-named manufacturers, on the basis of a discount from the face value, determined by the length of time necessary for the account to pay up in full. The discount is 10 per cent plus a graduated discount varying from 4 to 8 per cent, covering payments taking up to twelve months. The dealer retains the down payment and sells the balance of the installment account to the corporation. Collection is accomplished through the dealer as agent, full completion of it carrying a 10 per cent commission for the dealer. No contract will be purchased on which the balance is under $30 or which will run over twelve months.

Recently house-wiring contracts have been added to the service, but not power-wiring contracts. Power motors of General Electric make are covered, however.

Besides the New York Contract Purchase Corporation, there are the Pennsylvania Contract Purchase Corporation, Witherspoon Building, Philadelphia; Ohio Contract Purchase Company, 1734 Ivanhoe Road, Cleveland; Illinois Contract Purchase Corporation, 28 East Jackson Boulevard, Chicago; Southwest Contract Purchase Corporation, Interurban Building, Dallas, Tex., and Pacific Coast Contract Purchase Corporation, 315 Mason Street, San Francisco. E. W. Miner is president of the New York and Ohio companies and vice-president of the others, with his offices in New York.

Gear Manufacturers to Meet Next Week

The semi-annual fall meeting of the American Gear Manufacturers' Association will be held in the Powers Hotel in Rochester, N. Y., Oct. 13, 14 and 15. The committees on standardization have various reports to offer, and a strong program has been arranged covering gear-tooth wear, tooth forms, grinding and gear materials. For the usual informal banquet the evening of Oct. 14 has been set aside. F. W. Sinram, Van Dorn & Dutton Company, Cleveland, is president and F. D. Hamlin, Earle Gear & Machine Company, Philadelphia, is secretary.

November to Be "Perfect Package Month" by Nation's Carriers

All trades and industries have been asked to co-operate in the "perfect package movement" to be inaugurated by the railroads, steamship lines and express companies in the United States and Canada in November, which has been designated as "perfect package month," according to a statement from the American Railway Association and the American Railway Express.

The purpose of the movement is to stimulate further public interest in good packing of shipments and to enable the carriers to improve the transportation service of the country. During November an examination of all shipments sent by freight or express will be conducted to obtain information as to the best shipping methods followed by the various trades and industries.

The entire working forces of the railroad and express carriers, comprising some 2,000,000 men, will aid in the movement. The railroads, through the American Railway Association, 431 South Dearborn Street, Chicago, are pushing the campaign as a means of raising the standard of the service, while the express agents are also getting ready to interest shippers in the undertaking.

American Building Exposition in Cleveland Next January

From Jan. 4 to Jan. 14 next the new Cleveland Municipal Auditorium will house the American Building Exposition, a complete building show for the encouragement of more and better buildings. It is a direct sales promotion plan for companies with plans and materials to sell, appealing intimately to the man about to build. The exposition is sponsored by the Builders' Exchange of Cleveland and is national in scope, with exhibitors and attendants from all sections.

Part of the exhibition floor will be given over to several cottages completed on the exterior and only partly completed on the inside, while the main exhibition floor will house all the interior material, decoration, finishing and furniture exhibits together with the contractors' and other machinery displays. The exposition will be under the direction of Ralph P. Stoddard, who managed the 1916 show, and Richard G. Collier will be assistant manager.

It may be of interest to note that last year Cleveland spent more than $78,000,000 for new buildings, and next year it is expected the city will exceed that. It is said that the builders hold more than 90,000 vacant lots in Greater Cleveland today.

Tulsa Chamber of Commerce Wants Catalogs

The engineering bureau of the Tulsa (Okla.) Chamber of Commerce desires catalogs of mechanical and electrical appliances, having in mind a catalog library for the use of engineers in that district where they can find any article listed in their respective lines.

Save Electric Corporation Purchases Toledo Factory

The Save Electric Corporation, manufacturer of incandescent lamps, at present at 220-254 Thirty-sixth Street, Brooklyn, N. Y., has purchased property fronting 100 ft. on Main Street and running back 390 ft. to the river in Toledo, Ohio. The first factory unit will be 70 ft. x 390 ft., two stories, with 50,000 sq. ft. of floor space, and additional units are contemplated as soon as operations in the first one are under way. The building itself will cost about $125,000 and will be equipped with about $200,000 worth of special machinery of the company's own make which is ready for shipment.

The Brooklyn plant has been operating at a capacity of about 20,000 lamps per day, and the opening capacity of the new plant will be for the same number, with space available to increase it up to 25,000 lamps per day. From 250 to 300 employees will be employed in this new plant. Distribution is effected through the corporation's manufacturers' representatives in fourteen cities and through its warehouses in San Francisco, Minneapolis, Chicago, New Orleans and Buffalo. The company is only about three years old. According to officials of the company, the output of the plant has been sold for about a year and a half ahead.

In its employment policies the company pays bonuses to its employees based on increased production and on reduction of shrinkage in manufacture. Max Ettinger is president and J. J. Steinharter is director of sales of the Brooklyn corporation. A new corporation will be formed with Eastern capital exclusively to operate the Toledo plant.

New Line of Industrial Supplies for Troy House

E. J. Van Doren announces the opening of his new office and sales room in the Times Building, Troy, N. Y., with an entire new line of direct-current, single-phase and polyphase motors, transformers, "Mazda" lamps and the "Airdry" electric towel.

Aluminum Company Issues $18,000,000 in Gold Bonds

An issue of $18,000,000 of twelve-year, 7 per cent sinking fund debenture gold bonds has been authorized and already taken up by prominent banking corporations. The coupon bonds are in the denomination of $1,000 and are dated Oct. 1, 1921.

Arthur V. Davis, president of the Aluminum Company of America, in a letter states that the business conducted by the company and its subsidiaries was established in 1888 and consists of the mining of the ore of aluminum, the smelting of aluminum therefrom and its fabrication. The company owns large fabricating plants in which aluminum sheets, wire, tubes and other fabricated forms are made and also large water-power plants for the production of electricity required by its smelters.

"The proceeds of these bonds," says Mr. Davis, "will be used in part to provide funds for the retirement of $8,000,000 of the company's serial 6 per cent notes, of which $4,000,000 mature respectively March 1, 1922, and March 1, 1923, and to retire current indebtedness heretofore incurred for capital expenditures. The bonds will be direct obligations of the Aluminum Company of America and will be issued under a trust indenture carrying special provisions." These are specifically described in the letter.

"For the ten years ended Dec. 31, 1920, the net earnings of the company after interest, taxes, depletion, depreciation, etc., have averaged in excess of $10,000,000 per annum. For the seven months of 1921 ended July 31 net earnings available for interest before depreciation but after payment of 1920 income taxes (charged when paid against 1921 profits) were $2,648,698. The company has outstanding $18,729,600, par value, capital stock, which at present quoted prices indicate an equity of about $75,000,000 behind these bonds."

The California Electrical Co-operative Campaign has removed its offices to the Rialto Building, San Francisco, according to R. L. Eltringham, manager.

The Electric Heating Apparatus Company, 18-34 Nesbitt Street, Newark, N. J., has filed notice of increase in its capital stock from $20,000 to $70,000.

The Ralco Manufacturing Company, 849 West Washington Boulevard, Chicago, manufacturer of electrical railroad supplies, has purchased a one-story building, 100 ft. x 180 ft., at the corner of Lake Street and Albany Avenue, which it plans to occupy soon.

The B. B. M. Ice & Refrigerating Machine Company, incorporated under the laws of the State of Delaware with a capital stock of $225,000, has filed notice of organization to operate a plant at Detroit for the manufacture of machinery. Henry J. Berry, 702 St. Antoine Street, Detroit, is vice-president.

Foreign Trade Notes

PRICES OF ELECTRICAL GOODS IN SOUTH AFRICA HOLD.—Prices of electrical goods in South Africa have not as yet been materially reduced, according to the Western European Division of the Bureau of Foreign and Domestic Commerce, but the tendency is toward lower levels. Switches have been reduced from about 21s. to 18s. 6d. Other lines remain about the same. Almost complete inactivity is reported by dealers.

ELECTRIFICATION OF RAILROADS IN MADAGASCAR PROPOSED.—The Governor-General of Madagascar has decided to electrify the railroads of that colony from Tananarive to Tamatave, according to the *Commerce Reports*. A hydro-electric power station will be built on the Vohitra River to furnish a maximum power of 30,000 h.p. The length of the line is 150 km. and the total cost of the installations will reach 23,100,000 francs. Assistant Trade Commissioner F. G. Singer, who furnishes this information, states that the Governor-General is also considering the electrification of the future railroad from Diego-Saurez to Joffre Ville, a road about 35 km. in length.

NEW JAPANESE HYDRO-ELECTRIC PLANT.—The Imperial Railway Department of Japan is planning to construct a great hydro-electric plant at Niiagata Prefecture, using the water power of the Shinano River, states the *Far Eastern Review*, as quoted in *Commerce Reports*. The plant will have a capacity of 84,000 kw. and will operate a section of 200 miles of line. It is expected that it will be in operation in 1926.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

A manufacturer in Italy (Nos. 81 and 36,-189) desires to purchase cotton thread for electrical insulation.

A commercial agent from India (No. 84) who is in the United States has formed a partnership with an American business man and desires to secure the representation of manufacturers of boilers, pumps and small engines.

A firm of importers in India (No. 87) desires to form connections with firms for the importation of all classes of belting, power pumps, brass and copper tubes.

An importing company in India (No. 92) desires to secure an agency and purchase electrical appliances.

A representative of a Russian firm formerly doing business in southern Russia (No. 107) reports that he anticipates he will soon have an opportunity to re-establish his business in view of the changed attitude of the Bolshevik regime. He invites correspondence with manufacturers in the United States producing steam boilers, pipe fittings, water softeners, fuel economizers, and miscellaneous power-plant equipment.

New Apparatus and Publications

WASHING MACHINE—The Clements Manufacturing Company, 609 Fulton Street, Chicago, is marketing a machine with new features.

FOOD MIXER.—The Air-O-Mix Corporation, 51 Beaver Street, New York City, has put on the market its "Air-O-Mix Whip-All" for kitchen and pantry use.

WASHING MACHINE — Improvements have been made in the electric washing machines of the Berthold Electric Manufacturing Company, 127 South Green Street, Chicago.

IRONER.—The "Baby Grand" electric ironer is being manufactured by the Grand Manufacturing Company, Detroit, and distributed by the Electric Servant Company, Detroit.

WIRE AND CABLE—The American Insulated Wire & Cable Company, Twenty-first, Sangamon and Morgan Streets, Chicago, has completed arrangements for circulating the new leather-bound vest-pocket catalog on its "American Brand" wire and cable.

FRACTIONAL MOTORS—The Domestic Electric Company, Cleveland, has issued circulars 201, 202, 203 and 204, describing its various type of "domestic" fractional horsepower motors.

TABLE STOVE—The Standard Stamping Company, Huntington, W. Va., is manufacturng the Armstrong table stove and equipment.

EXPANSION BOLTS—The Star Expansion Bolt Company, 147 Cedar Street, New York City, has developed a new "Sebco" pressed-steel lag expansion shield.

CABLE SUPPORTS—Russell & Stoll Company, 17 Vandewater Street, New York City, has developed a new type of cable support for long vertical runs.

SUCTION SWEEPERS—"How to Judge An Electric Cleaner" is the title of the new twenty-four-page booklet of the Hoover Suction Sweeper Company, North Canton, Ohio.

AIR COMPRESSORS—A new automatic motor-driven air-compressor pump and tank, equipped with magnetic pressure release, has just been put on the market by Hobart Brothers Company, Troy, Ohio.

REFLECTORS—"Industrial Reflectors for Street Fixtures" is the title of the new bulletin of the Wheeler Reflector Company, 156 Pearl Street, Boston.

WASHING MACHINE—The Easiest Way Manufacturing Company, Sandusky, Ohio, has a new development in Washing machines.

PULVERIZED FUELS. — The Hardinge Company, 120 Broadway, New York City, has issued catalog No. 9, entitled "Pulverized Fuels."

POWER ACCESSORIES. — The Elliott Company, Jeannette, Pa., has just issued two new bulletins. N-1 is on the "Deaëration Process" as applied to power, central-station and heating plants to prevent corrosion, and N-2 is on the "Deaëration Process" for domestic hot-water service.

New Companies

THE INTERNATIONAL SPECTACLE COMPANY, New York, N. Y., has been incorporated by D. Hines, L. McCormick and J. L. Gorman. The company is capitalized at $500,000 and proposes to manufacture electric lighting equipment and fixtures. C. M. Rubanks, 50 Pine Street, represents the company.

THE CARBON BATTERY & ELECTRIC COMPANY, Lansford, Pa., has been incorporated with a capital stock of $5,000 to manufacture and deal in electrical equipment. Milton Kleckner, Lansford, is treasurer.

THE PARCOL INDUSTRIES, INC., Alpena, Mich., has been incorporated by H. H. Campbell and George K. Parsons, Alpena, and H. J. Collins, Pontiac. The company is capitalized at $50,000 and proposes to manufacture electrical appliances and equipment.

THE PROVIDENCE (R. I.) RADIATOR & ELECTRIC HEATING CORPORATION has been incorporated under the laws of the State of Delaware with a capital stock of $2,000,000 to manufacture electrical and mechanical products. The incorporators are Daniel Owen, P. S. Howland and M. A. Colter, Boston. The company is represented by the Delaware Registration Trust Company, 900 Market Street, Wilmington, Del.

THE EDISON FIXTURE COMPANY, Boston, Mass., has been chartered with a capital stock of $5,000 to manufacture electric fixtures and other electrical equipment. The incorporators are Caesar Heyndricks, 37 Shurtleff Street, Chelsea, Mass., and Harry E. Kidd, Boston.

THE CAZENOVIA (N. Y.) TELEPHONE COMPANY has been organized with a capital stock of $100,000 to operate a local telephone system. The incorporators are M. R. Joy, A. B. Carpenter and H. Gurden. The company is represented by B. H. Shepard, Syracuse.

THE EVERETT (MASS.) ELECTRICAL COMPANY has been incorporated with a capital stock of $50,000 to manufacture electrical equipment. The officers of the company are Roy C. Blackburn, president, and Michael F. Culliney, 15 Olney Street, Dorchester, vice-president and treasurer.

Record of Electrical Patents

Notes on United States Patents

(Issued Sept. 6, 1921.)

1,389,829. Method of Electrolyzing a Solution of Nickel Salt; Christian Heberlein, London, England. App. filed Dec. 7, 1918. Deposition of metallic nickel from nickel salt.

1,389,831. Electric Light Chandelier; Sidney M. Israel, Richmond Hill, N. Y. App. filed Aug. 4, 1920. Concave-convex plaque with several bracket arms.

1,389,871. Apparatus for Charging Storage Batteries; William R. Hersh, Dayton, Ohio. App. filed April 12, 1920. Will automatically disconnect batteries when they have received a charge.

1,389,895. Electrical Signaling and Indicating Device for Ships and Other Vessels; Rodolph S. O'Neil, London, England. App. filed Oct. 27, 1920. Lamps illuminated in differing orders of succession.

1,389,902. Telephone Instrument or the Like; Oscar A. Ross, New York, N. Y. App. filed April 26, 1918. Telephone stand.

1,389,914. Antiseptic Mouthpiece for Telephones; Frank C. Tabler, St. Louis, Mo. App. filed Nov. 17, 1919. Applicable for use upon transmitters of all forms.

1,390,001. Signaling or Indicating Apparatus; Paul H. Waller, Camberwell, London, England. App. filed Dec. 10, 1919. Station indicator for vehicle.

1,390,017. Recording-Lock System; James W. Bryce, Binghamton, N. Y. App. filed July 16, 1919. Records time at which lock was operated.

1,390,018. Master Clock; James W. Bryce, Binghamton, N. Y. App. filed Aug. 24, 1920. Synchronous clock system.

1,390,028. Electric Kettle and the Like; Allen S. Ford, Taunton, England. App. filed March 24, 1920. For heating liquids by electricity.

1,390,039. Electric Bulletin; Ralph E. Jones, U. S. Army. App. filed Aug. 8, 1918. Bulletin board.

1,390,050. Transformer; Corliss E. Lee, Pittsfield, Mass. App. filed Sept. 10, 1917. Polyphase transformers and reactors.

1,390,062. Power Plant; Arthur R. Smith, Schenectady, N. Y. App. filed Dec. 15, 1920. Steam turbo-generator sets.

1,390,063. Winding for Dynamo-Electric Machines; Henry W. Taylor, Bilton, England. App. filed Dec. 9, 1920. Armature winding for alternating-current machines.

1,390,064. Winding for Dynamo-Electric Machines; Henry W. Taylor, Bilton, England. App. filed Dec. 9, 1920. Armature winding for alternating-current machines.

1,390,070. Lamp; Gustave E. Villaret, New York, N. Y. App. filed Dec. 11, 1920. To illuminate room and give diffused light for reading.

1,390,074. Constant-Current Transformer; Lyman Arnold, Lynn, Mass. App. filed March 14, 1918. Movable winding type.

1,390,118. Insulator; Peter C. C. Fridrichsen, Wheeling, W. Va. App. filed June 16, 1919. Insulating knob.

1,390,119. Cross-Over for Toy Railways; Albine Frohne, Chicago, Ill. App. filed May 31, 1921. Trolley contactors will not become grounded at crossover.

1,390,120. Trolley Contactor; A. Frohne, Chicago, Ill. App. May 31, 1921. For toy electric railroads.

1,390,155. Electric Accumulator; Albert Nodon, Bordeaux, France. App. filed Nov. 9, 1918. No buckling.

1,390,192. Electric Commutator; Pierre Bossu, Paris, France. App. filed Nov. 14, 1917. Commutators of great strength.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

HOLBROOK, MASS.—Steps have been taken by H. W. S. Roberts, Selectman, to have the overhead wires in Post Office Square placed underground.

Middle Atlantic States

BUFFALO, N. Y.—The Buffalo Light & Power Company, recently organized with a capital stock of $20,000 by F. Edward Walker and others, has awarded contract for the construction of a power plant, 20 ft. x 36 ft., of 100-hp. capacity to C. Benton. The company, it is understood, is asking for prices on electrical equipment and supplies. S. R. Woodward is engineer.

CAMBRIA, N. Y.—The Cambria Power Company, Inc., Sanborn, has been authorized to construct an electric light and power plant in Cambria.

LOCKE, N. Y.—The Moravia (N. Y.) Electric Light, Heat & Power Company, not the Empire Gas & Electric Company as previously reported, will construct a line to Locke as soon as the franchise and permit from the Public Service Commission are granted. Lewis C. Reynolds, treasurer of the Moravia Company, with offices at 387 Castle Street, Geneva, N. Y., is in charge of the work.

MARILLA, N. Y.—Permission has been granted to the Depew & Lancaster Light, Power & Conduit Company to extend its electric system to the town of Marilla.

SOUTH COLTON, N. Y.—The Racquette River Power Company, Potsdam, has been granted a certificate of public convenience by the Public Service Commission for the construction of a hydro-electric power plant on the Racquette River at South Colton, to furnish electricity for light, heat and power throughout the Colton Township.

PHILADELPHIA, PA.—The Mayer Baking Company, Sixtieth and Hazel Avenues, is contemplating the construction of a power plant in connection with its proposed baking plant on Thomas Avenue, to cost about $140,000.

PITTSBURGH, PA.—Preliminary plans are under way by the Duquesne Light Company for a new electric plant in the Bellevue district.

SUNBURY, PA.—The Butter Krust Baking Company is planning the construction of a new plant, 70 ft. x 130 ft., to cost about $150,000. Ovens, conveyor system, power apparatus and other mechanical equipment will be required.

FRANKFORD, DEL.—The City Council is considering the installation of an electric light plant in Frankford.

DANVILLE, VA. — Arrangements are being made by the Council to issue bonds to the amount of $10,000 for the installation of an electric lighting system.

North Central States

NORTH ADAMS, MICH.—Bonds to the amount of $5,000 have been voted for the erection of a transmission line from Hudson to North Adams. The local authorities have decided to abandon the operation of the municipal light plant.

MARIETTA, OHIO. — Plans are under way for the construction of a hydro-electric power plant for municipal service. Bids, it is understood, will be asked at an early date by G. H. Gampers, engineer, 220 New First National Bank Building, Columbus.

ZANESVILLE, OHIO — The Zanesville Provision Company is contemplating an addition to its main plant and the construction of a new power plant.

ZANESVILLE, OHIO.—Improvements and extensions to the local power plant of the Ohio Electric Railway Company, to cost about $100,000, are under consideration.

CANTON, ILL.—Arrangements have been made by the Canton Gas & Electric Company for the erection of an electric transmission line from Dunfermline to East Liverpool.

CLINTON, ILL.—The Board of Supervisors of Dewitt County is contemplating the installation of an electric light plant at the county farm.

ANTIGO, WIS.—Plans are under consideration by the Wisconsin Traction, Light, Heat & Power Company, Appleton, for the development of the power plant site on Wolf River at Gardner Dam to furnish 12,000 hp. The company also plans to erect a transmission line to Antigo.

FOND DU LAC, WIS.—The Galloway-West Company, 24 West Division Street, is having plans prepared by Martin Tullgren & Sons, architects, 425 East Water Street, Milwaukee, for a four-story addition, 60 ft. x 160 ft., to its cold-storage warehouse and dairy products plant in Fond du Lac. Generating, boiler and refrigerating equipment will be required. M. E. West is manager.

GLASGOW, MO.—The Kansas City Light & Power Company, it is reported, is planning the construction of a light and power plant at Glasgow, to cost about $1,000,000.

ST. LOUIS, MO.—The Union Electric Light & Power Company is planning an expenditure of $1,000,000 for improvements.

MADISON, NEB.—Plans are under way by the Henningson Engineering Company, National Building, Omaha, for the construction of a new municipal electric power plant in Madison, to cost about $75,000. Bids will soon be received by the engineers.

Southern States

SWANSEA, S. C.—Bonds to the amount of $20,000 have been voted for the installation of electric lighting in Swansea.

MACON, GA.—The plant of the Central Door & Sash Company was recently destroyed by fire, causing a loss of about $150,000, including machinery, power equipment, etc.

TUSCALOOSA, ALA.—Plans are under way by the Bonnie Coal Company, recently organized, for the installation of an electric power house and other mechanical equipment at its properties. C. C. Huckaby, Blocton, is consulting engineer in charge. William Jones is president and manager.

STARKEVILLE, MISS.—Bids will be received by the State Bond Improvement Commission, Jackson, until Oct. 15, for furnishing two 200-kw. alternating-current generators, direct-connected to steam engines or turbines; two stage air compressors of 700 cu.ft. displacement, direct-connected to synchronous motor; two centrifugal pumps of 600-g.p.m. capacity against 150-ft. head, and one centrifugal pump of 50-g.p.m. capacity against 50-ft. head, also single-acting triplex plunge feed-water pump, 40-g.p.m. capacity, all connected to three-phase induction motor; duplex outside end packed plunger, pot valve, feed-water pump of 70-g.p.m. capacity at 30 strokes per minute; two 8-in. and 10-in. x 12-in. vacuum pumps for heating system; ice-making plant complete except pans and distilling system, capacity 7½ tons per 24 hours; castiron stack type, open feed-water heater for approximately 1,200-hp. boiler capacity; closed-type hot-water supply heater with 2,500-gal. hourly capacity, storage space for about 900 gal.; ten-panel black marine-finish slate switchboard; radial-brick or concrete chimney, 7 ft. inside diameter at top and 150 ft. high above top of foundation, at Mississippi A. & M. College, Starkeville. Theodore C. Link, Box 636, Jackson, is supervising architect.

FAIRLAND, OKLA.—The construction of a municipal light and power plant is under consideration. H. T. Olmstead & Company, Oklahoma City, are engineers.

SAYRE, OKLA.—Bids will be received Oct. 25 for waterworks, light and sewer extensions and power plant. The plans provide for one mile of water mains, two 300-g.p.m. motor-driven pumps, one 500-g.p.m. marine-engine fire pump, one 75-kva. and one 125-kva. oil engine-generator set, etc. V. V. Long & Company, 1300 Colcord Building, Oklahoma City, is consulting engineer. E. Simmonds, Sayre, is city clerk.

MEXIA, TEX.—The Mexia Refining Company, Telephone Exchange Building, has awarded contract for the construction of its new oil refinery to Charles B. Miller & Company, Fort Worth. The cost is estimated at $300,000, of which $150,000 will be expended on machinery. A new power house will also be built.

Pacific and Mountain States

SEATTLE, WASH.—The Washington Coast Utilities Company has filed notice of increase in its capital stock from $300,000 to $1,000,000.

FAIRFIELD, CAL. — Estimates of the cost of the installation of a lighting system are being prepared by the Fairfield Chamber of Commerce.

MERCED, CAL.—Plans and specifications have been adopted by the city trustees for the installation of a complete electrolier system, to cost about $300,000. The present plans provide for 460 electroliers.

OROVILLE, CAL.—Announcement has been made by Lars Jorgensen, chief engineer, and Karl Brehme, vice-president and financial manager of the Middle Fork Development Company, of San Francisco, that arrangements have been made for financing a 201,000-hp. hydro-electric and irrigation project on the Middle Fork of the Feather River, to cost about $30,000,000. The proposed scheme includes three storage reservoirs and three major plants of 60,000-hp. generating capacity each, to be built at Nelson Point, Crooked Bar and Bear Creek. Three smaller plants are also planned, but sites have not yet been located. All work prior to building the power plant will be done by the Middle Fork Development Company and the Constant Angle Arch Dam Company. Application has been made to the Federal Power Commission for a permit to proceed with the hydro-electric development.

SAN ANDREAS, CAL. — The County Supervisors have authorized the formation of the Murphys Lighting District. M. H. Manuel is one of the trustees of the district.

TURLOCK, CAL.—Plans have been accepted by the joint boards of the Turlock-Modesto Irrigation Districts for the construction of a power house and the installation of machinery, to cost about $1,500,000, at the Don Pedro Dam. The plans provide for an initial capacity of 16,000 hp. and an ultimate development of 45,000 hp. A. Wiley is consulting engineer. Percy Jones is chief of the Modesto District.

MISSOULA, MONT.—The Rock Creek Power Company has been granted a license by the Federal Power Commission for water-power rights on Rock Creek. The present plans provide for the construction of a power house diversion dam, 3-mile conduit, etc. John Shaunessy is interested.

PUEBLO, COL.—Bids will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until Oct. 21, for repairs to the lighting system, etc., in the U. S. Post Office at Pueblo. Copies of specification and drawing may be obtained at the above office or at the office of the Custodian, Pueblo, Col. James A. Wetmore is acting supervising architect.

Canada

AMHERSTBURG, ONT.—The construction of a power station at Amherstburg is under consideration by the Hydro-Electric Power Commission of Ontario.

CREDITON, ONT.—The installation of a new electric light and power distribution system in Crediton, to cost about $33,000, is under consideration. J. N. Wilson, 190 University Avenue, Toronto, is engineer.

TECUMSEH, ONT.—The Hydro-Electric Power Commission of Ontario contemplates the erection of a power station at Tecumseh.

TORONTO, ONT.—A by-law has been authorized by the City Council providing for the raising of $750,000 for extensions and improvements to the municipal electric power plant.

WEST VANCOUVER, B. C.—The Municipal Council is contemplating the installation of an electric light and power plant to cost about [illegible]. James Olkason is clerk.

Electrical World

New York, Saturday, October 15, 1921

A Public Servant to All Classes of Electrical Men

NO MAN can live for himself alone, neither can any business. The inter-relationships of society automatically influence each person in everything he is and does, even to limiting his liberty in order to preserve the liberty of others. Just so, every business institution becomes an element in the industry of which it is a part and cannot think of or for itself without regarding others.

The manufacturing enterprise, the jobbers' organization, the central-station company, the contractor-dealer—each is engaged and engrossed in an independent business; yet in every case there is this interdependence upon and responsibility to the other manufacturers, the other jobbers, the other central-station men, the other contractors and dealers that morally restricts them. As members of one industry they are all embraced by a general application of the golden rule. And each manufacturer or central-station company, each unit in this industry, cannot in fairness be looked upon entirely as a selfish business conducted for its own benefit. For each unit is also a working element in an industry in which its influence and value can be measured.

The ELECTRICAL WORLD is a national institution. As a business enterprise in which much money is invested, it must be operated to earn a profit. But since its entire function consists of providing an essential service to electrical men of every class, its impersonal aspect as an institution in the electrical industry far outweighs in importance its embodiment as a business. It is a vehicle that carries business and engineering ideas and ideals and other necessary information of the industry to electrical men the world around and affords a means whereby the manufacturers may lay their messages before the builders of the industry and those who must maintain and operate its machinery. Every division and individual unit of the electrical community of interests is therefore directly concerned with the ELECTRICAL WORLD and affected by the success with which it does its work and the degree to which it serves. As a utility rendering a public service within our industry, it is made and owned, not by its stockholders or its editors, but by its readers and its advertisers.

Electrical men have been a bit class-conscious. They have thought too much as manufacturers, as jobbers, as central-station men or contractor-dealers. It is a natural, common failing. But it has delayed their progress and impeded their prosperity. It is a weakness and a failing that must be combated and controlled, and there is but one way to do this—which is by broader thinking, broader reading, broader study of our industry and its affairs by all of us.

Ralph Wainwright Pope

Honorary secretary of the A. I. E. E., to whose constructive efforts during more than a quarter of a century as secretary may be attributed much of the present financial and [illegible] strength of the organization.

THIS week the board of directors of the American Institute of Electrical Engineers is meeting to consider among other things the detailed recommendations for putting into practice the matter of holding sectional meetings which formerly were monthly national meetings. It seems fitting, therefore, to recall the efforts of Ralph W. Pope to build up and strengthen the section idea for the Institute. Mr. Pope resigned as secretary of the Institute in 1911, soon after being elected to that position for the twenty-seventh consecutive time, and was made honorary secretary for life.

As early as 1893 Mr. Pope pointed out in a paper before the Institute the necessity for establishing sections. In the spring of the following year the first Chicago local meeting was held. The question of local meetings, however, languished until 1902, when under the administration of President Charles F. Scott it became a well recognized policy of the Institute. Because of his keen personal interest in local activity Mr. Pope lent all the assistance he could to its development, with the result that the section idea has been built up on a firm and strong foundation.

Born Aug. 16, 1844, at Great Barrington, Mass., he developed at an early age a taste for mechanics. At the age of fifteen he worked for the Housatonic Railroad. When the Civil War broke out he entered the service of the American Telegraph Company [illegible]. [illegible] Collins Overland Telegraph Expedition. [illegible] went into the wilds of British Columbia in an effort to establish an overland telegraph system with Europe by way of Alaska and Siberia. The building of this line was [illegible], however, by the success of the Atlantic cable. From 1867 to 18[illegible] Mr. Pope was with the Bankers & Brokers Telegraph Company. He then became [illegible] with the Gold & Stock Telegraph Company and in 1880 was advanced to be deputy superintendent, at the time when the company's apparatus was considered by many as representing the highest development which had so far been reached in the art. In 188[illegible] he became manager of the Union Electric Manufacturing Company. Two years later he was associate editor of the *Electrician and Electrical Engineer*. He had previously had journalistic experience as assistant editor of the *Telegrapher*.

The A. I. E. E. was formed in 1884 and in the following year Mr. Pope was elected secretary. Commencing in 1888 when the first independent office of the Institute was established at 5 Beekman Street, New York, he devoted his full time to this work. In addition to his Institute activities he founded in 18[illegible] the monthly periodical *Electric Power*, and in 1891 became editor for electrical terms of the *Standard Dictionary*. He was a member of the [illegible] judges for the [illegible] at the Columbia Exposition held in Chicago in 1893.

Mr. Pope [illegible] more than a quarter of a century of service. He studied other and similar organizations to find out ways to improve and advance Institute activities. He believed that the affairs of the Institute should be conducted on business principles, and his insistence on this throughout his tenure of office has been reflected in the organization's strong financial position. That he [illegible] and laid the right foundation is attested by its subsequent growth. Upon retirement Mr. Pope was presented with [illegible] many evidences of appreciation of the Institute for his constructive work.

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The Testimony of Insurance Companies on Utility Bonds

THE life insurance companies of the country are doing a true and laudable service to the community and to public utilities in advertising, as the Prudential Insurance Company of America recently did, that part of their money is invested in the securities of electric light and power companies. Indorsement of the safety and stability of public utility securities from such quarters is doubly welcome. Moreover, it reveals a keen appreciation on the part of insurance men of their obligation to use the funds intrusted to them for the greatest good. What though crusaders of the Untermyer type rail at them for not putting out more of their money in real estate bonds and mortgages, the difficulty with building is not a disinclination to build or to loan money, but rather the high prices of material and labor and the loss which must inevitably follow any shrinkage of inflated real estate values. One million invested in the securities of electric light and power companies makes electric service available for hundreds of thousands, while the same amount of money put out in mortgages would benefit a very few or at most a few hundred. Surely the policy holders of the Prudential ought to feel with Pope: "He serves me most who serves his country best."

Good Public Relations Are Like Good Health

SO MUCH is being said nowadays about public relations that it would almost seem that good public relations are something only to be achieved by the most painstaking effort. As a matter of fact, good public relations for a utility company are like good health for the individual, simply the normal, natural condition that follows right living and right conduct. Discontented men who are seeking health are often those who have squandered it in careless living and bad habits and then realized their loss; and the central-station company whose public relations are unhappy is simply suffering from past indiscretions that have bred popular misunderstanding and dislike until at last it has come to see how priceless a possession has been thrown away.

Well men do not worry about their health, though they are proud of it and guard it sensibly. Neither do popular and respected utilities have cause to fear concerning their public relations, though they must jealously protect themselves against the hasty acts of thoughtless employees who may misrepresent them and cause them to be misunderstood. We must remember that health, not sickness, is normal, and that to be thought well of is normal too. But the laws of health and the laws of living cannot be disregarded with safety.

A little care, a little thought, however, and a man keeps well and a utility enjoys the full respect and confidence of the community.

Help the Railroads Solve Their Terminal Problems

NO ONE giving thought to the matter can escape the conclusion that the railroads of the country are in a bad way. A malignant palsy has affected almost all of them, and the diagnosticians as well as the patients are naturally puzzled and worried that the roads do not respond to treatment. The latest cure proposed is a grouping of the chief railroads into nineteen systems. Although greater centralization and concentration will effect economies, we doubt if they will be sufficient to ward off the inevitable. Palliative after palliative has been applied time and again, but the last state of the railroads seems to be worse than the first. For this condition the bankers have been blamed by some, management has been called incompetent by others and labor inefficient by nearly all. Crimination and recrimination, however, are of little avail. If the railroads are to be saved, a more general and keen appreciation of the seriousness of the transportation problem and the urgency of its solution is needed. It must be recognized at the outset that, the motor truck notwithstanding, there is nothing so economical for carrying freight and passengers as a train of cars running on a track. Nor is there any danger in the long run of the uneconomic superseding the fundamentally economic in the transportation field. Obviously, then, we must take the railroads as they are and apply to them modern engineering methods. But the experience and knowledge of railroad men themselves are necessary, and no solution will be forthcoming until they are convinced that plans proposed are practicable and efficacious.

In point of importance no railroad problem transcends the question of terminals, and it is in the redesign and equipment of terminals to handle freight expeditiously that the electrical engineer can be of most help. The problem is national in scope and worthy the combined efforts of engineers and railroad men. The largeness of the task is obvious when one considers that there are between 250,000 and 300,000 railroad terminals in the country handling material weighing hundreds of millions of tons. Observation and test show that it takes twenty-three minutes to handle a ton of freight from car to platform by means of hand trucks and that with a four-wheeled truck the time ranges from sixteen to seventeen minutes. By means of tractors and trailers the time may be reduced to half, but by the proper application of electricity a ton can be handled in less than a minute. Such records have been made at marine terminals and duplication ought to be possible at railroad terminals. Speed is the all-important consideration in handling freight at terminals, and electricity is synonymous with speed. If, therefore, the railroads are once more to fulfill their proper functions and render good service at reasonable rates, they must master this problem of terminal congestion. Electrical engineers owe it to themselves, to the railroads and to the country to apply their skill to this problem and do all within their power to assist the railroads in its solution.

Is the Horse Doomed to Extinction?

THE analysis of the commercial electric truck situation in New York City published elsewhere in this issue with diagrams raises inevitably in the mind of the reader the question whether the horse is not ultimately doomed to follow the dodo into the realms of ancient history. From 1917 to 1919 the draft horse in Manhattan and the Bronx diminished in numbers by something like 30 per cent, and motor trucks, electric and other, increased enough not only to take care of the diminished horse traction but also to make up for the natural traffic increase of these years as well. So far as pleasure vehicles are concerned in and about the metropolis, one might almost say that the horse is extinct. There fell under our eyes on Fifth Avenue a few weeks ago the spectacle of a pair of sleek and well-fed horses drawing some wheeled vehicle of ancient design, a "victoria" we believe, and we hear that others have, in the same locality, had a similar experience. We would almost as soon have expected to meet a cave man riding a brontosaurus.

Looking at the matter in all seriousness, the indications are that for commercial trucking purposes the horse is rapidly disappearing—almost as rapidly as from the field of pleasure driving. He is more costly and less efficient than the truck, gasoline or electric, and from sheer economic pressure is bound to go. Whether he will still drag out a toilful existence in the country in face of the competition of tractors is another question. Expelled from the city, he may go back to the farm to find his occupation gone and his old stable converted into a garage for the cars of yesteryear.

Improvement in Central-Station Operating Conditions

THE notes and tables regarding the operating ratio of electric utilities which were published in the Oct. 8 issue of the ELECTRICAL WORLD show in the most forcible manner the skill and energy which have been put into the betterment of operating conditions. The operating ratio, in the sense in which we use the phrase—that is, the ratio between operating and maintenance expenses and gross revenue—gives a rather accurate measure of the financial success of plant operation. It defines the proportion of revenue available for meeting fixed charges and dividends. Of course, the conditions as between steam plants and hydro-electric plants vary radically. In the case of the latter the fixed charges are often relatively very high and a much lower operating ratio must be maintained than in the case of many of the steam-driven plants, where the investment charges are lighter but the operating charges relatively much greater. The necessary variations in operating ratio are considerable on account of fluctuations in cost of fuel and of labor.

In a rough way the operating ratio averaged a little better during the first half of this year than in the preceding year, so far as steam plants were concerned. Nearly 56 per cent is a fair average estimate for the operating ratio where no hydro-electric power is available. In the hydro-electric plants the operating ratio for the last two years was in the general neighborhood of 24 per cent, showing a slight decrease in the current year. This decrease, however, is perhaps not altogether associated with a genuine decrease in costs, since in the low-water season of the middle of the year a good many steam auxiliaries found large use, especially in small plants, and many of these therefore appear in our tables as mixed plants, having both hydro-electric and steam units Thus there were left mainly the larger hydro-electric plants from which good results were to be anticipated. The main point of the matter is, however, that it is plainly evident that the sales of electric supply plants are steadily going up while various economies have tended to lessen the costs of output. It is a remarkable and highly satisfactory condition to find the sales of energy holding their own during a period of conspicuous industrial depression. Nothing shows more plainly how important to the public the supply of electricity has become and how far manufacturing operations must necessarily depend upon it.

The Revised Code of Lighting

THE report of the committee on lighting legislation presented week before last at the convention of the Illuminating Engineering Society is not greatly different from the original code as regards mandatory rules, but contains a valuable mass of explanatory and suggestive matter which facilitates the interpretation and carrying out of the rules. Stated in simple terms, the changes in the rules themselves as regards intensity of lighting were in substance an increase in the lighting of spaces like halls and stairways to 0.5 foot-candle minimum and a recognition of the fact that there are certain classes of work which cannot fairly be classified as real manufacture, though they require the handling of material in the rough, and which do not actually need the illumination of 1 foot-candle previously assigned to them. Such crude operations are in the new rules relegated to the 0.5-foot-candle classification, which, like the raising of hallway and exit lighting to the same figure, is doubtless a wise change. It seems to be pretty well established that hallways and stairways are a fruitful field for accidents and need more lighting than has previously been set aside for them.

The revised rules contain a more complete recognition of the evils of glare than in the original draft, and in particular they state flatly that the use of bare light sources is presumptive evidence of glare. All the required planes of illumination really reach minima far below those which experience has shown to be desirable from the standpoint of efficiency. The mandatory part of the regulations is obviously intended for the benefit of the pinch-penny employer who is willing to take any sort of chances with his workers rather than lay out a cent for improved conditions. Well-informed manufacturers who understand what illumination means to their output can find little excuse for adverse comment on the minima of this code, but may offer some constructive criticisms on the lowness of the figures.

In the second part of the code, which is explanatory of the whole situation, a very valuable mass of information has been accumulated regarding desirable intensities for various manufacturing operations and also, in particular, regarding the conditions which produce glare and their classification. Of course, it is well known that glare involves not only the intrinsic brilliancy of the source but its absolute intensity and its position with reference to the eye of the worker. It is the entrance of these complex factors into the problem that has made glare conditions so hard to define in the past. Even the best attempts at codification have usually dealt specifically with only one of the important phases of the matter, others being met by regulations directed to a general average. The present code contains tables taking all these matters into account and so relating them that by cross-reference an inspector can determine directly whether a source before him should be for the purposes of its use regarded as glaring. The tables look complex, but in reality they are in use quite straightforward, merely requiring passage from one table to another to take account of the several things which cannot be all expressed in one table or in a simple graph. This part of the report is enriched by some effective illustrations, and we believe that it will be found of great use to engineers as well as to the inspectors for whose particular benefit it is put on record.

Electric Leader Cables Aid Navigation

RECENTLY several announcements have appeared both in this country and abroad regarding experiments with "leader cables" and thermionic vacuum tubes for guiding ships into harbors. These accounts indicate an ultimately successful development. A number of patents were issued fifteen or twenty years ago, and among them were two to Dr. R. B. Owens, now secretary of the Franklin Institute. Extensive experiments were carried out under the Owens patents, but without success, owing to the weakness of the signals received on board ship. One of the most recent published accounts of successful application of the principle is that of J. J. Bennett in the *Electrician* (London). The generally accepted plan appears to be a single cable connected at one end to an alternator and of which the other end, after leading through the channel, is connected to a ground plate, the current thus returning to the source of supply by means of the water and the earth. It is stated that such cables have been used up to lengths of 40 miles and in water as deep as 180 feet. The power used in the experiments now mentioned is 9 amp., 220 volts and 500 cycles per second. Unfortunately the published accounts are very meager as regards the results of actual experiments with the equipment. It is asserted that signals may be received up to distances between 400 yards and 600 yards, but little or nothing is said as to actual experience in the piloting of ships through channels, say on a dark night or foggy day.

It appears that the most serious difficulty so far encountered with these methods is the uncertainty as to the distribution of the magnetic field around the cable. If the field were perfectly circular, like that around an indefinitely long conductor, the problem would be simple and the exact position of the cable with reference to a ship could be determined very closely. However, two factors upset this ideal symmetrical field, one being the uncertain return circuit made up of the earth and the water, and the other the screening effect on the detecting coils caused by the mass of the ship itself. These two factors have so far made it impossible to form correct conclusions from the magnitude of the signals received as to the exact location of the cable. It seems probable that further experiment will give more definite knowledge on each of these influences since the field of any one cable should remain fixed and it should be possible to plot it.

Future experimentation, therefore, should take the direction of actually laying out the distribution of magnetic field around "leader cables" and a study of the influence of the metal of the ship on detecting coil when placed in these fields. It appears safe to predict that within a short time we may find a very general application of this device in the problems of navigation offered by dark nights, fogs and uncharted channels.

Industrial Equipment Should Be Tuned to Higher Economic Key

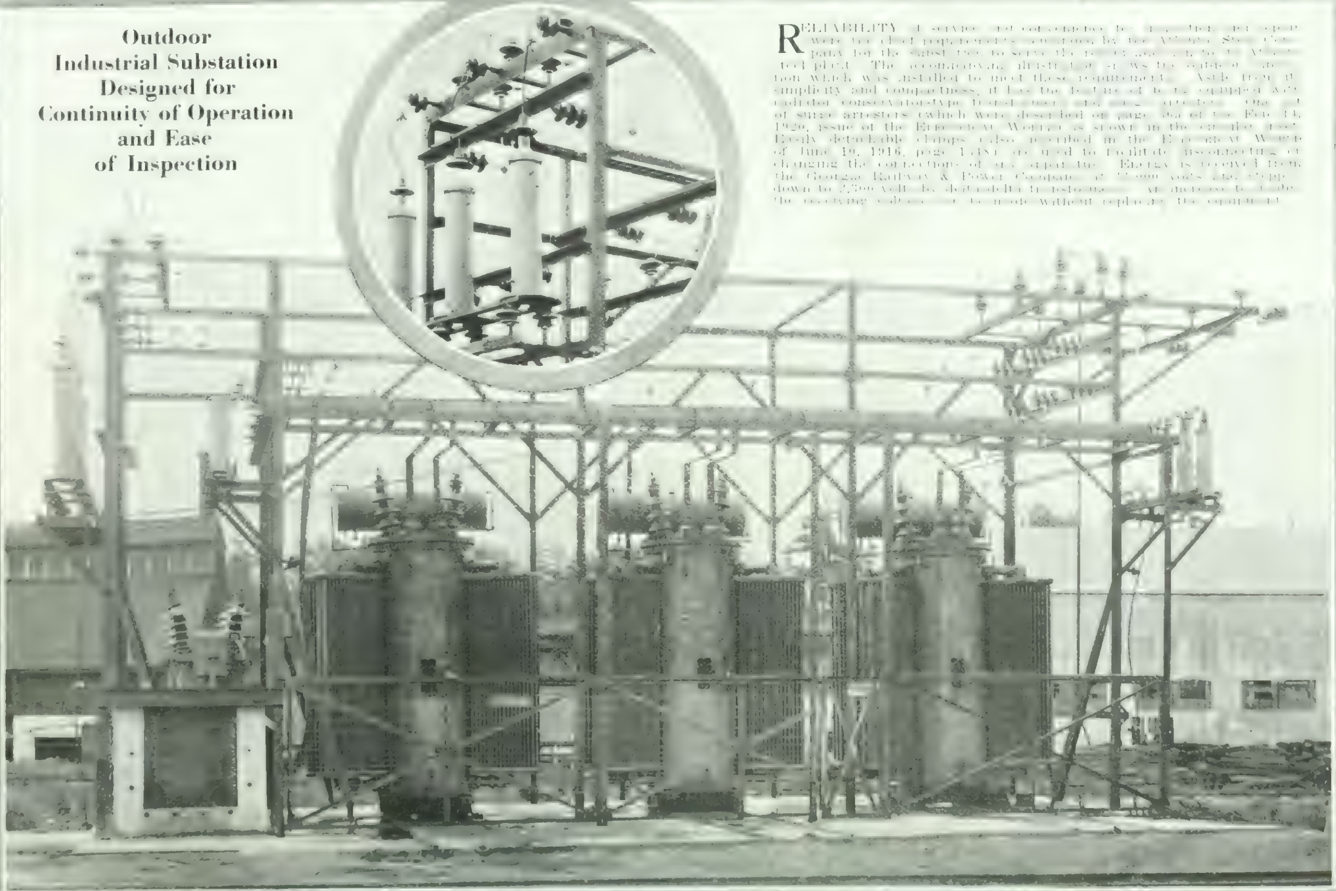
WITH the revival of business increased pressure is sure to be brought to bear by plant owners upon machinery and apparatus to yield service upon a new plane of efficiency. Under stress of war conditions thousands of motor applications, lighting installations, wiring layouts and electric heating devices were put into service with little regard for anything but immediate output capabilities. Accelerated production lasted many months after the armistice was signed, followed by curtailments and shutdowns as the depression now passing hit different industries. The dawning of better days warns the engineer to tune his equipment to a higher economic key, in order that it may not be found wanting in efficiency as prosperity returns.

Visits to industrial plants since the war show a surprising number of cases where the owners apparently have put a stop order on investigations into the suitability of equipment. The need of husbanding resources has varied widely. Some concerns have been obliged to reduce their engineering personnel sharply, and it has been intimated that the remaining staff has had all it could handle to keep the plant equipment in reasonable shape for service at low outputs in proportion to installed capacity. In other instances large war profits have been set aside and still the conduct of betterment work has been discouraged if not actively forbidden. A drifting policy has prevailed in too many establishments where a very modest outlay for surveys, tests and so forth would yield remarkable returns in the approaching days of good business. In many plants today incomplete records of equipment exist. Overcapacity in motor applications remains, with its actual or potential waste of energy and its continuing toll upon fixed charges. Technical organizations are loosely formed or poorly considered with regard to future possibilities. Testing equipment is scanty and in dubious condition and lighting applications are of a temporary order.

Much needs to be done before these plants can measure up to the new standards of service which will be demanded under the competitive conditions of the post-reconstruction era. The material is available for the presentation of a strong case to the executive superiors of the plant engineer, and fortunately a large part of the necessary survey work can be done at moderate cost,

Outdoor Industrial Substation Designed for Continuity of Operation and Ease of Inspection

RELIABILITY of service and convenience for inspection and repair were the chief requirements considered by the Atlanta Steel Company for the substation to serve the power demands of its Atlanta steel plant. The accompanying illustration shows the outdoor station which was installed to meet these requirements. Aside from its simplicity and compactness, it has the feature of being equipped with radiator conservator-type transformers and surge arresters. One set of surge arresters (which were described on page [illegible] of the Feb. 14, 1920, issue of the ELECTRICAL WORLD) is shown in the circular inset. Easily detachable clamps (also described in the ELECTRICAL WORLD of June 10, 1916, page [illegible]) are used to facilitate disconnecting or changing the connections of any apparatus. Energy is received from the Georgia Railway & Power Company at [illegible] volts and stepped down to 2,300 volts by delta-delta transformers. An increase to double the receiving voltage can be made without replacing the equipment.

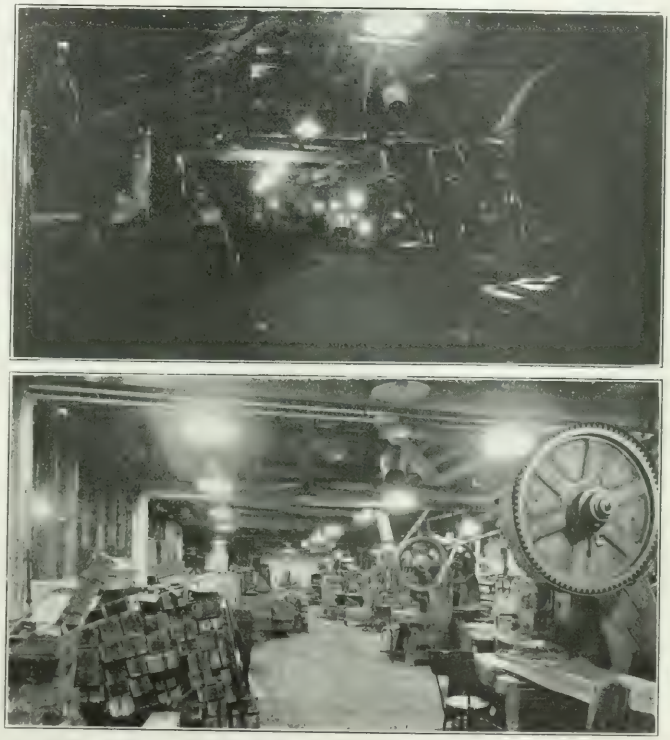


Better Illumination Cuts Production Costs

Test Data Show an Increase in Production of 12.2 per Cent Due to the Installation of a Modern Lighting System—Increase in Lighting Expenditure Only 2½ per Cent of Annual Payroll

By WARD HARRISON, ORVILLE F. HAAS and FRED W. DOPKE
National Lamp Works of General Electric Company

SO MANY industrial plant managers have to be shown the dollars and cents value of improved illumination that the following information, based on tests made by the Dover Manufacturing Company, Dover, Ohio, should be helpful to an industrial plant engineer in inducing his manager to rehabilitate his lighting equipment. In the test it was found that the production could be increased 12.2 per cent, with an increase in lighting expense equal to approximately 2.5 per cent of the annual payroll.



FIGS. 1 AND 2—THE OLD AND THE IMPROVED LIGHTING

Total production under the new lighting was increased 12.2 per cent, by an increase in lighting cost equal to only 2½ per cent of the payroll

The Dover Manufacturing Company makes an extensive assortment of electric, gas and ordinary sadirons for home and laundry use. The press department, where the investigation was conducted, is a rectangular area, approximately 29 ft. x 112 ft. (8.7 m. x 33.6 m.) in area, and is equipped with five punch presses, two milling machines, eight drill presses, one tapping machine and with one tool grinder.

The chief operations performed on the punch presses consist of blanking, forming, shearing, reforming and punching hoods for the irons, while the work performed on the drill presses consists of drilling and tapping the iron castings. The milling operations consist of surfacing the bottoms of the irons. At the time the investigation was begun the personnel of the department consisted of fourteen men, a foreman, ten machine operators and three helpers. The press department has no skylight and is partitioned off from other parts of the plant in such a manner that there are no windows having an outside exposure even on a court, and therefore virtually no daylight reaches the department, the average daylight illumination at noon on a sunny day being less than 0.1 foot-candle. The original lighting system consisted of thirty-two outlets, twenty-two of which were equipped with 50-watt lamps used for local lighting, one with a 100-watt lamp also for local lighting, and nine with 100-watt lamps for general illumination, only two of the latter, however, being equipped with reflectors. The lamps for local lighting were fitted with wire guards and in a few cases also with home-made tin glare shields. The average illumination on the working plane throughout the room was about 0.7 foot-candle, and the illumination supplied at the tool points varied between 0.3 and 12 foot-candles, the average being about 4 foot-candles.

As originally planned, the investigation called for a comparative test with the old system and with a general overhead lighting system consisting of twenty-seven "RLM" standard-dome reflectors and bowl-enameled lamps. It was also planned to vary the levels of illumination with the new system, noting the production under each level and checking back at intervals to the old system. However, a partial shutdown of the plant very much curtailed the scope of the investigation, and this latter idea was reluctantly abandoned. The data secured, therefore, simply indicate an answer to the first question, namely, the comparison of production under the old or original system with the average production results as found under the new system, which afforded an average illumination over the test period of 13 foot-candles. With the largest lamps in the test illumination was approximately 22 foot-candles.

It was found that ninety-eight distinct operations were performed in the press department while the investigation was in progress. However, there were a great many minor operations so far as the test was concerned—that is, operations which were not carried on for more than three or four hours under each of the two systems of lighting—and eliminating these there remained twenty operations from which definite conclusions were warranted as to production changes under the original and new systems of illumination.

SUMMARY OF INVESTIGATION

Plant	Dover Manufacturing Company, Dover, Ohio
Product	Electric, gas and ordinary sadirons for home and laundry use.
Test area	Press department (29 ft. x 112 ft.).
Press department personnel	Foreman, ten operators, three helpers.
Old lighting equipment	Twenty-two 50-watt clear lamps—no reflectors. Ten 100-watt clear lamps—two with reflectors. Average illumination, 0.7 foot-candle. Average illumination at tool point, 4 foot-candles
New lighting equipment	Twenty-seven "RLM" standard-dome reflectors with bowl-enameled lamps. Average illumination, 13.5 foot-candles.
Cost of old lighting system per year*	$290.00
Cost of new lighting system per year*	$800.00
Increased expenditure for lighting	$510.00
Payroll per year	$20,000.00
Percentage of increased lighting cost to payroll	2.50
Percentage increase in production due to modern system of illumination	12.20

* Cost of energy, 4 cents per kilowatt-hour.

Of the twenty operations it will be seen from the accompanying tabulation that fifteen showed increases in production, four indicated decreased production and one showed no change. The operation which showed neither loss nor gain was one which required no special discrimination of details. It consisted merely of picking up an iron, laying it in a jig, pulling a lever for drilling, and then removing the iron. Operation No. 6-G-42-½, which showed an increase in production of 210 per cent, required very close discrimination. It consisted of accurately locating the center of an iron casting with dividers and then center-punching for drilling. The four individual operations for which decreases in production were indicated come under the head of drilling operations or of tapping operations. It will be noted in the tabulation that in each of these two groups there are several operations carrying separate numbers and listed separately; for example, there is one operation number for drilling a hole in a certain part and another operation number for a differently sized hole or for a hole in a differently sized iron. As a matter of fact, if all drilling operations are placed in one group and likewise all tapping operations in one group, it will be found that in each case the gains in production more than offset the apparent losses. In other words, the precision with which the data could be recorded (to the nearest half hour) and the variation in the quality of the material worked upon were such that it is dangerous to place too much weight on the exact percentage of gain or loss indicated for any one operation. When all of the figures are averaged to obtain the production of the shop as a whole, many possible sources of error, such as those due to recording time and to variations in material, are eliminated.

In order to determine the percentage increase in efficiency of the shop as a whole, it was necessary to weigh each operation in proportion to the total number of hours devoted to it. It was considered that the relative shop importance of any one operation was simply the ratio of the number of hours spent on the operation during the investigation to the total number of hours spent on the twenty operations tested. It is readily seen that the short-time operations thus have very little weight, whereas the operations which were worked upon for a long duration are given greater weight. The result of the investigation, with the operations weighted as described above, indicate that at an increased expenditure for lighting of approximately 2.5 per cent, production in the press department was increased 12.2 per cent.

There were several operations on which sufficiently accurate data were not obtained to warrant tabulation in this summary, but which also showed increased economy in operation. For instance, under the original lighting system it was necessary to drill and tap two pieces used in making the electric iron, load them on trucks, assemble them in an area where there was daylight, and then carry them back into the shop for further tapping. Under the new system of illumination it is possible to assemble the pieces right at the machines. Again, it had been the custom to have several men work on Saturday afternoons to clean up the shop. After the new system was installed it was found that the department was kept in a more orderly condition during the week and it was possible to dispense with Saturday afternoon work. This saving alone was sufficient to defray a large part of the lighting cost.

One of the operators stated that the drop cords they had previously been using interfered with his movements about the machine; another, that although he believed he would not produce more work under the new system, the work he would produce would be of better grade. A helper who cleaned up the steel scrap from the punch presses remarked that the new system offered safety protection in that he could now see the sharp, ragged edges of the scrap. Some of the other comments made by the men in regard to the increase in illumination were: "Room appears to be larger"; "More pleasant to work under the increased illumination"; "It will be impossible to do very much stalling on the job in the future." The company officials were equally impressed with the new lighting and have purchased the equipment used in the investigation. At their request a complete illumination design was made for the entire plant, and parts of this new system are already installed.

The foregoing tests were conducted jointly by the management of the Dover Manufacturing Company and the engineering department, National Lamp Works.

PRODUCTION DATA FOR PERIOD OF INVESTIGATION

Factory Operation Number	Factory Operation	Pieces per Hour Old	New	Change in Production per Cent	Time per Operation Hours
1-32	Drilling	133	164	23	[illegible]
1-33	Tapping	293	258	12	32
6-G-11	Milling	54	60	11	[illegible]
6-G-11½	Spotting	188	222	18	[illegible]
6-G-42½	Punching	42	130	210	20
6-G-43	Drilling	59	52	—12	27
6-G-44	Tapping	82	108	32	[illegible]
62-3	Drilling	420	519	24	[illegible]
62-4	Tapping	490	609	24	34
72-3	Drilling	255	255		[illegible]
622-4	Drilling	535	464	—13	[illegible]
901-5	Blanking	1,517	1,652	9	48
911-1	Blanking	916	1,034	13	48
911-2	Shearing	1,074	1,800	68	33
921-1 and 2	Blanking	849	962	13	43
921-4	Reforming	1,043	1,534	47	28
921-5	Punching	1,125	1,296	[illegible]	25
922-4	Tapping	447	399	—11	[illegible]
C-97	Blanking	1,495	1,517	[illegible]	[illegible]
	Plugging	90	98	9	[illegible]

The Public Utility from the Customer's Viewpoint

Common-Sense Business Dealings Essential to Popular Understanding of Utility Affairs—Frankness and Liberality of Policy Build Good Will

By Bert H. Peck
General Manager Southern Illinois Light & Power Company, St. Louis, Mo.

THE relationships between public utilities and those whom they serve are being viewed in a new light and their importance appreciated not only by the utilities but by representatives of the public as well. In spite of all that has been said in the past on this subject, including the advancement of many theories, it is doubtful if sufficient attention has been paid to the common, every-day methods of obtaining and maintaining satisfactory relations. Recent publicity has done much to emphasize the need for active co-operation and to pave the way toward a better understanding. Thus the utilities' part in the program has been made easier.

Formulas and set rules cannot be applied to public relations. Each situation requires individual treatment, with methods varying over a wide range in different localities. The problem in a large city is usually very different from that in the smaller community. None the less, there are certain considerations which in my opinion are fundamental and generally applicable in cities of less than 100,000 population, and I believe that if these are met, the remainder of the problem may be solved according to local requirements.

Public Relations Not Complicated

The question of public relations is one which has been needlessly complicated in the past owing to the belief that it presented a very peculiar problem, entirely dissociated from the relationships prevailing between most business enterprises and their patrons. Rapid development, indeed, has characterized the public utility field. Types of equipment and methods of transmission and distribution have undergone swift changes. This development has drawn into the field educated men who are inclined to the technical viewpoint, and, in the past at least, often to the exclusion of adequate consideration of public relations. These are equally important in the problems of generation, transmission and distribution. In reality, public relations matters deserve the best talent in the industry, without theorizing and speculation, and with the production of results by good common-sense methods.

The public utility in a community is engaged in a business just the same as every other commercial enterprise in the community. The public has been educated to the average retail merchant's methods of doing business, and if an attempt is made to consider the public utility business upon a different basis, the public naturally opposes the idea and will join in an effort to place utility service upon the ordinary plane of transactions. Although there are essential differences between public utility service and the grocery or the hardware business, there are also many elements in common which should be recognized. If these common elements are recognized by the public utility, the public will then more nearly accord the utility the treatment it gives other enterprises. The avoidance of complications in handling complaints, undue routine and emphasis upon theoretical elements in dealing with the public, so far as possible, will be most helpful. Although the public utility is a natural monopoly with its attendant advantages and disadvantages and as such is subject to governmental regulation, these differences over ordinary business can be explained by common-sense publicity with a groundwork of fair dealing. Let the utility meet the public and inform the latter regarding its business as freely as other merchants, striving to get rid of annoying methods which the public does not understand or appreciate.

The monopolistic character of public utilities is perhaps the greatest single feature which has given rise to discord in public relations. A person becoming dissatisfied with the public utility has no other source to which to look for his service. He may become dissatisfied with a retail merchant and go across the street to his competitor; then in turn he may again become dissatisfied and go back to the first merchant. With the average citizen we know that this changing about is constantly occurring. The dissatisfied public utility customer is resentful in many cases because of the absence of an alternative source of supply, and this imposes an additional responsibility upon the utility to maintain a good public relationship. It places requirements upon us which are more severe than the average business experience, but this does not relieve us from meeting the situation face to face if we are to keep the good will of our patrons.

It is scarcely necessary to state that one of the primary requirements for maintaining satisfactory public relations is that the broad general policy of the utility shall be one of absolute fairness, sincerity and co-operation. This is true of any business enterprise. With a utility it is much more essential that its business shall be conducted along broad-minded lines of fair dealing in order to counteract antagonism to the existence of a monopoly. We in the industry know that at the present time practically all utilities are conducted upon this basis. There has been a change in the attitude of all business enterprises in the past twenty years in this respect. The permanently successful business enterprises are indeed those which desire a square deal alike for themselves and for their patrons and which refuse to take advantage of conditions that in some cases might appear to be temporarily profitable though open to objection from the public relations standpoint.

"Service" a Widely Inclusive Matter

That good public relations depend on satisfactory service is axiomatic. The term "service" should be considered in a very broad sense. It is too often considered as applying only to voltage and continuity of supply. It should be extended in all cases to include the attitude of the utility representatives, their treatment of the public and their general conduct. A retail establishment, selling good material and not misrepresenting it, might in a narrow sense be selling satisfactory service, but in a broad sense the service to be satisfactory requires a congenial atmosphere and one conducive to the attraction of business to the establishment.

The voltage on the lines of a public utility may be held within reasonable limits and there may be no service interruptions, but satisfactory service from the public relations viewpoint includes also an attitude of officials and employees which makes the public glad to do business with the utility and certain of the justice which will be accorded individual complaints. It is a profitable thing for a utility to check this carefully and see whether its representatives are enthusiastically "boosting" the company and exhibiting faith in its honesty and integrity. If in any case such is not the situation, the fact is bound to be seriously reflected in the public relations of the company.

CONSTRUCTIVE COMPLAINT BEST SUGGESTION

Complaints, so closely identified with service matters, should not be regarded as something unusual or to be shunned. Constructive complaints received offer a company its best opportunities to remedy defects in service. Assumption by a company that no or very few defects exist is most likely to be made by a utility most seriously in need of improvement. All representatives should be trained to investigate complaints thoroughly, not merely to satisfy the customer temporarily, but to remove the cause of complaint so that the general service may be improved and the opportunity for the repetition of defects eliminated. They can only be trained in this attitude by first placing them in a proper frame of mind as to their own relationship to their employer.

Another fundamental element in good public relationship is the acquaintanceship which the representatives of a company have with the consumers personally. The average retail merchant depends for a large part of his patronage upon his personal friendship with the people whom he serves. The public utility should take every means to become acquainted with its customers, not by forced methods, but through the idea of co-operation in both business and personal ways. To defer the making of friends until the need for them arises is a serious mistake; no other business can be conducted successfully upon that basis, and neither can a public utility. Personal friendship between utility employees, officials and the public enables the company to keep in touch with popular feeling and to anticipate complaints to a greater degree than by any other method.

TELL THE PUBLIC ABOUT THE UTILITIES

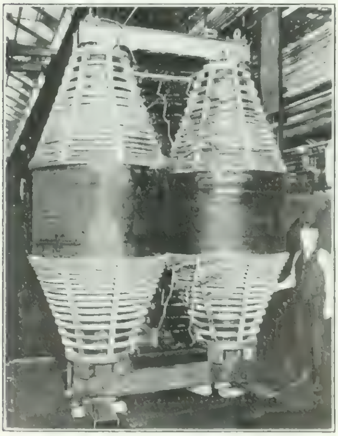
Another phase of public relationship which has received much attention lately, but no more than it deserves is the spreading of general information regarding the public utility business. The elements of difference between this and ordinary business should be explained so that the average citizen will understand the public utility business as fully as he does the grocery or hardware business. The utility should not wait until an emergency arises in its public relations to explain these matters, but should consistently and thoroughly every day of its existence take every opportunity to explain details of commission regulation, the meaning of load factor, of off-peak service, etc. It should explain why it has a monopoly and how the public benefits by this fact. It should also explain to the public the efforts it is making to maintain service under adverse conditions, to increase its plant capacity to keep up with the demands, and should repeatedly call the public's attention to the vital part it is playing in the city's development and the need of the public for its service.

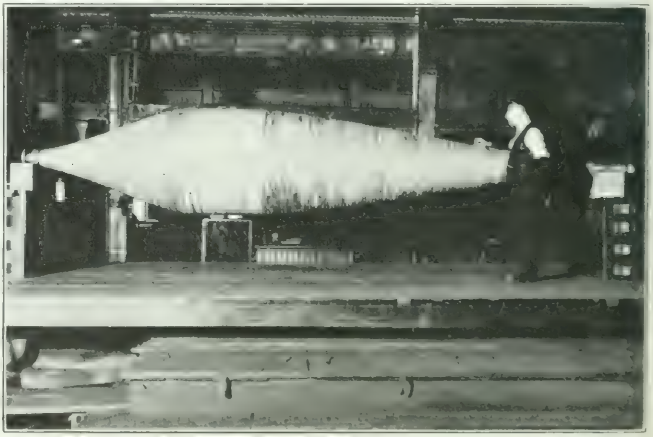
If the public can be brought to understand thoroughly the public utility business as it understands most lines of business, and if the utility will then follow the same line of procedure which the average successful business man follows, it will be in the best possible position to meet an emergency in its public relations and under most conditions need have little to fear from this source.

Million-Volt Transformer with Bushing 19 Ft. Long

A 1,000-KVA., 1,000,000-volt transformer is being built by the Westinghouse Electric & Manufacturing Company for the experimental laboratory at Trafford City, Pa. The accompaning illustrations show its relative size, but they do not indicate the immensity of the transformer. In the windings there are nearly 70 miles (112 km.) of wire. The transformer is built on the principle of distributing electrostatic stress as developed by C. L. Fortescue of the Westinghouse Company seven or eight years ago.

The terminal bushing is the largest ever built in the Westinghouse shops. Special machines had to be fitted to turn the bushing on this account. Its length is 19 ft. (5.7 m.) and it is 41½ in. (104 cm.) in diameter. The static shield will be 10 ft. (3 m.) in diameter and 20 in. (50 cm.) deep. The bushing will weigh about 9,000 lb. (408 kg.) when completed.





WINDINGS AND TERMINAL BUSHING OF 1,000,000-VOLT TRANSFORMER

Inductive Interference as Seen by the A. R. A.

Railway Men Overlook the Result of Communication or Telegraph Circuits Being Equipped with Apparatus Which Is Unduly Susceptible to the Influence of Power Circuits

A REPORT recently submitted by the inductive-interference committee of the American Railway Association includes among other things a description of the causes and effects of inductive interference as seen from the viewpoint of the railway industry. The report of the committee, which has been accepted for submission by letter ballot for inclusion in the manual of the association, will be interesting to central-station men. In analyzing it the reader should keep in mind the attitude with which the discussion has been approached. It is that the interference is entirely a problem created by the presence of the power circuits. Although this is true in a sense, since there would be no problem if there were no power circuits, the angle not considered in the discussion is the situation that may result if the communication or telegraph circuits are equipped with apparatus that is unduly susceptible to the influence of the power circuits with which they may be parallel. This is a phase of the inductive-interference problem that is receiving increasing attention and should be fully carried in mind in any study undertaken. What this factor may amount to is a question that only future study can answer. The first section deals with the theory of inductive interference and is not reproduced here, but the second section follows:

Causes and Effects of Inductive Interference

Inductive interference as considered in this report is understood to mean detrimental inductive effect on telegraph and telephone circuits caused by adjacent power circuits or systems. The effect is to impair or destroy the service in the communication circuits affected and in the most severe form may also be responsible for damage to property, personal injury or loss of life. Apart from the personal injuries which may be the immediate result of an acoustic shock, sometimes called a "bat in the ear," received by the exchange operators, dispatchers and others using the circuits, or of shocks received by the linemen or maintainers working on the circuits, there is a certain demoralizing effect on the service caused by fear of a possible repetition of these abnormal conditions.

Inductive interference from telegraph circuits or telephone circuits (metallic or grounded) may also exist with parallel communication circuits. If either the circuits which produce the interference or the circuits affected are metallic, the interference can be reduced by suitable transposition schemes, which are covered by specifications of sub-committee D (transpositions) of committee No. 1 (construction and maintenance, outside plant).

Inductive interference with telegraph and telephone circuits may be caused by either the normal operation of the adjacent power circuits or abnormal conditions which may occur as a result of short circuits, grounds or opens in the power circuits, switching operations, electrolytic lightning arrester charging, or sudden changes in the power load.

Inductive disturbances may be of a most serious nature, and the railroad companies are unable by themselves to cope with the problem of protecting their lines and service against them. In order to make this more clear, some of the fundamental characteristics of telegraph and telephone service are reviewed briefly, together with some of the distinctive features of the plant which are required to make this service possible.

The fundamental technical problem of telephony is threefold—(1) the production of an electrical wave which is a faithful copy of the spoken word; (2) the transfer of this wave without appreciable delay over distances which may amount to hundreds or thousands of miles without excessive change of form by distortion, without the accession of foreign disturbances and without undue loss of intensity; (3) the production at the receiver of an audible sound wave which is an adequate counterpart of the electrical wave and therefore of the original spoken word.

As speech is carried on telephonically by means of an extremely small amount of energy, it is necessary that a large part of the telephone plant be of a sensitive and delicate construction. This includes the telephone sets where occur the delicate transformations from air wave to electrical wave and vice versa.

A large proportion of these telephone sets cannot be located at central points where they would be under the constant supervision of maintainers, but must be placed at outlying points.

Telegraph systems, transmitting electric impulses according to a signal code, have the same fundamental problems of faithful reproduction of signals and operating on small energy with delicate apparatus.

From this brief consideration of the communication problem, showing that a large portion of the telegraph and telephone system is inherently of a delicate nature and susceptible to interference, it is clear that communication apparatus circuits would be destroyed if but a small fraction of the powerful currents and voltages used by other electric utilities were permitted to enter into the telegraph or telephone system.

CLASSES OF INTERFERENCE

The interference may manifest itself in the railroad telegraph and telephone plant in the following ways:

1. Interference with operation:
    - (a) Interruption of service.
    - (b) Noise.
    - (c) Interference with telegraph communication.
    - (d) Interference with telephone signals.
2. Physical injury to plant; e.g., fire hazard, damage to apparatus or protective apparatus.
3. Hazard to employees:
    - (a) Electric shock.
    - (b) Acoustic shock.

Interruption of Service.—Induced voltages may be high enough to operate the protective devices and, if the current across the protector is sufficient, the line will become permanently grounded and the communication service interrupted until the protector is restored to normal condition. If the protector is located in an exchange, the time required to make repairs is relatively short, but if it is at an outlying point considerable time may be required for a repairman to reach that point. In cases where the operation of the protector does not actually ground the line, it may lower the insulation resistance sufficiently to make the line noisy.

In order to appreciate the effect of small currents in producing noise in telephone circuits, it must be considered that a very small fraction of a microwatt of power at voice-current frequencies will produce an audible sound in a telephone receiver, and a few microwatts are sufficient for a telephone conversation in a quiet place. When the current in the telephone receiver caused by induction from an outside circuit is large enough to produce an audible sound it has an important effect on the efficiency of the circuit for transmitting speech, particularly when the circuit is used for talking over long distance so that the energy of the voice currents approaches the minimum which will give a satisfactory conversation. An extraneous sound which is scarcely audible to an untrained ear and might be thought to be of negligible consequence frequently may have the effect of seriously impairing a telephone circuit, or, otherwise expressed, of destroying a material part of the value of the circuit, for service.

The interfering effect of foreign current of a given magnitude depends very largely upon the frequency. The maximum effect on telephone conversation is for current having a frequency of about 1,100 cycles per second. At lower frequencies the effect falls off rapidly and at 25 cycles is probably only about one two-hundredths as great as from 1,100 cycles. If noise is caused, it is due to the higher harmonics of the 25-cycle and 60-cycle currents and voltages. Owing to the lower fundamental frequency, 25-cycle power systems produce relatively smaller noise effects than 60-cycle systems. Noise from power circuits is liable to become especially serious under any conditions which produce a bad wave shape in the power circuit.

Interference with Telegraph Communication—Interference with telegraph circuits is greatest at frequencies of the order of 10 to 100 cycles per second; thus at 25 cycles an induced current of the order of 1 milliampere is liable to reduce the efficiency of ordinary Morse transmission, while rapid telegraph systems, printers, etc., are more or less impaired by even smaller extraneous currents. Serious interference is also encountered from 60-cycle and, in some cases, from 180-cycle induction. Harmonics higher than 180 cycles, in general, have little effect upon the telegraph circuit.

Interference with Telephone Signals—Interference with telephone switchboard signals or false ringing of telephone bells may be caused by abnormal conditions, such as short circuits, grounds, etc., existing in the adjacent power system. These conditions are not usually produced under normal operation.

Fire Hazard—The use of heavy insulating coverings for wires in telegraph and telephone switchboards is impossible on account of the necessity of bringing many wires within a limited space. It is not feasible to employ for this purpose such insulation as is considered good practice for electric light and power wires, nor is it necessary under normal operating conditions. Thus it is unavoidable that the dielectric strength of the telegraph and telephone wiring be relatively low.

Investigation of the fire hazard due to foreign voltages impressed on telegraph and telephone lines indicates that voltages of 200, or even less, when backed by considerable power, as in the case of induced voltages from an alternating-current system, may create a fire hazard. Fire hazard is reduced by the proper installation and maintenance of inside wiring in accordance with recommendations of committee No. 2 (construction and maintenance inside plant) and of protective apparatus in accordance with recommendations of committee No. 4 (protection against lighting or electric light and power circuits).

Electric Shock—At times of short circuits on the power circuits and sometimes during switching operations electrical surges may be set up in the communication circuits which are of sufficient intensity to produce electrical shocks to persons using or working on the circuits at the time. While it is unusual that such shocks will be the cause of serious personal injuries, even minor shocks are objectionable.

Acoustic Shocks—Inductive surges that are capable of producing electric shocks to persons also are liable to cause loud noises in the telephone receivers which may result in acoustic shocks to persons using the telephone at such times.

BALANCED AND RESIDUAL VOLTAGES AND CURRENTS

In analyzing inductive phenomena it is advantageous to classify power circuit voltages and currents under two general heads:

1. Balanced voltages and currents; that is, those which are balanced or symmetrical with reference to the earth.
2. Residual voltages and currents; that is, those which are wholly unbalanced with reference to the earth. The circuit of the residual voltages and currents is composed of the metallic circuit conductors as a group, constituting one side, and the earth (including grounded conductors), constituting the other side.

At every instant the algebraic sum of the balanced currents and likewise of the balanced line voltages is zero. Hence, at any instant the algebraic sum of the currents in the line conductors is the residual current, and similarly, the algebraic sum of the voltages to earth of the line conductors is the residual voltage. For example, in an ordinary railway circuit, consisting of overhead trolley wire and grounded rail return, all the voltage and current are residual.

There is no definite relation between these two classes of voltages and currents, and different means usually have to be taken in counteracting their respective inductive effects. In general, the residuals cause more inductive disturbance than the balanced components, as the residuals are all in phase and their effects are cumulative, whereas the induction from the balanced voltages and currents in one conductor is partially neutralized by the induction from balanced components in each other conductor of the circuit. Also, the residuals frequently contain a larger proportion of harmonics than the balanced components, and this is another reason why they are likely to cause more disturbance, particularly to telephone circuits.

PRINCIPAL FACTORS IN DETERMINING INTERFERENCE

A general statement of the principal factors which determine the amount of induction and whether it is sufficient to constitute interference is as follows:

Length of the Parallel.—Other things being equal, the longer the parallel the greater the interference.

Separation of the Two Classes of Lines.—In general, other things being equal, the less the separation of the power line and communication line the greater the induced voltage.

Configuration of the Power Line.—The investigations of the California Joint Committee on Inductive Interference show that the configuration of the power line has an important bearing on inductive effects, the relative merits of different configurations varying with the separation between the power and communication lines, the spacing of the power conductors and the relative importance of balanced voltages and currents. While it is not possible to draw a simple general rule for determining the most advantageous configuration, the differences in particular cases are marked and deserve special attention, as oftentimes substantial benefit can be secured in this way at small additional cost. This is particularly true of multiple circuit power lines, the resultant induction depending largely on the relative poling of the power circuits.

Voltages, Currents and Frequencies of Power Circuits.—The effect of electric induction is proportional to the voltage of the power line, and that of magnetic induction to the current in the power circuit. Induced currents are usually, for both cases, approximately in direct proportion to the frequency.

Magnitudes of Residual Voltages and Currents—The residual voltages and currents are a principal cause of inductive interference. Hence, while the amount of residuals on metallic circuits is usually small as compared with the balance components, the inductive effects of the former are liable to preponderate.

The effect of wave shape on interference, particularly to telephone circuits, is exceedingly important. Wave shapes in practice on different power systems are found to have extremely wide variations. An unfavorable wave shape—*i e*, one having a large proportion of high harmonics—may make the telephone circuit inoperative, whereas the fundamental frequencies would have little or no effect.

A meter for measuring directly the telephone interference factor of power circuit voltage waves has been developed. When connected to power apparatus or circuits, this instrument gives a reading which is approximately proportional to the interfering effect of the voltage wave when acting by induction on telephone circuits, other conditions remaining fixed. Articles on the design and application of this meter have appeared in the publication of the American Institute of Electrical Engineers.

UNBALANCE OF METALLIC COMMUNICATION CIRCUITS

Such unbalances are caused by inequalities in resistance or inductance of conductors and insulation resistance or capacitance to ground. The inductance and capacitance are balanced approximately by transposing the conductors. The other elements enumerated require proper design, construction and maintenance of these lines, whether in open wire or in cable, together with their connected apparatus. The following factors are of great importance in determining the amount of noise produced in telephone circuits by voltages induced between wires and ground: high resistance joints, broken or dirty insulators, low insulation resistance, defective cable terminals, contact with trees, etc.

The sensitiveness of the terminal apparatus is an important factor in determining the allowable amount of induction. Also, if the parallel is at a considerable distance from either terminal of the communication circuit, the induced voltages and currents may become considerably attenuated before reaching the receiving instruments. Prospective developments as well as present conditions must be given consideration.

The voltage and currents of power circuits under abnormal conditions, which are liable to be largely residual in character, produce the most severe inductive effects. The values of these quantities under abnormal conditions, in relation to corresponding values under normal conditions, vary a great deal on different power systems.

NUMBER OF PARALLELS WHICH MAY AFFECT COMMUNICATION CIRCUITS

In many cases the same communication circuit, especially if it be on a long trunk line, may be involved in a number of different parallels. In such cases the induction contributed by each parallel must be sufficiently restricted so that the cumulative results from all will not produce disturbances which cannot be endured.

Importance and Character of Use of the Communication Circuit.—It is obvious that the more important circuits on which interference is most serious should be afforded a higher degree of immunity from disturbance than circuits of less importance. The character of the communication circuit, as, for example, whether it is a telephone or telegraph circuit, is of fundamental importance in considering the question of inductive interference.

Volume of Transmission of the Communication Circuit.—In case of a long-distance telegraph or telephone circuit, where the volume of transmission is small, a less amount of extraneously induced current will interfere with receiving than on shorter circuits where there is a large volume of transmission.

Relative Cost of Preventing Interference.—While in all cases means should be employed which will allow adequate communication service to be given, still it is not expected that complete freedom from inductive disturbance can be obtained. Any induced voltage, no matter how small, will generally cause some impairment of service. The amount of induced voltage which it is justifiable to allow depends to some extent on the difficulty and expense involved in further reducing such voltage. After the foreign voltage has been reduced to an amount which can, if necessary, be tolerated, it becomes simply a problem of balancing the value of further improvement against its cost.

It will be seen that the number of elements affecting inductive interference is quite large. Moreover, some of these elements—for example, the wave shapes of the power circuit voltages and currents—are not ordinarily known and have induction-producing values varying enormously in different cases. Hence there is difficulty in formulating any simple method of determining in advance whether a given construction will or will not produce interference.

More Than 20,000 Cu.Ft. of Water for Every Ton of Coal

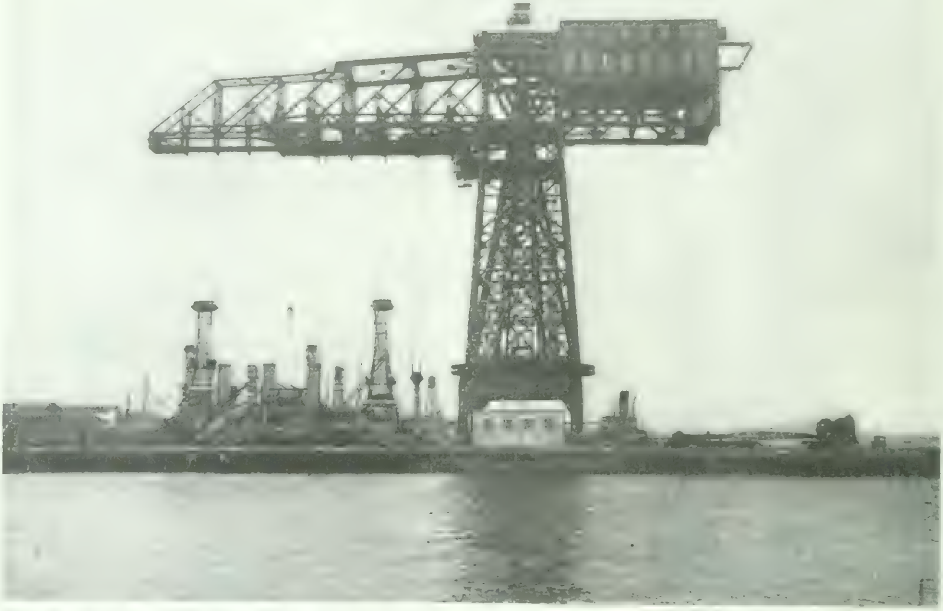
MOST persons, and even many officials of power companies, believe that coal is the big commodity the power company has to handle. The large stockpiles and the machinery installed for handling are things which make a decided impression on the public, and the amount of the coal bills paid by the companies makes the officials and stockholders realize the great quantities of fuel required. Unfortunately, however, the quantity of coal handled is far from being the biggest thing. The supply of circulating water is a much larger undertaking. A good central station will evaporate about 8½ lb. of water per pound of coal burned, so that the quantity of boiler-feed water handled is many times that of the coal used. However, as the steam is condensed and then returned to the boilers for re-evaporation, the quantity of feed water required to keep the plant in operation is comparatively small, being only that needed to make up the losses by leakage, etc. Now, with the vacuum maintained in the average modern station averaging within less than an inch of the barometer, the quantity of circulating water required will be about seventy-five times the weight of the steam to be condensed. Therefore for every pound of coal burned under the boilers the station needs about 640 lb. of circulating water; and, moreover, this water cannot be very warm or the vacuum will be impaired, thereby reducing the output of the station. The water should be reasonably clean and must be free from foreign matter such as acids, which would destroy pump runners, condenser tubes and similar apparatus.

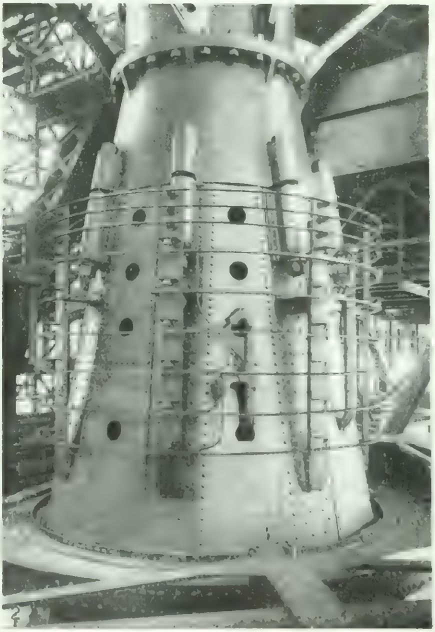
Take a power plant of average size, say one that burns 200,000 tons of coal a year, and it will be seen that its annual water requirement is about 128,000,000 tons, or about 4,100,000,000 cu.ft., that should have at all times a temperature less than 70 deg. Fahr. On many days during the year this station will burn more than 1,300 tons of coal per day and require over 832,000 tons, or 26,600,000 cu.ft., of circulating water each twenty-four hours. Therefore, in determining the location of a large power plant the first requirement to be satisfied is that of an ample supply of cooling water for the condensers.

The next step is reasonable facilities for obtaining, handling and storing fuel. Where both these conditions cannot be fully satisfied a study of the economics of the situation will usually determine that preference should be given to the circulating-water supply. Unfortunately, the mining regions are lacking in the needed water supply and the quality is usually bad; therefore until other methods are found for converting the heat energy of the coal into the form of electrical energy it is doubtful whether any large power plants will be built at the mouth of the mine or alongside very large culm piles.

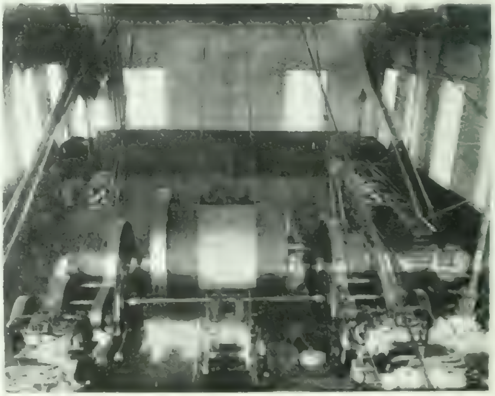
This information was furnished by I. E. Moultrop, assistant superintendent Construction Bureau, Edison Electric Illuminating Company of Boston.

There Are Few Operations Which Cannot Be Electrified Advantageously





IT IS NECESSARY only to look around any progressive industrial plant, ship or railroad terminal or similar place to get an idea of the many ways in which electricity has been applied to make material handling less expensive in time and labor. The surprising thing is that there is not a more general application of the material-handling equipment which has been tried and proved economical. One way in which to correct this condition is for every manufacturer who makes this equipment and every central-station power sales engineer and consulting engineer who recommends it to take aggressive steps to disseminate broadcast the experience of those who use it.



In the accompanying illustration is shown what may be considered a unique installation, but it indicates that practically no material handling process exists which cannot be electrified advantageously. This installation, which consists of a hammerhead crane at League Island Navy Yard, Philadelphia, has been in satisfactory operation for several years. It is rated at [illegible] gross tons and has a radius of operation of 115 ft. The contact rings that collect current for the operating equipment at the base of the crane are shown at the left and the hoisting mechanism at the right. Electrical control and safety devices perform a very important part in the operation of this gigantic crane.

Determination of Line-Loss Expense*

Can Be Based on Equivalent Hours of Peak-Load Usage—Method of Applying to a Specific Case—Corrections for Special Conditions—Range of Values for Equivalent Hours

By P. O. REYNEAU† and H. P. SEELYE

IN ORDER to design a line for the transmission of electrical energy it is necessary to consider the total yearly cost of the energy losses in relation to other costs. Usually it is convenient to obtain the energy losses per year in terms of the load carried. By "load carried" is meant the peak load for the year, since it is for that load that the size of the wire and transformers must be determined. Since the energy loss over a line is dependent on the square of the current at any time, it is evident that the total loss is not proportional to the load factor because the load factor is determined from the average load and hence involves only the first power of the load at any time. The computation of total energy loss in terms of peak load must be based on the square of the loads at any time. For this purpose it is therefore convenient to determine for each of the various classes of load considered a quantity called the "equivalent hours."

"Equivalent hours" may be defined as "the average number of hours per day which it would be necessary for the peak load of the year to continue in order to give the same total energy load as that actually given by the variable load throughout the year." It is a quantity which, if multiplied by the loss at peak load on any line, gives the average loss per day over the year. If this average daily loss is then multiplied by 365 the total yearly loss in kilowatt-hours is obtained. This multiplied by the cost of energy per kilowatt-hour gives the annual cost of energy loss. It is evident that if the equivalent hours for any load and the peak demand of the year are known the total yearly cost for losses would be $I^2R \times t \times 365 \times C_e$, where I is the current at peak load, R is the resistance of the circuit, t is the equivalent hours, C_e is the cost of energy per kilowatt-hour. The quantity, equivalent hours, is also of use in determining the cost of energy per kilowatt-hour, since the cost of energy losses is a component of that cost.

If the characteristic curve for any type of load were available for a whole year, the sum of the squares of the current for each hour taken from that curve times the resistance of the conductor would give the total yearly loss in watt-hours. This, however, would be a tedious computation and in most cases impracticable. It is usually sufficiently accurate to obtain characteristic curves for each month, or at least a typical charteristic curve applicable to any month with allowance for the variations in the peak from month to month.

EXAMPLE OF APPLICATION

An example of an actual calculation of equivalent hours on residence lighting circuits will indicate a method which can be followed in such computations. The characteristic variation of the load on a residence lighting circuit from month to month was obtained from the following table of maximum current readings for each month during one year on twelve typical circuits in various districts and with various loads:

MAXIMUM CURRENT READINGS ON TWELVE TYPICAL RESIDENCE CIRCUITS (AMPERES)

Circuit	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	190	180	180	175	160	135	120	125	160	175	180	195
2	200	180	175	165	145	140	110	130	200	195	205	210
3	175	165	150	140	120	125	90	115	160	165	180	185
4	185	175	180	150	140	140	105	130	175	185	200	210
5	155	155	155	150	135	130	100	130	160	175	180	195
6	150	140	135	125	110	100	90	80	120	135	150	150
7	245	225	210	200	190	180	120	140	225	245	285	285
8	235	225	225	210	200	185	150	205	250	280	280	280
9	225	225	215	225	175	175	135	170	215	235	240	250
10	185	185	185	175	150	140	130	140	170	185	225	240
11	125	120	115	110	105	105	90	100	120	125	135	150
12	130	120	110	105	100	100	85	100	125	135	145	130
Total	2,200	2,095	2,035	1,930	1,730	1,645	1,325	1,565	2,080	2,235	2,405	2,480
Average of the 12	183	175	170	61	144	137	111	130	173	186	200	207

The curve on page 772, plotted from the above average values, indicates clearly the variation of the monthly peak loads on a typical circuit. Since the peak for the year occurs in December, the peak for any month may be expressed as a fraction of this yearly peak as follows:

Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
0.884	0.845	0.820	0.778	0.695	0.662	0.536	0.628	0.83[illegible]	0.898	0.965	1.000

Hence, for example, the maximum current for February equals .845 multiplied by the maximum current for the year, etc.

For convenience the I^2R loss for any month may be considered equal to the loss for a typical day in the month times the number of days in the month, since the variation of load from one month to the next is not enough to warrant more detailed computation. The I^2R loss in a feeder for any one day would be very nearly equal to the sum of the squares of the current readings for each hour during the day multiplied by R. For a great part of the day, however, the load on a lighting circuit is very light, the heavy load and hence most of the loss occurring within a few hours in the evening. By adding the squares of the hourly current readings throughout a day and dividing by the square of the maximum current for the day a figure is obtained which represents the number of hours for which the peak load for the day would have to be carried steadily to produce the same I^2R loss.

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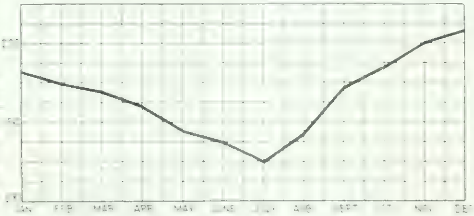
*Fourth installment of a series on Distribution Economics; see ELECTRICAL WORLD, Feb. 5, 1921, p. [illegible]; Jan. 15, p. 146, and March 26, p. 702.

†Distribution engineer, Detroit Edison Company.

For a strictly accurate calculation, enough data should be available to determine the shape of the load curve on a typical circuit for one typical day for each month in the year. If this is not possible, however, a fairly accurate approximation may be arrived at if the load curves for only one or two months are available.



AVERAGE OF MONTHLY MAXIMUM LOADS ON TWELVE TYPICAL RESIDENCE CIRCUITS

If the equivalent number of hours at peak load for a typical day for these months is determined the equivalent hours for the other months may be calculated more or less accurately by making them proportional to the number of hours between sunset and about 10 p.m., allowing a little additional time in the winter months for the morning lighting peak. The figures obtained in the present case for these monthly equivalent hours at peak load will be found in the second column of the accompanying table.

The loss for any day in a month is proportional to the square of the maximum current for the day multiplied by the equivalent hours per day at peak load as obtained above. Therefore, if it is assumed that the average daily peak will be 95 per cent of the peak for the month, the loss for the day considered is proportional to the square of the maximum current for the month multiplied by $(.95)^2$ multiplied by the equivalent hours per day at daily peak load as determined above. The monthly peak, however, is equal to a certain fraction of the yearly peak as shown before, hence the loss for this day in terms of the yearly peak is proportional to the maximum current for the year, squared, multiplied by this fraction for the month, squared, multiplied by $(.95)^2$, multiplied by the equivalent hours per day at daily peak load. If this figure is multiplied by the resistance of the circuit, R, the actual loss is obtained. For example, the equivalent hours per day in terms of daily peak load as determined for February are four and one-half. The peak for February is .845 of the yearly peak. Hence, for a typical day in February the I^2R loss equals (yearly maximum current)^2 × $(.845)^2$ × $(.95)^2$ × 4.5 × R.

The total yearly loss would be the sum of the daily losses thus obtained. An average of the figures for each month would then give the average loss per day. Since the quantity (yearly maximum current)^2 × R is the loss due to the yearly peak load, the average number of hours per day which that load must continue may be obtained by averaging the other factor entering into the computation of average daily loss in terms of yearly peak. These are the quantities (equivalent hours per day at daily peak load) × $\left(\frac{\text{monthly peak}}{\text{yearly peak}}\right)^2$ × $(.95)^2$ as determined for each month. The resulting average is the value of "equivalent hours" for that load.

The following table shows the data worked out from the example of residence lighting considered:

Month	1 [illegible]	2 [illegible]	3 [illegible]	1x3
[illegible]	5	[illegible]	[illegible]	[illegible]
[illegible]	4	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	2	[illegible]	[illegible]	[illegible]
[illegible]	2	[illegible]	[illegible]	[illegible]
[illegible]	1	[illegible]	[illegible]	[illegible]
[illegible]	2	[illegible]	[illegible]	[illegible]
August	2	[illegible]	[illegible]	[illegible]
September	3	[illegible]	[illegible]	[illegible]
[illegible]	4	[illegible]	[illegible]	[illegible]
November.....	5	0.965	0.931	[illegible]
[illegible]	5	1 [illegible]	1 [illegible]	[illegible]
[illegible]				[illegible]
Average				[illegible]

[illegible]

The preceding indicates that for the example used of purely lighting load the total loss for the year will be the same as if the peak load were carried 2.27 hours per day through the year.

Under certain conditions the preceding figures must be corrected, because actual loads on circuits were used and no allowance was made for the normal increase which might be expected on lighting load due to additional customers, the increased use of current by old customers, etc. For example, if distribution transformers are kept loaded nearly to capacity, new installations would care for the yearly increase and each individual transformer would show nearly the same load from year to year. In case the annual rate of increase is known, a correction can be applied to the figures given for each month to reduce it to the same maximum load for the year. In the example given the average yearly increase over a number of years was found to be 20.3 per cent, or 1.69 per cent per month. Assuming December as the yearly peak, the ratio of the peak for each month to the yearly peak was corrected by a proportional part of the yearly increase, *i.e.*, for November it was increased by 1.69 per cent, for October 3.38 per cent, etc.

The preceding figures indicate that the actual corrected peak for the load considered is in January, but not enough difference will be introduced to necessitate a revision of the figures to that basis. If the equivalent hours are computed on the basis of the ratios given a new figure may be obtained for a loading with no yearly increase. In this case the equivalent hours thus corrected are computed to be 2.65 instead of 2.27 as determined for actual loading, with a yearly increase.

A further correction may be applied if, as in the case

	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	July	Aug.	[illegible]	[illegible]	[illegible]	Dec
* Monthly ratio..........................	0.884	0.845	0.820	0.778	0.695	0.662	[illegible]	0.628	0.835	[illegible]	[illegible]	[illegible]
[illegible]	1.177	[illegible]	[illegible]	1.126	1.119	1.102	[illegible]	1.068	[illegible]	1.034	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	0.876	0.778	0.729	0.581	0.571	0.878	[illegible]	[illegible]	[illegible]

$$\text{M[illegible]} = \frac{\text{peak load for month}}{\text{peak load for year}}$$

of transformers, the full load capacity is to be used in studying losses rather than the actual load carried. If, for example, on the above circuits the transformers were carrying, on an average, 89 per cent of their full-load capacity, the equivalent hours based on connected capacity would be $2.65 \times (.89)^2 = 209$. That is to say, the year's loss in energy would be equal to the full-load current on the transformer carried 2.09 hours per day throughout the year.

The subject of equivalent hours should be carefully studied and as accurate figures as possible obtained for various classes of load. The values will vary, naturally, for different sections of the country as well as for different localities in the same section or on the same system. The habits of a community, as to hours of rising and retiring, etc., will affect the value for lighting loads. On power loads, of course, the nature of the industry will be a controlling factor. In general, for the cases coming within the experience of the writers, the values lie within the following ranges: Power load, from none to ten equivalent hours; residence lighting, from two to three equivalent hours; store lighting (small), from two to three equivalent hours; store lighting (large), two to five equivalent hours, and street lighting, five to ten equivalent hours.

Commercial Electric Trucks in New York City

Metropolitan District Accounts for 51 per Cent of Electric Street Trucks in Use in 1920—Vast Field for Development

NEW YORK CITY has adopted the commercial electric truck to no small degree. On Jan. 1, 1921, there were 52,128 electric trucks registered in the metropolitan district, which includes Greater New York and contiguous districts and cities in New Jersey and Westchester County. This is more than half the number of electric trucks registered in the remainder of the United States. Fig. 1 shows how the commercial electric truck has forged its way to the front in the larger cities of the country. It appears from these figures that more than 97 per cent of all the electric trucks in use are confined to cities east of the Rocky Mountains. Fig. 2 shows the increasing relative importance of original as compared with repeat orders. In 1920 there were eighty-six purchasers of electric trucks in the boroughs of Manhattan and the Bronx, of which fifty-two, or 60.4 per cent, were repeat orders. The eighty-six purchasers bought 536 trucks, of which 461, or 86 per cent, were purchased by companies formerly the owners of electric trucks.

The rapid disappearance of the draft horse in the boroughs of Manhattan and the Bronx is clearly defined in Fig. 3. During the two-year period from 1917 to 1919 the number of horses decreased by almost 30 per cent. On the other hand, the number of electric trucks increased by about 16 per cent in this period. A large portion of the displaced horse traffic was, of course, taken over by gasoline-driven trucks, but the figures clearly indicate the decreasing use of the draft horse in large cities and the consequent growth in the field of gasoline and electric trucks.

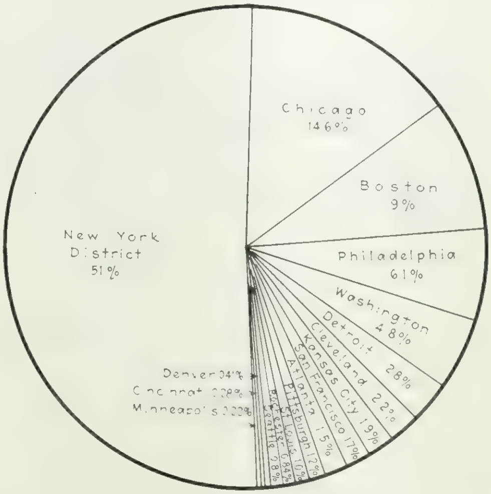


FIG. 1—DISTRIBUTION OF ELECTRIC TRUCKS BY CITIES

That the commercial electric truck is still only in its infancy is indicated in Fig. 4. Taking the United States as a whole, the possible field of development has hardly been touched as yet. It is only natural that the field of greatest electric truck sales activity should at first be confined in large part to the concentrated commercial areas, such as the metropolitan districts of New York and Chicago. As the electric truck proves its worth in these districts it will begin to become a real competitor of the gasoline truck in the less concentrated commercial areas.

The accompanying diagrams were developed by Charles R. Skinner for the Automobile Truck Bureau of the New York Edison Company.

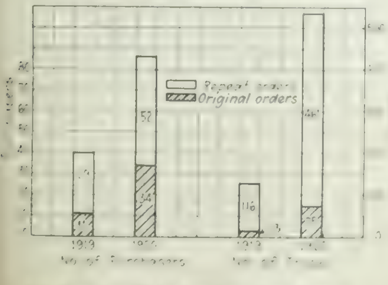


FIG. 2—NUMBER OF ORIGINAL AND REPEAT TRUCK ORDERS.

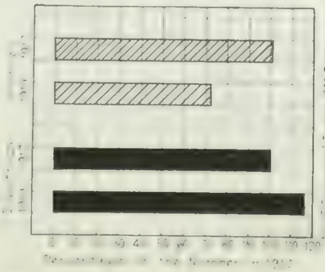


FIG. 3—DECREASING IMPORTANCE OF HORSE-DRAWN TRUCKS.

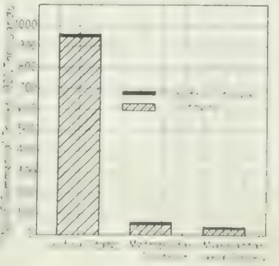


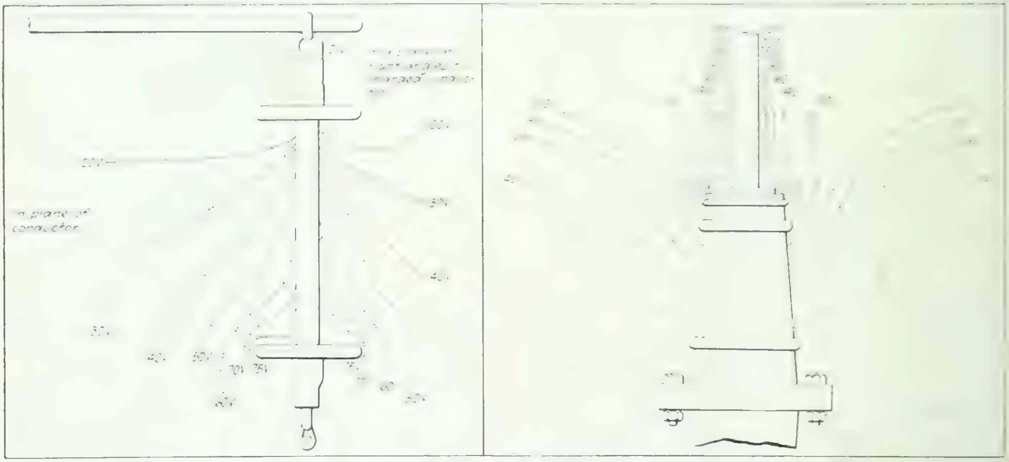
FIG. 4—LARGE FIELD FOR DEVELOPMENT OF ELECTRIC TRUCK

Measuring Potential Distribution Around Insulators

Water Is Sprayed Over Insulator and the Electric Field Is Explored in the Spray Method Developed in Sweden

By Albert P. Strom
Stockholm, Sweden

A NEW method of measuring the potential distribution over the surface of an insulator and charting the equipotential surfaces in the surrounding air has been developed by Harold Norinder of Upsala, Sweden. The principle of this method is an application of a method of measuring potentials in air which was used by him, in previous researches for the Swedish Water Power Board, in an investigation of the electric field in air during thunderstorms. In the determination of the characteristics of a particular type of insulator it is naturally of great value if one can in some way determine the form of the electric field surrounding the insulator. It is true that the potential distribution may be calculated, but this is a difficult operation and requires too much time for practical application. While the method has been used only for low voltage thus far, it appears to be suitable for high-voltage measurements as well.



POTENTIAL DISTRIBUTION ABOUT INSULATOR UNITS DETERMINED BY EXPLORING ELECTRIC FIELD INTO WHICH WATER IS SPRAYED

Mr. Norinder's method is based on the principle of measuring air potentials with movable collectors. Either radioactive or water stream collectors may be used. It is a well-known fact that certain radio preparations will quickly acquire the potential of the atmosphere in which they are placed. The same is also true of a fine jet of water which becomes atomized before reaching the ground. Hence either of these may be used as collectors in exploring electric fields in air. The water-jet method was considered the more suitable for the purpose, and its application is given in some detail here.

An apparatus was constructed by which a fine stream of water was forced through a horizontal nozzle. This was set up so that the stream broke into drops in a vertical plane through the center line of the insulator to be investigated. This stream of water thus assumes the potential of the air at the point at which it is atomized. The nozzle is well insulated and is fed from an overhead supply of water which is also well insulated from the ground. Now, by attaching a static voltmeter, such as a quadrant, electrometer, at points between the nozzle and ground, the potential difference between the water stream and ground may be easily read directly.

By means of horizontal and vertical screw movements on the nozzle the water stream may be moved to any desired point with respect to the insulator being investigated, and by means of suitably attached scales the location of this point on a rectangular co-ordinate plot (containing also a side-elevation drawing of the insulator) may be read directly from the attached scales. A set of curves showing the equipotential surfaces in the air surrounding the insulator may thus quickly and easily be made. Diagrams of equipotential surfaces as obtained by this method are shown.

In the trials thus far made with this method only direct-current voltages of 440 and less have been used. With the proper apparatus and instruments, however, there seems to be no reason why it cannot be used with much higher voltages. There is also nothing to hinder the method being used with alternating voltages, since the electrometer would then read the effective voltage of the point being measured. Thus it is hoped that the method may eventually be used with high-voltage insulators which will be subjected to actual operating conditions.

Another application is the investigation of potential distribution in the air surrounding a house when the building is in an electric field, as is the case during a thunderstorm. This may be done by placing a model of the particular building in an electric field. The distribution of the potential over the surface could then be determined exactly as for an insulator. Such a knowledge of the potential distribution would be particularly useful for lightning protection.

Letters from Our Readers

This is a readers' forum. Comments on questions before the electrical industry presenting economic, financial, engineering or commercial aspects and new or supplementary viewpoints on published articles are cordially invited

Edinburgh Meeting of the British Association for the Advancement of Science

To the Editors of the Electrical World:

The recent meeting of the British Association for the Advancement of Science held in Edinburgh in September is not the first to be held in that historic city. Since the first British Association meeting in 1831 there have been meetings at Edinburgh in 1834, in 1850 and in 1871. Indeed, it is somewhat surprising that the city of Edinburgh should not have enjoyed a greater number of these meetings, because it is eminently well adapted for scientific gatherings of that kind. It is the home of the Royal Society of Edinburgh, a northern rival of the great Royal Society, whose fame is worldwide and whose residence is in London.

The presidential address by Sir T. Edward Thorpe was a remarkably clear and interesting epitome on recent chemical theories of the atom and atomic weight, with particular reference to isotopes. Isotopes are varieties of atoms having apparently the same chemical properties but differing in atomic weight. Thus chlorine has been found by a number of observers to possess the atomic weight of 35.46, on the oxygen standard of reference. "When, however, the gas is analyzed by the same method as that used in the case of neon, it is found to consist of at least two isotopes of relative mass 35 and 37." The belief is indicated that the oft-repeated value of 35.46 is merely a statistical average, and the persistency of this average is perhaps attributable to the fact that all the accurate determinations of this atomic weight have been made from samples of the substance derived from sodium chloride of the sea, wherein the mixture of molecules has been conducted impartially for ages, by winds and waves. Perhaps if samples of chlorine could be taken from independent original sources, other values of the atomic weight, ranging say from 35 to 37, might be found. Argon, neon, krypton, xenon, bromine, silicon and perhaps others are given as complex atoms; while fluorine, iodine, sulphur, phosphorus and arsenic are apparently simple elements.

The British Association divides itself into no less than thirteen sections, designated alphabetically, and at least one of them finds it desirable to proliferate. Each section has a section president, and each section president is supposed to arrive with an annual address in his pocket. The addresses, bound up together into a single little volume, make most interesting reading. Being authentic, and also usually devoid of unessential technicalities, they mark off the annual milestones of scientific progress in a manner that is welcome alike to the curious of this epoch and to the historians of the next.

The address of Prof. O. W. Richardson, president of Section A—mathematics and physics—discusses relativity, atomic structure, thermionic emission and contact electricity. It shows that there is a close connection between these last two properties of matter and that both are related to the modern quantum theory. Moreover, calling the "threshold frequency" that lowest observed frequency of light, incident upon a metallic surface, which causes electrons to be disengaged therefrom, then the maximum kinetic energy of such electrons is found to be equal to Planck's constant multiplied by the excess of the actual incident light frequency over the threshold frequency. These relations strongly oppose the chemical theory of contact difference of potential between metals, concerning which so much literature has accumulated since Volta's epoch-making discovery.

Electrical questions are likely to arise in any of the sections, but they are due for presentation either in Section A of physics, or in Section G of engineering. The papers in Section A this year were largely occupied with theories of the internal structure of atoms. The trend of opinion is toward the existence of a central positive atomic nucleus and of a number of negative electrons revolving about this nucleus in extremely minute planetary orbits at enormous angular velocities, each atom being thus a microcosmic solar system. On the other hand, others are content to assume the same central positive nucleus, with the same negative electrons attracted toward the central sun electrically, but also repelled therefrom by some independent force taking the place of centrifugal force. Under such assumptions the electron satellites will not describe orbits, but will merely group themselves statically at appropriate equilibrium distances around their sun, so that, if disturbed, they will pulsate to and fro in radial straight lines, with the same frequencies as the orbital philosophers predict. These two concepts, of a dynamic and a static atom respectively, are presented for future measurements to select or modify.

The presidential address in Section G—engineering—is entitled "Notes on Water-Power Development," by Prof. A. H. Gibson. This is a review of the recent hydro-electric development in various countries throughout the world. A conclusion would be that, despite rapid modern developments, there remains in all countries a large amount of available water power as yet wasted. Among the papers on electrical subjects was one by John Scott-Taggart, on "Two New Negative Resistance Devices for Use in Wireless Telegraphy." Both are electron tubes, operated in such a manner as to develop negative resistances, equivalent to emfs., in the circuits to which they are applied. One employs a pair of triode tubes and the other a special tetrode tube.

Among the exhibits was a "recording ultra-micrometer," shown in operation by J. J. Dowling. It consists essentially of a triode oscillator connected to an oscillation circuit of condenser and inductance in one of the regular systems for exciting sustained oscillations of, say, 500 kilocycles per second. The plate circuit contains a reflecting galvanometer ingeniously adjusted to give a zero deflection upon a steady flow of plate current. The small oscillation condenser is adjusted to give resonant oscillation when the plates are separated by an air gap of about one-third of a millimeter. In such a condition the strength of current in the plate circuit varies very rapidly as the capacitance of the condenser departs from the value of resonant excitation so that extraordinarily minute changes in the air-gap distance of the condenser, such as a millimicron, become detectable in a departure of the galvanometer index from its zero. Various applications of this principle were shown, depending upon minute changes in the air gap of the oscillatory condenser. It is stated that the decrease in weight of a kilogram mass when lifted one meter could be detected in this way. We rarely visualize to our mind's eyes the reduction of gravitation occurring between table level and floor level.

Another interesting exhibit, applicable to electromagnetic-wave analysis, was a mechanical device by W. L. Balls for detecting the harmonics in a complex wave form. A number of threads, actually eighteen, were strung from a common center, fan-wise, in a horizontal plane, at uniform small angular distances, each terminating at the free end in a small weight hung over a pulley. The wave form to be analyzed is cut out in cardboard, and this template has its edge smoothed with wax. The smoothed edge is then advanced under the threads, and in contact with them, in such a manner that the center is lifted rhythmically, as shown by a mirror and long-range light spot. The template has to be applied by trial at the radial distances along the threads, to reveal the fundamental and also a few of the lowest harmonics. The method avoids the use of arithmetic in revealing the presence of such harmonics, but some use of arithmetic becomes necessary in determining the amplitude of such harmonics as may be revealed.

The meetings, which lasted from Sept. 7 to Sept. 14, were well attended, the total registration having exceeded 2,700, which is the largest since the world war. A number of entertainments were provided for the visitors. Among these was a reception by the Mayor of Edinburgh, who goes by the title of the Lord Provost, at the Royal Scottish Museum, which, incidentally, is second only to the British Museum at London in wealth of collections and in the attractiveness of their display. The Provost and officers of the corporation, in their scarlet robes, receiving a long line of guests attended by halberdiers, against a background of classic antiquities, might well revive a medieval scene but for the modern attire of the hand-shaking oncomers.

The association usually meets at some city in Great Britain, but meetings have been held in Canada, Australia and South Africa. Invitations to hold a meeting are entertained two years in advance, in order to enable adequate preparations to be made. Rumor has it that the ninetieth and next year's meeting is to be held in the city of Hull.

An interesting lecture on Einstein's theory of relativity was given by Prof. A. S. Eddington, who is a leading British exponent of that new and much-debated philosophy. The lecturer briefly reviewed the famous Michelson-Morley experiment and accounted for its negative result by the contraction of the length of a bar held in the direction of the earth's motion, owing to electronic forces. This showed that length is not an absolute property of matter, after correcting for its temperature and pressure. Length and distance must be acknowledged to be relative quantities, strictly speaking; *i.e.*, relative to the velocity of the environment. As a further consequence of these conditions, time cannot be left out of account when discussing space relations. Time is necessarily involved, in a particular way, with the three dimensions of space, to make up a four-dimensional continuum. This led to the inference of non-Euclidian geometry in control of phenomena near matter. In the absence of matter, the phenomena of space might appear to belong to the classical three-dimensional geometry of Euclid, but in the neighborhood of matter space underwent a pucker or deformation which we are accustomed to interpret as a gravitational field of force. The lecture regarded the astronomical observations obtained during the solar eclipse of 1919 as virtually supporting the conclusion that in the neighborhood of the sun space deviates slightly from the Euclidian type. Further corroboration of the Einstein relativity theory had been revealed in the otherwise unexplained progressive motion of the line of apsides in the orbit of the planet Mercury. The theory also called for a small change in the waves of light emitted from the incandescent surface of the sun, as compared with light emitted from incandescent bodies on the earth. It was as yet doubtful whether this difference had been detected and this third corroboration secured, but, at least, the probability of its existence appeared to be increasing.

At the close of the lecture a few remarks were made by Professor Kapteyn from the astronomical standpoint, and by Dr. Oliver Lodge from the physicist's standpoint. Professor Kapteyn pointed out the difficulties which the ordinary trained mind encounters in apprehending or visualizing the Einstein four-dimensional time-space, but he considered that just as Copernicus had laid the scientific world under indebtedness by forcing scientists to shift their viewpoint of the universe from the geocentric to the heliocentric basis, so Einstein had contributed to our enlightenment by shifting the concept of velocity from an absolute to a relative basis. Dr. Lodge paid tribute to the zeal with which Professor Eddington had made Einstein's doctrines generally known in Great Britain. He regarded the ether as fixed and matter as having the property of motion through the ether. Neither Einstein nor Professor Eddington denied the existence of the ether; they merely deduced certain new properties affecting it. While he believed that the views of the physicists and the astronomers were coming to differ less and less from those of Einstein and Eddington, there were still outstanding differences. In particular, geometrical measurements belonged to the domain of physics. A. E. KENNELLY.

Paris, France.

[Dr. Kennelly, who for the current college year is on leave of absence from Harvard University and the Massachusetts Institute of Technology, is serving as the first exchange professor of engineering subjects to France.—EDITORS.]

Arc Rupture in Magnetic Blowout Switches

To the Editors of the ELECTRICAL WORLD:

In my article on "Arc Rupture in Magnetic Blowout Switches," published in the Sept. 3 issue of the ELECTRICAL WORLD, page 461, I note a number of typographical errors. The curve shown for Fig. 3 should have accompanied the caption for Fig. 7 and vice versa. The caption for Fig. 5 should have read "in Figs. 4 and 6," instead of "in Figs. 3 and 4." This interchange of illustrations is unfortunate as it confuses the subject matter. Also there are two "Fig. 7s" in the article as published. O. H. ESCHHOLZ.

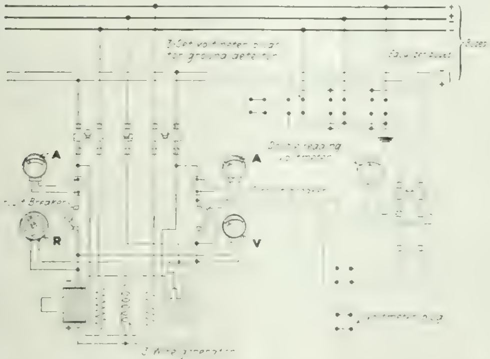
Material and Process Engineering Department.
Westinghouse Electric & Manufacturing Company,
East Pittsburgh, Pa.

Industrial and Station Practice

Installation, Operation and Maintenance of
Generating and Distribution Equipment and Economical Utilization of Electrical Energy
in Mills and Factories, Including Testing and Repair Methods

Paralleling Three-Wire Direct-Current Generators

THE protection of three-wire double-voltage generators involves factors which may be best understood by consideration of the special features of this class of apparatus which differentiate it from the ordinary two-wire generator. It is characteristic of this type of generator that its field winding must be compounded from both positive and negative leads; hence when operated in parallel two equalizer connections are required, thus making a total of five main buses connecting each generator. These connections are indicated in the accompanying diagram.



INTERLOCKED CIRCUIT BREAKER INSERTED BETWEEN BRUSHES AND EQUALIZER BUSES

To provide adequate protection the circuit breakers must be connected between the machine brushes and the equalizers in order that its tripping elements may be actuated by the full armature current and thus fulfill the functions of the device. The two single-pole breakers on the positive and negative leads must be interlocked; otherwise should only one breaker open the compensator for deriving the neutral would have to carry the full armature current and would probably be damaged. If placed between the series field and the busbars the device should be actuated by a current sometimes greater and at other times less than the armature current, depending upon the direction upon which the equalizing current is being exchanged between the machines. The equalizers are at the full terminal potential, and unless the voltage of an incoming machine is fully built up before it is paralleled with the machine running a violent short circuit is likely to occur in the armature of the incoming machine. For this reason switching equipments should be such that the series field will be thrown in circuit before a generator is paralleled.

Owing to the fact that unusual care must be exercised when paralleling three-wire direct-current generators it is advisable that a voltmeter be connected as shown in the diagram to reduce the likelihood of any accident. When paralleling, as already mentioned, the series fields of the incoming machines are connected first, then the two single-pole breakers are closed one at a time. By connecting a double-reading voltmeter (*i.e.*, a meter with a zero center) across the last circuit breaker an indication would be obtained if any short circuit existed on the incoming machine, also if the voltage of this machine was too high or too low for paralleling. In connection with this voltmeter connection if a double-pole, double-throw switch is inserted in the voltmeter circuit and connected through three voltmeter plugs, a very good ground detector is afforded.

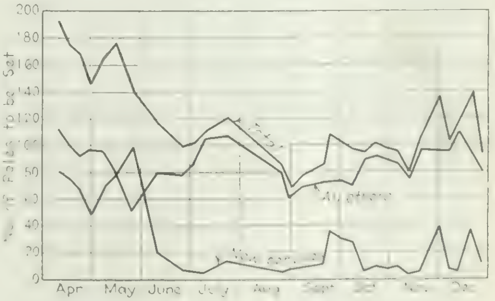
R. H. N. LOCKYER.

Bonnington Falls, British Columbia.

Graphic Records Show How Work of Setting Poles Is Progressing

TO SEE clearly at all times how the work of setting poles is keeping up with the number of orders on hand, graphic curve sheets are plotted from the weekly records of the Worcester (Mass.) Electric Light Company. These curves show the number of incompleted orders on hand for setting poles. If the curves rise at too great a rate, it shows that the forces are not able to handle the jobs fast enough. The forces are then increased or men are taken off other jobs to help in catching up with the work. Three curves are plotted, to show the total number of poles, the poles to be set for new services and the poles for other uses respectively.

Curves of this sort have proved a valuable aid to the management of the distribution department in this company. Other examples have been given in previous issues of the ELECTRICAL WORLD.



THE CURVES SHOW THE NUMBER OF POLES TO BE SET FROM WEEK TO WEEK

GEORGE M. HARDY,
Superintendent.

Worcester Electric Light Co.,
Worcester, Mass.

Running a Long Span Wire Over Rough Water

WHERE it is necessary to maintain wire communication over a stormy channel having strong currents and a rocky bottom, elevated span wires must be utilized instead of submarine cables. The maintenance of wire communication between Tatoosh Island and Cape Flattery presents one of the most difficult problems of this kind. The distance from the island to the mainland is about three-quarters of a mile. As the channel has extremely strong currents, and as high winds prevail during the winter and the bottom is rocky, any attempt to run a cable on the bottom would result in its chafing through within a short time.

In stringing the span, allowance for high tide and high masts must be made so as to permit a vessel to pass beneath the wire. Even if the land is sufficiently high, some form of tower is necessary as a support. The wire must be heavily galvanized to prevent corrosion from the salt air. For long spans, as at Tatoosh, the towers should be of steel securely bolted to heavy concrete foundations. There is a grooved porcelain insulator block on the top over which the wire is led. Directly in line and to the rear a heavy concrete anchor is placed to carry the weight of the span. This is accomplished by means of a galvanized chain shackled to the eyebolt in the anchor and connected to the wire through an electrose or other heavy strain insulator.

The running of the wire presents no great difficulty under circumstances where the bottom is smooth enough to permit direct hauling or laying, but at Tatoosh the bottom is so rocky that the wire has never touched bottom without being lost. The problem then is to get the wire across three-quarters of a mile of stormy cross currents without touching bottom. This is accomplished by means of empty 5-gal. oil cans.

First all towers and anchor supports are placed in readiness. The span wire itself is on a reel in the rear of the Cape Flattery anchor, and the reel has a powerful brake to prevent the wire taking charge. An eye is spliced in the free end of the wire. A power boat is in readiness off shore with a fifteen-thread dry manila line coiled free for running. The line must be dry and new enough to float and long enough to bridge the channel. When everything is in readiness the power boat runs close to the cape and passes the manila line ashore by means of a heaving line. This is quickly and securely fastened to the eye in the end of the span wire. The boat now proceeds at full speed across the channel, paying out the manila line but keeping a fair strain on it. The brake on the reel is kept set and no wire is allowed to run out at this time. While this line is being run another fifteen-thread manila line is passed from the island to a rowboat anchored off in water sufficiently deep for the power boat to maneuver in. The power boat runs alongside this small boat and the two lines are fastened together.

The island end of the manila line is now run through a snatch block on the top of the tower. A small boat with an Indian boatman has in the meantime been anchored near the cape end of the line about 30 ft. from shore and directly under the manila line which passes through a fair lead large enough to take the eye splice. This boat has about twelve empty 5-gal oil cans which are securely sealed. The island end of the line is manned by eight men, and at a signal from shore they heave it in through the snatch block on the top of the tower. As the eye splice passes through the fair lead the Indian in the boat securely fastens on a 5-gal. can. Other cans are fastened approximately every 400 ft. These cans keep the wire on the surface or near the surface and prevent it being cut by the jagged rocks on the bottom. A fair strain is kept on the wire by the reel brake. During the running of the wire the power boat patrols to clear any obstruction and to warn any approaching boats to keep clear. Signals are arranged to enable the hauling party on the island to call for more slack or more strain. After the eye splice is hauled through the snatch block in the top of the island tower enough wire is taken through to provide sufficient end for splicing and the reel tender holds fast.

The reel end is spliced into the insulator by means of a large thimble. This thimble is attached to the insulator, which is held by the chain, and the chain is in turn shackled to the ring bolt in the anchor. This splice is very important. The end of the wire is passed through the thimble and wound back on its own part for a distance of at least 2 ft., using a long open roll. The wire is then bent back on itself without too short a nip and wound down until the thimble is reached. The end is run through the thimble in the opposite direction to the first tuck and the operation repeated until there are four parts of wire in the thimble and the end wound down and secured at the top.

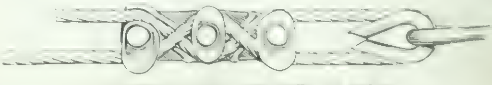
The whole splice must now be securely taped over with friction tape. On top of this it receives several coats of white lead, zinc and oil paint as a protection against corrosion. This splice completed, the other end is hauled in by means of two pairs of lineman's "come-alongs." When the proper strain is placed upon the wire it is spliced in a similar manner to the shore end. The strain is measured by means of a spring tension indicator, or, better yet, by the amount of sag. Both ends of the span being fast the aerial wire is spliced thereto at each end.

FRANK LUCKEL,
Lieutenant Commander, U. S. N.
Navy Yard, Puget Sound, Wash.

Boltless Clamp for Guy Wires

A ONE-PIECE boltless guy clamp is now coming into use by a number of central stations for guying poles, splicing messenger wires, etc., in the same way that the ordinary three-bolt clamp is used. The Postal Telegraph Company has had several thousands of these clamps in service for about a year, giving them a thorough practical test. The particular features of the clamp are that it can be applied in less time than is required for a three-bolt clamp and once it is put into service it will hold the guy wire without slipping up to the full breaking strength of the wire. Only two or three minutes is required for attaching the clamp.

The wire is woven around the projections on the clamp as shown in the accompanying illustration, and when the tension is put upon the line the wire is tightened in the clamp and cannot slip or come off the clamp. A tool in the shape of a wrench is used for applying the clamp when the wire is under tension.


GUY-WIRE CLAMP REQUIRES NO BOLTS

Shull Boltless Clamp Corporation, F. G. SHULL,
Niagara Falls, N. Y. President.

Electric Furnace Gives Excellent Results in Bluing Metal

BLUING metallic parts by heating is an art to which the accurate control of electric heating has been successfully applied in an experimental furnace recently built. In such work a temperature varying not over 5 deg. Fahr. must be maintained in all parts of the oven where the work is placed. It is necessary to place the work in the oven at a moderate temperature and raise the whole slowly up to the bluing point. The temperature must then be held constant during a certain period of time. About 590 deg. Fahr. is used for most work. With gas fuel the temperature as measured was held at 650 deg. Fahr. The same results are obtainable in the electric furnace with a lower average temperature. One reason for this is that no ventilation is required and therefore heating is more uniform than in the gas-fired furnace and there are no cold spots of which the temperature must be raised by raising the average temperature.

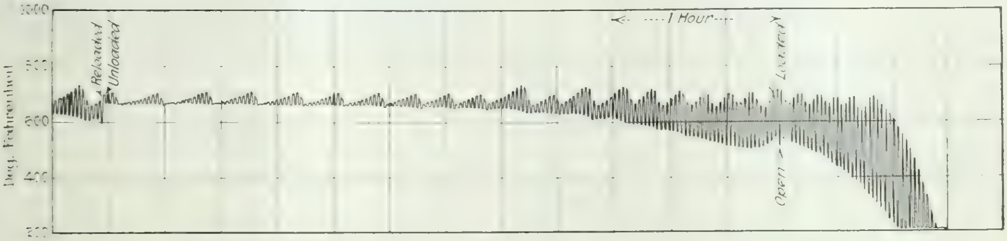
A bone charge to give off smoke for the bluing process is placed in the bluing drum after the furnace has been brought up to a temperature of 450 deg. to 500 deg. Fahr. After this smokes freely the rack is placed in a rotating drum and allowed to roll about in the bottom. It was firmly believed that by means of an electric furnace a great many of the variable factors met with in the gas furnace could be done away with and a standard cycle of operation for each type and size of work established which could be repeated day in and day out.

The experimental furnace consists of an American Gas Furnace Company drum mounted in a Crawford sectional oven having heavily insulated walls. General Electric heating units were placed in the bottom of the furnace directly beneath the drum. There is a General Electric control panel equipped with a Leeds & Northrup potentiometer control. Three thermocouples allow the temperature of both the front and rear of the drum as well as the temperature directly above the heating units to be read at will. Various controls were tried and the one-point control from the thermocouple at the heating units was found most desirable.

The two drum thermocouples were first placed in a hollow steel shaft extending through the drum, but they were found to register the work temperature inaccurately owing to the slow absorption of heat by the shaft and the slow falling off of temperature when the heat dropped. This objection was rectified by suspending the thermocouples along the top of the drum where they were fully exposed.

The first trials showed that there was a loss of heat through the front of the oven around the rotating drum which caused a rather large temperature gradient from back to front in the oven. A redistribution of the heating elements failed to overcome the difficulty mainly because when the current was off the loss was still present. The logical solution seemed to be separate units which should be run continually and compensate at all times for this heat loss. Units of 4-kw. capacity were consequently installed and operated continually in conjunction with the 16-kw. units originally installed. This gave the desired results, as will be seen by a study of the chart.

A variety of work has been tried on this experimental oven. It is firmly believed that from experience a heat cycle can be determined which may be repeated without fail.



STEADY TEMPERATURE HELD BY ELECTRIC FURNACE FOR BLUING METAL PARTS

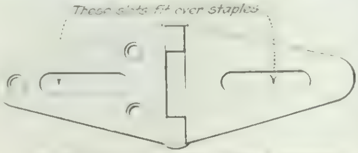
Bakes have been run at the rate of only two per day. The oven requires 30 kw-hr. for heating up from cold, but will turn out a five-hour bake of 50 lb. to 100 lb. with an additional consumption of 20 kw.-hr. to 25 kw.-hr.

This thermal efficiency of the oven can be greatly improved and the consumption of power energy reduced to a point where it can compete with gas. The economy, however, is of secondary importance so long as successful bluing can be assured. Certain it is that the variable factors have been cut to a minimum and experiments point to a fair higher average of successful work being done than ever before.

Hartford Electric Light Company, H. W. Derry,
Hartford, Conn. Power Engineer.

Double Hasp Allows Separate Locks for Joint Property

WHEN a transformer or meter house is installed on the property of an industrial consumer it frequently happens that the consumer wants a key to it. If the utility has a standard lock for transformer houses and the consumer has a line of standard locks for the different departments, friction is liable to develop over the question as to whose lock shall go on the door. To overcome this an Eastern utility uses a home-made double hasp. It consists of the ordinary hasp with a slot cut in what is normally the stationary side, as shown in the illustration. In this way each party puts on his own lock, two staples being provided, and since



EACH SLOT IS SLIPPED OVER A STAPLE AND A PADLOCK IS INSERTED one lock is always in place the hasp is held in the same way as if it were fastened with screws on the locked side. When used with double doors one staple is placed in each door, bringing the hinge over the crack between them. With a single door one staple is placed in the jamb and the other in the door. D. A. McNulty.

Waterbury, Conn.

Wires Kept from Twisting When Pulling in Conduit

WHEN running a large number of small wires through conduit it is often difficult to keep them from twisting and crossing inside the pipe. In order to keep the wires straight under such conditions the writer makes use of a fiber guide through which the wires are fed at the entrance to the conduit. This guide consists of a piece of fiber about ¼ in. thick in which holes slightly larger than the size of wire to be run are drilled. There is one hole for each wire. The wires are passed through the holes and then twisted together and pulled through the conduit. The fiber guide is held a little distance away from the conduit if the number of wires is great compared with the size of the conduit so that the wires will not enter at a sharp angle. As the wires are pulled they are kept separate as they enter the guide, all twists and tangles being taken out before they reach the guide. With this arrangement about the only difficulty that can be experienced is that the whole mass of wires may twist spirally.

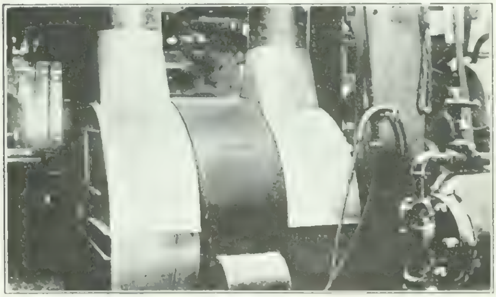
New York, N. Y. W. A. Harris.

Motor Housing Prevents Dust Collection and Improves Ventilation

PROPER ventilation and elimination of dust become very important factors in the operation of large heavy-duty motors such as are found in sawmills and other dusty places. The illustration shows a 400-hp., 900-r.p.m. motor directly connected to an edger in the mill of the Inman Poulsen Lumber Company at Portland, Ore. An airtight, sheet-iron housing has been placed on each end of the motor, and each of these housings is tapped by an 8-in. pipe leading to the outside of the building. The housing keeps all dust away from the motor, and the fan blades on the rotor cause a circulation of cool, clean air through it. Sliding doors are provided in each housing opposite the bearings on motor for oiling and inspection. W. C. Heston,

Industrial Engineer.

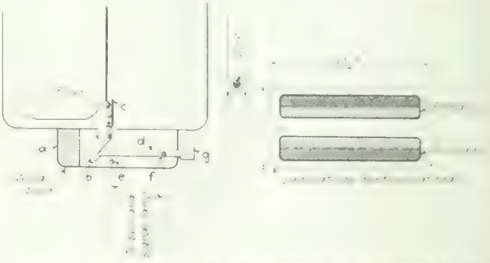
Portland (Ore.) Railway, Light & Power Company.



ONLY CLEAN, COOL AIR PASSES THROUGH THIS MOTOR

Loud Telephone Signal for Mill and Factory

IN MANY places in mill and factory difficulty is experienced in hearing the telephone bell, due to noise, distance from the instrument, etc. Since the ordinary extension bell often proves unsatisfactory, a simple arrangement is here shown that solves the difficulty and also insures continuous alarm until the call is answered and the signal reset.



LOUD SIGNAL ATTACHMENT FOR TELEPHONE IN A NOISY PLANT.

Left—Relay mounted on telephone box. Right—[illegible] reducing voltage on bell and signal lamp. The laminated core has a cross section 0.4 deep by 1 in. wide. Wiring is as follows:

Turns	Size Wire	[illegible]
	Primary	
2 200	40	[illegible]
	Secondary	
80	26	[illegible]
120	26	[illegible]
160	26	[illegible]

A wood block *a* about 1⅜ in. by 3¾ in. in size is slotted (₁⁵₆ in. wide) as shown in the cut. A piece of ¼-in. fiber *b* is formed with a piece of thin sheet steel *c* extending upward so that the vibrating bell clapper will strike it (one bell having been removed). The latch *d* is made of ¼-in. square or round copper or brass with the end *g* insulated to serve as a resetting handle. At *e* and *f* are copper or brass pins extending through the wood block and slot and serving as contacts to which the line is attached. An ordinary house bell in combination with a signal lamp has been found very satisfactory for connecting to the other end of the circuit to give the alarm.

An easily and cheaply made transformer to operate the bell from a 110-volt circuit is shown at the right. The iron is cut in strips 1 in. by 12 in. in size and the coils are wound directly on the iron, the ends being then turned back and lapped as shown in the drawing.

Truscon Steel Company, R. H. Pool,
Youngstown, Ohio. Assistant Electrical Engineer.

Open Wiring Permits Quick Relocation of Factory Lamps

TO ENABLE lamps to be easily relocated in the factory and offices of the American Bosch Magneto Corporation, Springfield, Mass., the open type of wiring illustrated herewith is used. The circuits are of No. 12 copper, insulated with fire-resistant covering, and carried by porcelain cleats supported by two parallel No. 10 steel messenger wires fastened to beam clamps at intermediate points and to eyebolts at the ends of spans. Two parallel steel guard wires are also run just below the conductors. The intermediate attachments of the messenger wires are 1¼ in. wide by ⅛ in. thick and are bent at the ends to clamp the steel wires in position.

The tops of the porcelain cleats are capped by ½-in. x 2¾-in. x ⅛-in. flat bars, and the strain terminals at the ends of the spans are fastened to 2½-in. x 2½-in. x 1.4-in. angles by four ⅜-in. eyebolts. Attachment to the concrete beams is by ⅝-in. bolts seated in slots provided in the lower beam surface. Spans 8 ft. to 10 ft. long are easily installed, and the relocation of taps for lamps or drop services is a matter of a few moments.

POSITION OF LAMPS EASILY CHANGED ON THIS WIRING

Boston, Mass. FIELD EDITOR ELECTRICAL WORLD.

Conditions that Should Be Watched When Dipping and Baking Armatures

OBSERVATIONS on armature dipping and baking made by E. C. Parham in the July 16 issue of the ELECTRICAL WORLD prompt the writer to bring out a few points aimed at preventing wrong conclusions from some of the results recorded. It is true that satisfactory results can be obtained without careful checking to maintain constant baking temperatures, definite specific gravity and uniform length of bake, but to get the best results these points must be watched. All the advantages claimed are true, especially where old armatures are being overhauled.

The statement that the amount of ventilation did not affect the length of time required to bring an armature to a definite resistance may be taken as an argument that a good supply of air is not required. This, however, is not the case, since the better grades of insulating varnish depend upon oxidation for drying and this can only be accomplished by having a good circulation of air. The length of time required to bring the insulation to a definite value does not depend entirely on the drying of the varnish, but rather on driving off the moisture and solvent and slight natural ventilation will do this.

Insulating varnish in itself has a rather high resistance, so it is readily seen that the required resistance may be obtained without the varnish drying to the desired degree.

The conclusions might be drawn from the results obtained with different temperatures that a low one will dry out an armature just as well and as quickly as a higher one. The results which seem to indicate such a condition can be explained by the effect of temperature on insulation resistance. Insulation resistance is very sensitive as regards temperature, and an armature may be drier at a high temperature with a low resistance than with a higher resistance at a lower temperature. No doubt the armatures at the higher temperature were drier for the same length of bake than the others, although the resistance was lower. The same is true in the case of transferring armatures to a higher temperature oven, for as the temperature of the armatures rose the insulation resistance fell. This great change in insulation resistance with temperature can best be illustrated by taking the insulation resistance hot, and again after the armature has reached room temperature. The writer recently observed an armature having an insulation resistance of 1 megohm to 2 megohms at approximately 110 deg. C. which increased in resistance to about 2,500 megohms when cooled to room temperature.

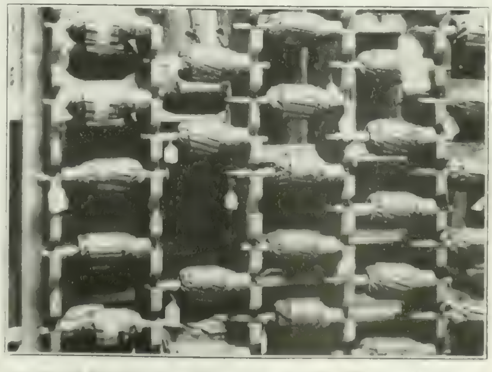
It is difficult to determine just how dry an armature should be before dipping. Any moisture remaining is driven off much more slowly after the armature is dipped, and consequently if an armature is dipped before it is sufficiently dry, enough moisture may be trapped in the armature to give trouble if concentrated at one point. For this reason baking out the armature thoroughly before dipping is advisable.

From the points brought out it is clearly seen that to obtain the best product the condition of the armature before dipping, the temperature of baking, the specific gravity of the varnish, the circulation of air and the length of baking must be watched; but a considerable range may be allowed and good results still be obtained. That dipping and baking will take a prominent place in the maintenance of railway motors in the future is assured, as all companies that have given the process a trial are convinced that it pays. I. B. STEIFEL,

Railway and Motor Engineering Department,
Westinghouse Electric & Manufacturing Company,
East Pittsburgh, Pa.

Over Six Hundred Armatures Stored in Small Space

TO STORE compactly and yet accessibly the armatures of small motors of automobile lighting sets the New Haven (Conn.) Electric Company uses the home-made rack of which a section is shown in the accompanying illustration. The rack is built of ¾-in. pine strips in which holes 1¼ in. in diameter were drilled near the edges on each side of the strip. The stock between the outer edge of each hole and the edge of the wooden strip was then sawed away on an angle of about 15 deg. from the horizontal, forming a series of slots with circular backs and bottoms about 1½ in. deep and 2¾ in. apart by vertical center-to-center measurement.



RACK 12 FT. LONG AND 7 FT. HIGH HOLDS 784 ARMATURES

The rack strips of ¾-in. stock are set parallel 6½ in. apart horizontally. In a space 12 ft. long and 7 ft. high, using a double rack (front and rear) the company stores 784 armatures, every one within easy reach of a person of ordinary height when standing on the floor.

Boston, Mass. FIELD EDITOR ELECTRICAL WORLD.

Management and Policy

Embracing Central Station Commercial Organization and Management, Customer and Trade Relationships, Public and Financial Policies, Advertising, Selling and Service Methods

Boston Edison Abandons Merchandising Where Dealers Are Competent

THE BOSTON Edison Company has taken still another step in the development of closer co-operation between the central station company and the contractor-dealer. The new policy embodies nothing less than the withdrawal of the company from the direct sale of electrical merchandise in territory where the nearby contractor-dealer shows himself competent to promote appliance sales enthusiastically and efficiently. With it goes all of the company's influence to advance the sale of electrical products.

BOSTON EDISON COMPANY'S OFFICE AND CONTRACTOR DEALER'S STORE SIDE BY SIDE IN WINCHESTER

About six months ago the company decided to see what could be done in the Boston Edison territory to get more contractors to sell appliances and work on the so-called fixed-schedule house-wiring business. The first actual step toward turning over appliance business to contractors has been taken in the town of Winchester, 8 miles north of Boston. An electrical contractor, E. B. Sanderson, opened a fine appliance store next door to the Edison company's Northern District office. No appliances are displayed in the Edison company's office in view of the fact that the contractor-dealer's store is next door, but inquiries for appliances are courteously referred to the contractor-dealer.

Winchester had been selected as the first town because this contractor proved his ability, efficiency and reliability as a business man who was willing to co-operate with the company. Fifteen years ago he was what is generally termed a small contractor, but he established a reputation for constructive co-operating. Eight years or more ago, when the company through its sales department established a definite schedule for house wiring, Mr. Sanderson was quick to see its possibilities.

He went after the house-wiring business energetically, though at the time many other electrical contractors felt that they couldn't afford to do wiring on the Boston Edison schedule. Mr. Sanderson has made money on the so-called Edison contract, and today he has between forty and fifty men working on house wiring. Negotiations are under way for similar co-operation with the shops of other electrical contractors in other sections of the more than 600 square miles of territory that the Boston Edison Company serves.

Contrast of Old and New Makes Interesting Window Feature

CONTRASTING modern electrical equipment with similar apparatus of obsolete type affords the central-station company many good opportunities for window trims or salesroom exhibits which will bring home to customers and the public the rapid strides that have been made in the development of the electrical art and what it means to the public welfare. The first dynamo operated in Louisville, Ky., was recently used in an interesting display of this kind in the office of the Louisville Gas & Electric Company, linked with the portraits of Thomas A. Edison and Col. H. M. Byllesby. The same thing has been done effectively where the utility company has borrowed the oldest washing machine in town and displayed it in contrast with the latest model, a prominent card telling what Mrs. Brown thinks of this old machine of hers. Similar displays can be made with old and new lighting fixtures, electric signs, flatirons, motors, switches or any other piece of apparatus that offers a spectacular comparison.

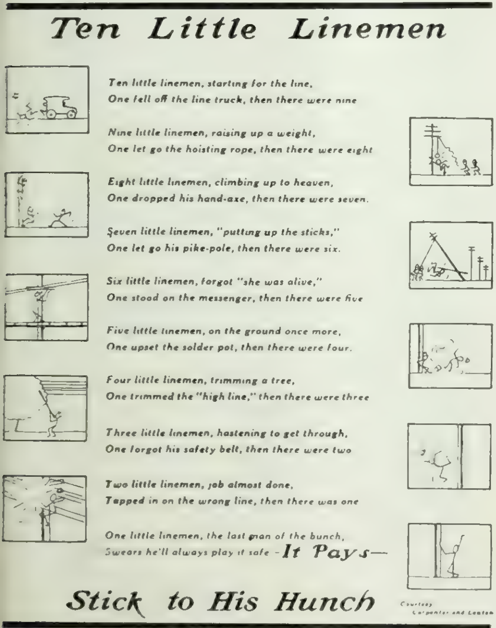
TYPE OF DISPLAY WHICH DEPICTS PROGRESS OF ELECTRICAL ART

Columbia Offers Course in Study of Electrical Appliances

OPPORTUNITY for the systematic study of electrical household appliances and heating devices will be offered at Columbia University, New York City, this winter in the physics laboratory of Teachers' College. The course will be on "Household Mechanical Appliances," and will be given by F. F. Good. Practical experiments will be conducted on vacuum cleaners, flatirons, toasters, immersion heaters, sewing machines and motors. These experiments are intended to provide practice in mechanical skill, study of the principles of operation, diagnosing and correcting troubles and selection and cost of apparatus.

"Safety First" Poster Carries Clever Appeal

TO GET the "safety first" idea across is not the easiest thing in the world. The accompanying poster is particularly effective for it carries a serious message in an interesting manner and draws an object lesson that can be easily visualized by the reader. The poster appeared in a recent issue of the Safety Bureau's *Bulletin*.



Ten Little Linemen

Ten little linemen, starting for the line,
One fell off the line truck, then there were nine

Nine little linemen, raising up a weight,
One let go the hoisting rope, then there were eight

Eight little linemen, climbing up to heaven,
One dropped his hand-axe, then there were seven.

Seven little linemen, "putting up the sticks,"
One let go his pike-pole, then there were six.

Six little linemen, forgot "she was alive,"
One stood on the messenger, then there were five

Five little linemen, on the ground once more,
One upset the solder pot, then there were four.

Four little linemen, trimming a tree,
One trimmed the "high line," then there were three

Three little linemen, hastening to get through,
One forgot his safety belt, then there were two

Two little linemen, job almost done,
Tapped in on the wrong line, then there was one

One little linemen, the last man of the bunch,
Swears he'll always play it safe -It Pays—

Stick to His Hunch

Courtesy Carpenter and Lenton

AN INTERESTING "SAFETY FIRST" POSTER

Minneapolis Company Interviewed 35,540 Persons in August

IN CONNECTION with the volume of business transacted by the Minneapolis General Electric Company during the month of August, which was the busiest in the history of the company, a record was kept of the number of interviews which the sales department had with the public. Both personal and telephone interviews totaled 35,540. They were divided among various branches of the department, as shown above.

	People Interviewed in Person	People Interviewed by Telephone	Total
Information bureau	2,600		2,600
Contract	7,500	2,600	10,100
Appliance department	3,500	520	4,020
Range department	7,500	2,600	10,100
Power department	650	1,000	1,650
House wiring department	1,400	1,100	2,500
Suburban department	560	760	1,320
Sales manager's office	650	2,600	3,250
	24,360	11,180	35,540

What Other Companies Are Doing

Pueblo, Cal.—With 5¼ miles of "white-way" system just completed in its business and residential sections this city claims a record for ornamental street lighting in cities of 50,000 population. There are three types of standards. In the business district, covering 1¾ miles, Corinthian standards are used, arranged eight to the block, four on each side of the street. Ornamental five-light posts are used on 2¼ miles of streets and through several blocks of the residence district. Single-light posts cover 1¼ miles of the residence district. The three types are divided as follows: 155 Corinthian standards, one 100-watt and four 60-watt multiple lamps; forty-three five-light posts, one 100-cp. and four 80-cp. series lamps, and 66 one-light posts, one 100-cp. series lamp. That portion of the system which was built before the flood last June withstood the strain remarkably well.

Philadelphia.—A valuable service to women's clubs, improvement societies, neighborhood and business men's organizations, churches and the like is being offered by the Philadelphia Electric Company in the form of an illustrated lecture with slides or "movies," or an informal talk on the subject of household efficiency and the electrical equipment of the home. The service is offered without charge and has no commercial feature or connection. The company is calling the attention of women's clubs that are making up their fall and winter programs to this service. Already talks have been made before half a dozen prominent organizations in the nature of informal discussions on up-to-date housekeeping and the part electricity plays in it.

Omaha, Neb.—"Don't let up advertising in newspapers or anywhere else because you feel that times are hard. That is the time to advertise," said J. E. Davidson, general manager of the Nebraska Power Company, in an address before a recent meeting of power and light company operators in Omaha. "When business is slow advertising will stimulate it. Cut down expenses but leave your advertising appropriation intact. Tell the citizens of your community about your business."

Norristown, Pa.—Employees of the Counties Gas & Electric Company, a subsidiary of the United Gas Improvement Company, subscribed 100 per cent to a stock offering recently made by the company. The stock was 8 per cent cumulative, preferred, and a customer-ownership campaign is to be opened immediately by the Counties company.

New England.—Returns for the first half of 1921 compiled by Charles H. Tenney & Company, Boston, show encouraging gains in business for the public utilities affiliated with this organization. Eleven electric light and power companies gained 6.53 per cent in lighting customers, 6.38 per cent in power customers and 14.05 per cent in electric heating customers. The totals on July 1 were, respectively, 71,706, 3,267 and 414. Notwithstanding the depressed conditions of the first half of this year there was a gain in connected horsepower in motors of 1.98 per cent, bringing the total connected power load of the eleven companies on July 1 to 88,304 hp. Cyrus Barnes is new-business manager and V. M. F. Tallman power engineer of the company.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
of the World

Generators, Motors and Transformers

Present Status of Electric Machinery.—F. FLEISCHMANN.—At a recent meeting of the German Electrotechnical Association the author presented a paper on the latest developments of large electric machinery, and this article is an abstract of the paper. It is, therefore, obvious that the article contains in a very condensed form such an abundance of data and experiences that it is impossible to make a further abstract of it that would have any value. A large number of photographs accompany the paper, which in themselves will be of great value to any designer of motors and generators. The author deals with generators, high-frequency generators, motor-generators, rotaries, rolling-mill motors, railway motors and transformers. All of the machinery is of A. E. G. design. The important subject of heating and ventilating large machines is treated extensively.—*Elektrotechnische Zeitschrift,* Sept. 1 and 8, 1921.

Lamps and Lighting

Street-Car Lighting.—J. A. SUMMERS.—A discussion of the proper lighting intensities, taking into consideration the interior finish of the car, the voltage regulation, arrangement of seats, the standard of lighting in the community and the value of lighting from the standpoint of making car signs attractive. This paper discusses these points and mentions that there is a strong tendency to go to at least 10 foot-candles of intensity, which can be procured with an expenditure of about 2 watts per square foot of floor area. In all cases medium-density open reflectors are recommended, and they should be placed not over 5 ft. apart.—*Transactions of Illuminating Engineering Society,* July 20, 1921.

Radiation of Light.—CHARLES FABRY.—A description of the methods used for studying radiations of light, both visible and invisible, and a special discussion of the X-ray.—*Journal of Franklin Institute,* September, 1921.

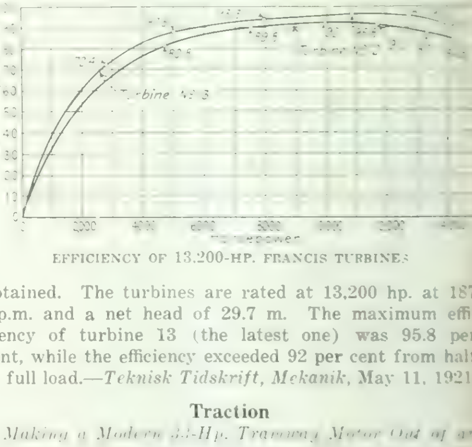
Generation, Transmission and Distribution

On the Distribution of Ground Currents.—R. RÜDENBERG.—A question frequently asked in transmission-line practice concerns the degree of danger incurred in walking near the base of a steel tower with a faulty insulator. The ground current J extending from the tower into the ground with a specific resistance ρ will cause along the surface an electric field of $e = \rho J/2\pi x^2$, which decreases as the square of the distance x from the tower. The potential difference between two points, separated by the distance s and distant x from the tower, will be

$$e_s = \frac{\rho J}{2\pi} \cdot \frac{s}{x(x+s)}$$

Under favorable conditions e_s may reach considerably over 100 volts where s is equal to one step, or about 3 ft. from the base of the tower. The greatest value of e_s, corresponding to the most dangerous position, will result if one foot is on the ground and the other foot touches the tower. In summer, when the ground is dry and therefore poorly conducting, a very dangerous potential may exist along the ground surface of a tower after a rainstorm. Under favorable conditions as much as 15 per cent of the total ground current may then flow from foot to foot in one step. The author shows the beneficial influence of a steel cable strung from top to top of each tower along the entire line in reducing this danger.—*Elektrotechnische Zeitschrift,* Aug. 4, 1921.

Hydraulic Turbine Efficiency.—During official tests recently made on two new horizontal Francis twin turbines delivered by Karlstads Mekaniska Verkstad, Kristinehamn, Sweden, for the Swedish state plant at Trollhättan the efficiency curves shown here were obtained. The turbines are rated at 13,200 hp. at 187 r.p.m. and a net head of 29.7 m. The maximum efficiency of turbine 13 (the latest one) was 95.8 per cent, while the efficiency exceeded 92 per cent from half to full load.—*Teknisk Tidskrift, Mekanik,* May 11, 1921.



EFFICIENCY OF 13,200-HP. FRANCIS TURBINES

Traction

Making a Modern 33-Hp. Tramway Motor Out of an Old 20-Hp. Motor.—J. V. BALSLEV.—Changing traffic conditions caused the Copenhagen street-car company to adopt the trailer system. It was at once realized, however, that the old Siemens 20-hp. car motors would very quickly break down under such heavy usage, and therefore a scheme was worked out for converting the 20-hp. motors into 33-hp. interpole motors running spark-free up to a load of 65 hp. The main features of the work were the following: 1. The armature slots were deepened 3 mm. to permit the use of the same number of wires per slot, while changing the area from 4.15 sq.mm., round, to 6.45 sq.mm., rectangular. 2. The field magnets were also rewound with rectangular wire, 20 sq.mm. being used, instead of the original 13.5 sq.mm., round wire, and at the same time the number of turns was cut from 99 to 100 per pole. 3. To insure good commutation four interpoles were inserted, the motors being four-pole series wound. 4. To compensate in part for the weakening of the field, the air gap was cut down from 3 mm. to 2 mm., ball bearings being installed to prevent hugging, due to wear in the bearings. In this way the capacity of the motor was increased from 20 hp. to 33 hp., while the efficiency was increased from 83 per cent to 88 per cent. Since the total copper weight of field and armature was very nearly the same after the rebuilding as before the rebuilding, this improvement was won at the expense of only about 6 kg. additional copper per motor for the interpole windings. One hundred and thirty motors are being changed in this way, and of these fifty have already been in service for about six months, with excellent operating results.—*Teknisk Tidskrift, Elektroteknik,* May, 1921.

Installations, Systems and Appliances

Electrically Driven Lumber Mills.—J. N. Dodds.—A description of a mill with 3,400 hp. in electric motors. This is one of the large modern sawmills which have been changed over from steam drive to electric drive. The advantages of electric drive are discussed and the power requirements are given as follows: Average power for sawmill is 1,130 kw., or 41.8 watt-hours from log to sorting table per board-foot of timber cut. This does not include shingle mill, planing mill or gang saw. The gang saw would raise this figure to approximately 48 watt-hours. For a planing mill with a capacity of 12,500 board-feet per hour the power in put is 25.4 watt-hours per board foot. The shingle mill with a capacity of 25,000 shingles per hour requires 7.3 watt-hours per good shingle.—*General Electric Review,* September, 1921.

Cost of Rolling Steel in Various Mills.—G. E. Stoltz.—A comparison of costs of driving rolling mills with electric power and steam engines is made in this paper. A big advantage pointed out for electric drive is that the energy measurements may be made very accurately to determine if the exact conditions of operation are being maintained. The record of power consumption in electrically driven mills is accurate, includes all incidentals and covers all periods. A slight change in some adjustment on the electrical equipment has reduced power consumption considerably. Small differences of the same character would not be detected on a steam-driven mill, and such refinement could not be obtained.—*Journal of Engineers' Club of Philadelphia,* September, 1921.

POWER AND MAIN-DRIVE OPERATING COST OF ROLLING STEEL IN ELECTRICALLY DRIVEN MILL

(34-in. reversing blooming mill; ingots 15 in. x 17-in., 4,200 lb.; blooms 8 in. x 8 in., 6 in. x 6 in., 4 in. x 4 in.)

All costs are based on cost per ton (2,240 lb.) of steel produced. Values are averages for years 1913 to 1919, inclusive

Months in operation	10.43
Tonnage*	18,800†
Kilowatt-hours	21.2
Power cost	0.1445
Repairs and maintenance	0.0058
Miscellaneous supplies	0.0030
Labor in operation	0.0132
Total	0.1660

* Finished tons (2,240 lb.) on the blooming mill

† Monthly average tonnage finished on the blooming mill over the entire period

Electrochemistry and Batteries

Heat Treatment in Electric Furnaces.—Edwin F. Cone.—A review is presented of electrical apparatus for furnaces used commercially in the United States as a means of heat-treating steel. Several companies have developed furnaces of types especially adapted to the product to be treated. Not only are castings and forging now being treated in such furnaces, but sheets, steel chains, automobile parts, axles, bolts, nuts and small parts for airplanes are being treated as well as non-ferrous and other products. In the steel field alone there are about eighty furnaces now installed or contracted for. Other furnaces are operating on non-ferrous material and the application to glass and other industries is growing.—*Iron Age,* Sept. 15, 1921.

—*Gray-Iron from Electric Furnace.*—James L. Cawthon, Jr.—The advantages of electric furnaces and the superior quality of product are enumerated. As an indication of what can be expected from electric furnace iron, a user reports tensile strengths as high as 62,000 lb. (28,000 kg.) for iron made from scrap charges. Another reports an average of 5,100 lb. (2,300 kg.) transverse strength for iron made from gray-iron borings and axle turnings. An average analysis shows carbon 3.20 per cent, sulphur 0.05 per cent, phosphorus 0.25 per cent, manganese 0.70 per cent, silicon 2.19 per cent. The sulphur, it will be noted, is lower than is usual in cupola metal.—*Electric Journal,* September, 1921.

Units, Measurements and Instruments

Instrument for Measuring Frequency and Other Quantities.—R. C. Clinker.—A description of a meter which may be used for measuring frequency and also capacity and inductance.—London *Electrician,* Aug. 5, 1921.

Telegraphy, Telephony and Signals

Transition Period in Radio Communication.—A. F. Van Dyck.—Radio development has advanced by a series of steps rather than by a steady progress. The present transition period results from the application of comparatively recent inventions, and improved methods which have enlarged the general scope of the art to a heretofore undreamed-of degree have made wireless telephony practicable and have placed radio at last on a reliable basis of operation by displacing from the equipment those elements which at times were erratic in behavior. In this article these recent developments are described.—*General Electric Review,* September, 1921.

Telephone Cables and Amplifiers.—A. Ebeling.—An interesting account of the history and development of the art of telephoning over long distances through cables, beginning with Professor Pupin's loading coils, their calculations and present use. The Krarup system of increasing the inductance of a cable by winding a layer of iron wire upon the copper conductors is mentioned as the second step. This system is used, for example, on the long submarine telephone cable in East Prussia. Then came the Brown microphone amplifier, based upon the electromagnetic principle, but never used practically, as it was superseded by the Lieben amplifier in 1910, which was a forerunner of the vacuum tube, and finally the present-day high vacuum electron tubes.—*Electrotechnische Zeitschrift,* Aug. 11, 1921.

Generators for Radio Telegraphy.—K. Schmidt.—This article deals with the development of the medium and high-frequency generators used today in radio work. It is written by an engineer of the C. Lorenz works and gives preference to the description of their machines.—*Zeitschrift für Drahtlose Telegrafie und Telefonie,* July, 1921.

Scientific and Industrial Research

(Printed in the Third Issue of Each Month)

A Department Devoted to Reports of Investigations Contemplated or Completed, Research Facilities Available, and Suggestions for Co-operative Work.

Conducted by **Prof. Vladimir Karapetoff**
Cornell University, Ithaca, N. Y.

Research in Progress and Completed

[When investigations which have been completed are, in the opinion of the editors, of wide enough interest to the field we serve, details thereof will be presented in other parts of this paper. Contemplated research or that which appears to have limited appeal will be only briefly reported in this section, but details may be had by communicating with the investigator or institution named in the report. Readers are referred to the department "Digest of Electrical Literature" for investigations reported in other journals. The news and engineering sections should also be followed for research reported before technical societies.]

CORONA ON AN ARTIFICIAL LINE

An examination is being made of the effects of corona upon the losses and voltage and current distribution in an artificial line of usual construction provided with adjustable leaks in the form of thermionic vacuum tubes which simulate corona. The artificial corona appears to duplicate the actual corona except in regard to an ionized envelope which occurs around the latter, and harmonics can be studied with great ease.—*Massachusetts Institute of Technology, Cambridge, Mass.*

HARMONICS PRODUCED BY HYSTERESIS IN IRON-CORE TRANSFORMERS.

Higher-frequency circulating currents due to the above cause are sometimes found in the secondary or tertiary windings of iron-core transformers and in the connected transmission lines. A detailed study of such harmonics with various single-phase and polyphase connections is being made. Data have been secured and numerous oscillograms taken.—*Massachusetts Institute of Technology, Cambridge, Mass.*

RECEIVERS FOR RADIO USE, TESTS OF.

A comprehensive study of the telephone receivers used in radio telegraphy and radio telephony is in progress. The tests include measurements to determine the loudness of response given by different types of telephones as well as the electrical characteristics which determine how satisfactorily they fit the electrical apparatus in which they are used. Accurate methods are being devised for these measurements.—*Bureau of Standards.*

GASES, DIELECTRIC STRENGTH OF.

A study is being made of the dielectric strength of gases other than air. The method used is that of observing the first appearance of corona on round wires and is a continuation of the work recently published in the A. I. E. E. Journal. *F. W. Lee, Johns Hopkins University, Baltimore.*

EMISSIVE POWER OF METALS, TOTAL THERMAL.

A formula has been developed by which the total thermal emissive power of metals may be calculated from their electrical resistivity. The formula has been tested in the case of chemically pure platinum and found to represent the observed emissive powers accurately up to a temperature of about 1,000 deg. K. This is of importance in the design of all heat cathode apparatus such as radio amplifiers. — *C. Davisson, Research Laboratories of American Telephone & Telegraph Company and Western Electric Company, New York City.*

AMPLIFICATION OF ELECTRIC CURRENT IN THE BUNSEN FLAME.

When an electric current is caused to flow between two dissimilar electrodes in a Bunsen flame there is usually a rectification or valve effect present. The resistance to current flow is much less in the direction which offers a cathode capable of emitting negative ions when heated. A third electrode of special type has been used to regulate the emission of the cathode and to produce amplification effects in a fashion similar to the grid of the audion. For some purposes the device is satisfactory, being easily set up and operated, but the output is small in a single-flame arrangement. Steady, reproducible conditions would be difficult to realize outside the laboratory.—*C. W. Heaps, Rice Institute, Houston, Tex.*

SPEED CONTROL OF SECTIONALIZED MOTOR DRIVE.

A new form of motor drive for paper mills has been developed in which synchronous motors are used for speed control. A small synchronous motor is mounted on the base of each driving motor and is connected to it by a gear and two belted cones. The speed of each driving motor may be adjusted with respect to the others, and unvarying speed relation between all units is maintained as positive as though they were geared together.—*Industrial and Domestic Power Committee, A. I. E. E.*

RECTIFIER, THERMIONIC.

A new low-power thermionic rectifier for alternating current has been devised which takes the form of an ordinary electric light bulb and from which direct current of the order of 100 milliamperes may be taken. A flat nickel plate is inserted between the two legs of a spiral tungsten horseshoe, and the load is connected across the plate and the middle of the tungsten filament. In this manner the bulb may be used at the same time as an ordinary lamp, although it is more efficient as a rectifier when the filament is inclosed in a cylindrical anode.—*[illegible] Scott [illegible]*

CURRENT TRANSFORMER.

A new design of current transformer has been developed which has an auxiliary winding in addition to the regular secondary winding. With this winding the phase angle may be brought virtually to zero and the ratio corrected for a wide range of load conditions. This type of transformer promises to be of considerable value as a high-grade standard and in extending the range over which commercial types of transformers may be used with accuracy.—*H. B. Brooks, Washington, D. C.*

STEEL, MANGANESE, MAGNETIC, MECHANICAL ANALYSIS OF.

In a comparative study of the Joule and Villari magnetic effects on a series of ferromagnetic substances, observations of those two effects in manganese steel were recently completed. Manganese steel is particularly interesting from the magnetic standpoint in that ordinarily it is non-magnetic, becoming magnetic when heat-treated at about 500 deg. C. for sixty hours. The manganese steel rod thus studied showed properties quite different from ordinary steel, and the full value of the results cannot be estimated until exhaustive studies have been made of other ferromagnetic substances.—*S. R. Williams, Oberlin, Ohio.*

COAL MINES, STORAGE-BATTERY LOCOMOTIVES FOR.

Preliminary laboratory tests and field investigations were made in co-operation with locomotive manufacturers to determine the permissibility of storage-battery locomotives in mines containing explosive gases.—*Bureau of Mines, Washington, D. C.*

TRANSMITTER, ELECTRON TUBE, FOR COMPLETELY MODULATED WAVES.

The modulation of the wave train of an electron tube generator for non-oscillating receiving systems by the use of high direct voltage interrupted mechanically is often inconvenient. A compact transmitting set has been designed and built which uses audio-frequency alternating current for the modulation. The current is supplied from an alternator which supplies the power through suitable transformers for both the filament and the plate circuits. An over-all efficiency from alternator terminals to the antenna of as high as 35 per cent has been obtained. Tests have shown that though it cannot be received by crystal detectors at quite so great a range as a spark set of the same power, for heterodyne reception it is virtually the equivalent of a continuous-wave transmitter of the same power output and can be received over a somewhat smaller range by any non-oscillating detector.—*Lewis M. Hull, Bureau of Standards, Washington, D. C.*

Suggestions for Research

WAVE ANALYSIS BY ELECTRIC MEANS

An irregular wave can be resolved into its sinusoidal components (Fourier series) analytically, graphically or by means of a mechanical analyzer. All these methods are either tediou or require an expensive and delicate piece of apparatus. Pro F. S. Dellenbaugh, Jr., has developed an electric analyzer (*Journal A. I. E. E.*, 1921, page 135) which in its present form is suitable only for a few lower harmonics because the result is based on only eleven ordinates of the half wave (15 deg apart). It would be very desirable further to improve and develop this device to enable a curve to be represented by a much larger number of ordinates without making the arrangement much more complicated. The goal to strive for is an electrical device such that by tracing a given oscillogram with a stylus a desired harmonic shall be determined in its phase and amplitude.

MOTORS, INDUCTION, IRON LOSS IN.

This subject has been studied to some extent and several formulas have been deduced, but as far as the writer knows no one has investigated the subject thoroughly enough to give a scientific or mathematical explanation for making definit calculations in predetermining the iron loss in a new design of motor. Each designer, of course, accumulates a great deal of information along this line and gets a fair idea of cause and effect, but as far as we know this information has not been correlated so as to be of practical use to other designers.—*J. L. Hamilton, St. Louis, Mo.*

CURRENT TRANSFORMERS, TESTING OF.

There is a need of a rapid and accurate commercial method of testing current transformers in advance of what has been available up to the present time.—*Meter Committee, N. E. L. A*

LOCATION OF SUBMERGED STEEL OBJECTS.

A large all-steel coal car being towed across Blue Mountain Lake recently was tipped into the lake by the sinking of the float. It lies in 30 ft. or 40 ft. of water, possibly embedded in mud. We have failed to locate it by dragging or diving. There may be some method of finding it by electricity or magnetism. If so, what apparatus would be needed and where could it be obtained?—*Raquette Lake Transportation Company, Hamilton County, N. Y.*

[This is a case where some of the methods developed for locating enemy submarines may be applied to a peace problem.—Editors.]

MACHINERY, ELECTRICAL, THEORY OF THE ACTIVE LAYER.

That part of an electrical machine which comprises the air gap and the adjacent portions of the two iron cores with their windings is known as the active layer of the machine. The principal electromagnetic phenomena and energy transformations take place in this layer. A general theory of this layer is desired, with magnetomotive forces arbitrarily distributed in space and in time and with one iron core moving at an arbitrary velocity with respect to the other. The final formula of such a theory could then be applied to obtain directly the important characteristics of the principal types of machinery or to predict the performance of proposed new types.—*Editorial suggestion.*

COPPER, COMPARATIVE PROPERTIES OF, WHEN HARDENED IN TWO WAYS

There are two well-known ways of hardening copper—by means of mechanical working and to alloy it with a certain amount of another metal. Further investigation is desired as to the exact properties and the relative [illegible] and electrical uses of the copper hardened in [illegible].—*Bureau of Standards, Washington, D. C.*

News of the Industry

Chronicle of Important Events and General Activities in the
Technical, Commercial and Manufacturing Fields With Announcements and
Reports of Association Meetings and Conventions

California Municipal Officers Indorse State Development of Power

AT THE recent annual meeting of the California League of Municipalities a resolution was passed approving the proposed initiative measure which would establish a hydro-electric power state board fashioned after the Ontario Hydro-Electric Power Commission plan. The resolution met with but little opposition as the delegates to the meeting were officials of the various cities and towns of the state and expressed themselves generally as being in favor of movements which would extend political ownership and control of utilities. Among the speakers during the convention was Gifford Pinchot, former head of the Bureau of Forestry, who voiced his views in favor of political ownership.

Edward Wolfe, former State Senator and now a supervisor of San Francisco, touched upon the most vital point in the campaign for state power when he said that "Just so sure as you let the impression go forth that this state is hostile to private enterprises, your efforts will fail, even though you put the credit of the state back of state power to the extent of $500,000,000."

Basic Soundness of Electrical Industry as Seen by F. A. Ketcham

BLAMING the present inactivity in the household appliance market on overproduction and forced selling methods, F. A. Ketcham, general sales manager of the Western Electric Company, recently asserted his complete faith in the fundamental soundness of the electrical business. "Just so surely," Mr. Ketcham said, "as electricity shall continue to play an important part in the march of civilization, in the field of power, transportation, communication, illumination and the other phases of everyday life, just as surely will the foundation of our business rest secure and the demands for the products we sell continue.

"There are sound reasons for our confidence," he continued. "Although the sales to the supply trade this year have fallen under the 1920 figures, there are sections of the country in which the demand is greater than it was twelve months ago. As a whole, however, we expect the increase in our business to come about slowly.

"The public utilities offer the best field for sales efforts at the present time. Having recovered from the handicaps they faced during the war, the electric light and power companies, the telephone companies, and to a lesser extent the other media of national service, are improving and adding to their systems.

"Far-sighted manufacturers are also taking advantage of the inactivity that prevails in their respective spheres now to get ready for the production demands of the future. They are putting their plants in shape by improving their lighting facilities and adopting the latest applications in electrical labor-saving devices. The smaller electrical contractors offer promising sales opportunities just now. While there has been a falling off in all the larger type of building operations, the smaller contractors are increasingly active in keeping up with the demands for the wiring of new homes."

State Inspection of Electric Wiring Proposed for Oregon

WORK has been started by J. H. Sroufe, chairman of the Oregon Association of Electrical Contractors and Dealers, to establish adequate state inspection of electric wiring, and with this end in view a committee headed by L. W. Going, chief electrical inspector of the city of Portland, has been appointed. This committee is holding regular meetings for the purpose of getting into shape an inspection law to be presented at the next session of the State Legislature.

A law was passed in 1919 establishing wiring rules. The enforcement of this act was placed in the hands of the Commissioner of Labor, and a provision was made for raising some revenue to provide for inspection by requiring the payment of a license fee by all electrical contractors.

Two years of operation under this law have proved that the license fees are entirely inadequate to give satisfactory inspection.

Narragansett Customers Will Get Benefit of Refund by Coal Dealer

THE Narragansett Electric Lighting Company of Providence, R. I., and its subsidiaries will distribute indirectly to consumers during the next twelve months $37,997.29, which will operate as a reduction in the cost of electricity. The company's plan, as presented to the Public Utilities Commission of Rhode Island and approved by that body, has become effective at once, without the thirty-day statutory notice. The consequent reduction in costs cannot be foretold, as it is contingent upon the amount of energy used.

In 1919 and 1920 the Narragansett company contracted for coal of a certain quality, but failed to get the quality and quantity specified. A claim for reimbursement made against the coal contractor led finally to a settlement in which the Narragansett company received $37,997.29. The company decided that this money did not belong to it, but rather to its customers, and plans for refunding it have terminated in the decision to apply the amount in twelve monthly installments to the fuel costs for the next year, starting with September. Accordingly, the company filed a new fuel clause under which the rates will vary each month instead of every three months.

By having a monthly adjustment the company believes the rates will be more responsive to the fluctuation of fuel costs, and the monthly installments will be deducted from the fuel cost before the rate is fixed. Rates of the Bristol County Gas & Electric, Wickford Light & Power and Narragansett Light & Power Companies will be affected by the adjustment.

Electric Utility Safeguards Discussed at Boston Meeting

NATION-WIDE interest in accident prevention was displayed by the representatives of many public utility, industrial, philanthropic and scientific organizations at the tenth annual congress of the National Safety Council, held at Boston, Sept. 26 to 30. Electrical interests received much attention, and at a luncheon on the twenty-seventh an inspiriting address upon the worldwide economic importance of safety engineering was delivered by Dr. William McClellan, president of the American Institute of Electrical Engineers, who declared that too many persons believe the safety movement to be a philanthropic activity and that its economic value is far from appreciated. Into the great movements of the times, epitomized by the slogan "Work and save," the safety engineer fits with economic justification. In stating the problems which are at hand for solution by engineers and economists, Dr. McClellan said that a Federal Reserve system is needed for labor as well as for capital, and that the elimination of waste in the operation of railroads, the development of water power, mining and distribution of fuel and the conservation of resources demand the energetic activity of all trained workers in applied science and economics.

Safeguarding hydro-electric plant employees from accidents was discussed in a paper before the Public Utilities Section by A. E. Bauhan, superintendent of stations, Pennsylvania Water & Power Company, Baltimore. Attention was concentrated upon the hydraulic side of such plants, including the consideration of hazards of various kinds. The hold-off system used at the Holtwood plant of the company was described. The company has abandoned the use of voltages higher than 32 in wheel-pit lighting. The author discussed in detail many features of safety practice which will be recapitulated in a later issue. An interesting conclusion was that in long-established plants the responsibility for safety observance should be placed upon the man in charge rather than upon a special committee, although full co-operation of all employees is, of course, essential.

John Morse, general superintendent Shawinigan Water & Power Company, Montreal, said that where virtually all operations are performed from a control room one or two hold-off tags placed on the controller handles are ordinarily considered ample protection. As an extra precaution at Shawinigan Falls the fuse plugs on the control circuits are removed by the operator. Simple, definite designations of apparatus are most important, and the grounding of all circuits worked on was commended. Unified responsibility in maintenance work, care in working around racks in winter and sympathy on the part of operating men with safety work are deemed essential to safety.

Wills Maclachlan, consulting engineer, Toronto, said that 4-in. x 4-in. timbers on top of racks enable heelholds to be retained during winter cleaning and that chains on stop-log winches should always be up when not in use. At the Niagara Falls plant of the Ontario Power Company, where 100 men are employed, interest in safety committee work is so great that monthly rather than quarterly meetings to discuss safety are urged by the employees. Adequate illumination, the speaker said, is of immense importance around such plants. Running circuits in conduit near hand rails and the use of safety-type porcelain sockets with suitable illumination were urged by J. F. Conner, United Gas Improvement Company, Philadelphia, and G. R. Rinke, Utility Mutual Insurance Company, New York, advocated care in the use of oxyacetylene welding in confined areas. The prevention of surge-tank accidents from the forcing out of ice was also touched upon.

ORGANIZED SAFEGUARDS FOR DISTRIBUTION SYSTEMS

A. B. Gates, Commonwealth Edison Company, Chicago, presented a paper upon "Care in the Construction and Maintenance of Overhead Lines," in which the importance of line designing from the safety standpoint was considered, together with safe working methods. The use of open types of construction was illustrated, and the opportunities offered employees for a voice in management through insistence upon safety practices by themselves and others were emphasized. The paper illustrated to what a remarkable extent safety engineering has lately entered the field of line construction and operation, and extracts from it will be presented in detail at a later time.

Other topics of interest to the electrical industry which were discussed at the congress included addresses on "Better Industrial Lighting," by R. W. Shenton, National Lamp Works, Cleveland, and A. S. Turner, Edison Lamp Works, Harrison, N. J.; "Electrical Hazards in and Proper Installation of Equipment," by W. J. Pefferly, Square D Company, Detroit; "Electrical Hazards in Foundries and Steel Mills," by Walter Greenwood, Carnegie Steel Company, Youngstown, Ohio (ELECTRICAL WORLD, Oct. 1, page 675); "The Use of Protective Devices," by Wills Maclachlan; "First Aid in the Telephone Field," by F. M. Downey, New York Telephone Company, and "The Necessity for Executive Support," by C. B. Scott, general manager Bureau of Safety, Chicago.

Ohio Companies Reduce Rates Voluntarily

REDUCTIONS in electric light and power rates, which became effective Oct. 1, have been made by the Springfield (Ohio) Light, Heat & Power Company. The reductions in the power rates range from 12 to 24 per cent, while the residence lighting rate is reduced from 12 cents to 11 cents for the first 15 kw.-hr., with the charge of 7 cents for each additional kilowatt-hour unchanged. The reduction is voluntary on the part of the company, which said in its announcement that the cuts were in line with lower costs for production. Further reductions are anticipated within the next few months, company officials said.

The Northwestern Ohio Light & Power Company, furnishing electric light and power to about twenty Ohio cities and towns, has also filed reduced power rates with the Public Utilities Commission, to become effective Nov. 1. The reductions average about 12 per cent. No change in the domestic lighting rate is made by the company, although it is understood the matter has been discussed with the municipal authorities.

Dinner to Returning Delegates of Engineering Societies

THE delegates of the four national engineering societies and others who went to England and France last summer to convey messages of fraternal greeting and appreciation to the engineers of those countries and to bestow the John Fritz medal on Sir Robert Hadfield of England and Eugene Schneider of France were tendered a dinner in New York on Oct. 10. Most of the delegation, which comprised Ambrose Swasey, Arthur S. Dwight, Charles F. Rand, Charles T. Main, John R. Freeman, Robert A. Cummings, Ira N. Hollis, Jesse M. Smith, William Kelly, F. B. Jewett, A. E. Kennelly and G. O. Squier, were present and briefly described their observations and impressions. J. V. Davis, president of the United Engineering Society, presided, and in addition to the talks made by the delegates, speeches were made by the British and French Consuls stationed at New York and by G. G. Clapperton, representing the British engineering societies, and Prof. Jacques Cavalier, speaking for the French. The desirability of greater unity and co-operation between the engineers of England, France and the United States was frequently voiced through the evening. As a token of appreciation and as an earnest of amity and friendship as well as of commemoration the French government, through Gaston Liebert, bestowed medals on Ambrose Swasey, Charles J. Main, Dr. Ira N. Hollis, A. S. Dwight, F. B. Jewett, G. S. Webster, E. Ludlow, E. S. Carman and William McClellan.

Public Seems to Be Turning Away from Home Rule in Utility Regulation

THE wave of sentiment in favor of home rule in the regulation of utilities which threatened to assume considerable proportions about a year ago, just before the elections, has abated, and there is now every indication that the public is absolutely reversing its position. M. H. Aylesworth, executive manager of the National Electric Light Association, who recently returned from an extensive trip through the Middle West and Rocky Mountain regions, says that it was forcibly impressed upon him during the trip that the people were turning against home rule.

"There seems," Mr. Aylesworth said, "to have been an awakening on the part of the public to the fact that home-rule regulation would result in poor service and in a much lessened service to the rural communities. This is due particularly to the circumstance that local authorities have been unable to cope intelligently with the problem of regulation, which is a specialized subject and of state-wide importance."

The farmer, of course, has never been misled, because of the effect of home rule on his comfort. This is well set forth in a recent issue of the *Southwest Farmer*, which says editorially:

> The day is past when the electric light and power company operation is to be confined within the city limits. The development of the electric power industry to the extent where electrical energy is now carried hundreds of miles over high-powered transmission lines has wiped out the "city limits."
>
> The farmer should come into his own. The farmer would come into his own were it not for the restrictions, limitations, arrestments and obstructions which are thrown in the way of development of the electrical industry by the people who live in the cities and think that they should have "home rule" over those public utilities which are in the business of generating electric power and distributing it to other people 300 miles away.

Utility Commissioners Come Out Strong Against Government Ownership

MEMBERS from thirty-two states were present at the opening session of the annual meeting of the National Association of Railway and Utility Commissioners, held in Atlanta, Ga., on Tuesday to Friday of this week. James A. Perry, president of the association, in a stirring address opposed vigorously centralization in Washington, in the Interstate Commerce Commission, of control over all railroad rates, thereby destroying the power of the states to regulate their domestic commerce. In discussing the local problems of utilities, such as electric light, street railway and gas companies, Commissioner Perry asserted that the rates have been too low, generally speaking, throughout the country for the past two years, and he predicted that a continuance of this policy of dealing with local utilities will very soon drive capital entirely away from utility investments, if, indeed, it has not to a large extent already done so.

The time has come, declared Commissioner Perry, for the public to realize that it is equally interested with utility stockholders in adequate service and adequate returns upon the value of the properties devoted to the public use. It is time for the public to realize that community growth is dependent upon utility growth, and that utility growth is dependent upon the investment of capital, and that investors of capital will not put their money into utility property when utilities are not allowed to earn as much as the legal rate of interest in the states where they operate.

Public or government ownership of public utilities, with either public or private operation, was strongly opposed in the report of the public ownership and operation committee, submitted at the afternoon session on Tuesday. The committee, whose report was submitted after an exhaustive inquiry into matters concerning government and private ownership both in the United States and abroad, went on record as favoring privately owned and privately operated public utilities, with the proviso that all utilities should have public regulation. Striking instances of the failure of government ownership were cited. The report declared that "the public must be given fair and adequate service at a reasonable cost," and that the safeguarding of these essential rights of the people makes the existence of regulatory bodies a necessity.

"Such regulatory governmental bodies, however," the report said, "at the same time must be sufficiently wise and fair and far-seeing to stand between the utility in question and unthinking, hasty public clamor not based upon full knowledge and careful thought. Public utilities are subject to the same financial laws of operation as are private enterprises. They must operate successfully in order successfully and adequately to fulfill their duty of service to the public.

"It therefore follows that, in order to maintain a just, equitable balance, and even to keep such utilities out of bankruptcy, it is necessary to maintain their higher rates longer than would to the layman seem necessary, judging by the surrounding decline in commodity prices. To follow any other policy would be to put such utilities out of business and to discontinue that service to which the public is so justly entitled and which is now more necessary to the return of the vast bulk of private business to the desired goal of normalcy."

The report was submitted by a committee consisting of Commissioners A. G. Patterson of Alabama, chairman; W. C. Bliss, Rhode Island; F. R. Spinning, Washington; H. H. Williams, New Mexico; H. A. Russell, Kansas; L. H. Porter, Vermont, and James Cansler, South Carolina.

Regulation Since the War

Wednesday afternoon was devoted to a round-table discussion on after-the-war phases of regulation, presided over by Henry G. Wells of the Massachusetts commission. In opening the discussion he pointed out that regulation should not penalize efficiency and place a premium on inefficiency. He referred to financing of utilities as one of the great problems and related how a solution was brought about in his state by adequate legislation. Other commissioners dwelt on the need of fairness and truthfulness in presenting cases to them in order to inspire confidence in the basis for the argument of the utility. Customer-ownership programs were viewed with much favor by commissioners and considered to afford a solution to a part of the financing problem. They urged that harmony be sought by every method.

S. Z. Mitchell and Martin Insull spoke for committees representing the American Gas Association and the N. E. L. A. Mr. Mitchell explained the service viewpoint in utility operation and emphasized the need for more money to supply existing service demands and a sufficient rate to make the securities attractive to investors in order to raise funds for new work and needed improvements. He urged prompt action by the commissions and expressed the hope that funds would be made available to commissions to employ needed assistance to study utility matters. Mr. Mitchell also showed why it is imperative to "go slow" in rate reductions, which would still further impair service and future development and betterments.

Mutual Understanding

Mr. Insull emphasized the point that after-war regulation should not differ essentially from regulation at any other time. The important thing is a mutual understanding between utilities and the commissions in their function of serving the public. He also considered it important to educate the public as to what constitutes service. In dealing with these problems he urged that they be approached with good will, good humor and good sense on the part of both utilities and commissions.

On Wednesday evening a banquet was tendered the association by the Presidents' Club of Atlanta, which is a club comprising presidents of some fifty-two civic bodies. Mell R. Wilkinson was toastmaster, and addresses were made by prominent business men, including Carl D. Jackson, president-elect, and James A. Perry, retiring president of the association; Harford Powel, editor of *Collier's Weekly*, and Joseph B. Eastman of the Interstate Commerce Commission. Arrangements for the banquet and other entertainment features were carried out by J. Prince Webster, formerly a member of the Georgia Railroad Commission.

Thursday's and Friday's proceedings will be reported in a later issue of the Electrical World.

Public Relations Occupy Tenney Service Convention

IMPROVEMENT of public relations and increased efficiency of service individually and collectively occupied the close attention of about 250 executives and departmental leaders in the utility properties affiliated with Charles H. Tenney & Company, Boston, at the twelfth annual convention of the organization, held in that city on Monday and Tuesday of this week. The program included three business sessions and a luncheon, with an address Tuesday noon by Governor Cox of Massachusetts. A talk on "Public Utility Organization" by M. H. Aylesworth, executive manager National Electric Light Association, and an address on European conditions by W. Irving Bullard, vice-president Merchants' National Bank, Boston, were given on Monday, following a keynote address by Col. Charles H. Tenney on the importance of a sane financial outlook.

H. T. Sands presided at the opening session, and D. E. Manson opened the meeting Tuesday morning with a program embracing the following topics: "The Tenney Organization," by Palmer York; "Good Housekeeping and Bad," by A. E. Bliss; "The Trend of Public Utility Legislation," by Allen Hollis, and "Present-Day Public Utility Obligations," by H. T. Sands.

Washington Conference on Unemployment Issues Recommendations

WITHOUT attempting the impossible task of assessing the relative weight of different forces, the Conference on Unemployment now meeting at Washington under government auspices has made the following summary of the more important matters that require constructive and immediate settlement if recovery in business and permanent employment are to be speedily brought about:

1. Readjustment of railway rates to a fairer basis of the relative value of commodities, with special consideration of the rates upon primary commodities at the same time safeguarding the financial stability of the railways.

2. Speedy completion of the tax bill with the contemplated reduction of taxes, in order that business now held back pending definite determination may proceed.

3. Definite settlement of tariff legislation in order that business may determine its future conduct and policies.

4. Settlement of the financial relationships between the government and the railways, having in mind the immediate necessity for increased maintenance and betterments, making effective increased railway employment and stimulation of general employment, in order that the railways may be prepared for enlarged business as it comes.

5. Limitation of world armament and consequent increase of tranquillity and further decrease of the tax burden not only of the United States but of other countries.

6. Steps looking to the minimizing of fluctuations in exchange, because recovery from the great slump in exports (due to the economic situation in Europe) cannot make substantial progress so long as extravagant daily fluctuations continue in foreign exchange, for no merchant can determine the delivery cost of any international shipment.

7. Definite programs of action that will lead to elimination of waste and more regular employment in seasonal and intermittent industries, notably in the coal industry, in order that the drain upon capital may be lessened and the annual income of workers may be increased.

8. In the field of all the different industries and occupations the rapidity of recovery will depend greatly upon the speed of proportionate adjustment of the inequalities in deflation.

San Joaquin Light & Power 7 per cent Bonds Offered at Par

EVIDENCE of the growing strength of electric light and power company securities is found in the offer by the San Joaquin Light & Power Corporation of $1,500,000 of unifying and refunding 7 per cent bonds at par. These bonds are a thirty-year issue, due March 1, 1951, and the low rate of return which they carry indicates that in the case of good public utility long-term bonds money is thought to be now procurable at a reasonable price.

N. E. L. A. Good-Will Film to Be Distributed

ARRANGEMENTS have been made for the distribution to N. E. L. A. member companies of the one-reel feature film entitled "Back of the Button" prepared for the association by the Rothacker Film Manufacturing Company and shown for the first time at the Chicago convention in May. This is the first of a series of motion pictures to be produced by the association for the benefit of the entire industry. It is expected that these films will place before the public all of the benefits of electric light and power service and also bring out the problems with which the industry is confronted.

Reclamation Service Makes Recommendations on Colorado River

ALL EXISTING data bearing directly upon the problems of the lower Colorado River have been condensed in a single report prepared by the Reclamation Service. Since the publication of a preliminary report a year ago by the irrigation committee of the House of Representatives further investigations have been made and embodied in the report, which comprises six volumes. The recommendations which form a part of the report are as follows:

1. That through suitable legislation the United States participate in the construction of the Boulder Canyon Reservoir and the High Line Canal from Laguna dam to the Imperial Valley, in proportion to the interests of the public lands and the Indian lands as set forth in the report.
2. That the Secretary of the Interior be authorized to enter immediately into contracts with such states, counties, municipalities and other interests as may desire to participate in the benefits of the construction herein recommended, provided that each participating agency furnish funds with which to defray its proportionate share of the expense, as allocated by a board to be appointed.
3. That there be appointed a board of three competent persons who shall not be resident in any of the states affected by the decisions of the board and who shall have no financial interest in those decisions, one being an irrigation engineer, one a power engineer and one learned in irrigation law, to allocate the cost and benefits of the proposed construction and assess the cost upon those receiving the benefits in proportion to such benefits. The decisions of this board should supersede the preliminary allocation recommended in this report, and contract should be entered into with all participating parties to abide by the decisions of this board and to supply funds for construction in proportion to benefits as determined by the board.
4. That the Secretary of the Interior be authorized to proceed with the work of development as rapidly as the funds are made available from any of the sources provided.

The report embraces the quantity and regularity of water supply for irrigation, data pertaining to flood control, data concerning storage facilities, and information as to the amount of land available for irrigation and the canal systems which will be required.

The opinion is expressed in the report that "the investigations at Boulder Canyon have shown the feasibility of a high dam at that point. The amount of storage which would be furnished by this dam has been computed at contour elevations ranging from 750 ft. to 1,300 ft., showing that the capacity would range from 58,750 acre-feet to 31,600,000 acre-feet. The canyon walls extend to the 2,000-ft. contour, or 700 ft. higher than the contour which would result in a capacity of 31,600,000 acre-feet.

The entire matter is to be taken up at a public hearing before the Secretary of the Interior in Washington on Oct. 27.

Must Maintain Values in Local Stock-Selling Campaigns

PUBLIC relations, with emphasis on the sale of securities locally, was the dominant subject of the convention last week at the Lake Placid Club, Lake Placid, N. Y., of the Empire State Gas and Electric Association. The program, which was particularly attractive in that it concentrated on a small number of important topics, drew representatives from about 150 utilities. Especial emphasis during the discussion was placed on local stock selling for maintaining values. President H. W. Peck opened the convention with a review of the past year and urged that particular attention be given to the questions of taxation, wage adjustment and sales of securities to the customer as the paramount issues of the year ahead.

The Thursday morning session was given over in large part to the consideration of public relations as a factor in the value of utility securities, with an address by H. M. Addinsell. Mr. Addinsell urged the sale of stock to the public in as large an amount as can be easily marketed with as small a bond issue as possible, but sounded the warning that during the sale of securities to the public proper measures should be taken to insure that the price of the stock on the open market be not less than the company's price, lest customers' securities depreciate in value and there be a reaction in public sentiment. J. T. Hutchings pointed out that the utilities have two purposes in selling stock—to obtain money and to improve relations with the public—and that therefore the value of the securities after selling should be conscientiously maintained. E. H. Palmer of Geneva stated that his company is publishing monthly in its house organ a detailed financial report for the information of customers who own the company's securities.

The committee on rural lines reported on the special need for rural rate classification and submitted rural service schedules recommended for varying conditions. Thursday evening was devoted to a banquet, followed by a lantern-slide address by Col. John P. Hogan on the "Electric Power Situation in New York City." Music was furnished by the "Con-Gas quartet."

Chairman Prendergast of the Public Service Commission addressed the convention on Friday morning and discussed the gas situation in Greater New York, recommending the consolidation of all gas companies in the greater city with a gradual assumption of ownership by the municipality. An address by Loyal S. Wright of Manlius, N. Y., followed on the subject "Serving the Public." Mr. Wright graphically illustrated the principles of service and the natural laws which measure the value of the service.

The following officers were elected for the coming year: President, E. H. Rosenquest; first vice-president, E. H. Beal; second vice-president, S. J. Magee; treasurer, W. J. Welch.

Plant Distribution Discussed by Steel Engineers

"POWER Distribution in Industrial Plants" was a topic that elicited considerable interest at the Philadelphia Section meeting of the Association of Iron and Steel Electrical Engineers last Saturday. The paper of the evening was presented by K. M. Raynor, assistant superintendent electrical department, Lehigh plant, Bethlehem Steel Company. Mr. Raynor referred to a 6,600-volt, three-phase overhead circuit which ties together six substations at the Lehigh plant. Each phase consists of two conductors which pass through current transformers at the entrance to and exit from each substation. These transformers are connected to relays in such a manner that an unbalance of load equal to 50 per cent of the normal rated load will trip the oil switches at each end of the circuit affected, thereby isolating the trouble. After two years' operation the system has cleared all cases of trouble with the exception of one.

In discussing this subject, Harold Goodwin called attention to the fact that the cost of relays is negligible compared with the value of the protection they afford.

R. B. Gerhardt contended that systems involving the distribution of large amounts of power cannot be operated with the same degree of reliability with the radial system as with the loop system. For relay protection he expressed a preference for the wattmeter type of relay rather than the bellows type. With the simple loop the number of substations which can be connected with the system is limited because of the time setting of relays and the time required for oil switches to operate, Mr. Gerhardt asserted. On the other hand, with split-conductor systems like that to which Mr. Raynor referred there is no limitation. However, Mr. Gerhardt said, the balanced relay system does not afford any protection in case of trouble on the substation busbars.

International Pooling of World's Radio Facilities Planned

REPRESENTATIVES of American wireless interests are now in Paris discussing world radio matters with a view to forming a combination of British, French, German and American radio facilities. Daily conferences are being held by the delegates, who expect to complete arrangements before Nov. 1. The proposed agreement is the outgrowth of a desire to place international wireless service on a sound commercial basis. Radio facilities of the four countries will in effect be pooled, but the companies in each country will retain control over their respective territory. It is thus expected to eliminate a great deal of waste occasioned in the past by duplication of equipment by the different organizations. The governments concerned have approved the conference.

The formation of an international corporation consolidating the radio interests in the various countries is not contemplated, according to David Sarnoff, general manager of the Radio Corporation of America. Mr. Sarnoff stated to a representative of the ELECTRICAL WORLD that the negotiations in Paris have not yet been completed but that details of the agreement will be given out when the American representatives return.

The American delegation includes Owen D. Young, vice-president of the General Electric Company; Edward J. Nally, president of the Radio Corporation of America, and J. W. Elwood. The Westinghouse interests are also represented. British interests are represented by Godfrey Isaacs of the British Marconi Company, those of France by E. Girardeau of the French Wireless Company, and those of Germany by C. Shapiro of the Telefunken Company.

September Licenses and Permits Issued by Federal Power Commission

APPLICATIONS for licenses and preliminary permits were received by the Federal Power Commission during September as follows, the name and address of the applicant, the type of application, the type of project, its location, its proposed use, the horsepower involved and "conflicts," if any, being shown:

Darwin Silver Company, Independence, Cal.; license; transmission line from Los Angeles line to mining property; mining purposes.

Gladstone Mining Company, Buena Vista, Col.; license; power development; Denny Creek, Col.; mining; power capacity, 100 hp.; installed capacity, 100 hp.

Rio Grande Light, Heat & Power Company, Albuquerque, N. M.; license; power project in Rock Canyon, Sandoval and Santa Fé Counties, N. M.; public utility; power capacity, 2,750 hp.; installed capacity, 25,000 hp.

Frank C. Dougherty, San Francisco; preliminary permit; four power projects on Crater, Long and Tease Lakes and at Sweetheart Falls near Port Snettisham, Alaska; pulp and paper manufacture; installed capacity, 80,000 hp.; power capacity, 66,000 hp.; conflicts with the application of the Speel River Company.

W. H. Samson, Corning, Cal.; preliminary permit; power project, Stuart's Fork of Trinity River; public utility; power capacity, 15,000 hp.; installed capacity, 25,000 hp.

Southern Sierras Power Company, San Francisco; preliminary permit; power project; Bear Creek and Santa Ana River, Riverside County, Cal.; public utility; power capacity, 5,000 hp.; installed capacity, 25,000 hp.; all in conflict with the application of J. G. Van Zandt.

Lars Jorgensen, San Francisco; preliminary permit; three major and three minor projects on the Middle Fork of Feather River in Plumas, Sierra and Butte Counties, Cal.; public utility; power capacity, 200,000 hp.; installed capacity, 350,000 hp.; in partial conflict with the application of the Richpoint Mining Company, the Great Western Power Company and with the application of R. T. Harding. The project contemplates the creation of six large reservoirs storing a total of 372,000 acre-feet, the construction of several diversion dams, several miles of conduits and tunnels and six power houses.

Northern States Power Company, Chicago; preliminary permit; six projects on the Mississippi and the St. Croix Rivers in Burnett and Polk Counties, Wis., and in Pine and Chicago Counties, Minn.; public utility; power capacity, 30,000 hp.; installed capacity, 60,000 hp.; in direct conflict with applications of J. D. Markham and of the St. Cloud Electric Power Company.

R. T. Harding, San Francisco; preliminary permit; power project, Bucks and Grizzly Creeks, Plumas County, Cal.; mining and manufacturing; power capacity, 7,900 hp.; installed capacity, 15,800 hp.; in conflict with applications of Lars Jergensen and of the Great Western Power Company.

Ed. Fletcher, San Diego, Cal.; preliminary permit; power project; Santa Yzabel and Black Canyon Creeks, San Diego County, Cal.; public utility; power capacity, 1,800 hp.; installed capacity, 3,600 hp.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest

Electrification of Sawmills.—A striking instance of what electrification of sawmills is accomplishing in the Northwest is afforded by the Carlisle Pennell Lumber Company, with headquarters at Onalaska, Wash. This company has made a record run in which more than 300,000 board-feet of lumber was cut on a single-cut saw in one day of eight hours. In these mills there is a total installed capacity of electrical motors of 3,200 hp., embracing 220 motors of various ratings.

Springfield, Ill., Votes to Extend Utility Franchises.—At a special election held Sept. 27 the people of Springfield, Ill., by a very decisive vote approved an ordinance extending the electric, steam and hot-water-heating franchises of the Springfield Gas & Electric Company for a period of twenty years. This is a straight extension of the company's franchises, which expired earlier in the year. The company, subsidiary of the Commonwealth Power, Railway & Light Company, also serves Springfield with gas, the franchise for which is unlimited as to its duration.

Hydro-Electricity Planned in South Carolina Through Joining Rivers.—By building a 24-mile navigable canal from the Santee River to the headwaters of the Cooper River, the Columbia (S. C.) Railway & Navigation Company plans to obtain 4,000 hp. of continuous power and perhaps three times as much secondary power. The proposal is to build a hydro-electric power house at the southerly terminus of the canal, where a head of 30 ft. would be obtained. The company has acquired a preliminary permit from the Federal Power Commission in which provision is made for surveys into the effect of the proposed diversion on the navigability of the Santee River.

Dr. Steinmetz on the Voltage of a Lightning Flash. — Addressing the Kiwanis Club of Schenectady recently on the subject of "Lightning," Dr. Charles P. Steinmetz asserted that only in the last few years, with the advance of electrical engineering, has science become able to understand and explain the electrical phenomena of the thunderstorm, to calculate the voltage and the energy of the lightning flash, and "finally we have been able to reproduce lightning experimentally in our laboratory." He said that corroborative evidence has shown that the voltage of a lightning flash was usually between 20,000,000 and 100,000,000, averaging probably about 50,000,000.

Electrification of Railroads in Japan.—Plans are being worked out by the Japanese government for the electrification of the Tokaido railroad from Tokyo to Kobe and of part of the line running from Tokyo to Kofu in the rear of Mount Fuji, where many tunnels make transportation slow. Electric trains will be for passenger service only, steam locomotives being retained for hauling freight.

Complaints of Discrimination Against San Francisco Companies.—Complaint has been made to the California Railroad Commission against the Pacific Gas & Electric Company and the Great Western Power Company charging discrimination against the Park-Presidio district of San Francisco in charges for electric service. Twenty-six residents of the district signed a formal complaint and say that they are supported by a petition signed by 3,000 consumers in the district. The complaint alleges that the rates charged in the Park-Presidio district are higher than the rates in other parts of the city in which the defendant companies are in competition with the Universal Electric & Gas Company. The petitioners ask that the Pacific and Great Western companies be ordered to lower their rates in the district to conform with the schedule in competitive territory. As an alternative prayer it is requested that the Pacific Gas & Electric Company be required to supply through the Sierra & San Francisco Power Company sufficient electrical energy at wholesale to the Universal company to permit the latter to enter the Park-Presidio district.

Formosa Developing Her Water Powers.—Since 1902, says a British consular report, five water-power electric stations have been built in the island of Formosa. These have a total rating of 11,200 hp. and supply five towns. Since the war there has been a large industrial development, and a governmental project is now on foot to utilize the waters of the Dakusui River and of Lake Candidius, which is the largest body of water in the island and lies almost exactly at its center. The cost of the undertaking is placed at 48,000,000 yen ($24,000,000 at par) and the date of its completion at about 1926. The lake, which is about 6 square miles in area and 2,400 ft. above sea level, has been gradually drying up, but when the waters of the river, which now passes within a few miles of the lake as it flows to the sea, are diverted so as to discharge into the inland body of water, the level of the latter will be raised 75 ft. A power station will be built 1,100 ft. below the reservoir, and it is expected to generate a maximum of 140,000 h.p. Eventually a second power house, with a maximum output of 62,000 hp., may be built 4 miles below the first one. A less ambitious project is now being carried out by a private company which in a few months will be capable of adding 10,000 hp. to the island's supply, and various other schemes are the subject of discussion.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

Telephone Pioneers of America.—The Telephone Pioneers of America will meet at St. Louis on Oct. 24 and 25.

Vancouver Section, A. I. E. E.— Officers of this section elected for the year beginning this fall are: Chairman, John R. Read; secretary, W. F. McNeill; executive committee, Frank Sawford, L. P. Philpot and T. H. Crosby.

"Cost Accounting from the Engineering Standpoint."—An address on this subject will be made on Monday, Oct. 24, at 8 p. m., before the Philadelphia Section of the Taylor Society by John H. Williams, New York manager for Day & Zimmermann.

A. I. and S. E. E., Philadelphia Section.—The second meeting of this section of the Iron and Steel Association is scheduled for Saturday, Nov. 5, at the Engineers' Club, Philadelphia. The topic selected is "Operation and Care of Power Transformers."

American Electric Railway Association Elects Officers.—The following officers were elected by the American Electric Railway Association at its annual convention in Atlantic City, N. J., last week: President, Robert I. Todd, president Indianapolis Street Railway and Terre Haute, Indianapolis & Eastern Traction Company; first vice-president, Britton I. Budd, president Chicago Elevated Railways, Chicago, North Shore & Milwaukee Railroad and Chicago Interurban Traction Company; second vice-president, C. D. Emmons, president United Railway & Electric Company, Baltimore; third vice-president, J. N. Shannahan, president Newport News & Hampton (Va.) Railway, Gas & Electric Company; fourth vice-president, Frank R. Coates, president Community Traction Company, Toledo Ohio; treasurer, Barron G. Collier.

Coming Meetings of Electrical and Other Technical Societies

N. E. L. A., Southeastern Section—Chattanooga, Tenn., Oct. 17-19. (For program see issue of Oct. 8, page 713.)

A. I. E. E., New York Section—New York. Oct. 19.

Telephone Pioneers of America—St. Louis. Oct. 24-25.

American Society for Testing Materials—Providence, Oct. 28 and 29.

A. I. and S. E. E., Philadelphia Section—Philadelphia, Nov. 5.

A. I. E. E. and Society of Naval Architects and Marine Engineers—New York Nov. 17.

American Physical Society—Chicago, Nov. 25-26.

Electrical Supply Jobbers' Association, Atlantic Division—Philadelphia, date in November to be fixed.

American Institute of Chemical Engineers—Baltimore, Dec. 6-9.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities

Increase of Rates Permitted to Improve Service.—Allowing an increase in gas rates over the protests of a city which alleged inferior service, the Washington State regulatory body pointed out that the utility concerned had operated last year at a loss and expressed the view that it would be harsh to deny it a sufficient return to prevent a deficit and at the same time compel it to spend several thousand dollars to improve its service. On evidence that the company was proceeding with the improvements necessary, the increased returns were allowed.

Interests of Consumers in Utility Dividends.—In commenting on the four expenditures that the earnings of public utilities must be large enough to cover—operating costs, taxes, depreciation fund and dividends—the Rhode Island Public Utilities Commission recently said: "It becomes at once apparent that the failure to earn sufficient to cover all of the above items means that depreciation or dividends, or both, must suffer. The consumers of the utility have a direct interest in the maintenance of proper depreciation and dividends. The former safeguards the efficiency of the plant, and the latter enables the utility to maintain its credit and have available at reasonable interest or dividend rates the new capital that is constantly required to extend and develop its service to meet the requirements of the community."

Company Has Right to Benefit by Bargain Purchase.—That the actual value of property and not the sum paid for it is the governing factor in regulation of utilities was insisted upon by the Virginia Corporation Commission in a case involving the Lynchburg Traction & Light Company. "The cost to the present owners is of no relevancy," the commission said, "in the absence of information as to the sums the property originally cost. If the present owners bought a bargain, they are entitled to profit thereby, just as the owners of private property are so entitled. Had they paid too much, as is the case with the owners of certain other utility property in Virginia, they would stand to lose and the public would not be made to suffer thereby. Some utilities are overcapitalized; the commission therefore pays no attention to their capital obligations and will not require the public to pay a return on securities not represented by property used in public service. In this instance the company is somewhat undercapitalized, and the fact that large dividends have been paid upon its stock in the past does not mean that its return upon the actual value of the property has been unduly large."

Discrimination Involved in Special Rate Contract.—A complaint was brought before the Pennsylvania Public Service Commission by the Apollo Steel Company against the West Penn Power Company because of rates alleged to be in conflict with a special rate contract. The commission, however, declared that a special contract giving reduced rates to a steel mill cannot be sustained on the ground that the consumer was a pioneer user of electricity in its business, that its successful operation would be of advertising value to the utility, and that it assumes the risk of interruptions in transmitting the electrical energy over a 40-mile transmission line, since these are not the distinguishing conditions and circumstances which justify a rate differential.

Dual Service Prevented as Detrimental to the Public.—In Rockton, Ill., an agreement between the Rockton Electric Company and the South Beloit Water, Gas & Electric Company stipulating that the South Beloit company should serve all future power business and the Rockton company all future domestic consumers was disallowed by the Illinois Public Utilities Commission as detrimental to the public interest because it would lead to agitation, dispute and a duplication of equipment. The consumers, the commission pointed out, might be compelled to pay a return upon the investment in two sets of line, either one of which would be adequate for the required service. The two companies were ordered to enter into an agreement by which the local company should acquire all distribution equipment of the other utility.

Tentative Increase of Rates with Provision for Refunding Excess to Customers Is Condemned.—The Railroad and Public Utilities Commission of Tennessee has held, in an application to raise telephone rates, that rates not in the nature of emergency relief should not be granted without a valuation upon which to base the return. The acceptance of a refunding bond from the company guaranteeing the return to its customers of any excess charges subsequently determined is condemned by the commission, despite the company's contention that it will suffer irreparable injury should the routine procedure be followed. "It would be," the commission asserts, "a herculean task to take up and follow through the books of the company all the transactions with a view of refunding to each individual the excess which he may have paid in each particular transaction with the compnay. When the case should have finally been completed so that an order could issue, thousands of those who might have paid the excess charges would have died, moved away or failed to keep in touch with the detailed operations of the company."

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies

Rate Procedure in Kansas.—Where rates fixed by the Public Utilities Commission of Kansas are adjudged to be confiscatory and set aside by a court of competent jurisdiction, the utility may, according to a decision of the Kansas Supreme Court in City of Hutchinson vs. Southwestern Bell Telephone Company, promulgate rates of its own which will be deemed legal rates under which the utility may operate until such rates are found to be unreasonable and excessive or until other rates are fixed by the commission, and rates promulgated in this manner may not be enjoined by the courts until action has been taken by the commission. (200 Pac. 301.)*

Damages Not Recoverable for Death of Electrician Who Failed to Exercise Ordinary Care.—An electrician employed by the Trenton (Mo.) Gas & Electric Company was killed through contact of a dead line on which he was making connections at a generating station with another line carrying high-voltage current which he had previously connected and which he had himself ordered to be energized. His widow recovered damages in the trial court (Egan vs. Trenton Gas & Electric Company), but the Supreme Court of Missouri reversed the verdict on the ground that the victim had not been ordered to perform the work in the manner that he did and that, as an experienced electrician, he was guilty of lack of ordinary care in so doing. (233 S. W. 239.)

Police Power of State Not Vested in Municipalities in South Dakota.—The South Dakota Supreme Court has sustained the Board of Railroad Commissioners in a suit brought against it by the city of Mitchell to annul an order increasing telephone rates over those named in the company's franchise. The court held that any delegation of police power must be clear and express and that courts should hesitate to hold either that a sovereign power of the state, such as the police power, the free exercise of which by the proper agency might be essential to the general welfare, had by implication been taken from legislative control and lodged even in part with the municipalities of the state, or that by implication the constitution had conferred upon municipalities a power through the exercise of which they might be able to confiscate the property of public utilities.

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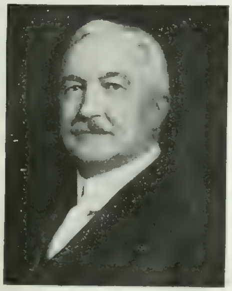
*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System

Men of the Industry

Changes in Personnel—Responsibilities and Association Appointments of Men Engaged in Professional, Executive, Operating and Commercial Branches of the Industry



M. E. COOLEY

Mortimer E. Cooley, who has been elected to head the American Engineering Council of the Federated American Engineering Societies, was born in Canandaigua, N. Y., on March 18, 1856, and was graduated from the United States Naval Academy in 1879. In 1881 he was detailed by the Navy Department to the University of Michigan at Ann Arbor as professor of steam engineering and iron shipbuilding, and in 1885 he resigned from the navy to accept the chair of mechanical engineering at the university, which conferred upon him the honorary degree of M. E. He became dean of the College of Engineering in 1904 and of the College of Agriculture in 1913. During the Spanish-American War in 1898 he served as chief engineer of the convoy Yosemite, which took an active and hazardous part in the naval operations. On returning to the university Mr. Cooley undertook a large amount of important appraisal work, including investigation of the 10,000 miles of Michigan railroads, valued at $100,000,000, as well as telegraph and telephone lines, plank roads and river improvements, and the evaluation of the power plants, rolling stock, stores and supplies of the Detroit street railways. His work in Michigan led the Legislature to adopt the ad valorem basis of taxation. In 1902 he assisted in the appraisal of the mechanical equipment of Newfoundland railroads and in 1903 acted as consulting engineer in the Wisconsin railroad appraisal. In 1904 he was a member of the traction valuation committee of Chicago, and since 1910 he has been in charge of appraisal of hydro-electric and steam-electric properties and railroads for the Michigan Public Utilities Commission. He has also investigated public utilities in Minneapolis, Milwaukee, Cleveland, St. Louis, Boston, New York and other cities and has served as chairman of important committees connected with the Interstate Commerce Commission and the Chicago and Pan-American expositions. In 1918-19 Dean Cooley was president of the A. S. M. E.

C. Rodman Stull, who for the past six years has been manager of the Kingston (N. Y.) Gas & Electric Company, has resigned to take up other work.

H. J. Gille, commercial manager Puget Sound Traction, Light & Power Company, Seattle, has been made a member of the industrial bureau of the Seattle Chamber of Commerce and Commercial Club, which is undertaking an important survey of industrial possibilities in the Puget Sound region.

Dr. Ernest F. Nichols, who was inaugurated last spring as president of the Massachusetts Institute of Technology, has been prevented by illness from assuming his duties, and until his recovery the institute will continue to be governed by an administrative committee. It is hoped that Dr. Nichols, whose illness is attributed to overwork, will be able to take charge by Jan. 1.

Lewis A. MacArthur, general manager Pacific Power & Light Company, Portland, Ore., has been made the recipient of an honorary degree, "master of arts in public service," conferred by the University of Oregon.

L. A. MAC ARTHUR

W. A. Wolls, the new president of the Ohio Electric Light Association, started in the central-station business in 1889 with the Columbus (Ohio.) Edison Electric Light Company. The company was then furnishing service to the downtown section of the city through the underground Edison tube. Mr. Wolls' occupation for a number of years was that of switchboard operator, and at the age of nineteen he became first assistant engineer in charge of the operation of the plant. Spare time was devoted to the study of mechanical and electrical engineering with the intention of becoming a power-station operator. Failure of health forced him temporarily into the commercial activities of the central-station company, and he developed a liking for that phase of the work and foresaw its possibilities. In 1912 he stepped out of the central-station into the merchandising field, undertaking department-store work. He found this unsatisfactory and went back to the central-station field. He is now the manager of the new-business department of the Columbus Railway, Power & Light Company. He brings energy and ripe experience to the service of the Ohio Electric Light Association that will make for better service to the industry of the state. He has seen the company he represents grow from its inception in 1883 until it now has 43,000 customers and a sale of 135,000,000 kw.-hr. per year.

W. A. WOLLS

Prof. Comfort Avery Adams, who was on leave of absence for the college year 1919-20 and on half leave for the college year 1920-21, and who has served as chairman of the engineering division of the National Research Council, has returned to Harvard University and will take up his full-time duties.

Frank G. Whitney, for the last fifteen years superintendent of substations, electric division, New York Central Railroad Company, has resigned to become superintendent of the Dutch Point power station of the Hartford (Conn.) Electric Light Company. A farewell banquet was given in Mr. Whitney's honor on Sept. 22 by a hundred of his associates and fellow-employees of the New York Central Railroad Company. Mr. Whitney was presented with a handsome watch and a traveling bag as tokens of their esteem.

Dr. Elmer D. Ball has been chosen by the Secretary of Agriculture to be the first director of scientific work. The office was created in the last agricultural appropriation bill so as to provide an official who would be in immediate general charge of all research work in the department. Through Dr. Ball an effort will be made to co-ordinate and correlate the scientific work of the department in a way to make it more effective in the study of national problems having a bearing on agriculture.

C. B. Buchanan has resigned the office of vice-president and general manager in charge of operation of the Virginia Railway & Power Company, Richmond, Va., to open an office in New York City for the promotion of the "trackless trolley."

H. P. Westervelt, formerly New England district manager for the Century Electric Company, Boston, has joined the sales enginering staff of the New England Appliance Company, 514 Atlantic Avenue, Boston, representative of the Union Electric Company and of the Watson and Kimble motor manufacturers.

E. L. Windenburg, who has been appointed office manager of the Cleveland branch of the Cutler-Hammer Manufacturing Company, fills the vacancy made by the sudden death of A. F. Loomis on Aug. 2. Mr. Windenburg has been with the Cleveland office since February, 1919, when he left the aërial service of the United States Navy. He is a graduate engineer, having taken his degrees from Iowa State College at Ames.

George T. Hansen, for ten years district manager of the Allis-Chalmers Manufacturing Company at Salt Lake City, Utah, has resigned to enter private business. E. N. Greenleaf, who has been Mr. Hansen's assistant, will become the new district manager of the Allis-Chalmers Company. Mr. Hansen will devote his time after Sept. 15 to the practice of mining engineering and to looking after his mining and oil interests.

Fred O. Erickson, formerly a member of the sales department of Roth Brothers & Company, has been appointed secretary and treasurer of the Central Armature Works, Inc., manufacturer of motors and generators. In addition to acting in the above capacity he will have complete charge of the sales department. Mr. Erickson has been with the Roth company for the last eight years. Prior to that he was connected with the Westinghouse Electric & Manufacturing Company's Chicago office, where he had charge of the repair and claim department.

John Hinds has been recently elected vice-president of the Philadelphia Insulated Wire Company in charge of sales.

Edward N. Hurley, Jr., and James A. McCoy have been elected vice-presidents of the Hurley Machine Company, Chicago, the number of vice-presidents having been increased from three to five. John Proudfoot, formerly assistant treasurer of the company, was elected treasurer in succession to Mr. McCoy.

P. S. KLEES

Peter S. Klees, who has been appointed general sales manager of the Tubular Woven Fabric Company, Pawtucket, R. I., has until recently been in charge of its New York City territory. In the sales field Mr. Klees has been identified for a number of years with prominent companies. He was sales manager and later vice-president of the Franklin Electric Manufacturing Company of Hartford, previous to its consolidation with the Westinghouse Lamp Company. Mr. Klees entered the electrical industry in the employ of the American Lamp Company of Philadelphia, where he remained until about 1906, when he became connected with the Franklin company as sales manager. He has taken an active interest in the work of national associations and he is also well known in the electric manufacturing field.

Herbert Metz, for the last two years in charge of farm electric light plant advertising with the Western Electric Company, has been appointed its power and light sales manager, with headquarters at the company's general offices in New York City. Mr. Metz joined the Western Electric Company upon graduation from Penn State College in 1914, starting in the commercial student course at its big plant near Chicago. The following year he entered the advertising department in New York and, except for a year in field sales promotion work in the Rocky Mountain territory, he has since been connected with publicity work on the extensive farm electric equipment campaign which the company has been carrying on.

Obituary

Dr. Emil Arnold Budde, a well-known electrical engineer who represented Germany on the International Electrotechnical Commission in pre-war days, is dead at the age of eighty.

Arthur F. Loomis, office manager of the Cleveland branch of the Cutler-Hammer Company, died suddenly at his home on Aug. 22. He was forty-nine years old and a graduate of Lehigh University.

J. H. Lord, an electrical engineer who had had charge of the installation of electrical equipment in the Fairfield plant of the Tennessee Coal, Iron & Railroad Company, has died at Bengal, India, where he was connected with the Tata Iron Works.

Lloyd W. Chapman, industrial editor of the *Journal of Electricity and Western Industry*, San Francisco, died on Sept. 6 after an attack of spinal meningitis. He had been at his desk three days before. Mr. Chapman, who was only thirty-six years old, was born in Massachusetts and had been connected at different times with the electrolytic laboratory of the Anaconda Copper Company at Great Falls, Mont., and as chemical engineer with the E. T. du Pont de Nemours Company at Wilmington, Del. In May, 1919, he became the Pacific Coast editor of *Chemical and Metallurgical Engineering*, being transferred last February to the position named above.

Henry J. Kimman, since 1902 manager of the Cleveland plant of the Chicago Pneumatic Tool Company, died in Cleveland on Sept. 7. Mr. Kimman was born in Haarlem, Holland, in 1863. He came to America in 1870 with his parents, who settled in Chicago. He served an aprenticeship with the Adams-Westlake Company and other manufacturing concerns in Chicago and the Far West. Ambitious to engage in business for himself, he converted the basement of his home on Nineteenth Street, Chicago, into a small machine shop and carried on work there in the evenings, while he continued to work for others in the day. He designed and in collaboration with his brother, T. P. Kimman, built the first practicable portable piston air drill, known as the "Little Giant." Soon after engaging in the manufacture of air drills he became associated with E. N. Hurley, and they formed the Standard Pneumatic Tool Company in 1898. On the consolidation of pneumatic-tool interests in 1901 he became associated with the Chicago Pneumatic Tool Company as manager of the Cleveland plant. He remained in active charge of that plant until his death.

Trade and Market Conditions

Business Reviews, Together with Market Letters from Important Trade Centers, on the Supply, Demand and Prevailing Prices of Electrical Apparatus and Supplies

September Construction Activity Breaks Records

AN ANALYSIS of the report of the F. W. Dodge Company on building activity during the month of September shows that new records in construction activity were set. Building contracts awarded during that month in the twenty-seven Northeastern States amounted to $246,186,000, an increase of 11½ per cent over contracts awarded during August. This is not only the largest monthly total that has been reached this year, but also the largest September figure on record. During the ten-year period previous to 1921 the average September figure is 14½ per cent below the average August figure.

Greatest increases were noted in the entire Middle Western territory and in the New York district, while New England, the Northwestern States and the Middle Atlantic States showed the usual seasonal September decline. Figures for August were given in these columns of the issue of Sept. 17.

New England's proportion of this total of $246,186,000 amounted to 6.5 per cent; New York State and Northern New Jersey accounted for 35 per cent; 13.8 per cent was taken up by the Middle Atlantic States; the Pittsburgh district contributed 16.6 per cent; 25.3 per cent came from the Central West, and 2.8 per cent from the Northwest.

Residential building still leads all other classes, amounting to nearly 39 per cent of the total in September, but of greater significance is the increase in volume of business buildings. This amounted to nearly 17 per cent of the total and is the largest monthly total in this class since June, 1920. Public works and utilities represented 14 per cent and educational buildings 11 per cent.

These figures are of such a nature that the electrical industry, it would seem, should feel greatly encouraged over the outlook for fall and winter work. They show probably, a volume of building contracted for in the neighborhood of 20 per cent in excess of that represented by a like value a year ago.

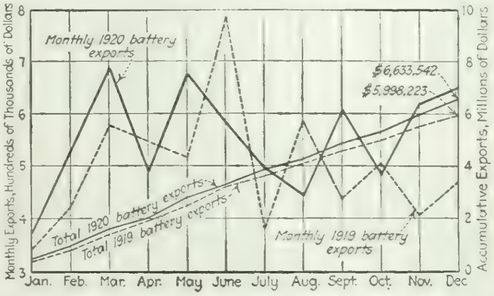
British Possessions Lead in 1920 Battery Exports

OF THE exports of batteries from the United States during the calendar year 1920, amounting in all to $6,633,542, the British possessions, including England, took nearly 51 per cent of the total, or $3,360,181 worth. Canada led all countries with $1,734,126, and England was a poor second with $467,858. From here on the decreases were quite gradual for the other countries. Twenty-five are tabulated, each of which took a value of $50,000 or more in batteries. Sixty others took batteries aggregating in value $534,398. Total exports of this commodity for the year 1919 amounted to $5,998,223.

BATTERY EXPORTS IN 1920

Canada	$1,734,126	Dutch East Indies	$93,779
England	467,858	Norway	79,407
Argentina	448,260	Denmark	72,873
Cuba	405,814	Panama	66,268
Australia	364,461	Newfoundland and Labrador	65,356
Mexico...	302,046	Straits Settlements...	65,119
British South Africa	250,780	Chile	63,716
British India	230,304	Colombia	58,417
New Zealand	226,896	Uruguay	[illegible]
Spain.	205,724	Peru	52,597
Philippine Islands	195,770	Sixty countries importing less than $50,000 in batteries	534,398
Brazil	189,582		
China	147,230		
Japan	141,231		
France	114,149		
Total			$6,633,542

With the assistance of Canada the continent of North America, considering geographical divisions, stood first, with a total of $2,441,986, 37 per cent of the whole. Europe was second, five states contributing $940,011 in battery imports from the United States, 14 per cent of the total value. The islands southeast of Asia, with $881,306, or just over 13 per cent, were followed closely by South America, with $869,571, or just under 13 per cent. Four Asiatic countries took a value of $583,984, or 9 per cent of the total. The sixty other countries importing less than $50,000 each accounted for 8 per cent, and the remainder of the total went to Panama and British South Africa.



BATTERY EXPORT VALUES INCREASED 16 PER CENT IN 1920 OVER 1919

The diversity of the market for batteries in the foreign field is clearly shown in this table, and all the countries listed took a fair volume of imports. Of course, the item of batteries includes storage batteries, wet batteries, dry cells and flashlight batteries. Even outside of Canada, the largest market for exports of electrical equipment from the United States, it is interesting to note the volume of these imports to British domains. During the fiscal year ended June 30, 1918, Canada again was the largest importer, followed in order by England, Australia, Cuba, Argentina, British South Africa, New Zealand, France, Brazil and Mexico.

Considering monthly figures in 1919 and 1920, there seem to be no parallels in the volume of exports except that January is shown to be the poorest month. This compilation was made by the ELECTRICAL WORLD from data received from the Bureau of Foreign and Domestic Commerce.

Copper and Brass Products Higher in Stronger Market

WITH the rise in price of electrolytic copper throughout the month of September and to date in the present month it is not surprising that prices of copper products should have been advanced. Since the first of September, when electrolytic copper was quoted at 12 cents, delivered, for spot, copper wire, net, at the mill has advanced from 13.25-13.50 cents per pound to 14.50 cents. Electrolytic is now quoted 13 cents for spot, delivered. Black wire rods have taken the same advance, high brass wire has advanced 1 cent, copper sheets and copper bottoms are ½ cent to ¾ cent higher, square copper rods are 0.67 cent higher, and round copper rods, high brass sheets and seamless copper tubing are ½ cent higher. Low brass wire is quoted 1 cent lower, and high brass rods, low brass sheets and rods, seamless brass and commercial bronze tubing are quoted ½ cent lower.

In line with these higher prices there is an increased demand for finished copper and brass products. Bare and insulated wire is quoted on a higher level this week by manufacturers who did not advance their price a week ago. During September jobbers were quoting No. 14 rubber-covered wire in 5,000-ft. lots at $6 per 1,000 ft. in several important centers of the country. Today those prices are from $6.25 to $6.60. Meanwhile the trade saw the impending advance and laid in stocks. Weatherproof, too, is higher about 1 cent in base prices.

Scrap heavy copper and wire prices since Sept. 1 have advanced from a level of 9.50-10 cents a pound to a level of 10-10.75 cents a pound. Heavy brass is up from 4.50-4.75 cents to 4.75-5.25 cents a pound. Light brass scrap is still higher at 4.50-4.75 cents as against 3.75-4 cents.

Buying of copper by wire manufacturers and by brass manufacturers has been at a high rate since Sept. 1, about 100,000,000 lb. having changed hands in the month of September. This is about double present production with most of the mines shut down.

Electrical Sheet Prices Holding, While Raw Market Is Stronger

STEEL-MILL orders are reported falling off a little during the past week. At the same time comes the announcement that several independent sheet makers in the Youngstown district have notified their customers of a five-dollar advance in sheet prices on Oct. 15. This would bring black sheets to 3.25 cents, blue annealed to 2.75 cents and galvanized to 4.25 cents, 0.25 cent in each case above the prices effective the middle of September.

Sheet production is running pretty high, one mill operating at about 90 per cent of capacity. Electrical sheet operation is on a low basis, on the other hand, in line with the buying by electrical apparatus manufacturers, with considerable stock still on hand. Prices on this material are holding, no advance having been made with the September sheet advance and no immediate advance being contemplated, it is reported, on this newly announced rise of Oct. 15.

Strong Flatiron Market Keeps Distributers' Stocks Low

A SURVEY of the markets for electrical heating devices shows the flatiron market to be the strongest of them all. Since the schedule of prices on heating devices was lowered last July the effect has been clearly shown on flatiron sales, although it was a few weeks after the price change before the consumers realized what the cut amounted to and came into the market.

Very heavy stocks were held in manufacturers' warehouses and in distributers' hands when summer broke and factory production was at a relatively low ebb for this device. Since August, however, the buying has been on such a plane that these stocks have been materially reduced and factory operation is on a fair plane again. In some quarters distributers report that they are cleaned out of stock and are actually in need of large replenishments to satisfy their customers. Other distributers are not in accord on this point. They admit that their stocks are low, but say their factory is able to make satisfactory shipments.

Distribution of irons to the consumer is said by one prominent distributer to be getting back again to the channels of trade existing before the war. That is, the ranks of the dealers that sprang up at that time and immediately after the armistice have been reduced to a large extent because of the number that have fallen by the wayside, and the trade is consequently dominated to a greater extent by the central-station companies, department stores and the better class of electric shops, thus insuring a better type of service.

Insulation Market Ruling Stronger with Better Buying

WITH the higher prices ruling for cotton yarns and cloth, the insulation market is on a little stronger basis and buying has been reported more active. The principal increase in the buying has been noted in the fields concerned in repair and maintenance work rather than in new manufacturing. Electric railway properties have shown considerable activity in this respect in the last three weeks in comparison with the light buying from that direction in the summer. Cotton insulation and cotton and rubber tapes are moving well, and a noticeable increase in buying of mica is found. This is not only in shapes for commutator slot insulation, but also in tubes and washers for grid insulation, undoubtedly in anticipation of winter needs.

Another increasing market for mica at this time is in the flatiron field, the one item of heating apparatus that is enjoying a real healthy trade. The apparatus-manufacturing field is increasing its production only slowly if at all as factory and distributer stocks have been ample to take care of the increases in buying which have developed recently for small sizes in motors and in transformers, generators, control and other electrical apparatus. Ample stocks of insulation have cared for manufacturing needs to date, but these are running low here and there and buying has resulted. From many quarters, however, the market is quite dull.

Some further price advances since Sept. 20 have been noted in varnished cotton tapes and cloth, in the nature of 10 per cent. Cotton yarns and gray goods at the mills have gone up again, and when insulation manufacturers come into the market for further supplies it is expected that still further advances in price of finished insulation will result. Then, too, stocks of cotton cloth at the mills have been reduced considerably through buying in the garment industry and a temporary shortage may result. Mica prices are up only slightly.

Metal Market Situation

COPPER buying for October and November accounts has continued at a good rate during the past week, but some producers are reported to have withdrawn from the October market because of their short stocks available. Producers' prices for October are 13 cents per pound for electrolytic, delivered, and the same price for November. December ranges up to 13.25 to 13.50 cents.

The outside market is on record as having made October sales at 13 cents, refinery, and is asking 13.12½ cents for November and 13.25 cents for December, approximately ⅛ cent above producers' prices.

Buying is still good from wire and brass mills. Export sales this month have been excellent, with a price of 13 cents f.a.s. as a minimum. This will not always be covered.

NEW YORK METAL MARKET PRICES

	Oct. 4, 1921	Oct. 11, 1921
Copper	£ s d	£ s d
London, standard spot	68 12 6	69 7 6
	Cents per Pound	Cents per Pound
Prime Lake	12 50 — 12 75	13 00 13 25
Electrolytic	12 62½	13 00
Casting	12 25	12 62½
Wire base	14 00 — 14 50	14 50
Lead, Am. S. & R. Co. price	4 70	4 70
Antimony	5 00 — 5 25	5 00
Nickel, ingot	41 00	41 00
Sheet zinc, f. o. b. smelter	10 00	10 00
Zinc, spot	5.05	5 12½
Tin, Straits	26 87½	27.25
Aluminum, 98 to 99 per cent	24 50	24 50

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	10 00 — 10 62½	10 00 — 10 75
Brass, heavy	4 75 — 5 00	4 75 — 5 25
Brass, light	4 25 — 4 50	4 50 — 4 75
Lead, heavy	3 50 — 3 75	3 50 — 3 87½
Zinc, old scrap	2 25 — 2 37½	2 25 — 2.37½

THE WEEK
IN TRADE

Prices When Quoted Are Those Prevailing at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for all Eastern Points

THERE seems to be no let-down in the demand for electrical materials, although some sections report no increase this week over the past. In the Atlanta district the improvement is continuing and jobbers are getting bigger orders and more of them. The trade there is looking toward the central-station companies to extend their lines as a further market for equipment. Chicago trade is quiet. The labor situation is still in a muddled state, but it is thought the light is breaking through and that the later fall will witness improvement in construction.

Building had a great impetus during September in New York, Atlanta and St. Louis territories. Electrical goods are moving well in St. Louis, with special emphasis on weatherproof wire and sockets. Hardware for pole lines and also poles increased slightly. New York trade is lively in heaters and irons.

Rubber-covered wire is somewhat stiffer as a whole, but no advance has yet been applied to armored conductor. Buying of this conductor is on an increasing curve.

NEW YORK

Improvement in trade as reported from week to week for the past month and a half continues to hold its own. No spectacular increase in activity has appeared along any line, but jobbers seem to be well satisfied with a gradual return of better conditions. Wiring material is moving steadily and demand is good. Compared with two months ago jobbers' offices present a much busier appearance, and the general attitude of both jobbers and contractors is much more optimistic. Prices show little tendency to weaken; if anything, wire, flexible armored conductor and tape have stiffened somewhat.

Heating appliances are moving better than at any time during the past six months. There has been a fairly strong demand for heaters and the leading devices such as flatirons, toasters and curling irons. In fact, there is a decided shortage of some leading makes of the three latter appliances. Hollow ware, grills and small stoves are also moving. A great deal of interest was aroused in these appliances by the Electrical Show, which closed Oct. 8, and inquiries for all kinds of household electrical devices have been received literally by the thousands by the contractor-dealers in this territory.

Collections remain on virtually the same basis as last reported. Current sales are mostly on a thirty-day to sixty-day basis.

Conduit.—Sales have been fairly good and demand is steady, although orders are mostly for moderate quantities. The following prices were quoted: For ½-in. black pipe in 2,500-ft. lots, $54 to $55; ¾-in., $69 to $71, and 1-in., $99 to $101. Galvanized pipe in the same sizes was quoted at $59 to $62, $76 to $81 and $110 to $116. Most jobbers' stocks are fair to good in nearly all sizes.

Flexible Armored Conductor.—Active buying of this material continues, apparently in anticipation of an expected increase in price, which, however, had not been announced early in the week. No. 14, two-wire, single-strip, is quoted at $43 per 1,000 ft. and double-strip at $44.50 per 1,000 ft. in lots of that quantity. Jobbers' stocks are only fair in view of the present demand.

Rubber-Covered Wire.—Demand is a little better and contractors are ordering in larger quantities. No advance in prices was quoted, No. 14 in lots of 5,000 ft. remaining at $6.35 to $6.60 per 1,000 ft. as reported last week. For smaller quantities $7 per 1,000 ft. is asked. Jobbers' stocks are good.

Loom.—Demand for this material is very small in this territory, and only moderate stocks are carried by most jobbers. In 1,000-ft. lots the $\frac{7}{32}$-in. size sells for $19.25 and the ¼-in. size for $21 per 1,000 ft.

Lamp Cord.—No. 18 cotton, twisted, is quoted at $12.30 per 1,000 ft. and No. 18 parallel at $14.90 per 1,000 ft. Demand is fair, and jobbers report ample stocks on hand.

Tape.—Prices are somewhat higher than last reported. Friction tape in 100-lb. quantities is quoted at 40 cents per pound and rubber tape at 45 cents per pound. Demand is fair and stocks are generally good.

Schedule Material.—Another leading manufacturer has announced a revision downward of prices and discounts on such items as sockets, receptacles, snap switches, rosettes and so forth. These conform with the prices on these items as reported a month ago. Some jobbers report a shortage on pull-chain sockets and state that manufacturers' stocks are low.

Heaters.—All jobbers reported that electric heaters are moving better, and dealers have placed orders in quantities ranging from one dozen to one gross. Stocks are moderate.

CHICAGO

The labor situation continues to muddle along, with little apparent surface indication of a final settlement. The most important development of the week was a secret meeting of the various associations representing the employers and professions interested. The Association of Commerce participated. Published reports indicate that plans were formulated to support the Landis award in the building trades situation much more strongly than heretofore. The whole situation seems to be gradually drifting toward a settlement that will not be accomplished without much creaking and groaning of the machinery and a series of apparent deadlocks.

Wire.—Little change in prices is noted and the demand is fair to good. No. 14 rubber-covered sells for $6 per 1,000 ft. in any lot required. Weatherproof is quoted at 15 cents per pound in 1,000-lb. lots. Stocks are fair for the expected future demand, but would be insufficient if a heavy demand should arise.

Flexible Armored Conductor.—Prices on No. 14 two-wire double strip vary from $48 to $50 per 1,000 ft. in lots of any quantity, depending upon conditions of credit. Movement of this line is continuing below expectations.

Rigid Conduit.—Prices on this material remain about the same as last week. Jobbers quote ½-in. black at $48 to $50 per 1,000 ft. in 2,500-ft. lots. Galvanized pipe in the same size is quoted at $52 to $54. Sales are fair and stocks are fair to good, although not much activity is expected until some settlement of the building situation is brought about.

Tape.—Demand is moderate and stocks are fair to good. In 100-lb. lots friction tape sells for 38 cents per pound and rubber tape for 40 cents.

Poles.—Stocks are heavy and moving slowly. A nominal quotation is $8.60 for a 35-ft., 6-in.-top Northern white cedar, with competition active in this line.

Locust Pins.—Movement has been very slow and stocks are still large. Prices are fairly steady, the 1½-in. x 9-in. pins selling for $38.90 per 1,000 in. lots of 3,000.

Motors.—Inquiries continue to be fair although spotted. Prices remain firm, while movement on both fractional-horsepower and large motors is slow.

Washing Machines.—Movement in this line is dependent upon the sales effort and continues to be fair. Prices are still holding with little or no expected future drop.

Heating Devices.—Air heaters are moving well, and flatirons, toasters and grills are also moving fairly well. Stocks are fair with manufacturers' stocks reported to be only moderate.

BOSTON

Moderate increases in trade continue, with sustained activity in New England textile, paper-making and shoe-manufacturing fields. In miscellaneous electrical supplies a better tone is evident, although the machinery market is still dull. Household appliances are moving better as the dealers begin to appreciate the possibilities of the fall trade. Collections are holding up well and promise decided improvement within the next few weeks. Jobbers' stocks are much lower than earlier in the year. Prices are undergoing many readjustments, with upward tendencies in loom and rubber-covered wire. Building operations fell off about 25 per cent last week in the value of contracts placed, and the slow liquidation of labor is believed by many to be responsible for the lack of accelerated revival in this field.

Lamps.—Week by week lamps are reported in better demand. Seasonal consumption is increasing and larger business activity is also reflected in sales. Portables are moving reasonably well and sign lighting is healthier than for some time. Prices are encouraging to new business.

Wire.—No. 14 rubber-covered is moving fairly quickly at present, with sharp competition. No. 14 sells at $6 to $6.25 per 1,000 ft. in 5,000-ft. to 25,000-ft. lots and at $7.25 in lots of 1,000 ft. to 5,000 ft. In the larger quantities some instability of quotations is evident. Stocks are plentiful. Weatherproof base Monday was 14¾ cents.

Loom.—The market is dull this week, stocks being ample for current needs. Prices trend toward firmer levels, though current sales do not yet reflect this much. The $\frac{7}{32}$-in. size is selling around $16.50 to $17.50 per 1,000 ft. in 5,000-ft. lots, and the ½-in. size, correspondingly, at $19 to $20. Sales quickened Monday in anticipation of price stiffening.

Flexible Armored Conductor.—In 5,000-ft. lots this material is moving slowly around $42 per 1,000 ft. Liberal stocks are in hand.

Washers and Cleaners.—Unsettled conditions have not yet cleared in the electric washer market, owing to the divergence in prices of machines in competition. Sales are continuous, but intensive effort is needed to move goods. Better business is reported on cleaners, with more stable price conditions, good stocks and active factory production.

Meters.—Moderate improvement in building conditions is reflected in meter movement from stock. Prices hold firm.

Motors.—Spotty business continues to dominate the market. Industrial betterment work, however, keeps up a steady stream of small-order business, with ample stocks for current requirements.

Scheduled Material.—Price readjustment continue in prominent lines of plugs and switches, the tendency being downward. Pull sockets are steady at 31½ cents net, in case lots, keys at 18 cents and keyless at 16½ cents.

ATLANTA

The opinion of all lines of business is that conditions in general continue to show a steady improvement of a substantial and healthy nature. Everything seems to indicate that this section is again on the road to normal and healthy conditions. No very large operations have yet been undertaken, but reports of expanding activities have lately been received from a variety of sources, the more noteworthy being those recently announced in the textile, ice and stone working lines.

The report of the Federal Reserve Bank of Atlanta places August building permits of twenty-four principal cities at 3,506, valued at $5,814,000, an increase of 190 per cent over August, 1920. This heavy revival of construction is the cause for satisfactory activity in lumber and woodworking plants, brick manufacturing, etc. In the electrical lines it is having a tendency to overcome the hand-to-mouth purchasing that has been so much in evidence for the past few months, and contractors are now beginning to feel safe in accumulating small stocks of the faster moving materials.

Funds realized for fall crops are beginning to be evidenced in the increase in retail sales. Electrical jobbers are enjoying considerable increase in the number and size of orders from the contracting trade, and they are anticipating considerable revival in purchases by central-station companies for line material for maintenance and expansion.

Fixtures.—Both the commercial and residential types continue exceptionally active, owing to the large number of buildings going up in Atlanta and vicinity. Jobbers say they have stocks sufficient to meet the demand. While there have been reductions in some types, prices in general remain steady.

Poles.—The demand for poles of all varieties continues very satisfactory, with jobbers reporting white cedar and chestnut poles as increasingly active. One of the largest jobbers reports the receipt of heavy inquiries for poles from central-station companies during the past week. Stocks of the better class are fair to good, with shipments from yards fairly prompt.

Pole-Line Hardware.—The entire line of pole-line hardware continues active with prices steady, there having been no change for the past sixty days. Stocks are ample.

Bell-Ringing Transformers.—Jobbers report a steady and very satisfactory demand for this specialty, with prospects of it continuing for some months to come. Stocks are in good shape with no price change reported.

Safety Switches.—The movement of this line continues very good with the 30-amp., three-pole type the most popular, though sales of all sizes are becoming more satisfactory. Stocks are good.

Sewing Machines.—There has been little or no activity in this line for some time past. Jobbers are not placing orders for fall as they do not anticipate any increased activity for some time.

Farm-Lighting Plants.—After several months with few or no sales recorded the past few weeks have witnessed an awakened interest in this line. Several of the manufacturers and jobbers will exhibit at the county fairs this month, and they are anticipating considerably increased sales.

ST. LOUIS

Building permits for the city of St. Louis were of abnormally large value last month, the total being reported as $4,307,172, but permits were issued for only three new factories and workshops, and their value was only $42,500. The principal items were a million-dollar hotel, a million-dollar lodge building, a hospital to cost $600,000 and two schools totaling $260,000.

The buying of electrical goods continued to show slight advancement last week, no particular line of goods finding especial demand. Buying of weatherproof wire in larger quantities by the utilities was of interest, and the railroads also showed somewhat better buying strength. The situation in the South is being closely followed by all the jobbers, but as yet only a slight increase in purchasing is apparent. Money in the South is now easier to obtain, and materially better business, especially in appliances, is expected to develop in the next few months.

Non-employment, although declining slowly, will be strongly felt here this winter, and to alleviate conditions a committee has been appointed to study the situation and make recommendations. The first of these is for the city to engage in municipal improvements on a large scale, and the indications are that something of the kind will be done.

Wire.—Further stiffening of prices occurred last week, and now most jobbers are selling No. 14 rubber-covered for $6.50 per 1,000 ft. in lots of 5,000 ft. or more. The base price on bare and weatherproof is from 15½ cents to 16 cents per pound. One of the railroads purchased a large quantity of No. 9 bare, and a number of the utilities came in for good quantities of weatherproof. Some stocks are running low.

Flexible Armored Conductor.—The market is weak and no material changes in prices have been made. No. 14 two-wire is $5 per 100 ft. in lots of 1,000 ft. or more.

Lamp Cord.—A slight shading in prices over those of the preceding week is apparent, and No. 18 cotton-covered twisted pair is being sold for $13.25 in lots of 1,000 ft. The demand is showing improvement and stocks are slowly being reduced.

Knobs and Tubes.—Price increases have been generally made as the stocks obtained at the lower manufacturers' prices became exhausted. In barrel lots "Nail-It" knobs are priced around $17.50 per 1,000. Likewise, in barrel lots, 2½-in. tubes are selling for $5.25 per 1,000 and 3-in. tubes for $5.75 per 1,000. Low stocks are being maintained.

Conduit.—While the movement continues slow, particularly in the larger sizes, the week developed some improvement. Stocks are in good condition. In bundle lots ½-in. black sells for $49.75 per 1,000 ft. and 1-in. black for $93.16. In the galvanized the respective prices are $55.93 and $103.36.

Sockets.—Some improvement in buying is reported and a steady volume of sales has been maintained for some time. Representative prices are: Key, $18.15 per 100; keyless, $16.15, and pull, $33.00, all in standard-package lots. Stocks are in excellent condition.

Pole-Line Hardware.—Improvement is found as compared with the slack sales existing a few weeks ago. The sales indicate that the utilities are buying only for small extensions and for maintenance purposes. Quite a bit of line strengthening is being done in anticipation of the winter.

Poles.—Some variations in the prices on Western red cedar poles have been made, but they are small and cover only changes which have been made in freight charges, the variations depending upon the shipping base. The demand is increasing slightly, most of the improvement being in Illinois and Arkansas.

SEATTLE—PORTLAND—SPOKANE

The business tone in the Puget Sound and Portland districts is greatly improved over that of six weeks ago, and the marked gains made in September are apparently permanent. Conditions are better in the lumber industry than they have been during the past two years, and it appears that the corner has been rounded. The lumber market in the Seattle district has stiffened considerably during the past week. Fir lumber had advanced about $2 per 1,000 ft. with export business heavy. Lumber and wheat exports from Portland were unusually heavy during September. An average of more than 2,000,000 ft. of lumber and approximately 200,000 bushels of wheat was shipped each day during the month. Imports are increasing steadily.

Building of residences and small industrial and commercial building continues good in both the Portland and Seattle districts. Wages in the building trades are on the average about 20 per cent lower than a year ago. Electrical jobbers of Seattle report business to be holding the gains made during September, and a steady growth is anticipated. Some loosening of credits is observed. Few price changes are observed, but some slightly upward tendencies have been noted. Stocks for three months are carried in most lines, and shipments are fairly normal. Portland manufacturers and jobbers report the volume of business to be good, but mostly in small sales. Jobbers are carrying about four months' stock of goods that must be supplied from the East. There is pronounced activity in the sale of washing machines and ironers. A recent drop of 15 per cent or more in the price of washing machines has undoubtedly done considerable to influence this activity. Some retailers report business very active.

Electric Washers.—Following the slashing of prices effective Oct. 1, washers have been moving rapidly in Seattle. Dealers have taken advantage of the price reduction by instituting aggressive selling campaigns with good results. Washers now range in price from $120 to $140.

Heaters.—Owing to the low rate for energy used for heating in Tacoma a considerable market for 2-kw. and 3-kw. heaters exists. The movement for heaters is now under way and promises to be good for several months.

Hollow Ware.—Specialties are beginning to feel the influence of the fall and holiday season and are livening up considerably.

Wire.—The price of copper wire has stiffened slightly during the past week. Rubber-covered is up 5 per cent while 0.5 cents has been added to the base price of weatherproof.

Schedule Material.—Since the reductions in the price made effective a few weeks ago the movement in schedule materials has been very good.

SAN FRANCISCO

The oil-field strike still drags along, but it is likely an early settlement will be reached. Collections are better than they were a month or so ago, and credit men are again loosening up the amounts allowed their customers.

Schedule Material.—Standard brass key sockets are selling in package lots for approximately 20 cents each. Lower prices made on all standard sockets as well as on other standard schedule items are causing a demand which is reflected in good movements of stocks as reported by manufacturers maintaining schedule stocks on the Coast.

Heating Devices.—Jobbers' salesmen are now out on Christmas stock solicitation, but the first orders will be very low compared with last year because of long stocks remaining in the dealers' hands on items considered as particularly of a holiday character. Some heating pads retailing at $9 each have proved acceptable to the trade at $5.85 in lots of six. It may be generally said that the 1921-22 heating pad demand will be principally confined to low-price articles. Some dealers have thought so highly of the possibilities of instantaneous water heaters that they have put out special solicitors for them, and it is certain that there is a big public demand for the right heater.

Conduit.—Non-metallic flexible conduit, which has decreased about 10 per cent in price, is now selling for about $19 per 1,000 ft. in the standard wiring size. Local stocks are good.

Wire.—Local stocks in all standard sizes are very low. In rubber-covered wire some exceedingly low prices and a special drive have pretty well exhausted the local market. Prices are now on the upward trend, the new 5,000-ft. price on No. 14 single-braid solid being $7 per 1,000 ft., an increase of about 10 per cent.

SALT LAKE CITY—DENVER

A feeling of decided optimism, warranted by actual improvement in business generally, has developed in the merchandising field in the past three or four weeks. Crops are being liquidated, and the farmers are spending their money for the things they have long needed. The beginning of the beet harvesting has begun, and the first pay day, several weeks hence, will put hundreds of thousands of dollars in circulation. Electrical men, both jobbers and dealers, are noting positive indications of better times and dealers report a better buying tendency on the part of the consumer of electrical merchandise. Dealers are ordering stocks in better quantity. Money seems to be getting gradually easier, with collections showing some improvement.

The report comes through reliable channels that one of the largest smelting concerns in the mountain region will soon resume operation, taking back on its payroll 700 men. The employment situation generally, however, is not much improved, although an effort is being made by several agencies to co-operate with the federal government. The electrical repair business has been exceptionally good through the summer.

Flatirons.—A gratifying improvement in sales is reported, with jobbers in many cases far behind the demand for stocks. Reduced prices, together with vigorous advertising campaigns, are responsible for the pick-up in business.

Headlight Heaters.—The consumer demand is good and jobbers are adequately stocked.

Ranges.—The inauguration of financing plans whereby dealers can handle time payment contracts has resulted in better sales of electric ranges.

Manufacturers' Activities

Devoted to the Business Side of Manufacturing, Distribution and Sales, News from Jobbers and Foreign Fields and a Record of New Devices and Trade Literature

New Manufacturer Enters Insulation Field in Delaware

The Insulation & Specialty Corporation of America, 3154 Dupont Building, Wilmington, Del., on Sept. 1, 1921, was organized with a capital stock of $500,000 to manufacture "Fibre Granite" insulation. This comes in sheets, rods, tubes and special shapes. It is announced by P. C. Hennig, president of the company, that on Oct. 1 the capital stock was increased to $1,000,000.

The plant will consist of three concrete buildings, 60 ft. x 200 ft., boiler house, engine house, office building and shipping room, 80 ft. x 100 ft. There are about ten acres of land and railroad sidings. It is stated that the plant will give employment to from 400 to 500 men.

P. C. Hennig is president and chairman of the board of directors, W. L. Broman is vice-president and Lawrence J. Broman secretary and treasurer.

Majestic Electric Development Pushing Convenience Outlet

One of the few manufacturers of electrical socket devices and appliances who are pushing the campaign for the "convenience outlet" is the Majestic Electric Development Company, 656 Howard Street, San Francisco. In a recent letter T. D. MacMullen, sales manager of the company, states that it is the company's policy to draw attention to the use of the convenience outlet in all of its advertising, and an attached bulletin, distribution of which was estimated to have reached close to half a million copies, featured this policy. A window of one of the San Francisco electric companies was shown wherein every portable appliance was connected to a convenience outlet. This is in support of a campaign of publicity started some time ago to push the convenience outlet, but up to date assisted very little by the manufacturers of portable appliances.

Black & Decker Establishes National Credit Service

The Black & Decker Manufacturing Company, Baltimore, has recently put into effect what it terms The Black & Decker National Credit Service. The company's products are sold entirely through jobbers, and the new service enables customers to buy through their regular jobber by paying 23 per cent of the regular price of the item in cash, balance in six equal monthly payments.

Jobbers have been supplied with printed forms to be used for orders taken under this plan. These order forms are conditional sale agreements which make the item sold its own security until entirely paid for. The jobber forwards these orders to the company, which discounts them for the jobber, so that every sale made under this plan is in effect a cash sale for the jobber. The company shares fifty-fifty all responsibility with the jobber for the fulfillment of sale agreement.

Refrigerator Manufacturer Keeps Up to Year's Bogey

George Spalt & Sons, Inc., Albany, New York, makers of the "Powrkold" iceless refrigerators, have kept their sales this year up to the "bogey" set for them last year. The company is selling now directly through its factory and has been for the last two years, but, having brought its refrigerating machine to its present state of development, it is expected that distributer connections will be made about the first of the coming year.

Cuban Telephone Issue to Provide for Enlargements

The Cuban Telephone Company has released an issue of $4,000,000 of 7½ per cent gold bonds, series A, due in 1941, the offering price being 95 to yield 8 per cent. Proceeds from the sale of the bonds will be used, it is reported, for liquidating the entire floating indebtedness of the company and in addition will provide for extension enlargements to its telephone system.

Locke Changes New York Manager and Office Location

On Oct. 1 the New York City office of the Locke Insulator Manufacturing Company was removed from the Woolworth Building to the twenty-first floor of the Equitable Building, 120 Broadway. A month before this change C. H. Wheeler took over charge of the New York territory from Kent Hawley, who returned to the factory at Victor, N. Y., as chief engineer. Mr. Wheeler has been for nineteen years with the General Electric Company. Seven years of this time was spent at Schenectady, and since 1909 he has been in the general office in New York.

The Victor plant is running at fair capacity, not because of a few large orders, but by virtue of a great many small orders, indicating a rather healthy policy of central-station line extensions, although these may be of short length.

Return of Buying Conditions Shown in Success of New York Electrical Show

Reports Received from Exhibitors State Results Were Beyond All Expectations, Sales of One Company Going to $100,000 —Follow-Up Addresses Secured

That the fourteenth annual Electrical Show, held in the Seventy-First Regiment Armory in New York City on Sept. 28 to Oct. 8, was a distinct success is well attested by the reports of the exhibitors at the show. The public is again interested in electrical goods and equipment, and actual sales made indicate the return of better conditions and give hope for a good winter.

The attendance totaled about 100,000 paid admissions, besides passes, and the important feature of this is the common report that this attendance was made up of a higher type and better educated class of people than in the past. There was little hesitation on their part to give name and address so that sales could be pushed at a later time, a reversal of past form. The success of the show was beyond expectations on the part both of the retailer and the manufacturer and distributer.

Business booked was more than satisfactory, according to reports of the exhibitors. Although it was characterized as a household-appliance show, returns to date mention sales of one 5-ton and one 2-ton electric vehicle. Export business, too, was not lacking.

One dealer and importer of electrical glassware reported $28,000 in orders booked, half of which was on one order, and none of which he would have expected to get through regular channels. Motor-driven household appliances sold very well, one manufacturer reporting orders for well over 5,000 washers. A manufacturer of dishwashers reports more than seventy sales, and other manufacturers report in similar vein. Electric ranges and stoves also came in for satisfactory sales. The maker of a violet-ray machine reports retail sales of over 500 and total sales, including export business, of about $100,000.

An attraction that was very popular was the receipt of the world's series baseball game scores in the afternoons through the medium of the radio telephone with loud-speaking attachment. In the evening concerts were transmitted.

Francke Company Extends Line of Flexible Couplings

On Sept. 1 the line of flexible shaft couplings for direct-connected machines manufactured by the Francke Company, New Brunswick, N. J., was extended to take in the small light-duty motors from 1 hp. to 50 hp. or 75 hp. At the same time, a reduction in the price of couplings was announced by Smith & Serrell, Newark, N. J., general sales agents for the Francke Company. A new bulletin contains brief outline on operation characteristics of direct-connected machines.

Magee Furnace Now Has Wide Electrical Distribution

The Magee Furnace Company, Boston, manufacturer of coal and gas ranges for many years, has just completed plans for a very wide distribution of its electrical range equipment. The company is now manufacturing "Electricoal" ranges, a combination range burning both coal and electricity, or coal, gas and electricity. Besides its combination ranges the company also makes oven attachments and end-shelf attachments for its regular models of coal ranges.

Recent advices state that the electrical stove department is running 100 per cent capacity at this time. Since the first of July the following distribution points have been opened up, the Canadian ones having just been completed: San Francisco, Philadelphia, Cincinnati, Toledo, Detroit, Chicago, York, Milwaukee, St. Paul, Buffalo, Rochester, Albany, Omaha, New York and Boston. Montreal, Halifax and St. John have just been taken as distribution points in Canada.

More Boxing and Crating Courses to Be Given

Notice has just been received of another series of courses in boxing and crating at the Forest Products Laboratory, Madison, Wis., under the direction of the United States Department of Agriculture. These courses run for five and one-half days and will begin on Nov. 7, 1921, and Jan. 9, March 6 and May 1, 1922. The object is to demonstrate the principles that underlie proper box and crate construction and to supply information which will be of assistance in developing economical containers that will deliver the contents in a satisfactory condition at a minimum cost.

American Bosch Occupies New Building for New York Office

The American Bosch Magneto Corporation, Springfield, Mass., is now occupying four floors of the new ten-story building which it completed this summer at 17-23 West Sixtieth Street, New York City. There will be a large service station and installation garage in the basement, and the sales and stockrooms which will occupy the ground floor have been laid out with high ceilings and large show windows. The company outgrew its former quarters at 223 West Forty-sixth Street, after it brought out its new starting and lighting system, battery ignition system and spark plugs and after it took over the sale of the Gray & Davis starting and lighting system and automobile lamps.

Shipments Not Affected by American Line & Material Fire

About the middle of September the American Line & Material Company suffered a loss of approximately $100,000 through a fire which destroyed some of the stock in its yards just outside of South Norfolk, Va. According to advices from the president of the company, the property destroyed consisted of cross-arms, pins, wooden conduit and planking which was piled in the yards and in two sheds, and no damage was done to the manufacturing plant or to the office building. Manufacturing is being conducted as usual in the company's creosoting plants.

The Crane Company announces that it will soon transfer the manufacture of its brass valves and other products to the Chicago plant, leaving the Bridgeport (Conn.) plant free to handle the iron production. This latter plant recently increased its operations from three days per week to a four-day schedule.

The American Steel & Wire Company, 208 South LaSalle Street, Chicago, announces the appointment of E. E. Aldous as its representative in the St. Paul-Minneapolis-Duluth territory, with headquarters at St. Paul. Mr. Aldous has been connected with the company for twenty years in different positions.

The F. Rosenberg Elevator Company, 174 Reed Street, Milwaukee, has awarded the general contract for construction of its proposed new plant at Franklin and Becker Streets and the Chicago, Milwaukee and St. Paul railroad tracks. The building will be one story, 120 ft. x 223 ft., and the cost of construction with equipment will be about $100,000.

Foreign Trade Notes

PROPOSED CHANGES IN ELECTRIC PLANTS IN BRITISH EAST AFRICA.—Plans are on foot in Nairobi, British East Africa, it is reported, to organize a new company to take over the franchises of the Nairobi Electric Power & Light Company and the Mombassa Electric Company. The combined plan, it is understood, involves the development of a moderate-sized water power a short distance from Nairobi, in addition to the present one operated by the Nairobi company.

DUTCH INDUSTRIES FORM CLEARING HOUSE FOR DUTCH EAST INDIAN INFORMATION.—A step of importance is announced as having been taken by various enterprises engaged in the development of the Dutch East Indies by the establishment in The Hague of a "Council of Economic Initiative for the Netherlands Indies." The object of this organization is the formation of a permanent institute to serve as a clearing house for the study of questions affecting the general interests of different undertakings and industries in the Dutch East Indies. By concerted action when necessary of the various enterprises which have joined the new organization, it is proposed to foster the interests of the respective members in matters that affect their common development and welfare. During the year 1920 the Dutch East Indies imported electrical equipment from the United States to the value of $1,425,435, the leading items being telephone equipment, motors, insulated wire and cable, batteries, dynamos and generators, switches and accessories and transformers.

ALLIANCE OF MANUFACTURING COMPANIES IN JAPAN.—The Nippon Electric Company, an allied company of the International Western Electric Company, New York City, and one of the oldest concerns with participating foreign capital in Japan, has joined forces with the Sumitomo Electric Wire & Cable Works, Osaka, one of the oldest commercial enterprises in Japan. A new company has been organized, known as the Sumitomo Electric Wire & Cable Works, Ltd., for the production of power telephone and telegraph cables. It has started with a capital of 10,000,000 yen, or about $5,000,000. Under the provision of the alliance, the Nippon Electric Company has granted to its new associates the right to use all the manufacturing and engineering information and patents which it receives from the Western Electric Company covering the production of cable. The Sumitomo company, which is primarily a manufacturing concern, has on its side agreed to assist the Nippon company in the sale not only of electric wire and cable but also of all its other products. As a point of historical interest, the house of Sumitomo is one of the oldest banking and commercial organizations in the empire, its activities dating back to 1690. Baron K. Sumitomo is one of the heads of the company, and he will have associated with him in the new enterprise K. Iwadare, managing director of the Nippon Electric Company.

PROPOSED ELECTRICAL DEVELOPMENTS IN CHINA.—Four electrical undertakings, according to the *Far Eastern Review*, have recently been registered with the Chinese Ministry of Agriculture and Commerce, as follows: The Shou-shing Telephone Company, Shou-Shing, Chekiang; the Jui-An Electric Light Plant, Sui-an, Chekiang; the Chowshan Electric Company, Chowshan Chekiang, and the Sun Fong Electric Company, Kiangsu. Other electric companies that have been organized are the Yau Tai Electric Light Company, Tai Hsin, Kiangsu, and the Sing Yang Electric Light Company, Sing Yang, Honan. Chen Yi-hee, president and organizer of the Sunning Railway, the same publication reports, is planning to organize a company with a capital stock of $2,000,000 to develop a water-power project near the town of Sunning. As was the case in the construction of the Sunning Railway, it is proposed to obtain the money for this water-power enterprise from former residents of the Sunning district who are now living in the United States.

TELEPHONE EXTENSION IN SPAIN.—The Director of Communications of the Spanish government, according to a report from Commercial Attaché Cunningham of Madrid, Spain, has ordered the establishment of telephone exchanges in thirty-five towns. This will involve the purchase of a considerable amount of telephone material, but no details are available as to what will be required or when bids will be invited.

ELECTRIFICATION OF RAILWAY IN JAVA.—In connection with the extensive hydro-electric developments in the Dutch East Indies it is reported that the electrification of the steam from Meester Cornelis to Tandjong Priok will be started in the near future. No details as to the technical plans of the work are available.

SUBSIDY FOR ELECTRIC FOUNDRIES IN BRAZIL.—The Brazilian Parliament, in order to encourage the use of electric foundries in Brazil, according to the *Electrician*, is considering granting a subsidy of 200 contos of reis (£10,000) to each of the first three electric foundries to be established in Brazil.

HYDRO-ELECTRIC POWER PROPOSED FOR VIENNA, AUSTRIA.—The municipality of Vienna, in conjunction with a banking syndicate, is organizing a company with a capital stock of half a billion crowns to develop water power on the River at Ybbs, near Vienna, sufficient to supply the city with electricity. The cost of construction will be covered by an issue of bonds aggregating 10,000,000,000 crowns.

one-third of which will be issued in the [illegible] Plans for the [illegible] work, which will start in October, must be completed by June, 1926.

Foreign Trade Opportunities

[illegible] are listed [illegible] to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

A firm of merchants in India (No. [illegible]) dealing in precious metals desires to get into touch with manufacturers for the purchase of machinery for melting copper and brass household utensils, casting into ingots and rolling into sheets and bars, and for making wire.

A commercial agent in the United States (No. 136) who has trade connections with firms in Mexico desires to secure an agency from manufacturers for the sale of electrical appliances, etc.

PROPOSED HYDRO-ELECTRIC DEVELOPMENTS IN SPAIN.—Hydro-electric projects to develop a total of more than 750,000 hp. are under consideration in Spain at the present time, according to a recent report of Commercial Attaché Cunningham of Madrid. Of these the Douro enterprise is the most important and is expected to develop about 450,000 hp. This project is being financed by the Bank of Bilbao and Vizcaya, the capital for which is said to be entirely Spanish. A list of projects under consideration, with the addresses of the promoters, may be obtained upon application (File No. 48,376) to the Western European Division, Bureau of Foreign and Domestic Commerce.

PATENT FOR ELECTRIC DEVICE OFFERED TO AMERICAN MANUFACTURERS.—Ugo Cantutti, electrical engineer employed on the Italian State Railways, through A. A. Osborne, assistant commercial attaché at Rome, Italy, has submitted to the Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., a patented method for preventing sparking at the brushes of direct-current apparatus. Mr. Cantutti wishes to get in touch with some American manufacturer who will take over his patent in the United States; the idea has been patented in Italy. Information concerning the method, together with several small blueprints, is on file at the Electrical Equipment Division of the Bureau of Foreign and Domestic Commerce.

EXTENSION TO TELEPHONE SYSTEM IN ATHENS.—To meet the increasing demand for telephone service, the committee of technical experts appointed by the Greek Ministry of Communications has recommended the installation of a new central station capable of serving 10,000 subscribers. The committee also recommended replacing the present overhead wires with subterranean cables. Inasmuch as the committee believes that four years will be required to complete this work, it has advised that, to meet the emergency, the present system of overhead wires be continued and the switchboard be increased from 1,600 to 5,000 telephone connections, and has asked bids for this work. At the same time bids are requested for the large central station, which will accommodate 10,000 subscribers. Bids must be submitted to the Ministry of Communications, Athens, Greece.

New Apparatus and Publications

FLEXIBLE COUPLINGS—Smith & Serrell, Newark, N. J., general sales agents for [illegible] Company, New Brunswick, N. J., announce bulletin No. 32, showing the new line of Francke flexible couplings for motors up to 75 hp.

ELECTRIC HEATERS—The Hale Electric manufacturing Company has a new folder on its electric air heater.

REFRIGERATOR—George Spalt & Sons, Inc., Albany, N. Y., have issued a bulletin on their "Powrkold" iceless refrigeration.

ELECTRIC HAIR CUTTER—The P. A. Geier Company, Cleveland, has developed an electric hair cutter, the "Royal."

SEWING MACHINES—The Singer Sewing Machine Company, Bridgeport, Conn., has a booklet out on its new electrically driven chain stitch sewing machine and on its new No. 101-2 "motor [illegible]" [illegible]

BOILER METERS—The Bailey Meter Company, East Forty-sixth Street at Euclid Avenue, Cleveland, has issued bulletin No. 42, entitled "Bailey Boiler Meters," superseding No. 41, and bulletin No. 160, entitled "Multi-Pointer Gages for Draft and Other Factors."

ELECTRIC RANGES—The Magee Furnace Company, Boston, has issued [illegible] new bulletins, one entitled "Magee Electricoal" and the other "Magee Electrifies Every Range."

ELECTRIC IRONER—The [illegible] Corporation, Poughkeepsie, N. Y., is circulating a publication on its new electric ironers for family and institutional use.

AIR COMPRESSOR—The "Imperial Type XCB" is a new motor-driven air compressor recently developed by The Ingersoll-Rand Company, 11 Broadway, New York.

SHAFT COUPLINGS — The Hilliard Clutch & Machinery Company, Elmira, N. Y., has some new shaft couplings on the market.

ELECTROCATOR — S. M. Hanson, 601 Washington Street, Lynn, Mass., has developed a device, the "Electrocator," for facilitating the exact location of a given point in machine-tool work.

BENCH DRILL—A small portable bench-drilling machine has been placed on the market by the Model Specialty Company, 401 East Nineteenth Street, New York.

TRAVELER'S IRON—The Simplex Electric Heating Company, Cambridge 39, Mass., has placed on the market a new 3½-lb. traveler's electric iron, (No. 1914).

CURRENT TAP — Bulletin No. 17-4 describes the new "Te-Cap" current cap of Harvey Hubbell, Inc., Bridgeport, Conn.

PLUG FUSE—A clear-window plug fuse, the "Protex," has been put on the market by The Protex Fuse Works, 1623 East Forty-third Street, Cleveland.

DISHWASHER—The Crescent Washing Machine Company, New Rochelle, N. Y., is marketing a new electric dish-washing machine.

CHURN—The Taylor Brothers Churn & Manufacturing Company, St. Louis, is marketing a new motor-driven churn.

FIRE EXTINGUISHER—The Foamite Firefoam Company, 200 Fifth Avenue, New York, is making a new splash-proof fire extinguisher the U. S. No. 2½ of 2½ gal capacity.

COMMUTATOR TRUING DEVICE—Jordan Brothers, Inc., 74 Beekman Street, New York, have issued a new data sheet covering their commutator truing device.

OVERLOAD RELAY.—An overload relay, "Merco," designed to protect alternating-current motors has recently been placed on the market by Brown & Pengilly, 607 East Fourth Street, Los Angeles, Cal.

CONNECTOR.—The E & B Manufacturing Company, Fort Street and Mount Elliott Avenue, Detroit, has recently brought out a "Snap" connector for flexible cable.

TREE INSULATOR.—The "Barnes Universal" tree insulator, designed to protect high-voltage distribution wires, has been developed by the National Electric Corporation, Whitman, Mass.

CIRCUIT EXTENDER—The M. Propp Company, 524 Broadway, New York City, has developed a new device, known as a "circuit extender," which allows a number of sets of Christmas tree lights to be attached to a single circuit. It can also be used for connecting floor and table lamps and household appliances, etc.

TAP SOCKET — The E. H. Freeman Electric Company, Inc., 803 East State Street, Trenton, N. J., has recently placed on the market a pull-chain current tap socket designated as No. 680.

AMPLIFYING TRANSFORMER. — The General Radio Company, 11 Windsor Street, Cambridge, Mass., has recently developed an amplifying transformer (No. 231A) adapted particularly for use with vacuum tubes in radio work.

CABLE AND CONDUIT.—The Eastern Tube & Tool Company, Inc., 41 Gardiner Avenue, Brooklyn, N. Y., has placed on the market an "Ettco" single-wall, flexible, [illegible] conduit and a steel armored conductor for either two or three wires.

RANGE—The Walker & Pratt Manufacturing Company, 35 Union Street, Boston, is marketing an electric range with an adjustable broiler.

New Incorporations

THE KALONEKA ELECTRIC LIGHT & POWER COMPANY, Caroga, N. Y., has been incorporated with a capital stock of [illegible] by W. J. and [illegible] and O. J. O'Neil.

THE INTER-CITY TELEGRAPH COMPANY, New York, N. Y., has been incorporated by R. A. Adams, F. A. Hinners and K. L. Zimmermann. The company is capitalized at [illegible] and proposes to operate a local telegraph system. L. Oppenheimer, 60 Wall Street, represents the company.

THE AIR COMPRESSOR & EQUIPMENT COMPANY, has been incorporated at Portland, [illegible] to manufacture and assemble air compressors. Guy S. Malcom, George Larrabe and W. E. Thomas are directors.

THE BURLINGTON (ILL.) ELECTRIC COMPANY, has been organized with capital of $3 000 to supply light for the village. A transmission line will be built from Hampshire, Ill., to Burlington, and power will be purchased from the Northern Illinois Utilities Company. Address L. F. Kinef, Burlington, Ill.

THE NATIONAL GENERATOR COMPANY, New York, N. Y., has been incorporated by W. W. Harris, W. C. Swift and S. Null. The company is capitalized at $500,000 and proposes to manufacture electric and steam generating equipment. W. J. Bloch, 317 East Eighteenth Street, represents the company.

The COILITE CORPORATION, Utica, N. Y. has been incorporated with a capital stock of $100,000 to manufacture electric lighting fixtures and kindred equipment. The incorporators are G. R. and D. A. Hughes and J. Rothstein, Utica. The company is represented by Dunmore, Ferris & Dewey, Utica.

THE RADIO DEVELOPMENT CORPORATION, Springfield, Mass., has been chartered with a capital stock of $25,000 to develop and manufacture electrical devices, especially radio appliances. The officers of the company are: Frank W. Sickles, 683 South Main Sreet, president, and A. Raoul Silber, 39 Spruceland Avenue, treasurer.

THE HUGHES ENGINEERING & CONSTRUCTION COMPANY, [illegible] West Redwood Street, Baltimore, Md., has been incorporated by Charles H. Gunther, Charles C. Swegler and Theodore J. Robinson, to manufacture engines, power-house equipment and other machinery.

THE DAVIS LIGHT & POWER COMPANY, Galesville, Wis., has been incorporated by Ben W. Davis, Alfred N. Sagen and W. S. Wadleigh to take over the commercial light and power department of the Davis Milling Company. The new company is capitalized at $60,000.

THE HUGO (OKLA.) POWER COMPANY has been incorporated with a capital stock of $50,000 by R. D. Wilbor, W. A. Goforth and W. T. Larimore.

THE DENVER (IND.) ELECTRIC LIGHT & POWER COMPANY has been organized by [illegible] and Elvin R. Long. The company is capitalized at $10,000 and proposes to supply electricity for light and power purposes.

THE GULF COAST POWER COMPANY, Corpus Christi, Tex., has been incorporated with a capital stock of $100,000 by R. W. Marshall, Marshall Hicks and C. M. Dickson, all of San Antonio.

THE ATMOSPHERIC HEAT & POWER COMPANY, Biddeford, Me., has been organized with a capital stock of $1,000,000 to manufacture heating and power apparatus. [illegible] Biddeford, is president.

THE MARVEL LAMP COMPANY, Pittsburgh, Pa., has been incorporated under the laws of the State of Delaware by C. V. Brown and H. Nickum and Wallace H. [illegible], Pittsburgh. The company is capitalized at $50,000 to manufacture electric lamps and other electrical [illegible] The Capital Trust Company, Dover, Del., represents the company.

THE TRIANGLE APPLIANCE MANUFACTURING COMPANY has been incorporated by M. H. Silverstein, Roy Silver[illegible] and G. [illegible]. The company is capitalized at $1[illegible] and proposes to manufacture electric toasters, curling irons, lamps and other electrical [illegible]. Factory space has been secured at [illegible] North Wells Street, Chicago, Ill.

Record of Electrical Patents

Notes on United States Patents

(Issued Sept. 6, 1921)

1,390,201. ELECTRIC LIGHTING APPARATUS; John H. George, Bridgeport, Conn. App. filed March 16, 1918. Electric switch socket and lamp-focusing device.

1,390,250. X-RAY APPARATUS; Mathias B. Rodriguez, London, England. App. filed Sept. 18, 1919. Stereoscopic image of body under examination may be directly seen.

1,390,259. CONTROL FOR ELECTRIC MOTORS; Oscar F. Shepard, Cincinnati, Ohio. App. filed March 2, 1917. Magnetic rheostat type.

(Issued Sept. 13, 1921)

1,390,288. SYSTEM FOR CONTROLLING MOVING BODIES BY RADIO ENERGY; John Hays Hammond, Jr., Gloucester, Mass. App. filed July 24, 1913. Moving bodies at a distance by radio energy.

1,390,317. ELECTRICAL CURRENT-CONTROL DEVICE; Charles Wagner, New York, N. Y. App. filed March 25, 1920. Tattooing needle.

1,390,318. APPARATUS FOR REGULATING FREQUENCY; Henry E. Warren, Ashland, Mass. App. filed Sept. 29, 1916. For indicating the frequency of an alternating current.

1,390,319. SELF-STARTING SYNCHRONOUS MOTOR; Henry E. Warren, Ashland, Mass. App. filed Feb. 2, 1918. Starting into rotation at certain values of voltage and frequency and not at other values.

1,390,320. SELF-STARTING SYNCHRONOUS MOTOR; Henry E. Warren, Ashland, Mass. App. filed Feb. 2, 1918. Rotor having a starting member and a synchronizing member.

1,390,355. SEPARATOR FOR STORAGE BATTERIES AND METHOD OF MAKING; David F. Gould, Newark, N. J. App. filed Aug. 24 1916. Method of treating sheets of wood.

1,390,369. TROLLEY-WIRE CLAMP; S. S. Mathes, Mansfield, Ohio. App. filed June 9, 1920. Will simultaneously grip conductor and supporting hanger.

1,390,391. FLOW METER; Jacob M. Spitzglass, Chicago, Ill. App. filed Oct. 25, 1917. Dangers incident to a surge in the differential pressure may be overcome.

1,390,407. ELECTRIC HEATING UNIT; Johann G. Wallmann, Oakland, Cal. App. filed Sept. 25, 1920. Useful in electric radiators.

1,390,409. AUTOMATIC TELEPHONE SWITCH; Harry G. Webster, Chicago, Ill. App. filed April 19, 1916. For extending connections from one line or trunk to another line or trunk.

1,390,429. ELECTRODE; Joseph S. Cape, Detroit, Mich. App. filed Nov. 5, 1919. For electro-therapeutic apparatus

1,390,456. ELECTRIC-ARC LAMP WITH ROTARY ARC; Louis Maudoux, André Garbarini and Georges Gautier, Paris, France App. filed Oct. 23, 1917. Improvements in the construction

1,390,468. RAIL-BOND PROTECTOR; Mark T. Stanton, Cleveland Heights, Ohio. App. filed May 31, 1917. Adapted to bonds attached to the head of rails

1,390,501. TRANSFORMATION OF POLYPHASE CURRENTS INTO PRACTICALLY CONSTANT DIRECT CURRENTS; Orso M. Corbino, Rome, Italy. App. filed Jan. 7, 1918. For transforming alternating current into practically constant direct current

1,390,505. ELECTROLYTE; John Coulson, Wilkinsburg, Pa. App. filed Feb. 19, 1917. Lightning arresters, condensers and rectifiers.

1,390,515. CONTROLLER; Ralph Ehrenfeld and Niels Hansen, Wilkinsburg, Pa. App. filed Oct 17, 1918 For electric motors of small horsepower

1,390,521 ELECTRIC BATTERY; H F French and R. C Benner, Fremont, Ohio App filed Jan. 27, 1917. To prevent electrochemical action prior to time cells are put into use

1,390,526. ELEVATOR-CONTROL SYSTEM; Adolph A. Gazda, Pittsburgh, Pa App. filed Jan. 5, 1918. For accelerating electric motors and for dynamic braking.

1,390,543. CURRENT REGULATOR; Frederick L. Re Qua, Milwaukee, Wis. App filed Aug. 19, 1918. For current regulators for incandescent lamps.

1,390,545. DESK OPERATOR'S CIRCUITS; William A. Rhodes, New York, N. Y. App. filed Dec. 5, 1918. Testing equipment for operator's cord circuits.

1,390,575. ELECTROLYTIC CELL; Frederick H. Miller, Wilkinsburg, Pa. App. filed April 5, 1917. Condensers, lightning arresters, rectifiers, etc.

1,390,580. MEANS FOR REDUCING INTERFERENCE; Harold S Osborne, New York, N. Y. App. filed Nov 13, 1918 Signaling over ocean cables.

1,390,596. TERMINAL STRUCTURE AND METHOD OF MAKING THE SAME; Frank Thornton, Jr., Wilkinsburg, Pa. App. filed March 13, 1918. For use on electrical heating devices.

1,390,607. ELECTRIC CONTACT DEVICE; Clyde C. Farmer, Edgewood, Pa. App. filed Dec. 10, 1919. Electric train wire couplings.

1,390,624. SYSTEM OF ELECTRICAL SHIP PROPULSION; Benjamin G. Lamme, Pittsburgh, Pa. App filed June 29, 1918. Efficient operation throughout wide variations in speed.

1,390,629. ELECTRODE PLATE FOR STORAGE BATTERIES; Lamar Lyndon, West Orange, N J. App. filed April 30, 1919. For batteries of the Edison type.

1,390,646. ELECTRIC GAS GENERATOR; Rudolf Rosner, Chicago, Ill. App. filed Jan. 28, 1921. For generating a germicidal gas.

1,390,679. IMPULSE TRANSMITTER; Henry F. Dobbin and Edgar W. Gent, New York, N. Y. App. filed Nov 21, 1918 Used in automatic telephone systems.

1,390,696. DRY CELL; Samuel E. Gertler, Brooklyn, N. Y. App. filed Nov. 20, 1919. Electrolyte will not form a double salt with zinc.

1,390,719. THERMO-ELECTRICAL APPARATUS FOR BOILING AND HEATING PURPOSES; Joaquin G. Lozano, Madrid, Spain App. filed Jan. 8, 1920. Industrial or domestic.

1,390,727. SYSTEM OF TRANSFORMING DIRECT CURRENT INTO ALTERNATING CURRENT; Morris Schenkel, Charlottenburg, Germany. App. filed March 29, 1917. High-voltage direct current into single-phase or multi-phase alternating current.

1,390,729. AUTOMATIC TELEPHONE SYSTEM; Giuseppe Simonetta and Augusto Rosa, Milan, Italy. App. filed March 4, 1918. Line searcher.

1,390,743. MEASURING DEVICE; Chester T. Allcutt, Wilkinsburg, Pa. App. filed Feb. 4, 1918. For determining when a predetermined current traverses a circuit.

1,390,765 GALVANIC BATTERY; Harold N. Cox, Glen Ridge, N. J. App. filed April 12, 1919. Negative electrode of oxide of copper and positive electrode of zinc.

1,390,779. ELECTRICAL APPARATUS HAVING WINDINGS; Joseph Goodman, Hayes, England. App. filed Nov. 20, 1917. Transformers, etc.

1,390,780. ELECTRIC RANGE SWITCH; Gilbert W Goodridge, Bridgeport, Conn. App. filed Sept. 29, 1919. For controlling the connections for the heating elements of an electric range.

1,390,819. INSULATED ELECTRODE; Ray Van Sandt, Bakersfield, Cal. App. filed Dec. 29, 1919 For installation in tanks for use in oil-treating systems.

1,390,823 BURNING OF CARBON ELECTRODES; Sven E. Sieurin, Hoganas, Sweden. App. filed July 31, 1920 For producing carbon electrodes in an electric furnace.

1,390,843. REGULATING SYSTEM FOR DYNAMO-ELECTRIC MACHINES; Louis W. Thompson, Schenectady, N. Y. App. filed July 10, 1918 For varying excitation of an alternating-current dynamo as current varies.

1,390,883. RADIANT-ENERGY DETECTING AND TRANSLATING DEVICE; Theodore W. Case, Scipio, N. Y. App. filed April 5, 1918. For detecting light rays and translating the same into current variations measurable by instruments.

1,390,885. SAFETY TROLLEY; Owen L. Chesnutt, Atlanta, Ga. App. filed May 9, 1921 Susceptible of accommodating itself to lateral changes.

1,390,896 TELEPHONE-MOUTHPIECE DISINFECTANT; James Ferguson and William H. Bennett, Vancouver, B. C., Canada. App. filed Feb. 25, 1921. Easily applied and direct and lasting in its effect

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

BOSTON, MASS.—Arrangements are being made by the Edison Electric Illuminating Company to proceed with the enlargement of its electric generating plant. The project includes the installation of a 30,000-kw. turbo-generator, boilers and auxiliary operating equipment. Charles L. Edgar is president.

MIDDLEBORO, MASS.—A recommendation contained in a report submitted by a special committee for the installation of electric pumps for the local pumping station was recently adopted at a town meeting. The cost of the outfit, which provides for a duplicate set of pumps for main service and for the filtration plant is estimated at $14,000

NEW BEDFORD, MASS.—A portion of the power department of the New Bedford Cordage Company, Ash and Court Streets, was recently destroyed by fire. The department, it is understood, will be rebuilt.

WATERBURY, CONN.—Plans have been filed by the Plume & Atwood Company for the construction of a transformer station at its local works.

Middle Atlantic States

ALBANY, N. Y.—Tentative plans are under way by the Water Power Commission for the construction of a number of power plants on the Barge Canal. Development of a total capacity of about 40,000 hp. is contemplated, with distribution and sale in districts along the route.

BROOKLYN, N. Y.—Arrangements are being made by the Brooklyn Edison Company for an issue of $3,000,000 in bonds, the proceeds to be used for extensions, improvements, etc.

BUFFALO, N. Y.—Notice has been filed by the Niagara & Erie Power Company of an increase in capital stock from $300,000 to $900,000 for proposed expansion of its plants and system.

BUFFALO, N. Y.—Application has been made by the Niagara Gorge Power Company, an affiliated organization of the Niagara Gorge Railway Company, for permission to build a generating plant to utilize waters from the gorge section of Niagara Falls for the development of 300,000 hp.

FAIRPORT, N. Y.—A portion of the plant of the Douglas Packing Company, including five buildings, power equipment and general machinery, was recently destroyed by fire, causing a loss of about $1,000,000. John Clingen is general manager.

NEW YORK, N. Y.—Work will be started immediately by the Fulton Lumber Terminal Company, 120 West Forty-fourth Street, on the construction of a new plant on the Hackensack River, including planing mill, sash and door factory and other woodworking buildings, with cold-storage plant for foodstuffs Conveying, general operating and power-plant equipment will be required E. R. Eckley is president

NEW YORK, N. Y.—Application has been made by the New York Edison Company to the Public Service Commission for permission to issue $30,000,000 in bonds, also permission for its subsidiary, the United Electric Light & Power Company to issue a similar amount. The proceeds are to be used for plant and system extensions, etc.

NIAGARA FALLS, N. Y.—Plans are under consideration by the Niagara Falls Felt & Paper Company, a subsidiary of the Niagara Falls Power Company, Canal Basin, for the installation of considerable electrical equipment in its proposed plant on Sugar Street, to cost about $300,000.

PRINCETOWN, N. Y.—The Adirondack Light & Power Corporation has been authorized to construct an addition to its electric plant in Princetown and to exercise a franchise recently approved by the local authorities. E. J. West is vice-president of the company.

DOVER, N. J.—The New Jersey Power & Light Company of Dover is negotiating for the purchase of the Woodburne Light, Heat & Power Company. The Dover company, it is understood, plans to furnish electricity for light and power to Newton and Hamburg in Sussex County and a number of municipalities and industries in Morris County.

MONTCLAIR, N. J.—Negotiations are under way between the Chamber of Commerce and the Town Commissioners for the installation of an ornamental lighting system on Bloomfield Avenue.

NEWARK, N. J.—Plans have been prepared by the General Leather Company, 420 Frelinghuysen Avenue, for the construction of a new one-story power house.

NEWARK, N. J.—Arrangements have been made by the Public Service Railway Company, Terminal Building, for an issue of $1,540,000 in certificates, the proceeds to be used for extensions, improvements, electrical equipment, etc.

VENTNOR CITY, N. J.—Negotiations are under way between the City Council and the Atlantic City (N. J.) Electric Company for the installation of a new lighting system in Ventnor City. The present plans provide for replacing the arc lamps on the boardwalk, Atlantic, Ventnor and Winchester Avenues with incandescent lamps. Ralph Brooks is chairman of the lighting committee of the Council.

ARDMORE, PA.—Notice has been filed by the Counties Gas & Electric Company, of an issue of $6,120,000 in stock, the proceeds to be used for extensions, improvements, etc.

BRADFORD, PA.—Arrangements have been made by the Bradford Electric Company for an issue of $50,400 in bonds, the proceeds to be used for general extensions, improvements, etc.

KELLETTVILLE, PA.—The Salmon Creek Lumber Company is contemplating rebuilding its sawmill, power house and other buildings, recently destroyed by fire, causing a loss of about $100,000, including machinery.

PHILADELPHIA, PA.—The Quartermaster Department of the government, Intermediate Depot, is contemplating the construction of a power house at its local property.

PITTSBURGH, PA.—Notice has been filed by the Beaver County Light Company of an issue of $130,000 in bonds, the proceeds to be used for extensions, improvements, etc.

BALTIMORE, MD.—Arrangements have been made by the Consolidated Gas, Electric Light & Power Company for an issue of $9,000,000 in bonds, the proceeds to be used for plant expansion, improvements, etc.

NORTH EAST, MD.—J. W. Archer & Son are contemplating the installation of new equipment in the power house at their canning plant, to replace equipment recently destroyed by fire.

SOUTH CHARLESTON, W. VA.—Bids will be received at the office of the Chief of the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Oct. 26, for the construction of an electric cable system at South Charleston, W. Va. For further information address as above.

LURAY, VA.—Plans are under way by the Luray Ice Company for the construction of anew power plant. E. C. Harnsberher is president.

PETERSBURG, VA.—Work has been started by the Virginia Railway & Power Company on a small dam in the Appomattox River at Petersburg, in connection with a hydro-electric plant to be built at a cost of about $100,000.

North Central States

MANISTEE, MICH.—Ruggles & Rademaker, 381 River Street, have work under way on the construction of their new salt plant, to cost about $1,000,000, including machinery. A power house, machine shop and other buildings will be erected in connection with the proposed plant. F. W. Perkins, care of the company, is architect and engineer.

PETOSKEY, Mich.—The City Council is considering enlarging and improving the municipal lighting plant.

EATON, OHIO.—The Liberty Light & Power Company, Richmond, Ind., has been authorized to erect and operate electric transmission lines in Campbellstown and Jackson and Jefferson Townships, Ohio.

LIMA, OHIO.—The City Council has authorized the installation of an ornamental lighting system on West Market, West High and West North Streets.

BOWLING GREEN, KY.—The Lost River Cave Company, recently organized, is contemplating early construction of a. hydro-electric power plant in the vicinity of Bowling Green. Henry L. Underwood is president.

HELLIER, KY.—The Columbus-Edgewater Coal Company, recently organized, is planning the installation of power equipment for the operation of mines. The cost of the plant is estimated at $25,000.

JACKSON, KY.—Improvements are contemplated by the Jackson Light & Power Company. Machinery will be required.

LEXINGTON, KY.—The Dix River Power Company, recently organized with a capital stock of $10,000,000 by Lewis Herrington and others, is contemplating the construction of a 30,000-hp. plant on the Dix River. Electricity will be supplied to Louisville, Lexington, Frankfort, Danville, Harrodsburg and other cities in central Kentucky. The cost of the project is estimated at between $3,500,000 and $4,000,000.

WHITESBURK, KY.—The J. C. Burton Coal Company, Matoaka, W. Va., has acquired the plant of the Caudill Coal Company, Whitesburg, Ky., and is planning the installation of power equipment at the property.

KINGMAN, IND.—Plans are under consideration for the establishment of a lighting plant in Kingman, to cost about $18,582. J. M. Lewis is interested.

BARRINGTON, ILL.—The local power plant of the Public Service Company of Northern Illinois was recently destroyed by fire, causing a loss of about $200,000.

CENTRALIA, ILL.—The installation of an ornamental lighting system in Centralia, to cost about $39,533, is contemplated. The present plans provide for a rubber-insulated system and single-lamp, cast-iron standards.

CHILLICOTHE, ILL.—The sum of $4,000 has been obtained for the installation of an ornamental lighting system in Chillicothe. M. C. Kelly is chairman of the Light Commission.

SPRINGFIELD, ILL.—The Central Illinois Public Service Company has petitioned the Illinois Public Utilities Commission for permission to issue $450,000 of refunding mortgage bonds and $142,000 general mortgage bonds.

MANITOWOC, WIS.—The Brewer Manufacturing Company, manufacturer of piano benches, optical office supplies, etc., is planning the construction of a factory and power plant, 60 ft. x 120 ft., to cost about $40,000.

OSKALOOSA, IOWA.—Plans are under consideration for the construction of a hydro-electric plant on the Des Moines River southwest of Oskaloosa. The project includes a dam to provide for the development of 4,000 hp. T. H. Carlin is clerk.

LIBERTY,. MO.—The installation of electric pumps at the water-works to replace those now in use has been recommended by City Engineer Barnes.

FAULKTON, S. D.—Bonds have been voted for the establishment of a municipal lighting plant in Faulkton.

NEBRASKA CITY, NEB.—A transmission line, it is understood, will be erected from Nebraska City to Dunbar to supply the latter place with electricity for light and power.

NORTH PLATTE, NEB.—Bonds have been voted in Brady, Maxwell, Hershey, Sutherland and Paxton for the joint erection of a transmission line from North Platte to the respective villages.

DOWNS, KANS.—The local plant of the United Light & Power Company, it is reported, was recently destroyed by fire, causing a loss of about $100,000. The plant, it is understood, will be rebuilt.

Southern States

GASTONIA, N. C.—The Council is considering issuing $500,000 in bonds for extensions to the electric light and waterworks system.

PILOT MOUNTAIN, N. C.—At an election to be held on Oct. 25, the proposal to issue $50,000 in bonds for the installation of a hydro-electric plant on Ararat River will be submitted to the voters.

WESTFIELD, N. C.—R. T. Joyce of Greensboro is planning the installation of machinery at his power house and dam and the erection of a transmission line. Mr. Joyce, it is understood, is asking prices on a 100-hp. dynamo, 30-in. vertical wheel and 15,600 lb. No. 4 copper wire.

MARION, S. C.—The proposal to issue $100,000 in bonds for the installation of a lighting system, etc., is under consideration by the City Council.

CEDARTOWN, GA.—Extensions to the municipal light, water and sewer systems and other city improvements, to cost about $160,000, are under consideration by the Council.

FORT PIERCE, FLA.—The city authorities are planning an addition to the municipal light and water plant to provide for an increase in capacity to 450 kw. Equipment, including a 400-hp. oil-burning Diesel engine, 350-kva. generator and 500-gal. service pump, will be installed. The cost is estimated at $55,000.

PIGGOTT, ARK.—The installation of electric lighting and water systems in Piggott is under consideration by the City Council.

PLAIN DEALING, LA.—The Plain Dealing Light & Power Company contemplates the establishment of a power plant. M. S. Bolinger is president.

BROWNSVILLE, TEX.—Bids will be received Oct. 20 for furnishing one 500-kw. to 700-kw. turbo-generator to be intalled at the municipal electric plant. George Grupe is City Manager.

CAMERON, TEX.—The City Council is considering the proposal to issue $250,000 for the establishment of electric light, water and sewage disposal plants. The Engineering Service Company, Sumpter Building, Dallas, is consulting engineer.

Pacific and Mountain States

SEATTLE, WASH.—Bids will be received at the U. S. Engineer Office, Seattle, Wash., until Oct. 22, for constructing emergency dams for Lake Washington ship canal locks, Seattle, Wash. The specifications include operating mechanisms, switchboards, motors, controllers, electrical equipment, shafts, gears, wire rope, etc. Information may be obtained on application to the U. S. Engineer Office, Seattle, Wash., Chicago, Ill., or Pittsburgh, Pa.

LOS ANGELES, CAL.—Arrangements have been made by the Los Angeles Gas & Electric Corporation for an issue of $1,500,000 in bonds, the proceeds of which will be used for extensions, improvements, etc.

SAN FRANCISCO, CAL.—The Coast Valleys Gas & Electric Company has petitioned the railroad Commission for authority to issue stock to the amount of $100,000, the proceeds to be used for additions and improvements to its plants and equipment.

SAN FRANCISCO, CAL.—Plans are being prepared by the Pacific Gas & Electric Company for the construction of a substation on Lake Kemescal, Claremont, to cost $20,000; substation at Fiftieth Avenue, Oakland, Cal., $20,000, and a substation at Newark, $20,000.

SALT LAKE CITY, UTAH.—William Schuyler Post of Los Angeles has filed application with I. E. Caldwell, state engineer, for permission to appropriate 8,000 sec.-ft. from Green River, 1 mile below Minnie Maud Creek, to develop 500,000 hp. for municipal use and for electrification of railways, and 1,500,000 acre-ft. for storage. The project includes a dam 150 ft. high, reservoir canal 90 ft. wide at top and 50 ft. at bottom and the installation of twelve 5,000-hp. turbines.

MALAD CITY, IDAHO.—The Evans Light Company contemplates the installation of additional transformers and larger conductors.

ST. ANTHONY, IDAHO.—At a meeting of the city authorities of Rexburg, St. Anthony, Idaho Falls and Ashton, held recently, committees were appointed to investigate sites and consider other details in connection with the feasibility of establishing a joint municipal power plant to serve the communities which are named above.

Electrical World

New York, Saturday, October 22, 1921

America's Opportunity in the World's Trade

WHILE the world is slowly righting itself, men in this country are thinking more than ever before about export business. Foreign markets call unceasingly for goods to feed and clothe and stock the world with everything that human beings use. Yet many of our manufacturers have not made any serious effort to tap these boundless resources of rich trade—or, attempting, have through inexperience sent the wrong goods, or the right goods in the wrong way, and met with disappointment.

There is a saying "Blessed is the man who has found his work." Surely this thought should apply to nations no less logically. And what is the true work of America in the world's trade? The answer is not hard to find.

America stands today without peer among the nations for two great capabilities—ingenuity and mass production. The world has come to look to America for electrification of railways, without regard to competition. Our machine tools are unassailably the standard of the world. Our harvesting machinery has won its way to every land. Our small motor cars now run on the roads of every people. In the manufacture of labor-saving machinery of every type we have led in thought and in achievement and we sell abroad to eager markets. And when we export these and other kindred characteristically American products of our ingenuity and our mass production, we sell them profitably and freely—for price is but a secondary factor. The standard and the reputation of these goods—our specialty—has put them on a plane above the reach of competition.

Here, then, is a sensible basis for a broad, national economic policy for the extension of American foreign trade. We need no longer seek, we need not further experiment in exporting. If we would penetrate the markets of the world with American goods, we would do well to concentrate on these specialties which success already has shown to be "our work" and put the many typically American products of our ingenuity into mass production. When these have won our way into new ports and built us trade, then we may more easily extend our influence with broadened lines.

To make this truly a national program will naturally take some time, for men's minds move slowly in such matters. But to make it the export policy of the electrical industry should be simple enough since so many of our electrical commodities are distinctly products of our Yankee ingenuity. Let us put mass production behind these specialties of ours and make American electric labor-saving appliances the standard of the world.

Henry Damon Shute

Who brings to his work of directing the sales of one of the largest electrical manufacturing organizations a background of successful experience in engineering, production, administration and finance.

JUST as much of an obligation to develop the industry in the proper direction rests upon those in charge of sales as upon the electrical engineering talent of the country. It is they who bridge the gap between the inventive genius of the industry and the user. They tell the world what the engineer has made and bring back to the engineer the composite representation of the buying mind. It seems reasonable, therefore, that the sales managers of the country, particularly where heavy equipment is concerned, should have a sympathetic appreciation of the engineering involved and of economic limitations to engineering achievement. Such a sales manager is Henry D. Shute, vice-president in charge of sales of the Westinghouse Electric & Manufacturing Company, an engineer by education and training. Mr. Shute came into the sales branch of the business from the engineering department, but he has never been a salesman in the strict sense. He has, however, had a very wide experience in the Westinghouse company and in the electrical industry. In addition, he is endowed with that characteristic faculty of successful executives—the faculty of appreciating quickly the meaning of facts and making immediate decisions. He also possesses a vivid imagination, which is an asset of considerable importance to the man who plans for the future.

Mr. Shute was born in Somerville, Mass., Aug. 1, 1871. In 1892 he was graduated from the Massachusetts Institute of Technology with the degree of bachelor of science in electrical engineering. A year's post-graduate work followed in the School of Mines at Clausthal, Germany, and the Technical School at Dresden. On his return to the United States in 1893 he entered the Westinghouse shops as a student apprentice. During his eighteen years of service with this organization he has worked himself up, department by depart, to his present responsible position. His first transfer was to the transformer department; from there he went to the testing department, and thence to the engineering department laboratory. Later he was delegated to follow up the manufacture of switch gear for the Niagara Falls installation, and when this work was completed he was made assistant foreman of the shop experimental department.

Mr. Shute next became a designer of switchboards in the engineering department. Thus did he round out five years of engineering and production experience which served as a substantial foundation for his later sales and executive career.

In 1908 Mr. Shute was brought into the sales department and his knowledge of the company's products and their performance stood him in such good stead that before long he was made chief of the alternating-current division. In [illegible] Vice-President L. A. Osborne selected him as his assistant. In this work Mr. Shute received his schooling in executive and administrative duties and was identified with the developments made in heavy electric traction and particularly in single-phase work. In 1910 he was appointed acting vice-president with routine executive duties. Four years later he became treasurer of the company, continuing as such until 1917, when he took up the work in which he is now engaged. He is thus able to bring to his work a well-rounded experience in production, engineering, finance and administration.

As would naturally be expected, Mr. Shute's sphere of influence extends far beyond the confines of the Westinghouse organization. He has been very active in civic affairs in Pittsburgh and is a director of a great many Pittsburgh institutions.

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The Threat of a Great Railroad Strike

WITH the unemployment conference barely adjourned, the railroad brotherhoods have ordered a general strike on all the railroads of the land. The purpose is to compel two million workers now employed to quit and force out many other millions in affected industries. The issue is clear. In July, 1920, the Federal Railroad Labor Board raised the wages of the railroad men approximately 22 per cent to help them meet the higher costs of living. This they accepted. The total increase since 1915 then approximated 100 per cent. The same board is now ordering the railroads to reduce wages approximately 12 per cent in line with the deflation of general costs and prices. It is met by the unions with a call for a complete tie-up of the industry of the country. It is a strike not against the railroads but against the government.

Two points stand out. The situation must be handled with absolute justice and reason. The railroad men must not be asked to make greater concessions than the balancing of the economic situation demands. But deflation is a wave of readjustment that must affect all, and no single group of men can block its path. The railroad brotherhoods cannot change economic laws. Neither can they be permitted to intimidate the nation and nullify the efforts of the unemployment conference by forcing into idleness further millions now working. If necessary, we may well follow the precedent set stoutly by England's premier and pledge the whole resources of the government to prevent it.

This is a principle to which every red-blooded American will subscribe. The other point is a matter of no less national import and it concerns the electrical industry particularly. A railroad strike to the utilities means, essentially, fuel. Restriction in fuel supply means strangulation, not only to the electrical industry but to all industry, and paralysis of business, which in turn means more unemployment piled up in a rising, spreading pyramid. Be the argument what it may, strike or no strike, coal must come to the utilities for the service and the safeguarding of all the people. This should be made plain to all concerned.

Public Utilities and Municipal Politics

THE chairman of the Public Service Commission of New York is a rather shrewd political observer, and politicians are usually opportunists. When therefore he advocated municipal ownership of the gas properties in New York City in a speech before the Empire State Gas and Electric Association he exhibited a certain state of mind—political perhaps, for he voiced his own opinion and not that of the commission over which he presides. Perchance he was moved by an impelling sense of public duty. Who knows? At any rate, he is out of tune with the great body of public utility commissioners throughout the country, and dissonance to the musical ear can be no more horrid than a want of harmony between commissioners to the users and backers of public utility service. Moreover, the remedy which he suggests, uniform service at uniform rates, needs to insure its adoption no such machinery as municipal ownership would provide. The New York Public Service Commission has jurisdiction over both private and municipal utilities with regard to rates, service and accounts, including rates fixed by grant, statute, franchise or ordinance, and has jurisdiction over private utilities with respect to capitalization. If, therefore, there is anything radically wrong with the gas and electric properties in the Greater City, why does the Public Service Commission remain inactive? Is it not its bounden duty to enforce the law? From all of this it would seem that politics more than anything else is back of Mr. Prendergast's proposal. Nevertheless, his suggestion is not without merit, and the numerous utilities ought to perfect their operating organizations and interconnections so as to make possible greater uniformity of service and, where possible, of rates. With legal obstructions removed and a sympathetic commission much could be accomplished. The commissioner must know that rates are based on investment and not on wishes, and that with single ownership, and that not municipal, all that he seeks can be brought about. It is within the power of the Public Service Commission more than of any other body or of any individuals to determine whether a movement in this direction shall be expedited or impeded.

Another Vacuum Tube Makes Its Advent

ONE of the indirect results of the development of the thermionic tube is the stimulus to further experimental investigation of the possibilities of gaseous and electronic conduction in vacuum tubes. Among recent results of this work is the so-called "magnetron" noticed in these columns a few weeks since. Still another new type of tube has now been announced by V. Bush and C. G. Smith, who gave a description of it at a recent meeting of the Institute of Radio Engineers. Its principal property is that of rectification. In many external respects the new tube is similar to the magnetron. Fundamentally, however, the operation depends on a totally different physical principle.

Gases are ordinarily classed as insulators. They become conductors when the small number of free electrons always present are accelerated sufficiently in their free paths to ionize the molecules with which they collide. At atmospheric pressure the electric intensity required to accelerate the electrons is very high, but when once this value is reached enormous numbers of molecules break down at one time, resulting in a practical short circuit through the air in the form of the arc, or spark. As the pressure is reduced the paths of the electrons become larger and the molecules become fewer. Thus the electrons acquire higher velocities, gas begins to conduct at lower values of electric intensity and the resulting currents become smaller. Below one centimeter of pressure air begins to conduct somewhat freely, but the volume of discharge is limited by the number of molecules present.

The essential difference between the new rectifying tube and the hot cathode tube is that the former contains gas at low pressure, whereas the gas in the latter is withdrawn as completely as possible. The two electrodes of the tube are so arranged that normally an electron leaving one electrode and reaching the other does not acquire ionizing velocity. When a magnetic field is applied, however, the path of the electron is deflected, causing it to become longer, and owing to the longer path it is enabled to reach an ionizing velocity, thus setting up conductivity. The tube therefore may be changed from a non-conducting to a conducting condition by superposing a magnetic field. The rectifying property is obtained by using coaxial cylindrical electrodes. The deflection due to a given magnetic field of an electron leaving the inner cylinder is different from that of an electron leaving the outer cylinder. Consequently by adjusting the magnetic field so that electrons leaving one cylinder will cause conductivity, while those leaving the other cylinder will not, the tube will have a unidirectional conducting power.

A notable advantage of this new form of tube is that it has cold electrodes and when used as a simple rectifier requires no auxiliary circuit of any kind. Its rather obvious disadvantage is its low current capacity, the maximum figures mentioned so far being of the order of milliamperes. The voltage, however, is relatively high, and doubtless a capacity in rectification of several kilowatts could readily be obtained. However, these figures are all low as compared with the possibilities of the thermionic tube. The volume of electronic discharge from an incandescent cathode is far greater than may be reached in tubes of reasonable dimensions relying on gaseous conduction at low pressure. From its principle it would appear that this tube could be used also as a detector for radio signals. This usage is not mentioned by the authors, although further information as to other interesting properties of the tube is promised.

Accurate Accounting Vital in Deferred-Payment Security Sales

MANY new problems for the central-station company's accounting department have arisen out of the growing practice of selling securities direct to the consumer under the deferred-payment plan. The purpose of the public sale of utility stock is more than the mere raising of capital, important as that is. It seeks to establish a vast number of new contacts with the people of the community in order that a sure bond of mutual interest may be built up between the service corporation and the householder, the merchant and the business man. It is important, therefore, that in the sale of stock the company should come through clean in all its transactions with the public and sacrifice no confidence through errors caused by careless or inadequate accounting. If the new interest between the security purchaser and the utility is to be molded into friendship, it is essential that no annoying mistakes be made in the period when the installments are being paid and the first impressions of the unaccustomed relationship are being recorded on the new stockholder's mind.

To prevent such mistakes it is vital that methods of accounting for deferred-payment security sales be brought to the highest point of efficiency and helpfulness. It is not enough that each company should apply its own ingenuity and work out the answer as best it can. The matter is one in which the best experience is needed for all, because the success of every campaign is more than local in its influence. It is a factor in the spreading movement of customer stock ownership that is of vital interest to the entire industry. A plan such as is presented in this issue by W. Paxton Little is a practical contribution to the common knowledge that has a great value, and it should be considered and applied wherever its suggestions seem to offer further safeguards. The fact that Mr. Little is himself a certified public accountant who has played an active part in the development of the American Institute of Accounts makes for particular interest and confidence in this system of accounting which he has established for the Niagara Falls Power Company.

Some Modern Standards of Illumination

ONE of the recent Illuminating Engineering Society convention papers, that by Messrs. Curtis and Stair on lighting public spaces and offices, is specially notable as showing the effect of the very general adoption of the gas-filled lamp upon available methods and practicable intensities of illumination. At the present time artificial light is one of the cheapest of necessary commodities, so cheap that purely technical efficiency can be pushed into the background and the beauty and usefulness of illumination brought to the front. Efficiency is all very well in its proper place, but there are times when it should not be obtained at the expense of other things which practically are more desirable. We refer here particularly to the lighting of just such places as the paper before us describes. As a striking example, there was chosen for standard paint of walls and ceilings a soft tone of carbon gray and ocher having a reflection coefficient of 48 per cent. In the days of the earlier incandescent lamps such a choice would have been almost unthinkable, but now it proved to be worth the while merely as a factor in the general architectural effect and the pleasantness of the illumination.

Many of the fixtures described are of a compromise type in which the advantage of a brilliant upward reflector is obtained without the violent contrast of a heavy opaque bowl. If properly proportioned, fixtures of this sort are softer in effect without losing heavily in the efficiency of the upward reflection. In one of the installations noted careful tests were made to determine the loss of light from dust and dirt in a designed indirect fixture. It apparently proved to be about 10 per cent a month, so that by cleaning regularly every two months an over-all efficiency of 80 per cent in the equipment was practicable. It is interesting to note that the intensities in this particular office-lighting task were pushed up to above 10 foot-candles, and that this was done without undue expenditure of energy.

Still another example of effective lighting was in a second office building in which again the luminous-bowl type of indirect units was installed, the particular form selected utilizing about 12 per cent of the light for the luminous bowl and turning the rest upward. Here too the plane of illumination was carried high to an average of from 8 foot-candles to 14 foot-candles at the level of the desks.

Such installations as these carry out the conclusion which recent work on the technique of illumination has abundantly enforced—that on the whole workers have been trying to do their tasks with too little light, not perhaps too little for technical acuity tests, but quite too little for comfortable and easy working hour after hour. Today it is rather usual to find great spaces in which the natural light is comparatively insignificant. In these the necessities for artificial illumination carry with them a call for such lighting as will produce easy working conditions, not for an hour or two in the late afternoon, but during most of the day, and for persons who on the average require some extra light by reason of vision which would hardly be passed as normal by the oculist. Under such circumstances high intensities like those indicated in the paper we are commenting on become necessary, and they can fortunately be obtained without expense in the least forbidding.

Some Possible Plant Economies

IN POWER plants the limit of development along the lines that have prevailed in the past twenty years is nearly reached, if the view expressed by C. F. Hirshfeld, chief of the research department of the Detroit Edison Company, in a paper presented before the American Society of Mechanical Engineers, be correct. He referred specifically to improvements that might bring economies comparable to those that the steam turbine and the stoker have made possible. By utilizing the highest temperature and pressure limits permitted by available materials and introducing all the possible heat-saving devices the author sees the possibility of laying down a plant capable of developing a net kilowatt-hour for between 14,000 and 15,000 thermal units. The economics of the situation, based on fuel prices that may reasonably be expected in the immediate future, are such that he does not expect to see the figure reduced below 16,000 or 17,000 in the near future.

The study is interesting because of the future possibilities it indicates, but even more for the light it throws on our present development. A few large plants are producing a net kilowatt-hour on less than 20,000 thermal units, but the number that are not approximating this figure is a staggering indication of the distance we have fallen short of utilizing effectively the developments we have already made. Only the largest plants can hope to reach the highest efficiency, and very many plants, if not the majority, may not be able to reach the figure of 20,000 thermal units because of the limits established by the volume of production. The majority, however, can approach much nearer this limit than they are now doing. One method of doing this may be through intelligent reconstruction to eliminate intolerable operating conditions or inefficient equipment now eating up its cost in excess fuel. In more cases undoubtedly the less complicated method of getting rid of careless faults of operation will serve. Leaky drains, dirty boilers, improper practices in burning fuel and careless or slipshod maintenance methods are as much responsible for failure to obtain the economies possible with available equipment as any other factor, unless it be plain, downright ignorance, which is little less than criminal.

Industrial Tractors from a Large User's Viewpoint

THE report presented in this issue by John Causland on the practical costs of industrial tractor in moving material should be of interest to all users, prospective or otherwise, since it comes from the hand of a man who has probably as many under his general supervision as any one in this country. The last few years have disclosed the large importance of tractors in handling material about buildings where it is manufactured or stored. The old industrial railway with small skips pushed by men is rapidly passing out of use. The industrial railway itself is tending to disappear and to be replaced by the tractor, which gets around almost anywhere, can haul a capacious group of trailers and saves the labor of many men. We have heard some strong statements on this point already, but Mr. Causland's citation of an instance where one tractor has done the work of forty men is quite the most striking that has yet come under our notice.

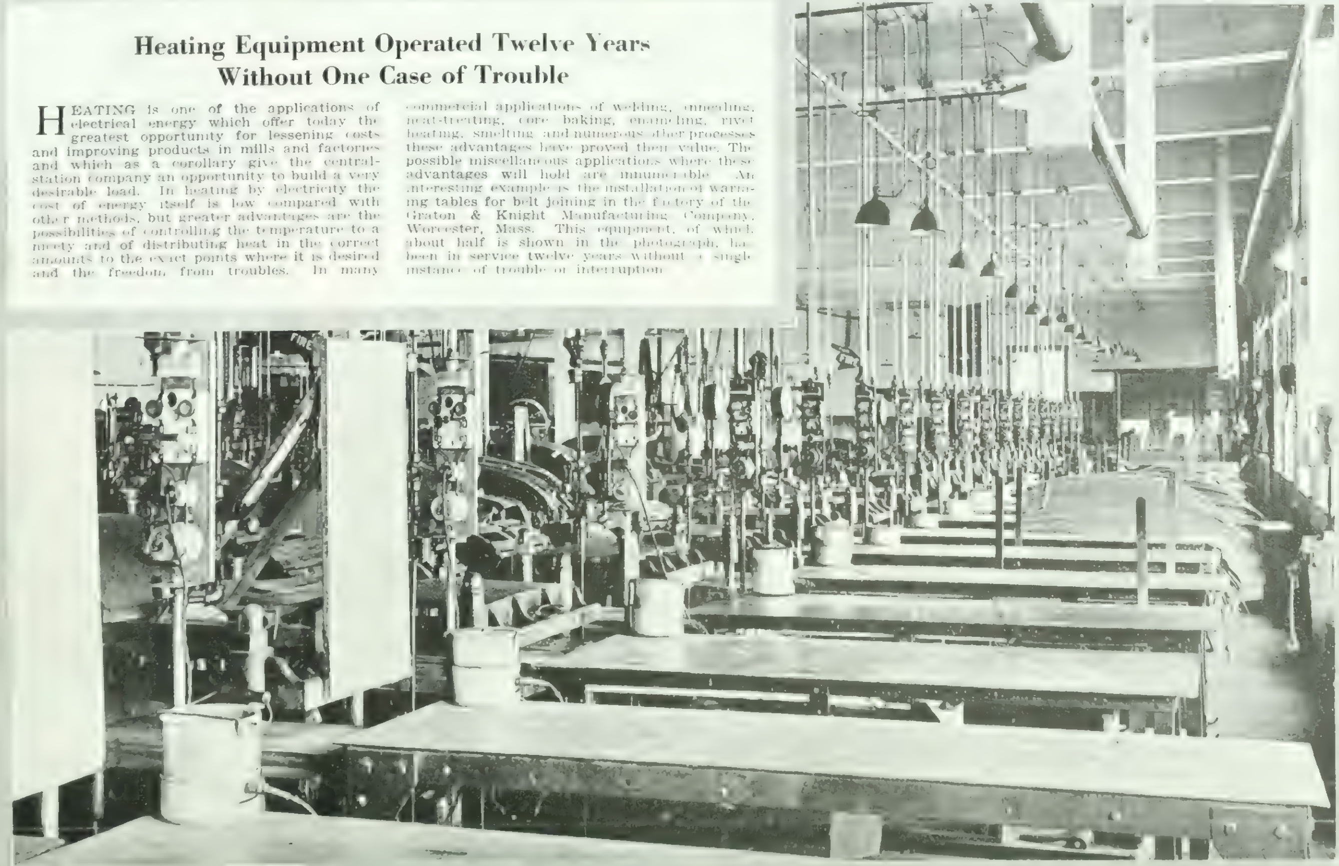
Men, of course, are required for loading and unloading, but for all that the saving of labor comes to a very large sum, in one instance rising to more than 85 per cent and frequently being from one-third to one-half the cost. Experience shows that there is a considerable difference between tractors, and it pays to purchase a substantial and thoroughly well-made machine. The main point is to get a tractor that is rugged and pretty nearly foolproof. It must be handled at times by unskilled men, and its electrical parts must be so arranged that the machine can be readily run without much or any technical knowledge. Of course, the storage battery is the vital part of the whole equipment, and experience is showing that the storage battery as made today, while by no means perfect, has still been developed into a very reliable piece of apparatus. Both the lead and the nickel-iron batteries are in wide use and have proved thoroughly successful. In either type the essential point is to keep close track of operations and see that the battery is properly treated and gets its rations regularly. The depreciation of both tractors and battery from rough usage often amounts to a considerable figure, but nevertheless the net result of their use is the saving of a large sum compared with the investment or with the competitive cost of hand haulage.

A Little Matter of a Word

YEARS ago, before central-station-company men had begun to think commercially, the habit was developed of speaking of the customer as a "consumer." The word has stuck in the electrical man's vocabulary, and yet it was not a good word for general adoption. It is too impersonal. People are people, not things, and the use of a term that classifies them as mere puppets is always offensive. The trainman who treats his passengers as if they were no more than "fares" incurs unpopularity. The lighting company employee who calls the man who pays the bill a "consumer" is doing the same bad thing. Purchasers of transportation and purchasers of electricity are valued customers of a utility, both of them, and, being human, both are pleased when they receive a little public recognition of the fact.

Heating Equipment Operated Twelve Years Without One Case of Trouble

HEATING is one of the applications of electrical energy which offer today the greatest opportunity for lessening costs and improving products in mills and factories and which as a corollary give the central-station company an opportunity to build a very desirable load. In heating by electricity the cost of energy itself is low compared with other methods, but greater advantages are the possibilities of controlling the temperature to a nicety and of distributing heat in the correct amounts to the exact points where it is desired and the freedom from troubles. In many commercial applications of welding, annealing, heat-treating, core baking, enameling, rivet heating, smelting and numerous other processes these advantages have proved their value. The possible miscellaneous applications where these advantages will hold are innumerable. An interesting example is the installation of warming tables for belt joining in the factory of the Graton & Knight Manufacturing Company, Worcester, Mass. This equipment, of which about half is shown in the photograph, has been in service twelve years without a single instance of trouble or interruption.



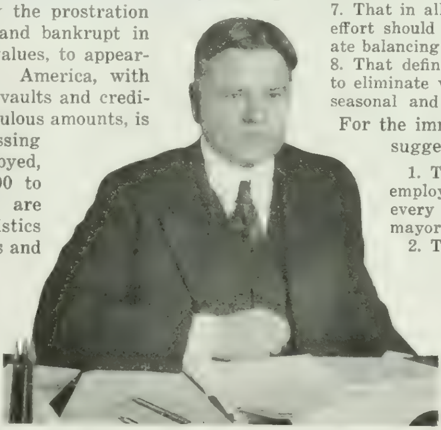
The Practical Achievements of the Unemployment Conference

A Crystallized Review of Its Recommendations and the Two Great Economic Background Problems Which the Conference Has Unveiled—The Need for Labor Statistics and Labor Load Dispatching

By EARL E. WHITEHORNE

NOW that the unemployment conference has done its work in Washington and gone its way and a week has passed in which to think about it, the question of results and responsibility comes uppermost. What did the conference accomplish? What is to be done about it next?

The world today is distraught by economic phenomena of the most unusual kind. Germany, supposedly bled weak from war, ruined by the prostration of its industry and commerce and bankrupt in face of its vanishing currency values, to appearances is busy and prospering. America, with one-half the world's gold in its vaults and creditor to almost every nation by fabulous amounts, is beset by hard times and the pressing need for relieving its unemployed, variously totaled from 3,500,000 to 5,750,000. And these figures are not to be thought of as statistics only, for they represent the lives and sufferings of men, women and children.



SECRETARY HOOVER, THE GUIDE AND INSPIRATION OF THE CONFERENCE

Therefore President Harding summoned to Washington a body of the men and women best qualified by position and experience to devise and recommend the way to prompt and permanent solution of this problem of non-employment and the perpetual menace which it brings. In other words, the people of the United States, through their executive, called this conference under the leadership of Secretary of Commerce Herbert Hoover to decide what should be done and to direct what agencies should initiate and carry on the measures for readjustment. This action carries with it the nation's acknowledgment of willingness to accept the decisions and follow the direction of the conference, to be satisfied for the emergency with its judgment, and without further argument or conversation to proceed to the application of the remedies recommended.

The various committees of the conference suggested many possible directions in which immediate relief can be sought and provided. They pointed out the larger economic principles and policies which when adopted and applied will permanently establish and maintain a better balance in the labor market. These reports have been published in detail in the daily press, but in brief they recommend for permanent relief the following measures of economic readjustment:

1. That railway rates be rescheduled to a fairer balance with the relative values of commodities.
2. That the working out of the present problem of taxation be speedily completed in a bill that will reduce the tax burden.
3. That tariff legislation be promptly and definitely settled.
4. That the financial relationship between the railways and the government be speedily adjusted.
5. That world armaments be limited.
6. That steps be taken to minimize the fluctuations in foreign exchange.
7. That in all fields of industry and occupation effort should be made to speed the proportionate balancing of the inequalities in depletion.
8. That definite programs of action be formed to eliminate waste and regulate employment in seasonal and intermittent industries.

For the immediate emergency relief it was suggested by the conference:

1. That emergency committees and employment agencies be established in every city under the direction of the mayor.
2. That statistics on the number and condition of the local unemployed be published daily in each city to impress upon the people their responsibility.
3. That private homes, hotels, offices, etc., do all contemplated repairs and improvements at once.
4. That municipalities expand their school, street, sewage, repair and public buildings work to fullest volume under existing circumstances, since the sale this year of the largest amount of municipal bonds in history shows that much is possible along this line.
5. That federal authorities should expedite construction of public buildings and public works covered by existing appropriations.
6. That congressional and state appropriations for roads be made immediately available.
7. That the present need for construction, estimated at more than a million homes, with a shortage in all buildings totaling from ten to twenty billion dollars, be met by co-operative action of federal, state and municipal governments to determine facts, discover causes and organize community action to secure readjustments.
8. That manufacturers endeavor to employ more men by part-time work, rotation of jobs, production for stock, plant construction and repairs, shorter working days and shorter working weeks.
9. That public utilities of all classes be urged to advance their programs for construction and repair.
10. That mines be urged to increase output and establish a larger stock reserve and that railways be asked to accumulate larger reserves of coal along their lines.
11. That appropriations be made to increase employment on reclamation projects no wunder way or proposed.
12. That American shipowners give preference to American seamen, that usual periodic overhauling of ships be done at once, that Shipping Board vessels to be broken up

be dismantled now, and that idle shipyards engage in other lines of industry.

13. That an appeal be made to all business men tempo-business practice to lower prices and encourage buying.

14. That a broad appeal be made to the public to buy now and stock up with general commodities and equipment in order to increase the demand for labor in the factories, in the warehouses and stores and on the common carriers.

Such are the definite results of the conference itself, and if the people of America stand to their responsibility the emergency will be relieved.

But beyond all that, the conference has focused the attention of the country on a great fundamental problem. It has set men to thinking more broadly about labor as a national resource and a universal responsibility. And in the course of this thinking certain facts have begun to stand out clearly in the light of reason that before have been both buried and ignored.

LABOR STATISTICS NEEDED

The first consideration which the conference has uncovered is the fact that in this country there are no reliable statistics on the condition or location of labor. We may know the cotton crop from month to month within ten thousand bales. We may report our grain and live-stock crops, our metal and our mineral production with embracing accuracy. But our labor—an element in every crop that we produce, a basic factor in every industry, whose welfare and employment is a matter vital to our economic health—we know nothing of in the broad sense. We know neither how much labor is at work nor what it is doing, nor how much idle labor is available, where it is nor what it best can do.

Therefore, when the present emergency arose and the country asked how many unemployed there were, the present sources of too limited information made a wild guess and announced the figure as 5,750,000 idle men. The country was shocked and many classes of trade were badly affected. The President's conference analyzed the situation and soon found the probable figure to be 3,750,000, of whom 1,500,000 are normally unemployed, leaving something over 2,000,000 as the emergency unemployed. Secretary Hoover has announced that only from 10 to 20 per cent of the really idle, numbering 375,000 to 750,000, are found to be actually in danger of suffering. The point in mind is that the nation has been thinking, planning and too often, unfortunately, struggling with labor in the dark. Neither labor nor capital, the worker or the employer, has ever known how much labor there was or how it was distributed. No wonder that it has been inefficiently utilized and that no common opinion has ever been reached as to its value and its price.

The second consideration pictured on the background of the conference is no less shocking. It is the fact that in this country—and all others—we have left our greatest natural resource, which is labor, absolutely unorganized, unregulated and abandoned to the unguided currents of the wabbling tides of agricultural and industrial demand. We say that labor is already organized and regulated, but its present organization is social or anti-social in its influences—class against class. It is not organized in any broad economic plan that co-ordinates the powers and the needs of labor with the needs and powers of industry.

and have begun to think these thoughts will perhaps prove to be the greatest practical achievement of the unemployment conference.

Look it in the face and we know that labor in the mass is the greatest of all national resources. It cannot be left to wander over the earth, seeking the demands of industry in chance ways, without the grossest waste. It is more valuable by many times than water in the streams and timber in the forest, but we conserve the water and the wood and cast out our man power a prey to seasonal demands and intermittent markets without the slightest effort made to harmonize harvest season, construction operations, factory fluctuations and other labor market trends.

The trouble has been that no one accepts responsibility for labor. Call it industrial man power and responsibility falls naturally in two directions. The government is responsible for man power, as it is for other natural resources. Industry should be responsible—each industry—in just the same degree to which it is permitted to absorb its portion of this resource. And when we recognize and apply and operate under that responsibility as a nation, we will have begun permanently to solve the economic problem of labor.

THE WAY CAN BE FOUND

The responsibility of the government, as the unemployment conference quickly decided, must be expressed through the mayor of every city. For idle men congregate only in cities. The mayor must be responsible for reporting a waste of the labor resource and aid in directing it to other markets.

The responsibility of industry can be expressed as simply. When a factory employs a number of men it automatically absorbs a certain measure of the labor resource and should become responsible for it to the nation. If a factory is prepared to utilize and maintain a labor force of 1,000 men, it is entitled to absorb our man-power resource to that extent. But it is not economically right that this factory should intermittently absorb 2,000 men and cast 1,000 of them out again when the rush work is done. That universal practice on the part of industry plus the demoralizing effect of seasonal occupation is to a large degree responsible for our present predicament. It has resulted in such conditions as exist in the extreme in the coal fields, where men receive a wage of $12 a day or more but are working this year about 161 days.

The way can and will eventually be found to solve this problem in an economic manner that will protect our national resource of industrial man power and maintain the price of labor on the basis of its worth. Seasonal occupations we will always have, for the crops must be harvested as they mature. But intermittent non-seasonal occupations such as construction, reclamation, public works and general repair and maintenance can be so regulated that they will not pile up upon the peak of harvest time, but be distributed across the valley of the labor curve. Each factory can be made responsible for the even maintenance of the fragment of the labor resource which it absorbs. A national law compelling the payment of a maintenance wage for a fixed re-employment period when labor is laid off, except for cause, might regulate this automatically. But time and the evolution of constructive thought with practical experiment will tell.

The problem rests today on the American business man and on the government which he elects. We need labor statistics. We need a national labor load dispatcher. The fact that men and women, employer and

Remodeling Plant to Increase Rating

Crib Dam Replaced by Concrete, Old Waterwheels Supplanted by Modern Units, Antiquated Drive Eliminated and Penstocks Renovated—Quadrupled Rating Permits Low Energy Rate with Fair Return on Investment

By **PHIFER SMITH**
Chief Engineer Bangor (Me.) Railway & Electric Company

OPERATING companies which are handicapped by inadequate plants built a long time ago could probably in numerous cases benefit as much by rehabilitating them as the Bangor (Me.) Railway & Electric Company has done by remodeling its Veazie plant in the manner described in this article. Although all conditions are never the same in any two plants, it is quite possible that the method by which the Veazie plant was brought up to the required standard may suggest ways in which other companies can accomplish a similar object.

The Veazie plant, which was one of the early hydroelectric stations of this country, is on the Penobscot River about 3 miles (4.8 km.) above Bangor. The original installation consisted of fifteen vertical waterwheels, using crown gears and rope or belt drive for driving a horizontal shaft, from which an output of about 1,500 kw. was obtained under the most favorable water conditions through the direct connection of four horizontal generators and the belt-driving of two railway generators. The original dam was of timber crib construction, the head upon the wheels being about 14.5 ft. (4.3 m.) average. Wooden penstocks conveyed the water from a short forebay on one side of the plant to the wheels. Four 6,600-volt, three-phase generators composed the directly-connected units.

The first step in reconstructing the plant was taken in 1912 when the old timber dam was replaced by a reinforced-concrete rollway 570 ft. (17 m.) long. A maximum head of 16 ft. (4.8 m.) was produced, but the average head at the time of the dam reconstruction varied between this and 10 ft. (3 m.) on account of differences in the rock elevation at the outlets of the tailraces of the individual penstocks and of variations in the river stages. The spillway crest of the new dam was equipped with flashboards 3.5 ft. (1 m.) high which can be raised by means of a motor-operated cableway when several feet of water is spilling over the dam. At the downstream end of the forebay is an auxiliary spillway containing two Tainter gates.

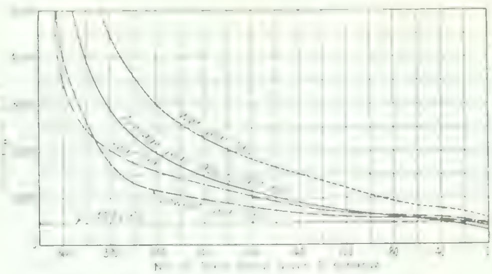
First Modifications

Soon after the construction of the new dam a 675-kva. vertical direct-connected waterwheel and generator was installed in the fifteenth flume, replacing the old geared wheel. In 1918 a 600-kva. similar unit was placed in the first flume, and three more vertical wheels were installed in 1919 in place of the old ones. These new wheels were rated at 445 hp. each at 16-ft. (4.8-m.) head.

On account of the slow delivery of vertical generators during the war these waterwheels were connected by crown gears to two of the old line-shaft generators. In 1920 construction work was begun on the remaining ten flumes, the work covering the installation of vertical direct-connected generators and waterwheels. The revised generator and wheel layout is therefore:

Penstock No.	Wheel Diameter, In.	R.P.M.	Cu.Ft. per Sec. (14.5 Ft.-Head)	Unit Rating Kva.
1	48	120	450	600
5–14, inc.	40.5	150	280	400
2–4, inc.	40.5	150	280	(Two gen. tot. 670 kw.)*
15	60	90	610	675

* Two generators, totaling 670 kw.



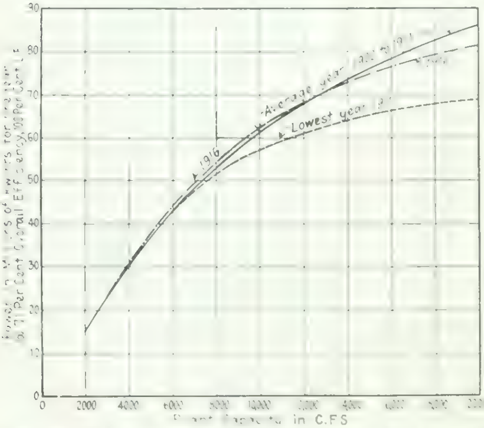
DURATION CURVE OF PENOBSCOT RIVER AT VEAZIE DAM

On account of the crowded condition of the penstocks, however, the capacity of the first and fifteenth units will total only 950 kw. under 14.5-ft. (4.3-m.) head, and that of units 2 to 14 inclusive will total 3,250 kw., making the total available capacity with the completion of the fifteen vertical units equal to 4,200 kw.

About the same time an extended study of the undeveloped power possibilities at the Veazie dam was made for the Bangor company by the Fargo Engineering Company, Jackson, Mich. In studying the Penobscot River, which has a drainage area above the Veazie dam of 7,700 sq.miles (19,700 sq.km.), it was decided that the flowage of 1916 was representative of an average year. On rare occasions the minimum flow at Veazie has dropped to 2,500 cu.ft. or 3,000 cu.ft. (70 cu.m. or 84 cu.m.) per second, and in 1905 to as low as 2,130 cu.ft. (60 cu.m.) per second. At the present stage of development, however, the capacity of the river so much exceeds the capacity of the plant that the extreme minima are relatively unimportant.

ESTIMATED COST OF PROPOSED ADDITION TO THE VEAZIE POWER PLANT TO UTILIZE 2,000 CU.FT. PER SECOND

Construction plant and supplies	$12,000
Cofferdam and pumping	7,000
Rock excavation, 2,620 cu.yd. at $5	13,100
Concrete, including form work, reinforcing and stop-plank [illegible] 1,500 cu.yd. at $28	42,000
Power house, 144,000 cu.ft., at 26 cents	37,440
Intake steel, 1,140 sq.ft., at 50 cents per square foot and 9 cents per pound	5,130
Hand crane, 10 tons	2,500
Turbines, four units, vertical, single-runner type, complete with governor installed	66,000
Generators, four 650-kva. vertical, direct-connected, complete with exciters	74,000
Switchboard installed	3,000
Oil switch	2,300
Transformers, three 600-kva. (25 per cent overload), oil-cooled, outdoor type, including structural unit and foundation, installed	14,300
Lightning arresters, installed	2,500
Station wiring and miscellaneous electrical	11,000
Engineering superintendence, resident engineer, miscellaneous expenses	19,000
Contingencies	14,730
Total	$326,000



RELATION OF OUTPUT TO PLANT CAPACITY BASED ON AVERAGE MAXIMUM AND MINIMUM FLOW

ANALYSIS OF ESTIMATED RETURN ON INVESTMENT (VEAZIE HYDRO-ELECTRIC PLANT)

I. Cost of installation:	
Renovation of thirteen penstocks [illegible]	[illegible]
II. Annual charges:	
1. Maintenance (operation [illegible])	[illegible]
2. Depreciation:	
Foundations, buildings, and appurtenances. Take fifty years' [illegible]	[illegible]
Machinery. Take twenty-five years' annual amortization, including 6 per cent interest	5,740
3. Taxes and insurance, 2 per cent	12,480
4. Interest on bonds [illegible]	[illegible]
5. Amortization (ninety-year bonds)	2,150
Total	[illegible]

Selling prices at which various rates of interest* will be earned on the capital [illegible]

Rate of Interest on Capital	Selling Price per Kw.-Hr. (Cents)
0	0.325
10	[illegible]
15	0.71[illegible]
20	0.839

* Based on relation [illegible] invested, E = annual expenses, O = annual output [illegible] kilowatt-hour.

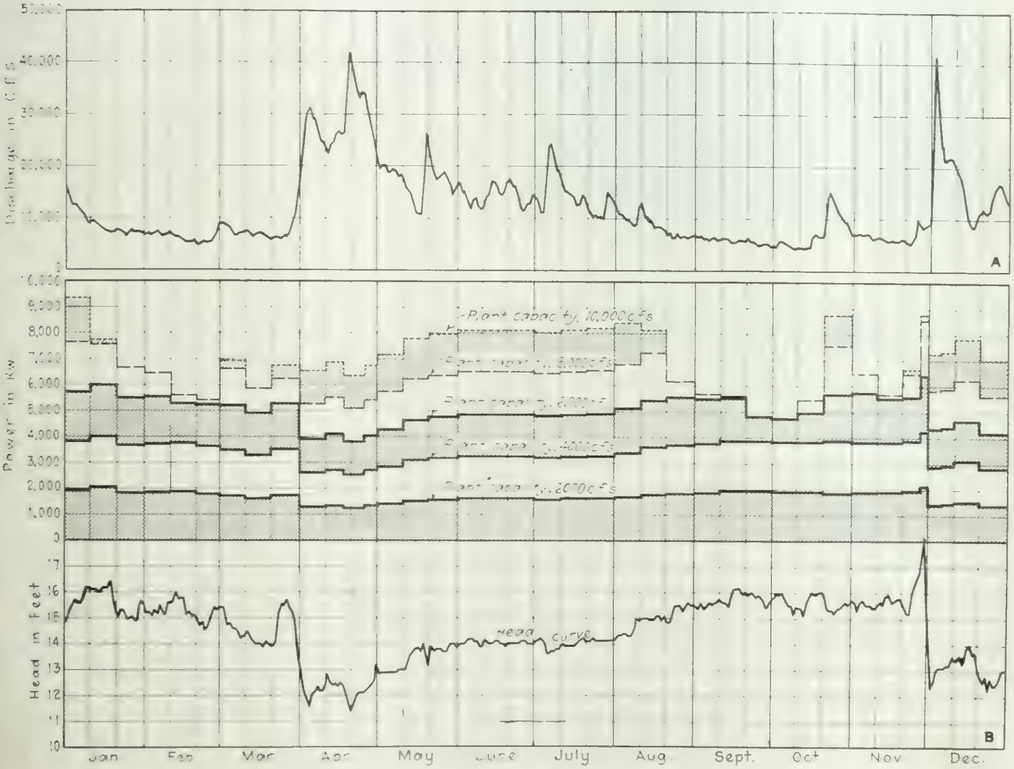
The power output for 1916 was computed in detail for plant capacities of 2,000 cu.ft. to 10,000 cu.ft. (56 cu.m. to 280 cu.m.) per second in steps of 2,000 cu.ft., taking into account the varying head and varying wheel capacity. As a conservative over-all efficiency at the high-tension side 71 per cent was assumed and the average twenty-four-hour power was computed for ten-day periods. These computations furnished the curves shown for plant capacities of 2,000 cu.ft. to 10,000 cu.ft. per second and 100 per cent load factor, and the plotted integration of these curves gave the average annual kilowatt-hour output at 100 per cent load factor for various plant capacities for the typical year 1916. These figures were computed in detail and served as a basis for comparison with the average from 1902 to 1917 inclusive.

From the duration curve of an average year, 1902 to 1917, the power output was computed by taking the output proportionate to the duration, which was nearly equal to that of 1916 for various plant capacities, and this curve was also plotted. Below a discharge of 10,000 cu.ft. per second this curve differs very little from the curve for 1916.

With the fifteen existing penstocks carrying 4,700 cu.ft. (131 cu.m.) per second, the output at 100 per cent load factor could be 35,000,000 kw.-hr. a year, and at 80 per cent load factor it could be 28,000,000 kw.-hr. The utilizable power at the Veazie dam taken at 100 per cent load factor and 71 per cent average over-all efficiency is given in the following table, taken from the Fargo investigation:

	Plant Capacity	Output at 100 per Cent Load Factor, Kw.-Hr.
Average year	10,000 c.f.s. (9,200 kw.)	63,951,000
	20,000 c.f.s. (18,300 kw.)	86,210,000
	6,700 c.f.s. (6,000 kw.)	46,500,000
Dry year	10,000 c.f.s.	57,400,000
	20,000 c.f.s.	69,068,000

Although the limit of firm power is reached at a lower plant capacity than that given in the preceding table, 6,700 cu.ft. (187 cu.m.) per second being 7.41 per cent above the limit, it was decided that the plant could be economically developed to utilize this flow, since the forebay has a cross-sectional area at its entrance of 1,835 sq.ft. (169 sq.m.) and could easily allow an average velocity of 3.65 ft. (1 m.) per second. The flow of 6,700 cu.ft. (187 cu.m.) per second is 2,000 cu.ft. (56 cu.m.) per second more than the fifteen penstocks could carry satisfactorily, but this additional amount could be discharged through the Tainter gates, to which reference was made previously, and four generating units with a capacity of 500 cu.ft. (14 cu.m.) per second each installed below them. Such an arrangement would permit utilizing the forebay without excessive velocities of approach.



PLANT CAPACITY THAT WOULD BE AVAILABLE AT DIFFERENT TIMES OF YEAR BASED ON 1916 HYDROGRAPH AND HEAD CURVE OF PENOBSCOT RIVER AT VEAZIE DAM

New Units Will Have Capacity of 1,800 Kw.

The four new units would have a capacity of 1,800 kw., and the total plant capacity would be raised to 6,000 kw., giving an average annual power output at 100 per cent load factor and 71 per cent efficiency on the high-tension side of 46,500,000 kw.-hr. The load factor on the Bangor Railway & Electric Company's system is over 80 per cent, so that it may be assumed the Fargo investigation shows 37,200,000 kw.-hr. of this output to be salable power.

The river capacity is much larger than the plant capacity. From the curves shown it appears that the available energy output is 86,210,000 kw.-hr. for a plant capacity of 20,000 cu.ft. (560 cu.m.) per second, but this requires a large amount of stand-by power. Although 15,000 cu.ft. (420 cu.m.) per second plant capacity would be 8,300 cu.ft. (232 cu.m.) per second larger than the proposed utilizable capacity of the present forebay, such an addition would present considerable difficulty of proper arrangement. The maximum floods, estimated at 125,000 cu.ft. (3,500 cu.m.) per second, have to be considered and the spillway capacity preserved. The provision of a new tailrace for the present fifteen penstocks on the land end would be essential and the forebay would have to be increased in depth, with other changes or new construction.

The renovation of the fifteen penstocks and the addition of 2,000 cu.ft. (56 cu.m.) per second plant capacity at the downstream end of the forebay, bringing the total plant capacity to 6,700 cu.ft. (187 cu.m.) per second, will yield an average annual increase in output of 27,000,000 kw.-hr. The estimated cost of the remaining penstocks renovation in 1920 was $298,000, and that of the addition of 2,000 cu.ft. per second was $326,000. The expected returns on this investment are given in the accompanying table.

From the foregoing the Fargo company reached the conclusion that if the load factor of 80 per cent can be maintained, a selling price of 7 mills figured at the high-tension terminals of the generating station would yield an attractive return on the capital invested over and above 8 per cent interest on bonds and all other fixed charges, including amortization of bonds. The increase of plant capacity to 6,700 cu.ft. per second was therefore determined to be a proper investment.

GENERATOR ROOM OF PLANT AFTER REHABILITATION

Other improvements at Veazie lately effected include a rearrangement of the switchboard, the installation of all 6,600-volt switches in brick cells, the provision of a concrete floor in the generating room, and the complete dismantling of about 1,200 hp. in obsolete steam reserve. No plans have been made relative to a modern steam reserve, as this plant is tied in with the company's stations at Ellsworth, on the Union River, and at Milford, on the Penobscot. The hydraulic conditions on the two rivers are so different that a spare waterwheel unit at Ellsworth answers much the same purpose as a steam reserve. The Veazie plant is a central power-distributing point, energy being received from Ellsworth at 50,000 volts through a 5,000-kva. transformer bank installed outdoors. This outdoor substation was built in early 1920, at the time the capacity of the Ellsworth station was increased from 2,200 kw. to 4,700 kw.

The Fargo Engineering Company was the consulting engineering firm on the hydraulic portion of the work described above. The actual construction has been carried on by the engineering department of the Bangor and affiliated companies. This department also handled the electrical design and construction work for the Veazie and Ellsworth improvements.

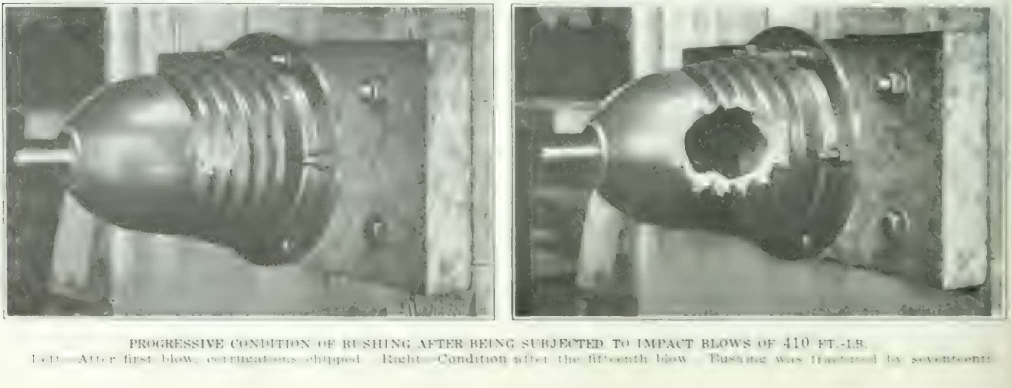
Shock-Resisting Test of Air-Gap Type Bushing

A SERIES of impact investigations have been carried out on a bushing developed recently for use in the naval service for radio-telegraphic purposes, as shown in the accompanying photograph. This insulator is a radical departure from other insulators of the bushing type in that the stresses between the central conducting rod and grounded securing flange are through a dielectric of air. The wall is approximately 1 in. in thickness. The impact was delivered to the insulator by a pendulum arranged with a 43-lb. sphere approximately 8 in. in diameter suspended in a direct line with the center of the insulator from a roller bearing secured to the ceiling of a room 12 ft. high. Impact was delivered at a centrally located point on the flat ribbed portion of the insulator by releasing the sphere from a height of 9½ ft. The photograph at the left below shows the condition of the insulator surface after the first blow of 410 foot-pounds had been delivered. A surface crack developed at the seventh blow extending from the top side of the middle securing bolt to the mashed portion of the insulator. This crack was very slight and did not extend through the insulation to the inner surface. The eighth blow broke a hole through the wall of the insulator approximately 1.5 in. in diameter.

IMPACT TESTS ON BUSHING

Impact Blow Number	Results of Each Blow [illegible]
1 to 6	Corrugations chipped
7	Surface crack
8	Hole 1.5 in.
9	Hole 2 in. x 3 in.
10	Hole 2 [illegible] in. x 4 in.
11	Hole 2.5 in. x 4 in.
12	Hole 2.5 in. x 4 in.
13	Hole 3 in. x 4.5 in.
14	Hole 3 in. x 4.5 in.
15	Hole 3.5 in. x 4.75 in.
16	Hole 3.5 in. x 4.75 in.
17	Fractured

The insulator top was carried away by the seventeenth blow, the fracture occurring along the plane of maximum stress. The insulating material was not pulled away from the securing flange when the insulator failed mechanically. A general summary is given in the accompanying table of the condition of the insulator after each impact blow. The foregoing information was furnished by George Lewis, engineer of the Electrose Manufacturing Company, Brooklyn, N. Y.



PROGRESSIVE CONDITION OF BUSHING AFTER BEING SUBJECTED TO IMPACT BLOWS OF 410 FT.-LB.
Left—After first blow, corrugations chipped. Right—Condition after the fifteenth blow. Bushing was fractured by seventeenth

Tractors Lower Freight-Handling Costs

Comparison with Hand-Labor Costs—Elements Entering Into Costs and Methods of Securing Basic Data—Points to Be Considered in the Selection of Tractors

By JOHN CAUSLAND

INDUSTRIAL tractors offer the most effective method for moving material in warehouses, railway terminals and shops, industrial plants and all similar places. A tractor will easily do the work of from five to twenty men, and in some instances it has been known to do the work of as many as forty men. Tractors can be operated to the best advantage where it is possible to make up long trains of trailers and then will readily handle many times heavier loads than the normal 20-ton capacity.

COST OF OPERATION

Based on the experience of the writer, the cost of operation of a tractor is figured, on an average, at about $4 a day, including depreciation on tractor, battery and tires, interest on the investment, maintenance, charging, etc. A four-wheel tractor, which has a 48-volt battery, will run approximately 15 miles (24 km.) on a charge, hauling a 10-ton load in one direction and returning with empty trailers. On this basis the cost per ton-mile for operating the tractor is 5 cents. Since the loaders or pilers frequently take care of coupling and uncoupling the trailers, only one man per tractor is required. If he is paid $4 a day, the total cost of moving material is 10 cents per ton-mile (omitting the cost of loading and unloading).

The three-wheel tractor is a lighter-weight machine with a battery of smaller capacity. Since it does not handle as much load per trip, the cost per ton-mile is necessarily higher than for the four-wheel tractor.

For the sake of comparison with manual handling of material we can take an operation where a car is being loaded with soap in boxes weighing 100 lb. (45 kg.) each, the distance from the warehouse to the car being 300 ft. (91 m.). A carload of such material amounts to approximately 30,000 lb. (13,600 kg.).

Two men in the warehouse can pile this soap on trailers in one and a half hours, and two more men at the car can pile the boxes ready for shipment in the same length of time. The tractor can readily keep the trailers moving between the warehouse and the car and still have time for other work, but for the sake of simplicity its entire time and the time of its operator for one and one-half hours is charged to this operation. Six hours' labor for the two piling gangs at 35 cents an hour makes a total of $2.10. One and one-half hours of the truck operator's time at 40 cents an hour is 60 cents more, and 30 cents for the tractor's time makes the total cost of loading the car by the tractor-trailer method $3, or 20 cents per ton.

Using man power throughout, the same two piling gangs will be required and in addition a trucking gang of approximately five men. This is estimated on a basis of three minutes per round trip with each man handling two boxes of soap per trip. Six hours' labor for the piling gang and seven and one-half hours' labor for the trucking gang result, a total of thirteen and one-half man-hours, which at 35 cents an hour amounts to a total labor charge of $4.73, or 31½ cents per ton. Thus the saving by the use of electrical equipment is 11.5 cents per ton, or 36.5 per cent. Actual installations show savings much larger than this. In fact, one user in Kansas City reports an advantage of over 85 per cent in favor of the industrial truck.

At one freight station in Chicago a four-wheel tractor is employed for the icing of cars. With this equipment nine men out of a crew of eleven have been eliminated. As the tractor without the operator costs about as much to operate as the wages paid one man, the cost of icing has been reduced to one-fourth what it was under hand-labor conditions.

In these figures the depreciation and maintenance of the trailers and of the hand trucks have been neglected, since these two figures closely balance each other and would not affect the final results.

COST RECORDS

Records of the cost of moving material are important since they furnish a barometer of the effectiveness of the handling system. The simplest method for figuring this cost is to maintain records of all handling expenses and of the tonnage moved. The cost per ton for any given period is then very easily calculated. In some cases the costs are figured on a basis of ton-miles, but this is only practicable where the tractors run repeatedly over the same courses.

In figuring costs it is important that maintenance and repair charges or any unusual expenses be distributed over a long period of time so that the cost for any short period of time will be a true indication of the actual expenses of handling material and not be affected by some unusual amount of maintenance work which was done during that period. Cost figures should include the following items:

I. Depreciation on (a) tractor, (b) battery, (c) tires, (d) charging equipment, (e) trailers.

II. Interest on the investment.

III. Maintenance of (a) tractor and battery, (b) charging equipment, (c) trailers.

IV. Cost of charging current.

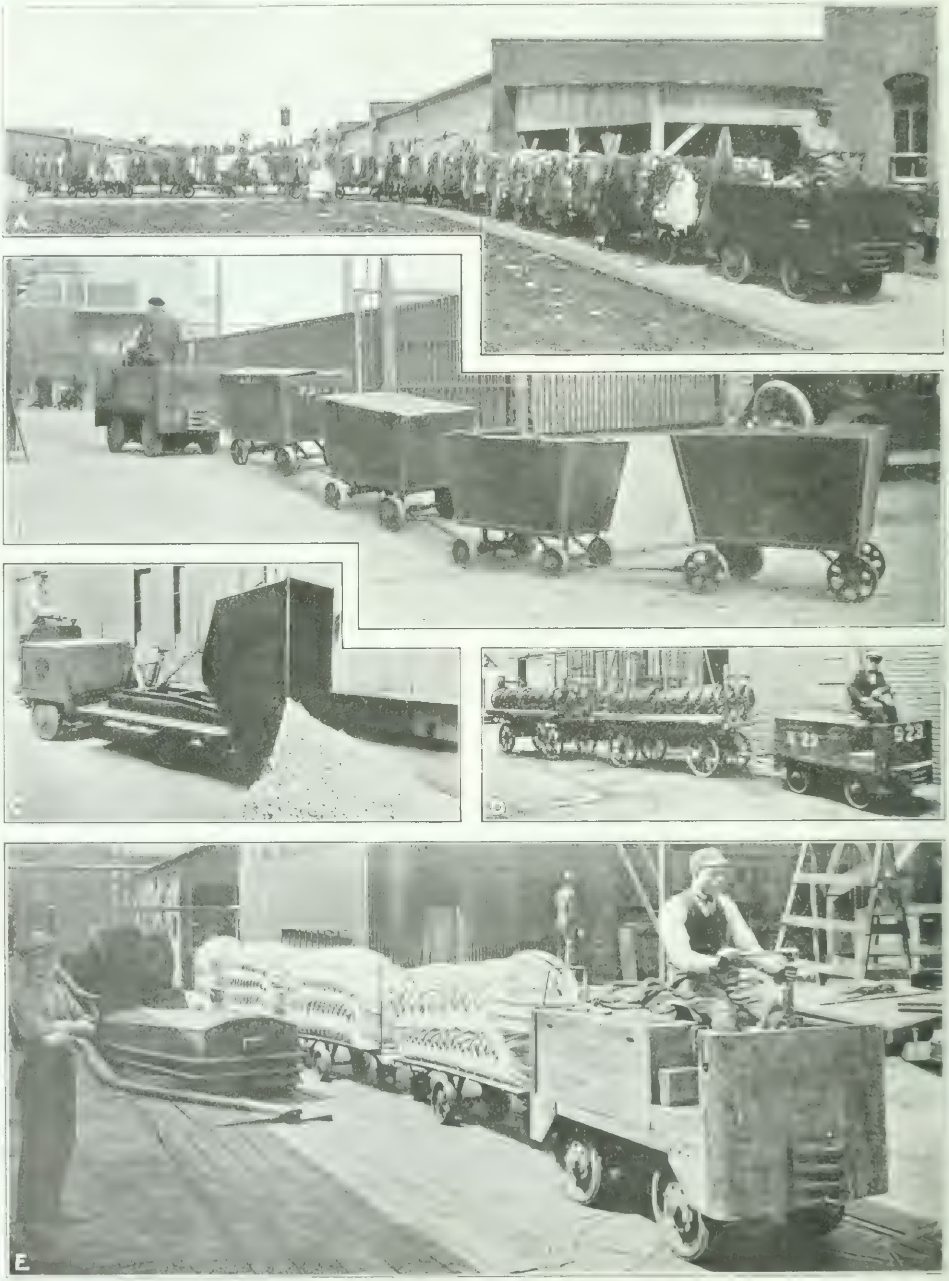
V. Pay-roll expense for (a) charging attendant, (b) tractor operator, (c) loading gang.

VI. Salary of foreman.

In order to keep records of the tonnage handled, unless weights are known, floor scales of the dial-reading type should be provided and placed where the trains would cross them in making regular trips. Each trailer should be plainly stenciled with its tare weight in order to assist in ascertaining the net weight of the load. These records could be kept by the scale man, who in some installations could also check the shipments into the car.

The first consideration in purchasing a tractor is ruggedness. No matter how much care is used in

Tractors Adaptable to Diversified Conditions



A—Hauling sixty bales of cotton at a large seaboard compress. Trailers of the four-wheel steer type are employed, as shown.

B—A special type of hopper trailer handling refuse being drawn over rough roads and grades.

C—Industrial trucks are frequently equipped with dump bodies or other auxiliary equipment.

D—Large "express type" trailers hauling wheels and other miscellaneous large parts.

E—Hauling load of rims on balanced-type trailers.

operating industrial-tractor systems, there is sure to be a great deal of abuse, and if the maintenance cost is to be kept down, a machine capable of day-in and day-out operation must be purchased. While first cost of the equipment should be considered, $200 or $300 difference in the purchase price is soon eaten up by the maintenance required by an inferior machine. One method by which to judge price is to figure the first cost of the machine on a per-pound basis, taking into account, of course, whether the weight of the machine is all in ruggedness of construction or whether there is a lot of superfluous weight which does not strengthen the machine.

The frame is an important consideration and also the axle suspension. The frame should be made of channel iron hot-riveted together and with strong cast braces. The axle suspension should allow for free spring action, but should also be designed so that it will maintain the alignment between the axle and the frame under all operating conditions.

Of all electrical parts, the motor is the most important, since the working capacity of a machine is practically determined by the combination of motor and battery. Of course, it is impossible to specify any particular motor. If a certain tractor is bought, that manufacturer's standard motor is furnished; but in purchasing it is well to make certain of one point, and that is that the motor has sufficient capacity to handle the work without overheating. The motor should have a rating which will enable it to operate continuously for at least thirty minutes at 300 per cent over the rated capacity. The motor should also be totally inclosed for protection from dust. It would be well to compare the brush and commutator sections of the various makes.

The controller should be inclosed, but the cover should be arranged so that it can be easily removed for frequent inspection. The contacts should be of large section and the fingers should have heavy tips in order to dissipate the heat generated by the large currents which are carried. The spring which holds the controller fingers against the drum should not be required to carry the current, as this might heat the spring, causing it to lose its temper. A flexible conductor should, therefore, be provided.

The automatic switch should operate in such a manner that whenever the operator leaves the tractor the power will be automatically cut off and may not be applied again until he has returned to his seat and returned the controller to the neutral position. In addition to the main contacts which should be of large cross-section, there should be auxiliary contacts which will do the actual making and breaking of the circuit. As these auxiliary contacts will wear rapidly, they should be designed so as to be easily replaceable.

The brake should be strong enough to bring the tractor and load promptly to a dead stop and should set automatically when the operator leaves the tractor. Two brakes are preferable, one for ordinary service and the other as an emergency brake.

In order that the tractor may start easily, the wheels should turn on individual yokes with the turning centers approximately directly over the center line of the tire. All steering connections and other movable parts not fitted with ball or roller bearings should be equipped with renewable bushings which can be replaced after the machine has been in service for a sufficient time to cause wear. This is an important point as it greatly lengthens the life of the machine and reduces maintenance expenses.

One of the most important factors to be considered when an installation of electric tractors or trucks is contemplated, and one which has been looked upon by many as a "box of mystery," is the storage battery. Many men who are not acquainted with electrical matters are afraid to adopt industrial trucks simply because of the battery. There is no substantial reason behind this feeling because there is nothing at all mysterious about a storage battery. Millions of them are in daily operation in starting, lighting and ignition service on automobiles, and every driver of an automobile knows how little trouble his battery actually gives him. In fact, there is hardly a car owner who finds it necessary to do more than add fresh water occasionally.

Two general types of batteries are used for industrial tractors—the nickel-iron and the lead. The nickel-iron battery is very commonly used because it will stand all sorts of abuse, has a long life and cannot be injured through faulty charging. This type of battery is furnished in several styles and sizes, the most common being the Edison type A-6, which has a capacity of 225 amp.-hr. For heavier duty, where more work is required of the tractor than can be taken care of by a single charge of the A-6 cell, the type A-8 with 300 amp.-hr. capacity is used. The internal resistance of the nickel-iron battery is very high, and this is particularly noticeable during heavy discharge, since the voltage falls off materially, causing the tractor to slow down. For this reason the Edison Storage Battery Company has developed the type G cells, which are recommended for installations where there are steep grades to climb. The G-9 cell has the same capacity as the A-6 and the G-11 slightly less capacity than the A-8.

LOADING A STEAMSHIP WITH MISCELLANEOUS FREIGHT; LOAD IS CARRIED TO DESTINATION ON THE TRAILERS

The smallest size of lead battery which is recommended for industrial tractor service is the fifteen-plate, which has approximately the same ampere-hour capacity as the A-6 Edison cell. For heavier work, requiring more capacity, the 17-plate, 19-plate and 21-plate cells are used. On account of the low internal resistance this battery will hold up the voltage and consequently the speed of the tractor even when operating at very high rates. For this reason it is a very good battery for installations where there are heavy grades to be negotiated. In such cases the 19-plate or 21-plate sizes are recommended.

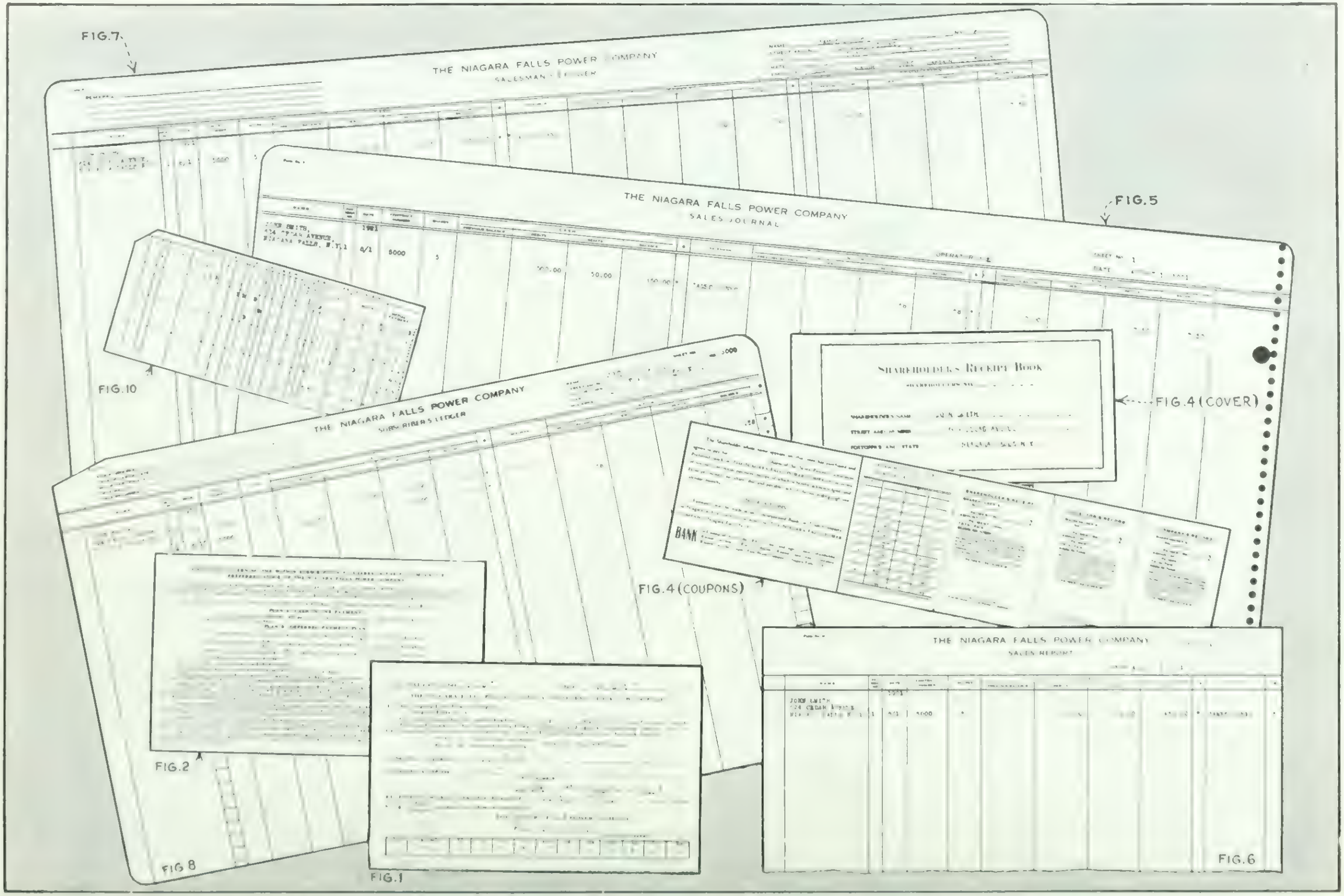


FIG.7
THE NIAGARA FALLS POWER COMPANY
SALESMAN'S LEDGER
FIG.5
THE NIAGARA FALLS POWER COMPANY
SALES JOURNAL
FIG.10
THE NIAGARA FALLS POWER COMPANY
SUBSCRIBER'S LEDGER
SHAREHOLDER'S RECEIPT BOOK
FIG.4 (COVER)
BANK
FIG.4 (COUPONS)
THE NIAGARA FALLS POWER COMPANY
SALES REPORT
FIG.2
FIG 8
FIG.1
FIG.6

The Face of the Records Required in Accounting for the Sale of Stock on Either the Cash or Deferred Payment Plan Under the System Developed and Now in Successful Operation by the Niagara Falls Power Company

Accounting for Customer-Ownership Sales

Detailed Plan of a System of Accounting for Sales of Shares of Stock on the Deferred-Payment Plan Suitable for the Public Utility Corporations Now Engaged In or Contemplating Such Campaigns

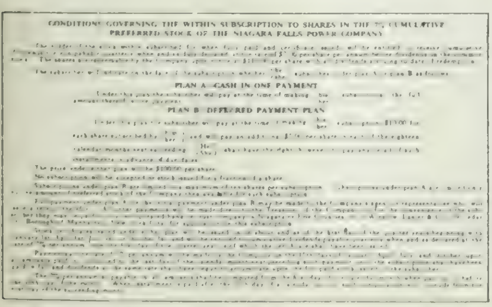
By W. PAXTON LITTLE, C. P. A.
Treasurer Niagara Falls Power Company

METHODS of accounting for sales of shares of stock by utility corporations direct to customers or to the public in the vicinity in which they operate are of absorbing interest to the accountants of such corporations now engaged in customer-ownership campaigns and of those contemplating similar sales. The comparative novelty of the problem and the consequent lack of practice by many corporations in such accounting, as well as the volume of work entailed if sales to "small-lot" customers reach large proportions, make a simple, effective and economical method of accounting most desirable.

The Niagara Falls Power Company, being a wholesaler of electrical energy, has not the large number of customers that would be attached to a retail business, and therefore in its recently inaugurated campaign for the direct sale of its preferred stock was obliged to make its offer to the general public in the territory served by it. This condition entailed features of accounting that perhaps would not be met with by corporations whose subscribers are composed largely of their customers.

Prior to the campaign for the sale of stock the system of accounting about to be described was devised, and since then it has been successfully operated. This system would seem to be adaptable to any project of selling securities on the deferred-payment plan. The prominent and attractive features of the method are:

1. The reciprocal convenience to the subscriber and the company in their dealings with each other and the consequent avoidance of misunderstanding by the subscriber.
2. The facilities afforded the company in its transactions with its agents and subscribers.



CONDITIONS GOVERNING THE WITHIN SUBSCRIPTION TO SHARES IN THE 7% CUMULATIVE PREFERRED STOCK OF THE NIAGARA FALLS POWER COMPANY

PLAN A—CASH IN ONE PAYMENT

PLAN B—DEFERRED PAYMENT PLAN

FIG. 2 — REVERSE OF STOCK SUBSCRIPTION CONTRACT, LISTING CONDITIONS OF BOTH CASH AND DEFERED-PAYMENT PLANS

3. The ability to obtain promptly information in any particular, due to the fact that no delay occurs between the receipt of subscription contracts, deferred payments, etc., and the entry of data relating thereto.

SPECIAL TRAY WHICH IS USED FOR FILING LEDGER SHEETS WITH EXTENSION TO PERMIT OFFSETTING SHEETS FOR REFERENCE

4. The daily balancing and proving of the accounts.
5. The daily report of sales in detail to executives.
6. The use of mechanical devices wherever economically possible.
7. Neatness and legibility of the records.
8. Economy and accuracy.

The accounting for sales of preferred stock on the "cash-payment plan" presents few, if any, difficulties, and the details of our method in connection with such accounting are therefore omitted. The "deferred-payment plan," on the contrary, involves a great deal of work on the part of the accounting department, and the remainder of this article consequently is devoted entirely to the accounting for such sales. It will be noted that the system deals with the method of accounting for sales under specific conditions embodied in the subscription contract.

The Contract.—Fig. 1 (face), Fig. 2 (reverse) is printed in triplicate and bound in book form. The original is for the files of the company, the duplicate is for the subscriber, and the triplicate is retained by the salesman for his record. In formulating this contract the endeavor was to state the terms and conditions as briefly and simply as possible, having in mind the accounting required in connection therewith.

The special features of the contract to which it is deemed necessary to call attention are:

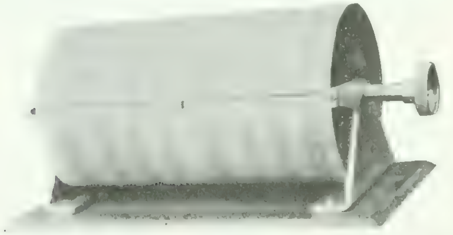
1. The arrangement by the company with incorporated banks and trust companies in the counties of Niagara and Erie to accept and receipt for deferred payments.

2. The provisions as to "payments at the rate of 7 per cent per annum" upon all amounts paid in and as to the computation of such 7 per cent payments.

The arrangement with the banks and trust companies was a most desirable one for the convenience of the company and its subscribers, since the company has not the contact with its subscribers afforded by the relations of an electric light or gas company with its customers. It makes it possible for any subscriber to pay installments at any bank.

The provision that "7 per cent per annum payments" will be allowed from the first day of a calendar month when installments are paid on or before the tenth day of that month, and from the first day of the succeeding month when paid after the tenth day of the month, was inserted to simplify computation of such "payments at the rate of 7 per cent," as well as to stimulate the interest of subscribers in making their deferred payments promptly. It will be observed that the provision made for the issue of stock certificates as of the first days of the quarter years and the provision made for the computation of the "payments at the rate of 7 per cent per annum" each quarter eliminate any complication between such payments and the payments of dividends on the stock. For legal reasons the word "interest" has not been used, and the phrase "payment at the rate of 7 per cent per annum" has been substituted.

Method of Accounting for Contracts and Initial Payments.—The subscription contracts (original), together with the initial payments, are delivered by the sales department to the cashier each morning. The cashier verifies the payments and enters in his cash book the aggregate amount received.


COMPUTING CYLINDER WHICH CARRIES THE COMPUTATION OF 7% PER ANNUM ON ANY INSTALLMENT PAYMENT UNTIL THE BEGINNING OF THE NEXT QUARTER

The contracts are then passed to the stock subscription clerk, who indicates upon them the amount which will have accrued at the end of the current quarter at the rate of 7 per cent per annum, computed from a chart (Fig. 3), and the amount of the commission to which each salesman is entitled. He then extracts from the contracts the data for a letter to be sent by the treasurer to each subscriber, welcoming him as a partner in the enterprise and inclosing the shareholder's receipt book (Fig. 4), which contains a formal acknowledgment of the subscription and initial payment.

The contracts are next transferred to the operator of an Elliott-Fisher bookkeeping machine. This machine is a flat-platen adding machine and typewriter combination, and the sheets upon which the accounting data are to be recorded are placed on the platen as follows:

Sales journal (Fig. 5).
Sales report, three copies (Fig. 6).
Salesman's ledger sheet (Fig. 7).
Subscriber's ledger sheet (Fig. 8).

By the use of carbons the entries appearing on these sheets are made simultaneously and cover the necessary entries required by the terms of the contract (Fig. 1 and Fig. 2). All of these entries are proved each day, and as soon as the work for the day is completed the sales reports (Fig. 6) are ready for the president, treasurer and manager of investment department. The prompt preparation of these daily records is of vital importance in the guidance of such a campaign.

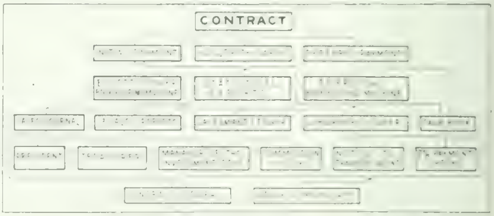


CHART SHOWING ROUTINE OF DEFERRED-PAYMENT SALES ACCOUNT SYSTEM

The filing of the sheets constituting the record is important and is done in the following manner:

Sales Journal (Fig. 5).—These sheets are filed in a loose-leaf binder and constitute the book of original entry from which monthly totals are posted direct to the general ledger.

Sales Reports (Fig. 6).—These sheets are filed in binders in the offices of the president, treasurer and manager of investment department.

Salesmen's Ledger Sheets (Fig. 7) and Subscribers' Ledger Sheets (Fig. 8).—These are filed in trays.

The work of the Elliott-Fisher operator in transcribing the necessary information from the subscription contracts is greatly facilitated by having the ledger sheets of the salesmen whose accounts are affected by previous days' sales offset two or three inches, thus enabling the operator to find quickly an individual salesman's account without reference to the indexes. A portable tray is recommended, and the use of trays so constructed as to permit the ledger sheets being offset is very important.

A number is given to the subscriber upon receipt of his contract by the treasurer, and that number follows him thereafter, appearing on the subscriber's account and record while his name is on the company's books either as a subscriber or a shareholder.

When the operator of the Elliott-Fisher bookkeeping machine completes the transcribing of data above referred to, the contracts are forwarded to the statistical department, where such statistical information as is required is recorded on tabulating machine cards (Fig. 10).

This information is indicated in code on the face of the contract (Fig. 1) and may be gathered by the salesman at the time of taking the subscription. The code is as follows:

Sal.—Salesman
Sh. No.—Shareholder's number
To.—Town
Ci.—City
Co.—County
St.—State
Emp.—Employee
Se.—Sex
Na.—Nationality
Oc.—Occupation
So.—Source of inquiry
Pl.—Plan
Sh.—Shares

By the use of Hollerith machines, which are used by us primarily for labor and material distribution, such statistics as are punched on the cards can be quickly tabulated.

Method of Accounting for Deferred Payments.—The shareholders' receipt book (Fig. 4) contains, besides the acknowledgment of the initial payment, eighteen sheets perforated to form three coupons to a sheet. The subscriber is required to present this receipt book when making a deferred payment. One coupon is bound in the cover of the book and constitutes the subscriber's receipt. The second is retained for its record by the bank or agency making the collection. The third is for the company's records and accompanies the bank's or agency's advice of collection.

The work of the bank or agency in this connection consists in receipting the subscriber's book, crediting the company's account with the aggregate amount of receipts from subscribers, and daily forwarding to the company an advice of credit accompanied by the coupons representing the collections.

The stock subscription clerk indicates upon the face of the coupons the amount of the "payment at the rate of 7 per cent per annum" which will have accrued at the end of the current quarter in respect to this particular installment in the same manner as he did in respect to the initial payment. The operator of a Burroughs bookkeeping machine identifies the subscriber's account by the number of the coupons and credits him with the amount of the installment payment and the amount of the "payment at the rate of 7 per cent per annum." A facsimile of this entry in the subscriber's account is shown in Fig. 8. The use of the Burroughs bookkeeping machine virtually eliminates errors in posting and facilitates quick proving of the work when the day's postings are completed.

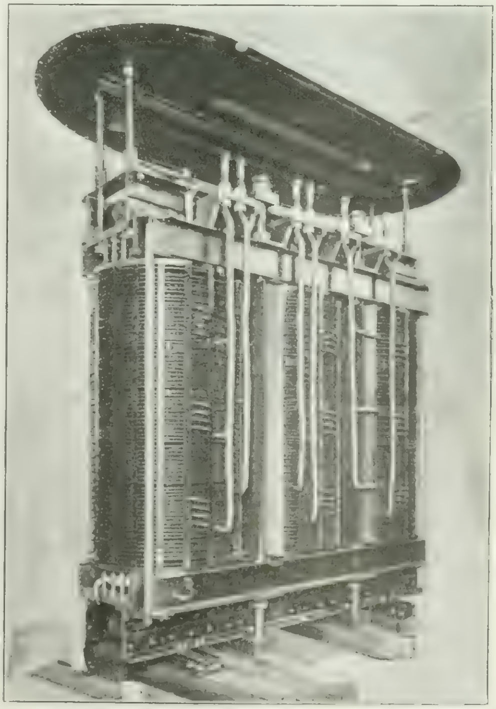
"Payments at the Rate of 7 per Cent per Annum."—Checks for quarterly "payments at the rate of 7 per cent per annum" are printed five to a strip, and the name and address of the payee are inserted with an addressograph. The amount of payment, both in script and figures, is then transcribed on each check in one operation by the use of a Defiance check writer, which is simple in operation and eliminates to a great degree the liability of error. The checks are signed with a "signagraph," separated, and placed in "window" envelopes ready for mailing. The Burroughs bookkeeping machine is used in debiting the subscribers' accounts with these payments, as well as for debiting salesmen's accounts with payments covering their commissions.

Issue of Stock Certificates.—Upon the completion of his payments by the subscriber and the surrendering of his receipt book, the company notifies its transfer agents and requests them to issue to him the certificate of stock to which he is then entitled. The transfer agents forward the certificate to the subscriber by registered mail, at the same time notifying the company; whereupon the subscription account is closed and the subscriber appears as a shareholder of record.

The chart presents a clear picture of the balanced plan of this accounting system for customer-ownership stock sales on deferred payments. It is the result of a very careful and deliberate study and has proved itself exceedingly accurate and economical. Not one error has occurred so far in the course of our campaign involving the customer in any way. This degree of practical perfection is due not alone to the correct planning of the system in its theory, but to the selection of mechanical devices that are exactly suited to the work. The bookkeeping machine, check writer, signagraph, filing trays, coupon books and record sheets all contribute to the orderly operation of the system and produce prompt reports that are "news and not history." The proper training of operators for the bookkeeping machines is, of course, most important, but no difficulty is found if the operator has bookkeeping sense. It is far easier to teach a bookkeeper to use the machine than to attempt to teach a machine operator bookkeeping.

Our experience has been most fortunate, and the facility with which this system has operated has won it the enthusiastic support of the entire organization, the selling men as well as the accounting staff.

Auto-Transformers Have Copper Capacity of 50,000 Kva.



TWO of these auto-transformers are installed at the Conners Creek station, Detroit Edison Company. They are three-phase, water-cooled, oil-insulated units with voltage ratio of 12,000/24,000 and reactance of about 8 per cent. Operated as ordinary transformers, with primary and secondary insulated, the rating is 25,000 kva.

Letters from Our Readers

This is a readers' forum. Comments on questions before the electrical industry presenting economic, financial, engineering or commercial aspects and new or supplementary viewpoints on published articles are cordially invited

Emphasize the Desire to Serve

To the Editors of the ELECTRICAL WORLD:

Before any appreciable amount of good will can be realized by utilities there must be a perfect understanding between the consumer and the company. Even the smaller patron must be assured of a desire to serve him and of an interest in him that extends further than his meter. Furthermore, these expressed desires must be put into practice continually by all company representatives coming into contact with the customers.

There must be no "passing the buck" to other departments, no shifting of responsibility. Such practice far from satisfies the consumer and may even exasperate him. This fact must be observed in all cases whether the consumer has cause for complaint or not. In some cases it may even be necessary to go more than half way in effecting an adjustment of a complaint.

Help the consumer understand his meter—tell him some causes of difference in monthly readings. If he has not received meter-reading instructions, see that he gets them before he leaves the office. Explain to him several readings in such a manner as not to bewilder him with technical terms.

In the case of complaints learn as definitely as possible the exact facts in the case. Give as much information as possible and in case of a serious complaint convince the customer that it will not be neglected. Serious complaint should be promptly referred to the head of the proper department for immediate adjustment, and special attention should be given to the prevention of its repetition.

As an example of the attitude that might be assumed on receiving a complaint the following case is cited: John Blank entered the office one Monday morning following a storm the evening previous. He violently complained that too much power had been turned on in his house—that a fixture was melted, parts falling on a library table, scarring it, and some hot parts burning holes in a fine rug. At first the occurrence was thought to be the result of lightning. However, the report of the service department indicated that the wind had broken a large limb from a tree and that this limb had fallen on the lines, bringing them into contact with a series street-lighting circuit. Upon comparison with the station records, it was observed that trouble appeared on this circuit at the time stated by the consumer and that instruments indicated a ground at the same time. The cause of the trouble was clearly explained to the customer, his fixture repaired and the tree trimmed. Whereupon he was satisfied, despite the fact that he first demanded a new rug and table and even threatened a lawsuit.

A company cannot hope to gain the friendship and respect of its consumers unless it can convince them that it is the company's desire to give a square deal. Personal contact of management and customer is of vital importance in adjusting complaints, although all complaints do not demand it. Those that do can be easily ascertained. Letters "referring to previous correspondence" are really worse than no attention. They serve to induce a belief that the complaint is being evaded or side-tracked. Instead of such a reply there should be endeavor to explain the situation clearly so that there will be no ground for future misunderstanding.

When the consumer gains an understanding of the importance of the utilities and realizes that they do not have boundless capital, that they have bills to pay and are limited as to profits, public utilities will receive consideration without so much complaint and grumbling.

There should be an understanding that the welfare of the utility reflects the welfare of its own immediate community, the customer's own welfare, and that they are in the business of serving the public—public servants, if you like. From these facts there can be no escape. In order to prosper, utilities must so operate as to improve these mutual relations and thus inspire the confidence and respect of their customers.

O. R. TOMAN,
Manager.

Bedford Light, Heat & Power Company,
Bedford, Iowa.

Electric Smelting of Iron Ore

To the Editors of the ELECTRICAL WORLD:

A statement was made at a recent meeting of the officers of the American Mining Congress in Washington by Charles W. Potts, mine operator, of Bearwood, Minn., that "present known reserves of high-grade iron ore, based upon constantly expanding requirements of the steel industry, will be exhausted in twenty years, and the merchantable grades of iron from the great mines of Minnesota will be, at the present rate of depletion, practically exhausted within the next fifteen years unless new discoveries are made." If, as Mr. Potts states, our available high-grade iron ore will be depleted in twenty years, is there not also a grave danger that our position today in the world's markets will pass, unless the vast deposits of iron sands and low-grade ores in this country are properly exploited? Other countries—China, Japan, Brazil, India—with cheap labor, have immense deposits of iron ore. They have water power available and already are installing large smelting furnaces operated electrically for reducing the iron ores.

The electric smelting furnace—using cheap water-generated power—will very probably in the next few years open up a vast supply of iron ore at present considered almost worthless. Immense deposits of iron sands and low-grade ores occur in the Adirondacks, on the Pacific Coast and in many other parts of the country. These ores are at present useless, as they cannot be economically treated in the ordinary standard blast furnace. Most of these deposits are in places where power is or could be generated very cheaply; the ore can be concentrated and smelted into iron by specially designed electric furnaces.

There are several known and proved processes for electric iron smelting, chief of which is the Swedish "Electrometall" process. Already twenty-seven large installations, with a total capacity of 100,000 kw., are running or under construction in various parts of the world. This type of electric smelter uses the gases generated in the melting zone to preheat and partially reduce the charge. It does not attempt to make steel direct, but in several cases the product is being tapped out into metal mixers or open-hearth furnaces and from there into finishing electric furnaces. Dr. Stansfield in his report on the commercial feasibility of electric smelting of iron ores in British Columbia writes:

"In Sweden the 'Electrometall' type of electric smelting furnace has proved very satisfastory for the production of low silicon pig iron. This is, as far as I am aware, the only type of electric furnace that has attained commercial success in the production of pig iron from ores. If a permanent smelting plant were being erected, the Swedish type of furnace would be selected."

Considerable publicity has been given recently to what was termed a recent Japanese discovery that iron sand and low-grade ores could be smelted and made into steel. There is absolutely nothing new in this so-called Japanese invention, since as long ago as 1907 John T. Jones of Iron Mountain, Mich., devised a similar process for treating low-grade ores. H. A. Greaves and H. Etchells, English scientists and inventors of the successful "Greaves-Etchells" electric steel furnace, also brought out a process a few years ago in which black iron sand was passed down a rotating tube or kiln and from there to a finishing electric furnace. The ore in this tube is preheated and partially reduced by the gases given off in the electric furnace. Finished steel from sand has repeatedly been made by their process. A French inventor, M. Basset, uses a similar method, but in his case external or additional heat is applied to the ore proceeding through the preliminary tube.

As long as good high-grade ore is available and coke reasonable in price, these electric processes of ore reduction cannot hope to compete with the standard blast furnace in anything but charcoal iron—or iron of special analysis. With the falling off in available supplies of high-grade ore and the generation of cheap electric power from water power, the electric smelters will come into their own. They can undoubtedly make iron superior in quality to that made in the standard blast furnaces. Very thorough tests made in Sweden and England with this electrically made pig iron also proved that by its use in the open-hearth furnaces considerable time could be saved in the steel-making operations. Actual figures have not been published, but in a number of cases that came directly under the writer's notice the saving in time per heat of steel was between one and one-half and three and one-half hours.

Although the initial cost of electric pig iron may still be somewhat higher than ordinary blast-furnace pig iron, yet considerations such as that mentioned above and the extreme purity of the electric iron do not make the difference in first cost as large as would at first appear. The electric smelter can also economically handle a very large proportion of turnings, borings and cheap scrap in its charge—material that is not suitable except in small proportions in the standard blast furnace.

In districts like the Pacific Coast, where good ore is available near cheap, water-generated electric power and where at present most of the coke, pig iron or steel has to carry heavy freights from the East, there is a splendid opening for some one with far-sighted enterprise to put down electric smelters and steel plants.

Probably the future method of making even cheap steels will be to take hot-blast furnace metal, from either electric or standard blast furnaces, directly into a large metal mixer, where additions of ore, cheap borings and turnings could be made, and from there to a Bessemer converter, where the metal would receive a partial blow only, and the deoxdizing and finishing off would be done very quickly in a series of electric furnaces. In the process outlined there would be virtually no loss of heat in the whole operation. The addition of ore and cheap scrap in the form of borings, etc., in the mixer would cause a thermic reaction and generation of heat, the Bessemer operation would add more heat, and all that the electric furnace would have to do would be to deoxidize, adjust temperature and, where necessary, refine or make additions of alloys. The writer is confident this process would make the cheapest steel in the world. FRANK HODSON,

Electric Furnace Construction Company, President.

Philadelphia, Pa.

Economy of Ball Bearings in Relation to Power Factor

To the Editors of the ELECTRICAL WORLD:

One of the principal reasons for the increasing use of ball bearings in induction motors is the various ways in which these bearings produce economy in service. It is generally understood that because starting friction in the case of ball bearings is low the initial current consumed will be lower with ball bearings than with plain bearings. In many cases, too, decided economy has been obtained in lubrication, both in the frequency of applications and the amount used. In a few instances ball bearings are used because they allow a shorter motor to be built than would be possible with plain bearings, and a saving of space and material is thus effected.

Another important saving, however, which ball bearings allow is the reduced current permitted in induction motors. This is due to the fact that a shorter air gap can be used with ball bearings than is permissible with plain bearings. It has been definitely proved that the air gap on ball-bearing induction motors may safely be decreased to a very few thousandths of an inch. With plain bearings this would almost inevitably entail burned insulations, overheated motors and ruined windings if the bearings became worn in the least degree.

It is quite possible to compute the saving which this reduction makes possible in the case of any particular motor. Take, for example, a 10-hp. motor of conventional design manufactured by one leading American company. The primary current drawn at half load with an air gap of 0.022 in. is 15.1 amp. and the power factor 75 per cent. Ball bearings allow this gap to be cut in half. By means of a circle diagram plotted on cross-section paper the current, after the gap is reduced, is found to be only 12.5 amp., while the power factor has increased to 90 per cent. No-load current decreases from 9.5 amp. to 5 amp.

Moreover, the wattless current absorbed by the motor decreases by about 12 per cent at full load and 50 per cent at no load, which would mean a further saving in power-house equipment. The great improvement of power factor at half load is particularly valuable since industrial motors generally operate at far less than their rated capacity.

In view of this decided economy in current consumption, decreased friction and low cost of lubrication, ball bearings in induction motors deserve more thought.

New York City. C. I. HEIKES.

Industrial and Station Practice

Installation, Operation and Maintenance of
Generating and Distribution Equipment and Economical Utilization of Electrical Energy
in Mills and Factories, Including Testing and Repair Methods

Long-Distance Water-Level Recorder

A WATER-LEVEL recorder that produces an accurate record at a distance of 9,000 ft. from the steam gage is in use at the United States Geological Survey station on the Kaw River at Topeka, Kan. The station was equipped with experimental instruments in the fall of 1918 and from that installation the present one has been developed. The wiring of the instruments has been so arranged that only two wires between the gage and the registering instrument are needed and these wires serve also as a telephone circuit. Fig. 1 shows the complete wiring diagram. The instrument at the river, called the sender, has two swinging mercury-contact devices, one of which is actuated through a flat perforated steel tape connected to the float in the gage well every time the float rises one-twentieth of a foot. The other contact is closed every time the float falls the same distance. The armatures of two magnets on the register (Fig. 2) are operated by impulses sent through the circuit by the operation of the two contact-making devices. One magnet operates in each direction. The armatures are connected through a ratchet and wheel to the chart cylinder, which is turned about its axis by the movements of the armatures to represent the rise or fall of the water level. The ratchet wheel turns only one notch at a time. The recording pencil is carried in a rigid holder that is driven by an eight-day clock along the length of the chart cylinder.

Operating current for the sender is taken from a 110-volt line through a lamp resistance. The telephone instruments are local-battery, bridging-wall sets. Between the receiving instrument and the receiving telephone 500-ohm impedance coils are inserted in the circuit. These prevent disturbance of the sensitive magnets on the receiving instrument by the bell ringer. Condensers in series with the telephone bells prevent current from the sending instrument crossing through the telephone and operating wrong receiving magnet.

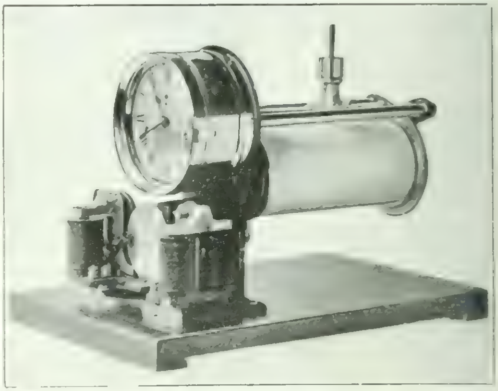


FIG. 2—REGISTERING INSTRUMENT AT WEATHER BUREAU OFFICE

The gage has been in constant service since the spring of 1919 with no operating troubles. Roger C. Rice, district engineer of the United States Geological Survey, now at Phoenix, Ariz., has been responsible for the development of the Topeka installation, while S. D. Flora, meteorologist of the Weather Bureau station at Topeka, has co-operated in the work.

Chicago, Ill. FIELD EDITOR ELECTRICAL WORLD.

Exciter Characteristics Cause Paralleling and Regulator Trouble

SOME time ago the Springfield Light, Heat & Power Company experienced considerable difficulty in paralleling two of its exciters and in obtaining proper operation of the Tirrill regulator used therewith. Both of the exciters are motor-driven, one being rated at 100 kw. and the other at 75 kw. Nearly every attempt

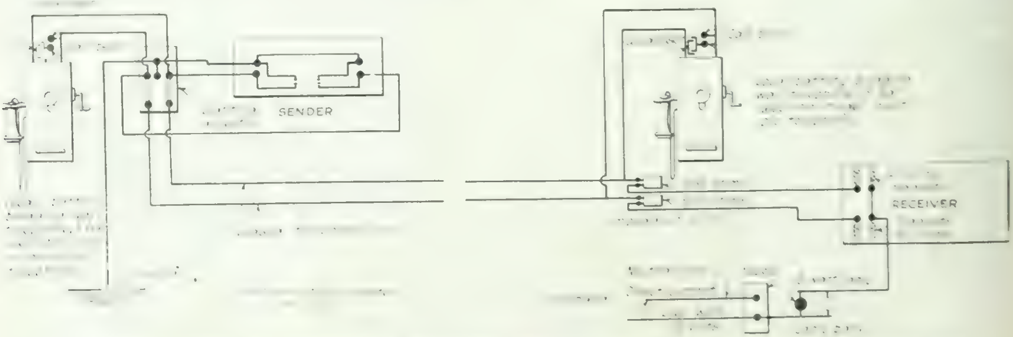
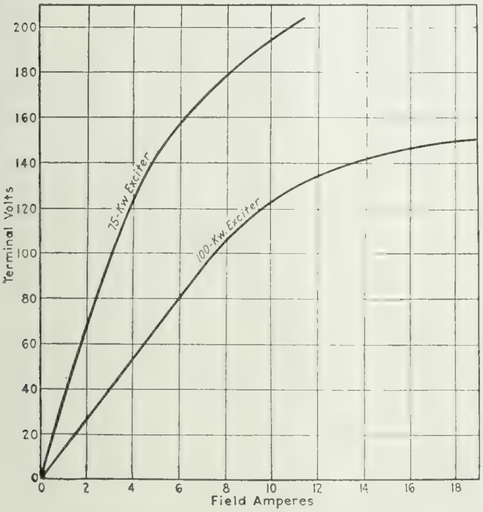


FIG. 1—WIRING DIAGRAM OF LONG-DISTANCE WATER-LEVEL RECORDER WHICH USES SAME WIRES AS TELEPHONE LINE

to parallel the two exciters resulted in a plant shutdown because of the failure of the excitation. It was also found that under certain conditions of operation the Tirrill regulator was unable to maintain the bus voltage at normal value when operating in conjunction with the 100-kw. exciter. At about 75 per cent load on either or both of the two small alternators which were used the bus voltage would sag under ordinary power-factor conditions. As a result the larger exciter was used as little as possible, even though its use might have been desirable at times on account of its greater rating. Emergency excitation is provided by a 35-kw. steam-driven outfit.



NO-LOAD EXCITATION CURVES OF TWO EXCITERS

To determine the reason of the failure of the exciters to parallel, no-load saturation curves of exciters were obtained from the respective manufacturers. These are shown in the accompanying illustration, where the curves are superposed for convenient comparison. The reason for the inability to parallel is very evident.

To determine the reason for the failure of the Tirrill regulator to maintain normal bus voltage when operating with the 100-kw. exciter, tests were made under load conditions, using various combinations of load, power factor and machines in service. One 2,000-kw. machine was made to take a load of 1,500 kw. at 60 per cent power factor. Under these conditions the exciter voltage rose to a limit of 141, the regulator sticking and causing the bus voltage to sag. The other 2,000-kw. machine was then put on the bus and made to circulate current, but not permitted to take load. The exciter voltage immediately dropped to normal and the bus voltage rose to normal. The explanation is that the unloaded machine supplied a magnetizing cross-current, lagging with respect to itself but leading with respect to the loaded machine. This current served to help the exciter and relieve it of part of the work. Next the load was divided between the two alternators, making the load on each so small that its inherent regulation did not reduce the voltage to the point where the regulator was unable to cope with the situation. Had the load on each machine been of the same value as on the one in the first test, the trouble would still have made itself evident, as was demonstrated by a later test made under this very condition. The machines were able to carry higher loads without difficulty as the power factor rose.

The explanation of the regulator trouble lay in the demagnetizing action of the load current, which was accentuated at low power factors and which demanded an exciter voltage beyond the range of the 100-kw. exciter. No trouble was experienced with the 75-kw. exciter under any conditions of loading.

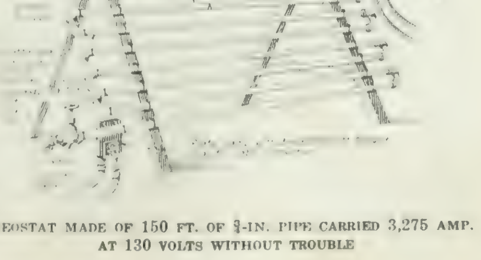
The trouble was remedied by first changing the shunt on the series field of the 100-kw. exciter and finally completely removing it from the circuit. Either of the 2,000-kw. machines was then made to carry a load of 2,500 kw. at 75 per cent power factor. Under this condition the regulator was very sluggish, but since it is not the usual practice to operate the alternators above full-load rating, the operation under normal conditions was satisfactory. It was also found that the cable from the 100-kw. exciter to the switchboard was of insufficient capacity, giving about 9 volts drop at full-load rating of the machine. Changes in accordance with the indications of the test made have resulted in fairly satisfactory operation, even under adverse conditions of operation.

L. E. BROWN,
Production Manager.
Springfield Light, Heat & Power Company,
Springfield, Ohio.

Water-Cooled Pipe Makes Good Rheostat for Heavy Load

IN THE ELECTRICAL WORLD for April 9, page 827, there was described a water-barrel rheostat for testing exciters. At this plant it is the practice to make use of water pipe for such tests. A load test was made recently on a 400-kw. 125-volt exciter. The rheostat was made up of $\frac{3}{4}$-in. pipe arranged on a wooden rack and connected up zigzag fashion with elbows and nipples as shown in the accompanying sketch.

This rheostat was made of nine standard lengths of pipe from 16 to 17 ft. in length, so that the total length with end connections was approximately 150 ft. No attempt was made to cut the pipe to a uniform length, but it was connected up as it came. Connection was made to the rheostat by plate clamps grooved to fit the pipe. Cooling water was circulated through the pipe by means of rubber-hose connections. The water supply was at a pressure of 55 lb. It was possible to adjust the temperature of the pipe by regulating the amount of water passing through by means of the valve shown. In this way a certain amount of varia-



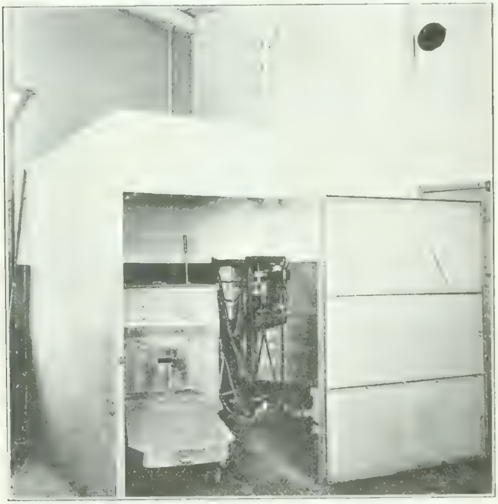
RHEOSTAT MADE OF 150 FT. OF $\frac{3}{4}$-IN. PIPE CARRIED 3,275 AMP. AT 130 VOLTS WITHOUT TROUBLE tion of resistance could be obtained. At the full load of 3,275 amp. the temperature of the outgoing water, with the valve wide open, reached a temperature of 90 deg. C.

This rheostat handled an output of 3,275 amp. at 130 volts for four hours without signs of distress. After the test was over the material was returned to stock.

C. R. Reid,
Powerhouse Superintendent.
Shawinigan Water & Power Company,
Shawinigan Falls, Quebec.

Charging Station Installed on Inter-Factory Bridge

To do away with transporting an industrial electric truck upon a local elevator for battery charging, the Graton & Knight Manufacturing Company, Worcester, Mass., installed a charging station in one corner of an inclosed bridge connecting two of its buildings and in close proximity with floors requiring the service of the truck at frequent intervals. A portion of the inclosed passage is also used as a locker room. To set apart the charging equipment the metal housing shown herewith is provided, the top being screened. Service to the charging panel is provided for this 2-ton Elwell-Parker truck by two No. 40 rubber-covered cables run through rigid conduit attached to wooden bases by metal straps as indicated. At the top of the run the conduit terminates in a split junction box with halves fastened together by bolts and nuts, this enabling the box to be easily opened and the cables carried around the short 90-deg. turn without other conduit fittings. Regular scrutiny of the truck and charging panel is given at night by the watchman, and the inclosure of the apparatus protects it from outside contact and prevents tampering with it by persons without authority.


THIS BOOTH FOR CHARGING IS PLACED ON BRIDGE BETWEEN TWO BUILDINGS ON LEVEL ON WHICH TRUCK WORKS

A. H. Magnuson,
Electrical Engineer.
Graton & Knight Mfg. Co.
Worcester, Mass.

Mercury-Vapor Lamps in Satisfactory Installation at Hosiery Mills

A saving of 370 watts of lighting energy per machine lighted was effected by a recent installation of Cooper Hewitt lamps at the Susquehanna Hosiery Mills, Philadelphia. This was not the only advantage gained, however, as the Cooper Hewitts did away with the necessity of individual lamps for the separate machines and supplied and evenly diffused light similar to that obtained under skylight conditions. In fact, the foreman of the mill is quoted as having said that one day when a thunderstorm occurred and the room was without natural light the Cooper Hewitts were turned on and the room was actually better lighted than from the skylights.

The machines in question are for embroidering hosiery and range from 15 ft. to 25 ft. in length. They are placed in rows, with an aisle between. They may be described as being in a sense double-decked, the upper part of the machine embroidering one lot and the lower part another lot, a fact which makes lighting them with artificial light rather difficult. The Cooper Hewitts are so placed that at least half the tube illuminates the lower deck, furnishing sufficient light for the operator to see the stitches and to observe whether the needle is sewing properly.

Light was formerly supplied by incandescent lamps arranged on a basis of 800 watts to a machine. The Cooper Hewitts were installed on a basis of 430 watts to a machine, there being sixteen 50-watt incandescents to one Cooper Hewitt. The mill foreman states that the light is very easy on the eyes of the operatives and that it reaches to the lower deck of the machines, which the light from the skylight did not do.

Cooper Hewitt Electric Co., W. J. Winninghoff,
Hoboken, N. J. Engineer

Energy Consumed by Electrochemical and Metal-Refining Processes

In the accompanying tables are given the energy consumption required for the electrochemical production of various materials and that for melting and refining metals. The low cost of this energy together with the superiority of the product produced electrically has resulted in an ever-widening application of electricity. Among the electrochemical products perhaps the most important are nitrates and nitrites, caustic soda, aluminum, zinc, ferro-alloys, calcium carbide, oxygen, hydrogen and chlorine.

Smelting, melting and refining applications are

POWER REQUIRED FOR ELECTROCHEMICAL PRODUCTS

Material	Kw.-Hr. per Ton	Material	Kw.-Hr. per Ton
Aluminum	30,000	Ferro-silicon (50 per cent).	5,000
Alundum	2,000	Ferro-cilicon (75 per cent).	10,000
Barium oxide	1,200	Ferro-tungsten (70 per cent)	7,600
Cadmium	2,500	Ferro-uranium (40 per cent).	8,000
Calcium carbide	4,000	Ferro-vanadium (35 per cent)	6,800
Calcium cyanamid	3,750	Graphite	7,800
Carbon bisulphide	850	Iron, electrothermic	2,500
Carborundum	8,500	Iron, electrolytic	4,000
Caustic soda, 2,000 lb......	3,000	Lead	145
Chlorine, 1,760 lb		Magnesium	27,000
Copper, electrolytic refining	300	Nitric acid	17,500
Copper, electrolytic reduction	2,600	Phosphorus	12,000
Ferro-chromium (60 per cent).	8,000	Potassium chlorate	1,350
Ferro-manganese (76 per cent)	5,000	Sodium	20,000
		Sodium chlorate	7,000
Ferro-molybdenum (60 per cent).....................	8,400	Tin, electrolytic refining	175
		Zinc, electrolytic....	4,000

POWER REQUIREMENTS FOR MELTING AND REFINING METALS

Material	Kw.-Hr. per Ton	Material	Kw.-Hr. per Ton
Aluminum	500	Cast iron	450
Brass	300	Cast steel	600
Bronze	330	High-speed steel	750

steadily growing in importance. This is recognized when it is remembered that the first electric furnace for refining steel was installed in 1904, at which time it was regarded as a laboratory device. Today furnaces are made rated at 40 tons and capable of pouring 65 tons. Twice this capacity is already talked of for the near future.

JOHN A. SEEDE,
Power and Mining Engineering Department.
General Electric Company,
Schenectady, N. Y.

Correct Temperatures Must Be Held in Babbitting Motor Bearings

TO PRODUCE reliable and dependable babbitted bearings the workmen must be trained, the babbitt metal carefully selected, temperatures kept within fixed limits, and the tinning process and handling of the shells, mandrels and metals during the heating and pouring processes must have careful study. In general the various babbitts most commonly used to line motor bearings divide themselves into two distinct classes of alloy, known as a tin-base and a lead-base babbitt alloy. They usually contain from 80 per cent to 90 per cent of tin or lead respectively as their principal elements. Both classes of metal appear to give good results in service when they are properly made and subsequently properly handled during the melting and pouring processes.

Tin-base alloys for babbitting have been hitherto more generally used as experience shows this type of alloy to be less affected by a wide range of temperature during the heating and pouring process. Thus, with less care and attention paid to the details in babbitting, very satisfactory results can be obtained. Bearings which will give very good results in service can be produced with certain grades of a lead-base alloy when heated and poured within definite fixed-temperature limits and when all other conditions, such as tinning, heating of mandrels and shells, etc., are kept right. In fact it has been noted that under certain test conditions certain lead-base alloys make a better showing than the tin-base metals as to their ability to stand up under successive hammer blows. Moreover, tests show that some lead-base alloys have better anti-friction properties than the tin-base alloys.

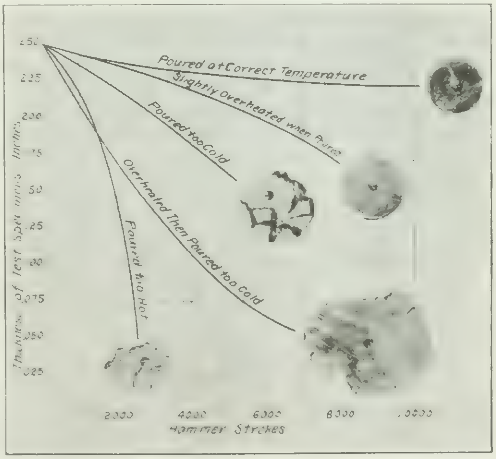
In babbitting bearings all operators seem to follow the same general practice, but there is a universal tendency to neglect details in connection with such points as (1) properly cleaning and tinning bronze shells, (2) preheating of mandrels and shells before babbitting, (3) correct temperature of the alloy, (4) handling and pouring of alloy in bearing shells, and (5) reliability of the source of supply of babbit metal.

There are very few shops that have babbitting pots equipped with temperature-indicating devices, and this important detail is left entirely to the judgment of the workman, who determines the proper temperature limits of heating and pouring by some of the following means, based more or less on intuition: (1) Use of a pine stick (the most common practice), (2) use of a piece of paper, (3) color of the metal, (4) condition of the surface of the heated metal, and (5) appearance and by stirring with a ladle.

As this subject is of vital importance, it seems advisable to outline in detail the method used by a large manufacturing company which has been worked out and developed after many years of experience and careful study. It has been found that this method is applicable to one of each of the more common and well-known tin-base and lead-base alloys and if carefully followed will give very satisfactory results.

The tinning alloy, half-and-half solder, is melted in an iron or steel pot, in which the temperature of the metal should be maintained between 410 deg. and 440 deg. C. (770 deg. and 824 deg. Fahr.). The tinning alloy should not be heated above 450 deg. C. (842 deg. Fahr.). If the pot is used only occasionally, cover the melted alloy with sawdust or charcoal to prevent the formation of dross. The metal should be stirred frequently when being used and always before using after standing for any length of time in a molten condition.

This tinning operation consists of coating the surface to be babbitted with a thin film of half-and-half solder. The machined parts that are not to be tinned should be coated with a thin mixture of red clay and water. When dry, swab the parts to be tinned with zinc chloride. (saturated solution of zinc in hydrochloric acid), then dip into the tinning solution. Leave the shell in the pot until it is just hot enough for the tinning alloy to run off. Remove the shell from the pot and thoroughly rub the surface to be tinned with zinc chloride, making sure that all parts have a thin coating of the alloy, and that no untinned spots are left on the surface to be babbitted. Immerse the shell again in the tinning alloy to remove the acid left from the swab and do not swab or otherwise touch the tinned surface again, but babbitt immediately.



LEAD-BASE BEARING METAL POURED UNDER VARIOUS CONDITIONS AND SUBJECTED TO HAMMER TESTS

In tinning bronze shells that are not to be babbitted treat them as outlined above except after their second immersion in tinning alloy the tinned surface should be cleaned with waste to remove any oxide or other foreign matter and the graphite brushed from the untinned parts.

It is not common practice to tin iron shells, although it can be done. Instead anchor holes are depended upon to hold the babbitt securely to the shell. All anchor holes should be cleaned well so that the babbitt will be held firmly in place. Standard anchor holes should be generous in number and should be near the ends and at the edge of the bearing windows of all shells in order to hold the babbitt securely at the edges.

Mandrels should be heated to prevent chilling of the babbitt when poured, and should be coated with a thin wash of red clay mixed in water to prevent the babbitt from sticking to the mandrel and to prevent blowholes in the babbitted lining. This coating can be applied with a brush or a swab and should be done before babbitting each shell. Best results have been obtained by preheating mandrels as follows: For tinned solid-bronze shells, 100 deg. to 125 deg. C. (212 deg. Fahr. to 257 deg. Fahr.); for tinned split-bronze shells, 125 deg. to 150 deg. C. (257 deg. Fahr. to 302 deg. Fahr.); for split or solid-iron shells, 240 deg. to 270 deg. C. (464 deg. Fahr. to 518 deg. Fahr.).

CORRECT TEMPERATURES FOR POURING BABBITT AND FOR SHELLS, MANDRELS, ETC.

	Correct Temperature, Deg. C.	Do Not Exceed, Deg. C.
Tinning alloy	410–440	450
Mandrels:		
For tinned solid-bronze shells	100–125	
For tinned split-bronze shells	125–150	
For split or solid-iron shells	240–270	
Shells:		
Iron	200–250	
Bronze	See note*	
Babbitt	460–482	490

* Temperature of tinning alloy.

Preheat all iron shells to a temperature of 200 deg. to 250 deg. C. (392 deg. to 482 deg. Fahr.) before babbitting so that the babbitt metal will flow close to the shell and also permit the shell and babbitt to shrink together and avoid loose babbitt. All tinned bronze shells must be poured immediately after the tinning operation and no additional preheating is necessary.

The babbitt metal, either a tin-base or lead-base alloy, must not be allowed to become hotter than 490 deg. C. (914 deg. Fahr.) at any time, and it should not have any other alloy mixed with it. Use a pyrometer for determining the temperature, and wherever possible use a regulator for controlling the temperature of the metal in the babbitting pot. Melt the alloy in an iron or steel pot and maintain the temperature when in use between 460 deg. and 482 deg. C. (860 deg. Fahr. to 900 deg. Fahr.). Mix the metal thoroughly from the bottom of the pot as soon as melted, again at frequent intervals when being used, and always just before using after the metal has been standing in a molten condition for any length of time. If the pot is used only occasionally cover the babbitt with sawdust or charcoal to prevent the formation of dross.

Ordinarily pour all bearings in a vertical position unless the irregular shape of the bearing makes this position inadvisable, in which case incline the bearing at the most suitable angle and pour at the most convenient point. In pouring a split bearing at an angle the parting face should be on the under side resting on the jig. The metal should be poured from a self-skimming ladle in a steady stream directly along the mandrel to avoid the pocketing of air.

Small blowholes, if few in number, should be filled in with the babbitting metal by the use of a hot soldering iron. If blowholes are large in size or number or if seams have formed the lining should be melted out and the bearing rebabbitted. Remove the excess babbitt which may have stuck around the windows with a hot soldering iron.

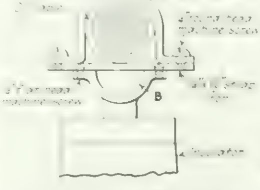
Too much stress cannot be laid upon the importance of maintaining certain definite temperature limits to which the bearing metal should be heated. Experience has shown that a perfectly good metal can be made almost worthless for bearings by allowing it to become hot, also by pouring when too hot or too cold. This is more applicable to a lead-base than to a tin-base alloy. As an example of just what will happen to metal poured under varying temperature conditions, a series of tests were made on a lead-base alloy by subjecting test pieces of the metal 1 in. (2.5 cm.) in diameter and ¼ in. (6.2 mm.) thick poured under different temperature conditions to a series of hammer blows. The results of these tests, which are shown in the curves, plainly tell their own story.

In order to maintain temperatures at the proper values a thermocouple connected to an indicating millivoltmeter which is calibrated in degrees centigrade or fahrenheit is inserted in an iron tube which is placed in the molten metal. A further development of this outfit has an automatic attachment which controls the temperature by regulating the flow of the gas. This scheme is by far more reliable owing to the fact that once adjusted it requires no further attention but works automatically.

A new type of soldering pot in process of development is heated by electricity and equipped with an automatic temperature control. On this pot the temperature is controlled by means of a chemical contained in a metal tube anchored in the pot, which changes from an insulator to a conductor between a predetermined range in temperature.

J. S. DEAN,
Motor Engineering Department.
Westinghouse Electric & Manufacturing Company,
East Pittsburgh, Pa.

Adapting Insulator Clamp for a Cable Which Is Too Large



A 2-IN. INSULATOR CLAMP ADAPTED TO HOLD A 2½-IN. CABLE

RECENTLY when supporting a length of 2½-in. cable in a substation of a large manufacturing company all insulators designed for this size cable were used before the job was completed. There were on hand, however, some insulators for 2-in. cable and these were used as shown in the accompanying cut. The upper half of the original clamp was discarded, and by means of flat-head screws a length of ¼-in. by ½-in. strap iron was bolted in its place. This formed a seat for the U-shaped strap made of ⅜-in. by 1½-in. iron, under which the cable was clamped. This held the cable securely and answered the purpose satisfactorily.

FRANK HARAZIM.
New York City.

Management and Policy

Embracing Central Station Commercial Organization and Management,
Customer and Trade Relationships, Public and Financial Policies, Advertising,
Selling and Service Methods

Free Trouble Service Found Best at Hartford

FIFTEEN years of free trouble service has convinced the Hartford (Conn.) Electric Light Company of the wisdom of handling this class of work without charge except where major failures of apparatus or wiring require subsequent reporting to contractor or manufacturer for attention. In 1920 the "trouble-shooting" staff handled 20,981 calls with about 40,000 connections to the system. Three men working nine hours six days per week, with a fourth man working part time in rush periods and a fifth as a substitute, care for this service. Forty-seven per cent of the total number of calls are classified as "fuses blown, cause unknown," against 15 per cent classified as trouble in appliances, sockets or fixtures, 11 per cent short circuits in wiring, sockets or fixtures, and 1 per cent motor trouble.

Salt Lake Gives a Good Example of a Well-Chosen "Home Electric"

RECENT examples of the "Home Electric" have shown conclusively that one of the biggest elements in their success is the selection of a well-designed house, generously furnished and in good taste. Salt Lake City has just conducted such a demonstration in a small Colonial cottage.

The home contained approximately 150 electrical outlets and nearly fifty switches. A number of guides were provided who explained to the visitors the wiring installation and the practicability and convenience of each outlet and appliance in every room. In a prominent place in the house a sign was displayed reading "No solicitation, demonstration or quotations made during this exhibition. Information will be cheerfully furnished by any electrical dealer."

LIVING ROOM OF SALT LAKE ELECTRICAL HOME

The home was conducted under the direction of the Rocky Mountain Electrical Co-operative League. L. B. Swaner designed and built the house, and electrical manufacturers, jobbers and dealers contributed to make it a success.

Tenney Companies Sponsor Employee Educational Efforts

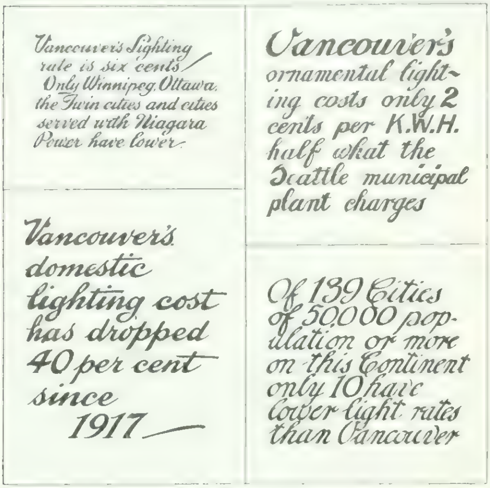
PUBLIC utility companies in the Charles H. Tenney & Company (Boston) group are embarking this fall on a policy planned to give the utmost encouragement to employee educational efforts. An educational director has been appointed for each company and charged with the responsibility of co-operating with employees taking various courses with the National Electric Light Association, Edison Electric Appliance Company, Alexander Hamilton Institute, International Correspondence Schools or other trade and accounting institutions. It is the policy of the company to meet such employees at least half way in relation to personal expenses involved.

It is not intended to advance the money before such courses are completed, but on presentation of certificates showing that the work has been accomplished financial encouragement will be given in approved cases along the above lines. It is also planned to provide lectures on many subjects of interest and value to utility employees during the coming winter, and plans have been formulated whereby representatives of manufacturing companies in the electrical field will speak to groups of employees on the principles and detailed application of their products. Much educational work was interrupted by the war, and the importance of recruiting future leaders in these companies from the ranks of ambitious workers is fully recognized by their executives. About fifteen utility companies, chiefly in New England, are concerned in this program.

Vancouver Advertises the Inexpensiveness of Its Service

CORRECTION of local impressions that its rates are high is the object of a series of advertisements now being run by the British Columbia Electric Railway Company, Vancouver, B. C. During the last year or more the company has been advertising extensively to increase its lighting business, and results have proved the value of the policy. It became evident, however, that there still lingered in the minds of some a more or less well-defined feeling that the company's rates for light, power and gas were high, and it was felt that such delusions must be dispelled. A series of advertisements, some of which are shown here, was prepared. Each advertisement carried one salient fact emphasizing the low cost of the company's service. These advertisements were run in street cars and in the daily papers. Each card remained in the cars one week, while it appeared printed in script in the daily papers one day during the same week.

Following this campaign, other advertisements giving the cost of using certain sizes of lamps were run. Explanations were made as to how any one might figure out for himself or herself the actual cost of a lamp. On such advertisements the slogan "Light costs little—use more" was used. It is believed that when the public realizes how inexpensive electric service really is one of the deterrents to the use of more light and to the sale of more electric appliances will be removed.



Vancouver's Lighting rate is six cents / Only Winnipeg, Ottawa, the Twin cities and cities served with Niagara Power have lower—

Vancouver's ornamental lighting costs only 2 cents per K.W.H. half what the Seattle municipal plant charges

Vancouver's domestic lighting cost has dropped 40 per cent since 1917—

Of 139 Cities of 50,000 population or more on this Continent only 10 have lower light rates than Vancouver

TYPICAL ADVERTISEMENTS EMPHASIZING LOW COST OF ELECTRIC SERVICE

Prize Emblem Features Pittsfield Electric Service

An effective emblem sign advertising electric service was recently installed by the Pittsfield (Mass.) Electric Company on the roof of its main office building. The design was the result of a prize competition for the best emblem that could be used for signing automobile plates, letterheads and company badges, which was won by a motor repairman. It consists in roof-sign form of an equilateral triangle with 10-ft. metal sides, finished in black, with a white center of inclined white-enamel steel at the apex of which is mounted a 500-watt incandescent lamp with a steel reflector. The sign is illuminated nightly until 11 o'clock and, with the corner-window display illumination at the company's office, has attracted no little attention. W. A. Whittlesey is manager of the Pittsfield company.

EMBLEM SIGN ADOPTED BY PITTSFIELD COMPANY

What Other Companies Are Doing

Reading, Pa.—Improvement of business in the territory served with electric light and power by the Metropolitan Edison Company is shown by the fact that in July and August the Metropolitan Edison Company signed contracts for more power than in the preceding seven months. During August, when the total power signed was twice the amount in July, five Reading industrial plants which were formerly operated by their own steam were connected to the electric power service of the company. For the eight months ended Aug. 31 the total of new contracts secured by the Metropolitan Edison Company was 2,714. There were contracts to serve 1,743 old houses and to furnish 1,590 hp. in motors. These figures show a substantial gain over the corresponding period of last year.

Sandusky, Ohio—The station records of the Sandusky Gas & Electric Company show an increased output for the first twenty-four days of September over a like period in August of 220,498 kw.-hr. Approximately 70 per cent of this increase represents new business taken on. The balance is a natural increase due to the greater number of lighting hours and the gradual resumption of business. All of the industries in the city of Sandusky and the surrounding territory report a decided improvement in the amount of orders being received.

Enid, Okla.—C. T. Barber of the Enid division of the Oklahoma Gas & Electric Company recites an incident which shows the growing favorable attitude of the public toward customer ownership. He says: "A few weeks ago a gentleman came into the office and inquired about Oklahoma Gas & Electric securities. After they were thoroughly explained he signed for five shares for his three boys, ranging in age from twelve to seventeen years. He explained that as this was the very best way for the boys to save money, he was going to start them off and they were to come into the office personally and make their own monthly payments."

Greenville, N. C.—Installation of the latest type of incandescent series street-lighting system has just been completed, replacing the old type of street arcs. The main thoroughfares of Greenville are now lighted with 600-cp. nitrogen-filled lamps, while the outskirts of the city are lighted with 400-cp. lamps of the same type. The new system has revolutionized the street lighting of the city. The 600-cp. lamps give about a third more illumination per unit than the old arc lamps, while the 400-cp. lamps give an illumination virtually the same as the old lamps. However, they have been arranged so that they have a uniform distribution of light without the glare and flickering of the old system. The management and officials of the Greenville company, together with the lighting committee of the City Council, have expressed their approval and indorsement of the new system.

Astoria, Ore.—The Pacific Power & Light Company, together with the local electrical contractor dealers and through the co-operation of the Northwest Electrical Service League, will conduct a "home electric" in Astoria during the present month and expects thereby to stimulate the sale of domestic electric appliances and interest the citizens in a greater use of household labor-saving devices.

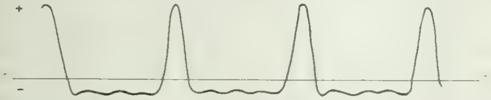
Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
of the World

Generators, Motors and Transformers

Calculating Characteristics of Synchronous Machines.—J. H. KUHLMAN.—Tests to determine the data required to compute complete performance curves and methods to be employed in calculating various values from the readings are explained. Data are given showing the results of tests made on an actual machine.—*Electrical Review,* Sept. 3, 1921.

A New Alternating-Current Generator with Asymmetric Wave.—MAX BRESLAUER.—An electric generator is described which delivers an asymmetric alternating current consisting of a very steep positive part of short duration and a very much smaller negative part of comparatively long duration. This is being achieved by driving synchronously a two-pole inductor within a two-pole field, the latter excited by ordinary sinusoidal alternating current. The mechanical coupling between driving motor and driven generator is once for ever established so as to give the maximum distortion of the wave form, this coupling being established with the aid of an oscillograph. Feeding a step-up transformer, such a small motor-generator set is eminently suited to produce X-rays. A diagram showing the construction of the machine and oscillograms of its current wave are given.—*Elektrotechnische Zeitschrift,* Sept. 15, 1921.



OSCILLOGRAM OF ASYMMETRIC CURRENT WAVE

Lamps and Lighting

Low-Voltage, Self-Starting-Arc Incandescent Lamp.—MCFARLAND MOORE.—A new self-starting neon-tungsten lamp which will operate on low-voltage circuits consists of two helices of tungsten wire in an atmosphere of neon gas, the ends of the helices being separated by a very short distance. When voltage is put on this lamp there first appears around the electrodes a corona discharge of light having the characteristic red color of neon, and the corona steadily evolves into a horizontal cylinder of intense white light. The output of the lamp constructed is about 178 spherical candles, and the specific consumption becomes 1.08 watts per spherical candle.—Paper presented before Illuminating Engineering Society, Sept. 29, 1921.

Desired Road Illumination from Automobile Headlamps.—H. H. MAGDSICK and R. N. FALGE.—There are presented data derived from thirteen observers and showing the road illumination from headlighting equipment in a moving car under various conditions of road surface, contour, boundaries, street lighting, weather, speeds, etc., with lighting facilities which offered a considerable range of intensity and distribution. These data indicate in a general way the lighting required for safety and a moderate degree of convenience; that is, the lower limit of what might be termed good practice for the more common road conditions. They are not sufficiently complete to permit an analysis of the effect of each of the variable factors. A description is given of the equipment employed, together with an outline of the procedure followed in obtaining the data.——Paper presented before Illuminating Engineering Society, Sept. 29, 1921.

Generation, Transmission and Distribution

Heating of Cables.—P. DUNSHEATH.—The writer states that lack of agreement on the subject of cable heating is due to two factors. On the one hand, numerous results of research and investigation have sprung up and obscured the real problem, and on the other hand, investigators have dealt with the cable and its surroundings as one entity instead of separating them into two distinct problems. With these two facts in mind, he proceeds to analyze and formulate the rise in temperature in cables.—London *Electrician,* Sept. 9, 1921.

Hydro-Electric Construction Sites Along Columbia River.—W. A. SCOTT.—The five natural power sites on the Columbia River between the mouth of the Willamette and the United States boundary line are described. The head and the amount of power available and the cost of development at each of the points are given.—*Electrical Review,* Sept. 3, 1921.

Developments in Power-Station Design.—One of a series of articles describing equipment for power plants. This article describes oil-burning furnaces and the auxiliary equipment which must go with them. The paper says that the conversion of a few boilers in large power houses to oil firing for meeting peak loads is well worth considering. Oil fuel is easiest to handle and is easily stored. The furnaces with an oil-fired boiler are at all times under perfect control and the steaming capacity can be readily adjusted to variations of loads. One ton of oil occupies 38 cu.ft. while a ton of coal occupies 45 cu.ft. When the calorific values are compared, the saving in storage space with oil fuel is more than 50 per cent.—London *Engineer,* Aug. 26, 1921.

Traction

The "1B-B1" Express Locomotives of the Swiss Federal Railways.—W. LÜTHI.—This detailed and elaborately illustrated paper describes one of the forty-one Brown-Boveri locomotives used on different lines of the Swiss Federal Railways. The system is single-phase, at 16⅔ cycles and 15,000 volts. The engines are designed to pull 300 tons over grades of 26 per 1,000 at 50 km. per hour, while their top speed reaches 75 km. per hour. There are four twelve-pole motors of 500 hp. continuous rating installed on each locomotive, driving in pairs over 1:3.2 gearing two jackshafts from which horizontal rods actuate the drivers. A transformer of 1,730 kva. with a great number of taps provides eighteen starting positions and the energy for heating the train. To cool the transformer oil is pumped through a set of cooling tubes arranged along both sides of the locomotive. Each main motor has its own 7½-hp. motor-blower set. Provision is made for braking the train on long down grades by short-circuiting the motors over resistors.—*Brown-Boveri Mitteilungen,* September, 1921.

Review of Electric Traction.—**FRANK J. SPRAGUE.**—A history of the development of electric traction with the influence exercised by different men from Thomas Davenport, the pioneer, up to the present age. The problem of development in technical features is discussed from the earlier days up to the present multiple-unit system and main railroad-line electrification.—*Journal of Franklin Institute,* September, 1921.

Installations, Systems and Appliances

Transformer Oil Sludge.—C. J. RODMAN. — Three types of transformer oil sludge, the asphaltic, the soap and the carbon, are described. Poor oil, containing unsaturates, water, small resinous bodies and certain accelerators, produces the oxidation of asphaltic and soap sludges most readily. The carbon type of sludge is produced during electrical breakdown. Highly refined oil of the saturated paraffine series, which is carefully filtered when the dielectric strength begins to lower during operation, can be successfully used for many years.—Paper presented before American Electrochemical Society, Oct. 1, 1921.

Internal-Combustion Engines in Marine Service.—CHARLES EDWARD LUCKE.—This, the second part of an article, compares various forms of propulsion for steamships, including electric drive. Data are given in the form of tables, curves and charts, showing costs of equipment, operating expenses, dead-weight distribution, cargo capacity per single voyage per ton-mile, annual operating expenses, annual return on investment, etc.—*Journal of Franklin Institute,* August, 1921.

Electrophysics and Magnetism

Application of Electrophysics to Ordnance Problems.—GORDON F. HULL.—Methods of measuring the velocity of projectiles by electrical means are described. Electrical apparatus has also been developed for measuring the pressure in a gun and the expansion of a gun during firing.—*Journal of Franklin Institute,* September, 1921.

Magnetic Force in Disconnecting Switches.—H. B. DWIGHT.—An explanation of the forces which exist in disconnecting switches tending to throw the switches open on passage of current. Formulas and curves are given.—London *Electrician,* Sept. 2, 1921.

Electrochemistry and Batteries

Factors Influencing the Electrolysis of Organic Compounds.—RAYMOND FREAS.—A contribution attempting to encourage further research and study of organic compound electrolysis. The discussion, limiting itself to electro-reduction processes, states that the concentration of a "depolarizer" relative to that of active hydrogen or H —, as well as H +, determines the nature of reduction possible. The factors influencing the relative velocities of reaction are enumerated, and in spite of their great number the author maintains that it is possible to obtain selective reduction electrolytically. An experimental arrangement used, and adaptable to continued study, is presented.—Paper presented before American Electrochemical Society, Oct. 1, 1921.

Telegraphy, Telephony and Signals

Reinforced Concrete Poles for Radio Antennas and High-Voltage Transmission Towers.—J. LEROY.—This short paper describes a novel design of high-tension and radio towers of reinforced concrete. The skeleton of the structure is built up of steel tubing held together by concentric steel rods. The finished steel construction is embedded in wooden molds for the concrete, which are so equipped as to give a hollow square pole with a number of openings on the four sides. Such a tower has a pleasing appearance and may be built for any strength desired by choosing proper steel cross-sections. For an actual case—a tower of 25 m. height, to carry two 100-sq.mm. three-phase lines—the complete calculation and drawings are given.—*Revue Générale de l'Electricité,* Aug. 27, 1921.

Direction Finding by Wireless.—J. J. BENNETT.—This paper describes several methods of using wireless telegraphy for guiding ships and aircraft.—London *Electrician,* July 29, 1921.

History of the Electric Signaling System Within the Arlberg Tunnel.—L. KOHLFÜRST.—In this unusual article the almost endless troubles experienced with an electric signaling system installed in the 6-mile (9.6-km.) Arlberg Tunnel, through which are operated trains driven by steam locomotives, are described in detail. It was very difficult to find properly designed cables, relays, bells and telephone apparatus sufficiently rugged to withstand the effects of great moisture combined with the acid fumes from the locomotives. Amid the vast amount of details there may be mentioned the fact that a telephone cable which when installed measured 8,000 microhms resistance per kilometer from copper to lead sheath dropped in six years to only 0.2 microhms.—*Elektrotechnische Zeitschrift,* Aug. 25, 1921.

Maritime Radio Service in France.—J. BRUN.—This service was inaugurated in 1904 and comprises today eight stations on French shores and one in Algiers. Each station has its own definite sending territory. A short description is given of each of these radio posts with photographs of four of them showing the arrangement of the antennas. Finally the author deplores the great noise caused by the many sending stations operating day and night, virtually all on a 600-m. wave, and suggests that designated wave lengths be used for specific purposes. This, he claims, would help materially to aid clear and easy reception.—*Radio Electricité,* August, 1921.

Miscellaneous

Electric Conservation of Fodder.—F. RUTGERS.—The Swiss Oerlikon Works have acquired the patents of a new method to conserve vegetable fodder in silos. At the bottom of the silo is placed a large metallic electrode, upon which freshly cut grass, clover, corn, beet leaves, etc., are piled to the desired height, a metallic cover serving as upper electrode. Between these two electrodes a low-voltage alternating current of from 200 volts to 500 volts is applied for a few days or nights, which kills all bacteria either directly by the current or by the developed heat. The conservation of 10 tons of fodder requires between 130 kw.-hr. and 200 kw.-hr. Several years of actual trial have proved this method to be far superior to any other means of keeping fodder in silos without previous drying. The steady night load is welcomed by power stations.—*Bulletin de l'Association Suisse des Electriciens,* August, 1921.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

Salt Lake's New "White Way" Lighting System Completed

SALT LAKE CITY'S new "white way" lighting unit has been completed, and on the evening of Oct. 5, with appropriate ceremonies and with 30,000 spectators in attendance, Mayor Neslen threw on the current switch. A civic celebration was held in connection with the turning on of the lights.

The new installation consists of 336 6.6-amp. luminous-arc lamps of 1,500 cp. each on steel ornamental standards, three lamps to each pole, the top lamp being 25 ft. above the street and the two lower lamps each 18 ft. above the street. The cost of the installation is approximately $150,000, of which the city will pay 10 per cent, the Utah Power & Light Company $50,000, and the merchants the remainder, this arrangement being made under the provisions of a new state law which specifies that street-lighting districts may be created and paid for by a special tax against abutting property. The maintenance cost will be shared by the merchants and the city, the city paying 10 per cent. The payment of the cost of installation will be distributed over a three-year period.

Plans are being formulated to light many more city blocks in a similar manner, and it is predicted that in another two years the intensely illuminated area of Salt Lake City will be double its present size.

Colorado River Plans of the Southern California Edison

THE Southern California Edison Company has filed an application with the Federal Power Commission for two additional power sites on the Colorado River. Including the filings on the four former sites, the total power contemplated in this series of projects equals 3,400,000 hp. The two new filings cover the Boulder Canyon dam site and the Pyramid Canyon dam site, further down stream and above Needles, Cal. The plans call for a 450-ft. dam at Boulder Canyon and a 200-ft. dam at Pyramid Canyon.

The filings on these sites bring directly to an issue the plans of the city of Los Angeles, which has filings on the Boulder Canyon site now pending before the Federal Power Commission. The plans of the Southern California Edison Company call for a comprehensive development of the river from a point near the southern boundary of Utah and continuing through the entire State of Arizona. A storage reservoir of more than 40,000,000 acre-feet is proposed at Glen Canyon, the upper point, which would be large enough to regulate the river over a complete cycle of wet and dry years. Below this the several power sites would be developed as the demand for power grew. Although the final plans have not been announced, it is understood that coincident with the construction of the first portion of the Glen Canyon dam, ultimately to be 500 ft. high, a generating station would be built lower down on the river and nearer the load centers.

The Pyramid Canyon site would be about 200 miles from Los Angeles and the Boulder Canyon site 250 miles. Recent studies of the latter indicate that the unit there would be the first completed and would be connected to Los Angeles by a double-circuit steel-tower 220,000-volt transmission line.

State Ownership of Hydro-Electric Power Still Agitated in California

PLANS to place on the California general ballot in November, 1922, the initiative petition proposing state-owned hydro-electric power have been developing but slowly. Headquarters of the organization of politicians who are fostering this movement have been opened in San Francisco and Los Angeles and funds are being solicited to carry on the work of obtaining signers to the petition. The organization is backed by men who, it is said, are interested in possible hydro-electric power sites which later might be sold to the state. The petitions are being circulated in a small way and must have more than 80,000 signatures before the measure can be placed on the ballot.

An indirect campaign against the measure is being undertaken by the California power companies, which are holding meetings of their stockholders at which facts about the companies are being presented by their officials. The meetings are being held in various centers throughout the state, and it is confidently expected that the tens of thousands of such consumer stockholders will have a material effect upon the results of the election.

Good Service Best Weapon Against Public Ownership, Says J. A. Laing

THE most effective weapon which the utilities have for combating municipal ownership agitation, declared John A. Laing, vice-president of the Pacific Power & Light Company, speaking before the first regular joint meeting of the year of the Portland (Ore.) Sections of the A. I. E. E. and N. E. L. A. and the Oregon Association of Electrical Contractors and Dealers, on "Regulations Under the Oregon and Washington Utilities Acts," is efficient and reliable service at the lowest consistent cost. Mr. Laing recommended that thought be given to some plan whereby stockholders of a utility might be rewarded for efficient management and penalized for inefficient management of their organization, and expressed the opinion that better results might be obtained from a commission appointed by the Governor than from the elective system that now exists in some states.

A. S. M. E. Backs Fund for Preparation of Accurate Steam Table

REALIZING the trouble caused engineers by the wide divergence in the value of the properties of steam given in the various steam tables in use by constructors and operators of steam machinery both in America and abroad, the American Society of Mechanical Engineers has agreed to be the custodian and administrator of a "steam table fund." The research committee of the association will supervise the work of investigation and the calculation and preparation of the table when the data are obtained. It is hoped that in this way a more accurate and extended table may be drawn up on which all specifications, tests and operating data of steam machinery can be based.

Any one who is interested in the matter is invited to contribute to the fund, many subscriptions of reasonable size rather than a few large ones being desired. The entire industry, both manufacturers and users, will be represented, and the committee has already sufficient pledges in hand to insure the starting of three out of five subjects of research. Bulletins will be issued from time to time as data are obtained. Arthur M. Greene, Jr., is chairman of the research committee, which may be addressed at the Engineering Societies Building, New York.

California, Alaska and Utah Power Projects Before Federal Commission

A LICENSE for a period of fifty years has been issued by the Federal Power Commission to the Southern Sierras Power Company of Riverside, Cal., covering a power project on the headwaters of Mill Creek in the Angeles National Forest. The project involves the diversion of water from High, Vivian, Falls, Alder and Lost Creeks. The water is to be dropped 2,047 ft. to a power house on Mill Creek. A storage reservoir containing 100 acre-feet would be formed on Falls Creek by the construction of an 80-ft. rock-fill dam.

A special condition of the license is that the construction of the entire project, except the Falls Creek storage dam and reservoir, is to begin by Jan. 1, 1922, and be completed by June 30, 1923. The construction of the Falls Creek storage dam and reservoir is to be begun by Jan. 1, 1925, and completed by the end of that year. The licensee also is required to construct and maintain suitable stream-gaging stations.

The commission has approved an amendment of the license issued to the Alabama Power Company for its project at Duncan's Riffle, on the Coosa River, in Alabama. The amendment allows the inclusion of lands west of the Coosa River, half a mile below the dam site, from which stone for use in building a dam and power house is to be obtained. A special condition of the amendment is that the control of the added land is to remain in the War Department and that operations on it are to be limited to such as may be required in the removal of the stone.

A preliminary permit for a period of fifteen months has been granted to the Unita Power & Light Company of Myton, Utah, covering a 4,800-kw. project on Spring Branch and the Unita River, in Duchesne County, Utah, which is necessary to meet the increased load requirements of the company.

A preliminary permit for two years has been granted to George C. Hazelet of Cordoba, Alaska, for the development of a project at the outlet of Silver Lake in the Chugach National Forest, Alaska. The project involves the construction of a dam across Duck River and a pipe line to convey the water 7,000 ft. to a power house to be built at the head of Galena Bay. The estimated power capacity of the project is 5,000 hp. It is to be used in the operation of a pulp mill.

An extension for one year, or until Oct. 1, 1922, has been granted to the United Mills Company of Hickory, N. C. The preliminary permit covers a power project on Harpers Creek, Caldwell County, N. C. The extension is made so that the permittee may determine in an intelligent manner whether or not the natural flow of the stream is of sufficient volume to justify its development.

Ohio Joint Rules Committee Organization

A FINE example of co-operative work is found in the movement now under way in Ohio to formulate rules to be presented to the commission for adoption in compliance with the recently effective law requiring the commission to promulgate rules and regulations governing overhead construction. The communication, power and railroad interests are all well represented on a general committee by experienced men, and in addition to the formal members of the committee a number of advisory members are subject to call.

A working committee of two members each from the communication, power and railway interests has been formed to carry the burden of the work of preparing and agreeing on the final form of rules to be presented.

Six sub-committees of the working committee have been formed to consider respectively the details of general rules and definitions, communication and signal lines, crossings over steam roads, power-line crossings over steam railroads and communication or signal lines, colinear or joint construction of power and communication or signal lines, and technical data and inductive interference. The sub-committees will work out their respective subjects as far as possible and present their conclusions to the working committee, in which the final decisions for presentation to the general committee will be made. Each sub-committee contains equal representation from all three interests participating in the joint work. Under the requirements of the Ohio law the commission must adopt rules in February, 1922, at the latest.

Joint Meeting of N. E. L. A. and O. E. L. A. Meter Committees Called

A JOINT open meeting of the national meter committee of the N. E. L. A. and the meter committee of the Ohio Electric Light Association, to which all meter-department men are invited, will be held at the Statler Hotel, Cleveland, on Nov. 16. In the morning, besides an address with a discussion, the N. E. L. A. film "Back of the Button" will be displayed. In the afternoon R. C. Fryer will read a paper on the "Value of Meter Department Activities in Central-Station Work," and there will be five-minute talks by visiting representatives and a general discussion of meter department problems.

Railroad Strike Should Not Seriously Affect Electrical Industry

SUFFICIENT coal is in local storage, it is thought, to prevent the possibility of any electric light and power station being forced to close down for want of fuel as a result of the threatened railroad strike. Electric utilities generally try at this season of the year to accumulate their winter reserve of around thirty days' supply. There has been considerable purchasing of coal lately by electric lighting companies for reserve against any such contingency as a strike of railroad employees.

Local stocks of electrical material have been kept very low, but it is doubtful if there will be any shortage unless there should be a strike of considerable duration. There is just the possibility that a strike might upset the distribution of holiday goods, but there is enough time intervening to obviate the occurrence of serious losses.

Electrical manufacturers, generally, have not large stocks of raw materials. However, unless the strike, if it comes, lasts long enough seriously to disarrange all transportation schedules for weeks afterward, these manufacturers will probably not find themselves greatly inconvenienced for materials.

Mine Operator Blames Cost of Coal on Freight Rates

SPEAKING before the American Mining Congress Exposition at Chicago recently, J. D. A. Morrow, vice-president of the National Coal Association, said that, although the bituminous output is now approximately 9,000,000 tons, which in an ordinary year would be an extremely low output, still because of general industrial inactivity throughout the country there is no indication that this output will prove to be insufficient for the country's demands for the winter. The point was brought out by Mr. Morrow that bituminous coal is selling at nearly all the mines in the country at less than the cost of production, but that freight rates, which are about 100 per cent greater than before the war, have greatly added to the ultimate cost to the consumer.

Public Ownership Through Security Sales Approved by Commissioners

AT THE concluding session of the annual meeting of the National Association of Railway and Utility Commissioners held in Atlanta, Ga., last week, M. H. Aylesworth, executive manager of the N. E. L. A. and former chairman of the Colorado Public Utilities Commission, made a profound impression on about 100 commissioners from thirty-two states of the Union through his analysis of "public ownership" of utilities as against ownership by cities or states. He pointed out that the results of public ownership can be observed in many sections, since at present more than a million and a half people own the securities of light and power companies under private management. Under such operation not only are the best interests of security-holding customers represented in the development of electric service to suit the development needs of any community, but there is a correlation of the business of furnishing electric service with all those lines of business activities which the diversified group of security holders represents.

To illustrate the far-reaching effect of the right kind of "public ownership" and the conditions which make it essential to maintain the highest quality of service, Mr. Aylesworth recounted the events of the Pueblo (Col.) flood, where through the efficient organizations of the electric light, power and telephone companies the restoring of service in remarkably quick time shortened the period of distress by many days and aroused a lively appreciation of the public spirit that was displayed, even at risk to life, by company employees and officials. In a fuller realization of the community-building influence of adequate electric service, Mr. Aylesworth maintained, lies the solution of some of the future problems of the utilities, particularly the urgent need for capital to carry out the developments and betterments that are everywhere required. The selling of securities to the public through customer-ownership campaigns he dwelt on emphatically as one of the vital phases of utility financing in the future.

The officers elected for the ensuing year are as follows: President, Carl D. Jackson, Wisconsin Railroad Commission; first vice-president, Dwight N. Lewis, Iowa Board of Railroad Commissioners; second vice-president, Alexander Forward, Virginia State Corporation Commission. Detroit, Mich., was selected as the meeting place of the next convention, which will be held on Sept. 26, 1922.

Customer Ownership and Good Will Interest Southeastern Convention

PROBLEMS of central-station executives were the principal topics discussed at the annual meeting of the Southeastern Section of the National Electric Light Association held at Chattanooga, Tenn., Oct. 17-19. Among nationally known men who took part in the discussion were M. R. Bump, president N. E. L. A.; M. H. Aylesworth, executive manager N. E. L. A.; W. L. Goodwin, assistant to president Society for Electrical Development, and John F. Gilchrist, vice-president Commonwealth Edison Company, Chicago.

Upholding the principle of fair treatment and giving a convincing demonstration to the public of the desire to render honest and efficient service, S. B. Irelan, president of the section, said in his address, are among the most important obligations of the central-station company.

"The public today," he went on, "realizes and appreciates the necessity of our giving continuous electrical service and its importance to the development of the communities and districts. It stands ready and willing to support honest efforts of organized groups of thrifty investors to supply their community with this commodity, but it must be truly informed of the various problems of our business and must realize that it also has a responsibility in the securing of an adequate supply of electrical energy for its community."

John F. Gilchrist, vice-president of the Commonwealth Edison Company, explained the organization of state public information committees in various sections of the country. He gave in some detail the organization and working plans of the Illinois committee, which has pioneered the way.

Under the title "Taking Our Customers Into Partnership," M. H. Aylesworth, executive manager of the N. E. L. A., created much enthusiasm for his viewpoint that public ownership of utilities of the right sort through the sale of securities to consumers is the solution of many financial and good-will difficulties now facing the industry. The number of holders of these securities is now around 2,500,000.

At the second session F. D. Mahoney, commercial manager of the Alabama Power Company, described the sales campaign launched in June, 1920, to sell 10,000 shares of preferred stock to employees and to the public through the effort of 1,200 employees. He reported that 15 per cent of the stock has been subscribed for by the employees and that 50 per cent of all sales have been for cash with the rest on time payments. The selling of stock locally has been so successful that it is now a part of daily operating routine.

Three Engineer Papers

Three papers were presented on engineering subjects—one by William K. Vanderpool, chairman of the overhead systems committee of the N. E. L. A.; another by G. A. Sawin of the Westinghouse Electric & Manufacturing Company, and the third by A. S. Turner of the Edison Lamp Works. Mr. Vanderpool discussed the main features of the committee's work, together with an explanation of the reorganization of the work of the N. E. L. A. technical committees. Mr. Sawin presented a paper entitled "Supplying Service to Farmers in Rural Districts," which took up line construction and the possible revenue for the service. Mr. Turner gave an illustrated talk on industrial and store lighting.

Under the title "The Port of Fair Values," J. Prince Webster presented a masterful discussion on rate of return and valuation from the viewpoints of the courts and public service commissions. He cited many legal decisions that establish fair value on the basis of present reproduction costs.

In an address enthusiastically received, William L. Goodwin of the Society for Electrical Development analyzed the mechandising policies of central-station companies and the trade and pointed out that for industry to expand commercially and in keeping with the engineering side there must be a more liberal application of common sense in the selling of electrical goods to the public with a profit sufficient to call into the trade honest effort and initiative.

In commenting on the sale of securities to the public, Mr. Goodwin expressed the opinion that time will soon see electrical dealers selling the securities of the local utilities over the counter as is done in France. In this connection he urged that the denominations be made small and payment of less than $1 accepted. The answering of such problems, combined with an effort to give the man in the street a better understanding of electrical work by removing many stumbling blocks—such as meter dials hard to read, the diversity of types of attachment plugs and convenience outlets, the varieties of voltages and frequencies and so forth—Mr. Goodwin maintained, will provide the key to the results now being sought in good-will campaigns.

M. R. Bump, president of the N. E. L. A., reviewed the work of the parent body during the past two years and outlined those phases of it which have been thoroughly organized and are now accomplishing practical results. He explained the work of two new committees, one dealing with the customer ownership of securities and the other dealing with the problem of rural business. Mr. Bump announced that the sale of securities to customers during the present year will total around $100,000,000 and said that this activity is one of the most important that the association can foster. He explained that with ability to finance junior securities satisfactorily an important part of the financing problem of utilities will be solved. In working out the needed developments to provide adequate service Mr. Bump urged a united industry, for only through co-operation of each branch of the industry, he said, can large and satisfactory service to the public be accomplished.

Railroad Electrification

With reference to the new committee on rural lines and extensions Mr. Bump pointed out that one of the phases of the work will be the making of contracts. A rural charge plus city rates seems to afford a basis for a satisfactory start. A general conference in Chicago will soon be called to discuss this subject. Another development of the future to which Mr. Bump called attention s the electrification of steam railroads. He said that important announcements might be expected in a very short time.

At the closing session the report of the meter committee was presented. This reviewed the measuring of power on three-phase circuits and commented on the problem of taking power factor into consideration and the method of adjusting rates with this in view. H. L. Wills of the Georgia Railway & Power Company, a member of the inductive-interference committee of the N. E. L. A., reviewed its work in a general way.

Charles A. Collier, commercial manager Georgia Railway & Power Company, reported the results of a round-table conference at which time the subject of the organization of a power sales bureau for the Southeastern Section was discussed.

The officers elected for the coming year are as follows: President, D. A. Cheney, Orlando (Fla.) Water & Light Company; first vice-president, F. D. Mahoney, Alabama Power Company; second vice-president, W. R. Sammons, Knoxville Railway & Light Company; third vice-president, Howard Hall, Western Electric Company.

Radio Companies of Four Nations Unite to Improve Service

An AGREEMENT whereby the four principal wireless companies of the United States, Great Britain, France and Germany will co-operate in the scientific and commercial development of wireless telegraphy throughout the world has been concluded at Paris. Executives of the four companies, who were in session for a fortnight, have announced the agreement in a statement which says: "A comprehensive arrangement which has been made will work for the efficient, economical and immediate dispatch of wireless messages and at the same time prevent the wasteful use of the relatively few wave lengths available for long-distance communication.

"The co-operation of the four companies," continues the statement, "should result in the full utilization of scientific research for the elimination of static and also lead to the fullest development of the radio art, thereby assuring to the public and the press reliable and adequate communication service throughout the world."

N. E. L. A. Committee and Secretary Merrill in Deadlock on Accounting

NO ACTION was taken at the Oct. 17 hearing before the executive secretary of the Federal Power Commission at which the classification of accounts was to have been considered. Secretary Merrill declined to reopen the discussion of the regulations having to do with accounting and depreciation, and the accounting committee of the National Electric Light Association declined to discuss the classification of accounts. As a result the hearing was brought to an abrupt close.

Qualities of Great Executives Analyzed Before Engineering Bodies

IDEALISTS and men with unobstructed vision are the greatest need today in developing large engineering projects. Such was the gist of remarks made by Philip Cabot of White, Weld & Company, Boston bankers, before the first forum of the year, held Wednesday night, of the New York sections of the four national engineering societies. The subject of the forum, "Financing of Large Engineering Projects," drew such an audience that it was impossible for all who wished to attend to gain entrance to the hall.

The other speakers of the evening were A. B. Leach of A. B. Leach & Company, New York bankers and public utility financiers; John H. Delaney, former transit construction commissioner of New York City, and John H. Williams of Day & Zimmermann, Philadelphia engineers. Mr. Leach confined his remarks largely to the financing of the New York City transit companies, making special reference to the proposed change to municipal control.

"Your builder and leader of great industrial enterprises is essentially an idealist," said Mr. Cabot. "He is imaginative, enthusiastic, impulsive, intensely human, a dreamer of dreams with the power to make the dreams come true—in short, an artist capable both of great imaginative conception and fine technical execution, possessed of the power both to conceive and to do.

"A glance at the history of American industry during the last fifty years will show that the great figures are all men of this type—Vanderbilt, Hill, Ripley, Carnegie, Schwab, Gary, Wright, Rosenwald, Woolworth, Armour, McCormick, Cudahy, McElwain, Endicott, Ford, Westinghouse, Coffin and Vail.

"Take Vail, of the telephone company. Distinctly less remarkable than some of his predecessors in intellectual power and scientific training, he took the company when to some of us it seemed about to go upon the financial rocks and left it the most shining success of any public utility in the world, having steered it through the most difficult period for companies of this kind that we have ever known.

"His success was due, not to commanding intelligence, but to imaginative power and the capacity to select and direct men. And look at our dear Henry Ford, with all his sins of ignorance upon his head, who has, as it were overnight, leaped from nowhere into the multi-millionaire class, leading an automobile industry as large in some dimensions as all others in the country put together, and perhaps the only successful one.

"The reason why such men succeed is obvious. They have faith, they believe in things they cannot prove, possess the courage to stake their reputation and their future on their ability to make their dreams come true, and obtain from these qualities the power to inspire with enthusiasm and loyalty the great bodies of men under their command who are their necessary tools, controlling them with the precision and power with which the great painter handles his brush.

"Such a spirit in an organization is an essential—one is tempted to say the one essential—of industrial, as of military, success—unquestioning loyalty and the willingness to take desperate chances at the word of command Leadership in any field demands this type of man, this power to inspire.

"The great builders and leaders of large industries in the United States have all possessed the following qualities: (1) Imagination, giving (a) the power to see with remarkable clearness the customer or the market; (b) power of leadership, the ability to inspire loyalty and enthusiasm in subordinates; (c) judgment of men, the ability to pick subordinates of power. (2) Administrative ability, technique, the power to use tools, to do work through others.

"The qualities are essential because large industries involve the use of large bodies of men who must be led and cannot be driven. They must be always kept growing, which requires vision of the changing conditions of the market. The promotion stage is never over."

Continental Industrial Conditions Quite Similar to Those Here

THE general economic conditions existing in the countries of Europe are virtually the same as those existing in the United States, and of the industries affected by the present depression in business the electrical industry is the most favored, Dr. Walter E. Boveri, of the old-established electrical firm of Brown, Boveri & Company, Baden, Switzerland, told a representative of the ELECTRICAL WORLD last week. Dr. Boveri left Switzerland about a month ago and will probably be in this country for another six weeks or so. His company has important affiliations in many other European countries besides Switzerland, including France, England, Italy, Spain, Germany, Holland and Norway.

"Financial conditions in Switzerland have become considerably easier during the last six months," said Dr. Boveri. "While in the spring money for industrial issues was commanding 7 per cent, it can now be had for 6 per cent. But under present conditions of operation few of the industries are operating to such an extent that they require new money for extensions to plants.

"Of course, the electrification of the Swiss railways is providing a steady market for electrical materials of our own manufacture. The Swiss government made its decision to proceed with its electrification at a time when coal was scarce and very high in price, and a period of thirty years was considered sufficient in which to complete the work. Recently, however, coal has become more plentiful and the price has decreased to such an extent that the efficiencies of electrification do not stand out so prominently at this time, and, although the work is continuing, in all probability it will extend beyond the thirty-year period.

"The St. Gotthard Railroad, which is now operating under electric service, is running on a very light schedule, only two out of the ten generators in the two main power stations being needed to supply the power.

"The industries of Switzerland are running nowhere near up to operating capacity. The lace-making and the watch industries in particular are extremely quiet. Being dependent upon import of raw materials for so much of its manufacturing, Switzerland must find an export market for its manufactured products before it can operate on a capacity approaching normal.

"One of the biggest markets for Swiss electrical materials was in Russia. Of course, the instability of that government does not permit of its purchasing very much equipment except on the basis of cash in gold, and it is thought that a good part of the available gold supply is used up.

"Germany is able to fill its electrical needs from its own manufacturing companies, and Italy, too, is self-supporting. In the last-named country during the war excess profits were put into additional plant buildings, because when used in this way they were not subject to government tax. Now, however, a great part of this plant capacity is idle and 'eating its head off.'

"There is quite a bit of non-employment in Switzerland occasioned by the lack of industrial activity, but it is non-employment of an orderly nature. Labor in the electrical industries is still costing less than labor in England, and this fact was of great assistance to Brown, Boveri & Company in securing a recent contract from the London Town Council for generating equipment. While our company has still work on its books of a hold-over nature, incoming orders at this time are probably not more than enough to operate its plants, scattered throughout the several countries, at an average rate of more than 30 per cent."

Ohio Public Service Issues $5,100,000 in Bonds to Yield 7¾ per Cent

AN ISSUE of $5,100,000 in first mortgage and refunding 7½ per cent gold bonds, due Oct. 1, 1946, and non-callable for ten years, is announced by the Ohio Public Service Company. The price will be 97¼ and interest, which will bring a yield of 7¾ per cent. The bonds will be in denominations of $1,000, $500 and $100, and application will be made to list them on the New York Stock Exchange.

Five Thousand Electric Trucks in New York City

IN AN article appearing in the issue of Oct. 15, entitled "Commercial Electric Trucks in New York City," through a typographical error the figure of 52,128 was given as the number of electric trucks registered in the metropolitan district. This figure indicates the total number of commercial vehicles registered in the New York metropolitan district, of which 5,000 are electric trucks.

Handbook to Be Provided for Electric Vehicle Salesmen

THE electric vehicle salesmen are to be provided with a handbook as a result of action last week by a committee of the Electric Vehicle Bureau of the National Electric Light Association. The pressing need for more specific usable data for these vehicle salesman was discussed at length, and it was established that a practical handbook would aid materially in presenting the qualifications of the electric truck to the manufacturer. A committee was therefore appointed to proceed with the compilation of material and the development of a vehicle handbook to be ready for use before the next convention.

Some New Moves in New Orleans Utility Settlement

ASSERTING that the City Council of New Orleans must accept as the best of a bad bargain the position of a rate-making and regulatory body in order that the negotiations in the controversy between the New Orleans Railway & Light Company and the city may proceed with some degree of hope for a satisfactory settlement, Commissioner of Public Utilities Paul H. Maloney has submitted ten points on which he believes a satisfactory settlement may be based. In these points a base property value of $44,700,000 as of Dec. 31, 1920, with a return of 7½ per cent plus the actual net revenue needed to pay the cost of new money, is included. The company must be reorganized within six months, and the city will select annually one-third of the board of directors, who shall not be city or state officials. All of the directors are to be citizens of New Orleans. The representatives of the city shall have access to the property, books and records of the property. The federal judge who has jurisdiction over the receivership must approve the financial plan of reorganization, and approval must be given by the city and the various other bodies interested.

Common-stock dividends must not be paid until after June 30, 1923, and must at no time exceed 8 per cent per annum. Under this plan the city, in obtaining the control of the utilities for operating purposes, will have an option to purchase this stock at par and accrued dividends. All future stock issues shall be limited to this rate of dividend, and such options in favor of the city as may be agreed on shall be established. The city shall have perpetual purchase options at a price stated as of Dec. 31, 1920. The city shall not be called on to pay for additions or improvements that have been paid for out of revenue received during the receivership. Securities must not be issued without the consent of the city, and the city must also agree to the amounts to be set aside for renewals and replacements. Agreements on new franchises must also be reached. A 7-cent carfare with universal transfers, $1.30 per 1,000 cu.ft. for gas and the present electric service rates for a six months' trial are suggested.

One of the difficulties in the settlement seems to be a conflict between certain groups of bondholders, and as a result the holders of the 4½ per cent bonds of the company are being urged through advertisements in the papers to deposit their securities with a committee that will act to protect their interest, which is understood to be paramount to those of other security holders. It is understood that under the proposed plan of settlement the holders of the 4½ per cent bonds might be called on to relinquish the relative standing of their lien. Mr. Maloney states that fair provision should be arranged for these security holders. He also states that "the holders of outstanding bonds and notes should receive in the aggregate no greater return on their investment than is now payable under existing contracts." The present move is understood to be a sincere effort for the settlement of the difficulties.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest

Pittsburgh Company Reduces Power Rates.—A reduction of approximately 7.5 per cent in the wholesale electric power rates of the Duquesne Light Company, Pittsburgh, has been announced by the company. No other changes in electric rates will be made at present, it says.

"Loud Speakers" to Be Used at Armistice Day Ceremony.—When President Harding delivers the address over the body of the unknown soldier at the Arlington National Cementery at noon on November 11, his voice will be carried by long-distance wires to New York, Chicago and San Francisco. In those cities the address will, through the agency of "loud speakers," be heard clearly by vast audiences similar to the great throng that heard the inaugural address on March 4 in Washington. In addition, amplifiers cleverly hidden in and about the amphitheater at Arlington will, it is said, enable any one within half a mile of the President to hear his words distinctly.

American Company Will Build Wireless Towers in China.—Information received by the State Department at Washington that the Federal Wireless Telegraph Company has signed a supplemental agreement with the Chinese government for the issuance of bonds for radio stations brings to an end an international dispute over the erection of these enterprises under American auspices. The position of the United States is considered to be fully vindicated, the protests made by Great Britain, Japan and Denmark having proved unavailing. Under the contract the company obtained the right to build high-powered stations at Hangkow, Harbin and Pekin. The British, Japanese and Danish governments objected on the ground that the concession was in effect a monopoly.

Tokyo Plans to Convert Rubbish Into Electric Power.—Residents of the western suburban districts of Tokyo recently held a meeting to indorse a plan for establishing two electric power stations at which the rubbish of the section, amounting in weight to 1,000 tons daily, will be used for fuel. The capital to be raised is only $250,000, according to advices from Japan, and 6,000 kw. of electrical energy will be produced per diem at an estimated profit of $194. Construction is to begin immediately. An accumulation of rubbish which has reached the proportions of a nuisance will rapidly be converted into fuel when the power stations are ready. It is reported, as the result of an investigation carried out at Yokahama, that the waste of Japanese towns contains twice the amount of combustible matter contained in the waste of English towns.

Cup Awarded in Radio Speed Contest.—At the recent New York Electrical Show a speed contest for the American open championship in receiving radio code messages was won by B. G. Seutter, transatlantic wireless operator for the New York *Times*, with a record of forty-four and one-third words a minute and no mistakes.

The Trackless Trolley Reaches New York City.—The New York City authorities have opened a trackless trolley line on Staten Island, the southernmost borough of the city. The new cars, according to the city's electrical authorities, possess greater stability than has been attained before with this type of traction. The cars are equipped with greater motive power and with all the safety appliances developed by experience in high-speed traction. The electric power is supplied by two overhead grooved trolley wires. One wire is positive and delivers the current to the cars, while the other is negative, receiving the current passing through the motor and completing the circuit.

Water Power in the Prairie Provinces of Canada.—C. H. Attwood, district chief engineer of the Dominion Water Powers Branch, Winnipeg, Manitoba, estimates, as reported in the *Electrical News* of Toronto, that the undeveloped water power in Manitoba indicates a minimum horsepower of 3,177,049 and a maximum horsepower of 5,234,173. In Saskatchewan the minimum horsepower is 568,761 and the maximum 1,312,071, and in Alberta the figures are respectively 466,134 and 1,114,446. The installed turbine or waterwheel horsepower in all three provinces is 141,465, of which more than 100,000 hp. is developed on the Winnipeg River and transmitted to the city of the same name and to other towns, while 32,000 hp. generated on the Bow River serves Calgary, Alberta, and adjacent places in the Rocky Mountain section.

Important California Rate Hearings.—Hearings to establish a basis for rate adjustments of the principal electric power companies of northern California are scheduled by the State Railroad Commission for the three months beginning Oct. 25. The companies affected are the Pacific Gas & Electric Company, the Great Western Power Company and the San Joaquin Light & Power Corporation. The case of the Pacific Gas & Electric, including the Sierra and San Francisco Power Company, under lease to the Pacific, is set for Oct. 25; the Great Western Power Company's hearing is to begin Nov. 8, and the San Joaquin Light & Power's hearing will be early in December. This is the first time that a complete survey of these companies has been undertaken in order to establish a definite rate base and a reasonable rate of return.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

American Society for Steel Treating.—The Philadelphia Section of this society will meet on Friday of next week.

Industrial Relations Association of America.—This association is scheduled to meet at the Waldorf-Astoria Hotel, New York City, on Nov. 1 to Nov. 5.

Electric Power Club.—The fall meeting of the Electric Power Club will be held at the Hotel Cleveland, Cleveland, on Monday and Tuesday, Nov. 14 and 15, possibly extending into Wednesday.

New York Section, A. I. E. E.—Meeting in joint session with the civil, mining and mechanical engineers' local bodies on Nov. 16, this section of the Institute will discuss the projected Great Lakes-St. Lawrence Canal.

Pacific Coast Section, N. E. L. A.—The Pacific Coast Section of the National Electric Light Association will meet at Del Monte, Cal., Nov. 11 to consider changes in its constitution and particularly a change in its name. As previously reported, the name proposed is Pacific Coast Electrical Association.

Philadelphia A. S. M. E. to Have "Public Utility Night."—On Tuesday next, Oct. 25, the Philadelphia Section of the American Society of Mechanical Engineers will hold a "public utility night" at 8 p.m. in the Engineers' Club, preceded by an informal dinner. William D. B. Ainey, chairman of the Public Service Commission of Pennsylvania, will speak on "The Relation of Public Utilities to the Development of the Community."

Coming Meetings of Electrical and Other Technical Societies

Telephone Pioneers of America—St. Louis, Oct. 24-25.

American Society for Testing Materials—Providence, Oct. 28, 29.

Industrial Relations Association of America—New York, Nov. 1-5.

A. I. and S. E. E., Philadelphia Section, Philadelphia, Nov. 5.

N. E. L. A., Pacific Coast Section, Del Monte, Cal., Nov. 11

Electric Power Club—Cleveland, Nov. 14-15.

A. I. E. E. and Society of Naval Architects and Marine Engineers—New York, Nov. 17.

American Physical Society—Chicago, Nov. 25-26.

Electrical Supply Jobbers' Association—Atlantic Division, Philadelphia, date in November to be fixed; Pacific Division—Del Monte, Cal., Nov. 10-12.

American Institute of Chemical Engineers—Baltimore, Dec. 6-9.

American Physical Society—Toronto, Canada, Dec. 27-31.

American Association for the Advancement of Science—Toronto, Canada, Dec. 27-31.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities

Repairs to Transmission Line Damaged by Balloon Not an Operating Expense.—An unusual accident to a transmission line was the subject recently of a decision by the Wisconsin Railroad Commission, which found, in valuation proceedings, that the cost of repairing a transmission line short-circuited by an army balloon had been charged to operating expense. The commission held that, if not collected from the government, the expense should be amortized over a period of years.

Standby Plant Excluded from Valuation.—The Wisconsin Railroad Commission in valuation proceedings for the purpose of fixing the rates of an electric utility serving a number of small communities excluded a standby plant maintained by the company on the ground that in any ordinary case of interruption of transmission the necessary repairs to the system could be made in less time than would be required to bring the standby plant, which, moreover, was of inadequate size, into use.

Discontinuance of Service for Non-Payment of Bills.—It is immaterial to the right of an electric service company to discontinue service for nonpayment of bills, the Arizona Corporation Commission held in adjudicating a complaint brought against the Arizona Gas & Electric Company, whether the account was presented to the consumer month by month as it accrued or whether, through a clerical error, a bill for the whole amount was presented at one time, although the consumer should have a reasonable time in which to meet the account.

Watered Stock Not a Factor in Rate Fixing.—Dissenting from the refusal of the Maryland Public Service Commission to grant the full amount of increase in gas rates asked by the Consolidated Gas, Electric Light & Power Company of Baltimore, Commissioner Whitman dwelt on the fact that, contrary to the belief of "intelligent and capable business men," the amount of a company's outstanding stocks and bonds receives virtually no consideration in making rates. "The law," the commissioner observed, "says that a utility is entitled to a fair rate of return on a fair valuation of the property. So, practically, the only two things to be determined are, first, the fair value of the property and, second, the fair rate of return, or the percentage of the fair value to which the utility is legally entitled. In 1912 . . . with these two factors determined and the number of thousands of cubic feet of gas and kilowatt-hours produced and sold during a year, the rates for both gas and electricity were established."

Apportionment of Expenses Between Departments.—In passing upon the reasonableness of rates to be charged by the Potomac Electric Power Company after Sept. 1, the Public Utilities Commission of the District of Columbia, dealing with the deficit in street-railway operations, says: "The Washington Railway & Electric Company and the Potomac Electric Power Company are two separate and distinct corporations, furnishing different classes of service to different groups of customers. Even though the companies were combined, there is no justification either in law or in equity that one class of consumers be required to pay a higher rate than the company's service is worth in order that consumers of an entirely distinct class may enjoy a lower rate than they would otherwise have to pay. There are many authorities to support the commission in its opinion that it is unjust and unreasonable to increase the charge to consumers of one commodity in order that the consumers of another commodity may enjoy an otherwise unremunerative rate." The commission therefore refused to allow a restoration of the maximum charge of electric light and power to 10 cents per kilowatt-hour, the rate existing prior to July, 1917."

Effect of Seasonal Business in Service.—Finding that the Cape May Illuminating Company has improved its service, which had previously been pronounced inadequate, the New Jersey Board of Public Utility Commissioners has permitted it to increase its rates for gas materially, observing: "In reaching its conclusion upon this case the board has in mind the urgent insistence of the representatives of the municipalities that their paramount interest is that service should be continued and their agreement that the board might fix whatever rate in its judgment might be necessary for the company to continue to render adequate service. Cape May, which is the principal territory supplied by this company, is a summer resort. The service is, therefore, very largely seasonal. The company, however, must maintain a plant of sufficient capacity to supply the peak demand created by the summer season. For the rest of the year the demand upon the company's service is comparatively small. Nevertheless, the company is required to maintain its plant ready to serve to the full capacity during the winter months with the necessary overhead expenses for those months as if the demand for service continued undiminished. This makes the condition of the company somewhat exceptional and requires, in order that the company shall continue to maintain service, that it be accorded a rate higher than would be necessary in territory not affected by seasonal variations."

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies

Missouri Commission Upheld in Its Rate-Fixing Methods.—In State ex rel. Southwestern Bell Telephone Company vs. Public Service Commission, the Supreme Court of Missouri has upheld the commission order fixing rates. Such an order, the court says, may be questioned on the ground that the rates are so low as to be confiscatory, that they were fixed arbitrarily without regard to the evidence, or that they were fixed in such an unreasonable manner as to cause the shadow and not the substance to determine the conclusions. None of these conditions existed. Where the commission gave primary consideration to the original cost of the plant, the estimates of the company's engineers of the cost of reproduction, the depreciation and working capital, and also considered the items of engineering, supervision, interest during construction, insurance and promotion and development expenses, and, moreover, reached the same result by taking the book value of the property, deducting property not used, working capital and depreciation reserve and adding 10 per cent for intangibles, it followed a proper rule. (233 S. W. 425.)[*]

Failure to Serve in Its Relation to Competition.—The Pennsylvania Power & Light Company, incorporated in 1913 by the consolidation of thirty-eight small electric companies, had up to Nov. 12, 1917, made no effort to comply with its charter obligations in the township of Macungie, according to the finding of the Supreme Court of Pennsylvania in a suit brought against the company named above by the Fogelsville & Trexlertown Electric Company, which was organized to supply electricity in Macungie because of the failure of the Pennsylvania Power & Light Company to do so. The plaintiff obtained an injunction from the lower court ordering the defendant to remove the pole line which it had built after the organization of the plaintiff company. The Supreme Court, holding that the case was one which should have been brought before the Public Service Commission and settled there in accordance with the policy of the Commonwealth to restrain competition between public service companies, modified the injunction so as to preserve the *status quo* for thirty days, during which time appellee could apply to the commission for an order that would further preserve the *status quo* until final determination. (114 At. 822.)

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[*] The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel—Responsibilities and Association Appointments of Men Engaged in Professional, Executive, Operating and Commercial Branches of the Industry

Harry E. Duren has been appointed manager of the Greenfield (Mass.) Electric Light & Power Company and assumes his new duties about Oct. 1. Mr. Duren was born in 1880 at Fairfield, Me., and was graduated in 1902 from the University of Maine, electrical engineering course. He then went to the Schenectady works of the General Electric Company, taking the student course in the testing department and serving three years at this plant. For two years he was in the engineering department of the company's office at San Francisco, and from 1910 to 1913 he lived in the Pacific Northwest, being occupied in electrical engineering work at Portland and Seattle. In 1913 Mr. Duren returned East, and he has since been employed by various public utilities on special power engineering work. He acted as power engineer for the Turners Falls (Mass.) Power & Electric Company from 1917 to 1919, and for the past two years he has been associated with the Fall River (Mass.) Electric Light Company as a power engineer.

H. E. DUREN

James M. Wakeman, formerly general manager of the Society for Electrical Development, Inc., is at present in England on a visit. Just before sailing from New York the New York Electrical League, of which he was at one time chairman, presented Mr. Wakeman with a gold fountain pen. A host of friends also crowded his stateroom with fruit, flowers and other remembrances at the time of his departure. Mr. Wakeman expects to spend about six months in touring the British Isles, France and Switzerland with Mrs. Wakeman.

Sir Adam Beck, chairman Ontario Hydro-Electric Commission, is receiving the condolences of his friends over the death of his wife last Monday.

Thomas Henry Day, executive secretary of the National Association of Electrical Inspectors, is seriously ill at his home at 59 Deerfield Avenue, Hartford, Conn. Mr. Day had hoped to celebrate his forty-fifth anniversary in the electrical field this month at a meeting of the association. Owing to his illness, however, the meeting will not be held. Mr. Day began his electrical career Oct. 10, 1876, his first task being to install a thermostatic fire alarm in the bunkers of the battleship Tennessee.

Admiral John Keeler Robison, whose appointment as engineer-in-chief of the navy has been confirmed by the Senate, has entered upon his new duties. Admiral Robison was born in Ann Arbor, Mich., Nov. 30, 1870. His early education was obtained in the public schools of Detroit. He was graduated from the United States Naval Academy in 1891, but continued his studies in Paris at the Ecole d'Application du Génie Maritime, where he was graduated in 1894. He attained the rank of past assistant engineer in 1897 and in 1899 was transferred to the line, where he passed through the successive grades, attaining his captaincy in 1916. Admiral Robison probably is best known for his work in organizing the post-graduate school in engineering at Annapolis.

J. K. ROBISON

Throughout his career he has specialized in the study of boilers. He has been an important factor for a number of years in determining the navy's policy regarding their use. It was he who started an information service for naval engineers which grew into publication of the manuals that guide the operation and maintenance of engineering plants aboard ships. He is the author of the navy's first boiler manual.

Carl D. Jackson, who was elected president of the National Association of Railway and Utility Commissioners at Atlanta, Ga., Oct. 12, has been chairman of the Wisconsin Railroad Commission since 1916 and has for an equal time been active in the affairs of the national association. In 1919 he was elected second vice-president and in 1920 first vice-president. He has served on numerous committees, and as chairman of the committee on state and federal legislation in 1920 he did much noteworthy work. During the past year he has served as chairman of the executive committee. Mr. Jackson was born at Evanston, Ill., in 1870 and was graduated from Harvard in 1894. Following graduation he practiced law continuously in Wisconsin until his election to the commission in February, 1915. From 1900 to 1906 he was District Attorney of Winnebago County. Although the Railroad Commission of Wisconsin is not so old as some of the other commissions, having been organized in 1905, it has done much original work under the chairmanship of Mr. Jackson and Halford Erickson, whom he succeeded. This work has been widely studied and followed in many details by other commissions. In railroad affairs the commission's study of the costs of railway movements was the first made in this country. In the public utility field similar studies have been made, notably on rates and forms of schedules. One of the special features of the Wisconsin form of regulation is the indeterminate permit, which does away with the indeterminate franchise. From the start the commission has had regulatory jurisdiction over municipal unilities as well as those privately owned, and this has not only met the approval of the municipalities but has been of decided assistance to them in the operation of their systems and the development of their service.

C. D. JACKSON

Senator Frederic Nicholls, chairman of the board of the Canadian General Electric Company, recently underwent a serious operation at the Toronto General Hospital. Although his many friends have hopes of his early recovery, his condition has not yet shown any large degree of improvement.

E. L. Callahan has been appointed sales manager of the Westinghouse Lamp Company, succeeding Elliot Reid, who has resigned. Mr. Callahan has represented the company as district manager in its Chicago office for six and one-half years, prior to which time for six years he directed the activities of the new-business department of H. M. Byllesby & Company, Chicago. Mr. Callahan was graduated from the Case School of Applied Science in 1900. Immediately on leaving college he received a commission in the War Department as electrical expert and was assigned to work in connection with a proposed submarine cable from Nome to St. Michael's, Alaska. His later experience was with the Westinghouse, Church, Kerr Company, assisting in the preliminary work on the electrification of the Pennsylvania Railroad terminals in and near New York. After this he entered the appliance branch of the industry as assistant manager of the Simplex Heating Company of Boston, later becoming manager of the heating department of the General Electric Company at Chicago. His activities in the industry were such that he was made chairman of the Commercial Section of the National Electric Light Association, he having been one of the founders of the section.

E. L. CALLAHAN

C. R. Alden has been appointed to the professorship in electrical engineering and the deanship of the College of Engineering at the Ohio Northern University, Ada, Ohio. Mr. Alden was formerly director of the School of Engineering, Detroit Institute of Technology. He is an associate member of the A. I. E. E., a member of the Society for Promotion of Engineering Education, and during the war period was lieutenant instructor in the naval school of steam engineering at the Stevens Institute of Technology, Hoboken, N. J.

T. B. Pierce, formerly president of the Kentucky & West Virginia Engineering & Electric Company, is now president and general manager of the Central Electric Company, Huntington, W. Va.

Ralph R. Rugheimer has been appointed representative of the Automatic Reclosing Circuit Breaker Company of Columbus, Ohio, in charge of the eastern Kentucky, Virginia and southeastern Ohio territory.

Marcus A. Curran, former manager of the Omaha (Neb.) district of the Western Electric Company, is now in charge of the Cincinnati (Ohio) office. He succeeds William H. Quirk, who has been transferred to the Chicago office in charge of the telephone department.

R. A. Stinson, vice-president of the Canadian Crocker-Wheeler Company, Ltd., St. Catharines, Ontario, has been made president and general manager of the English Electric Company of Canada, which has acquired control of the Canadian Crocker-Wheeler Company.

F. W. Price, who for several years has been associated with the Apex Electrical Distributing Company, Cleveland, as Southern district manager, has been promoted to the rank of Eastern district manager, taking in the territory of metropolitan New York, eastern Pennsylvania, New Jersey, Maryland, West Virginia and Virginia. R. H. Short, who has been associated with Mr. Price as assistant Southern district manager, is now in charge of the entire Southern district.

Obituary

Col. Spencer Borden, who in the early days had the New England agency for selling Edison electric lighting plants, died on Oct. 17, at the age of seventy-two.

William D. Kohlwey of the Kohlwey-Smith Electrical Company, San Francisco, died in that city on Sept. 25. He was one of the leading contractor-dealers in the state.

Dr. Joseph William Richards, professor of metallurgy at Lehigh University and secretary since 1907 of the American Electrochemical Society, died at his home in Bethlehem, Pa., on Oct. 12, at the age of fifty-seven. Dr. Richards was one of the founders of the American Electrochemical Society nearly twenty years ago and was its first president. He was also one of the founders of *Electrochemical Industry*, the forerunner of *Chemical and Metallurgical Engineering*, published by the McGraw-Hill Company, and during its early years was president of the Electrochemical Publishing Company, which issued the periodical first named. Dr. Richards was essentially a chemist and metallurgist and a teacher of wide influence.

Prof. Alexander Gray, director of the School of Electrical Engineering, Cornell University, died on Oct. 13, after a prolonged illness. Professor Gray went to Cornell from McGill University, Montreal, in 1915. He was born in Edinburgh of a well-known family of engineers. As a boy of fifteen he was apprenticed and worked for seven years at the lathe, bench and drafting board, during which time he attended evening classes and later engineering classes at Edinburgh University. He was graduated from that institution in 1903 in civil and mechanical engineering. Subsequently the Whitworth scholarship, which enabled him to spend two years in the study of electrical engineering at McGill University, was awarded to him. He joined the engineering staff of the Bullock Electric Company, where he was head of the alternating-current motor department, and continued with the Allis-Chalmers Company after the merger. During the five years that he was thus occupied he attained a wide experience in the design, construction and operation of all types of electrical machinery. He went to McGill in 1910 as an assistant professor. A number of patents for electrical apparatus were granted to him, and he also contributed largely to the literature of the industry. His two books, "Electrical Machine Design" and "Principles and Practice of Electrical Engineering," have been widely adopted as university textbooks.

ALEXANDER GRAY

Douglas B. Bronson, superintendent of shops of the Commonwealth Edison Company, died on Sept. 24. Mr. Bronson was one of the group of men composing the original employees of the old Chicago Edison Company, which was started in 1887. In June of that year he entered the service of Leonard & Izard, who did the construction work for the company. The following spring the Chicago Edison Company formed its own construction department, and Mr. Bronson was one of the first foremen appointed. He became superintendent of shops in 1900.

Trade and Market Conditions

Business Reviews, Together with Market Letters
from Important Trade Centers, on the Supply, Demand and Prevailing Prices of
Electrical Apparatus and Supplies

Hand-to-Mouth Buying Giving Way to Near Future Purchases

THROUGHOUT the month of October and also during the latter part of September there has been a noticeably better feling in the jobbing trade and noticeably better buying on the part of dealers and contractors. Virtually all sections of the country are now reporting a gradual liquidation of the high stocks of wiring devices and supplies held both by the contractor and dealer trade and the jobbing trade and a more even degree of ordering. The hand-to-mouth buying of the past ten months seems to be giving way to a carefully laid-out system of purchasing for a moderate period in advance, the result of a gradually improved condition in business in general.

Then, too, the volume of building is on an increase, and there is undoubtedly foreseen a better demand for wiring materials. At least, up to date the increase in buying appears to be more along this line than along any other. With lower prices in rubber-covered wire, weatherproof wire and many items of schedule material, trade in these goods has picked up. In the line of heating devices, air heaters have picked up well in fall demand and sales are on a pretty fair basis. Jobbers have now had to go back to manufacturers to replenish stock moved by the dealers. This is as was expected, because many jobbers signified their intention of waiting for a market to develop before making demands on manufacturers' stocks. This may not be fulfilling the whole function of a jobber, but it is the method frequently used this year.

As an encouragement to the industrial company contemplating new wiring, prices are reduced considerably. Several contractors in the New York City territory in refiguring bids for motor installations and necessary wiring find their proposals in the nature of 20 to 30 per cent below those submitted the first of this year

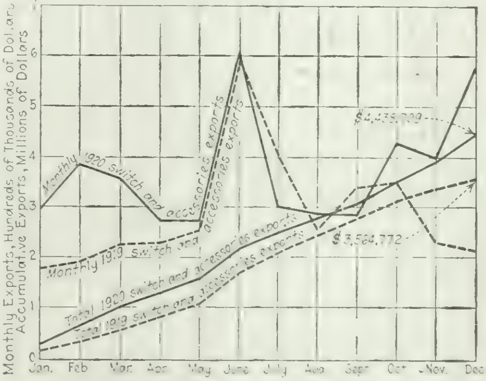
Switch Exports in 1920 Exceeded Those of 1919 by 20 per Cent

EXPORTS of switches and accessories from the United States during the year 1920 stood sixth in order of value of all exports for that year and amounted to $4,438,709. This is an increase of nearly 20 per cent over the value exported in 1919, in amount $3,564,772. It is virtually one-third of the value of motors exported in 1920. Exports by the month taken over the last two years showed few parallels, the outstanding feature being the high peaks registered in the month of July of each year.

In this item too Canada stands at the top of the list, with imports valued at $964,059. Belgium is not far behind, with $775,461. The countries next in order are separated by a wide margin from these two, but fall away in an easy curve one by one. Those countries taking over $25,000 in switches and accessories are shown in the attached table, and the total of the twenty-five so listed amounts to $4,249,034, nearly 96 per cent of total exports. The fifty-three remaining countries taking switches in amounts less than $25,000 each total only $189,675.

Three North American countries—Canada, Cuba and Mexico—lead the other geographical divisions with a value of $1,364,438, or 30.8 per cent of the total exports. European states are a close second, with 30.7 per cent, but it took eight states to make up this amount. Four countries in Asia accounted for 14.5 per cent of the total, imports to China and Japan being almost the same. Five South American states contributed 9.9 per cent, and the islands southeast of Asia took 9.1 per cent of all the switch exports.

This compilation was made by the ELECTRICAL WORLD from figures received from the Bureau of Foreign and Domestic Commerce.



PEAK OF BUYING IN BOTH YEARS HAS BEEN IN MONTH OF JUNE

EXPORTS OF SWITCHES AND ACCESSORIES IN 1920

Canada..	$964,059	Dutch East Indies	$83,273
Belgium	775,461	France	79,112
Cuba.	270,957	Philippine Islands	75,064
China.	264,462	Switzerland	66,403
Japan	249,357	Hong Kong	42,582
Brazil	207,275	Netherlands	40,526
England	156,741	Chile....	36,977
Australia...	153,493	Panama..	35,916
Argentina	134,890	Italy....	32,588
Mexico	129,322	Peru	31,630
Spain...	127,084	Uruguay....	29,702
New Zealand	91,572	Fifty-three other countries importing switches and accessories	189,675
British India	86,823		
Norway..	83,765		
Total			$4,438,709

Active Demand for the Medium to Higher Priced Lighting Fixtures

FIXTURE manufacturers and dealers are finding that the better grade of lighting fixtures have a more ready sale than those of lower price.. There has been considerable building of apartment houses and homes in and around New York which has created a fairly good market for residential fixtures. However, most dealers have fairly large stocks on hand and competition is keen. The demand for the moderately priced to cheaper grades of fixtures does not appear so good. One reason for this is the fact that few apartments for low rental have been built. There are also a large number of small manufacturers whose prices on this class of equipment are much below what would be a profitable price for the larger manufacturer. Price competition is much worse in the latter class.

Commercial unit types of fixtures are having a fair sale in business buildings. These are not only being installed in new establishments but in many instances old-type fixtures are being replaced. The educational campaigns for better lighting are producing results in the inquiries which have been received from commercial and business houses. Industrial lighting fixtures are also moving fairly well, but the demand is not so strong as for the commercial type.

Stocks of nearly all types are good and manufacturers are making immediate shipments from factory stock frequently phenomenally quick.

Some Comparisons Between American and German Motor Prices

FIGURES have recently been received from what has been ascertained to be an authoritative source giving prices of German-made electric motors calculated for export, including expenses of export and of packing, f.o.b. German port, except duty. This authority finds from experience, however, that, although interestingly low, the prices are believed to be based upon higher exchange rates than exist at present and are subject to alteration when an actual bona-fide purchaser attempts to place an order. The home office frequently refuses to confirm the order except at a higher rate.

AMERICAN AND GERMAN MOTOR PRICES

	German		American	
Hp.	R.p.M.	Price in Marks	R p.M.	Price
Three-phase, squirrel-cage, 220-volt:				
1	1,400	1,650	1,800	$59 40
5	1,400	3,500	1,800	103.50
5	925	4,200	900	144 90
Three-phase, slip-ring, 220-volt:				
5	1,400	4,500	1,800	$180 00
10	1,400	6,800	1,800	270 00
50	1,400	22,500	1,800	628.00
Direct-current, 220-volt, shunt-wound:				
5	1,100	5,300	1,100	$217 00
7.5	1,800	5,300	1,800	200 00
15	1,650	7,400	1,700	297.00

The motor trade in the United States probably fears little from German competition in this country, but must certainly run against it when considering the South American field. Experience in that field has established frequent examples of refusal to confirm agents' offers when these were sent as orders to the manufacturer of equipment in Germany.

A comparative table is presented herewith giving the German prices and representative American prices for motors as near similar as possible. The German motors are quoted as new with a one-year guarantee. No heating specifications are given. All quotations are given without pulley, base and starter. The mark on Oct. 18 was quoted at 0.60 cents.

More Co-operation Needed Between Sales and Credit Departments

AS A MEANS toward better credit conditions in the electrical jobbing and manufacturing field it has been brought forth that a closer co-operation between the salesmen, the sales manager and the credit manager would put the credit situation on a higher plane. This is particularly true, it seems, on new accounts.

There is always a certain amount of satisfaction in making a new sale and gaining a new account, which is frequently the only aim of the salesman. This would seem to apply more particularly in the case of the jobber's salesmen. The salesman is frequently the only point of contact between dealer or contractor and the jobbing house, and he would seem to be the logical man to establish a credit rating for his new customer. If the salesman felt that he was personally responsible financially for the credit of each new account, he would undoubtedly be more careful in opening these new accounts than he otherwise would be by putting the financial responsibility up to the jobbing house. The credit manager of the jobbing house pulls down his Dun or Bradstreet, and if the customer in question has a clear rating there he is generally passed as "O. K." In many cases that have come to notice a strict financial risk has been taken on in some of the accounts so listed.

Why cannot the salesman when he is making new connections for his house quietly sit down with the new customer and get from him his banking connections, the names of some persons with whom he does business, etc.? A check-up with other possible companies doing business with this customer would make this credit check much more complete.

In the district covered by the New York division of the National Electrical Credit Association the number of accounts reported to that body has increased considerably since the middle of this year, and the total of reported accounts has also increased. There have been more accounts for small amounts reported in the last four months. The total to date is well above that covering the same period in 1920.

The whole question of credit is a serious one at this time, and the increasing number of small amounts is probably due in some part to the lower prices of materials and to new customers coming back into the market and being accepted with too little credit establishment. Greater activity in this connection on the part of the jobbers' salesmen would probably accomplish much in overcoming this condition

Metal Market Situation

AFTER several weeks of activity the copper market has once more quieted down. Many of the large consumers have withdrawn from the market temporarily and it has been possible to supply the light current demand with copper at 12⅞ to 13 cents delivered. Large producers, however, will not quote under 13 cents. The situation may have been influenced by heavy liquidation in London, where spot declined £3 13s. to £65 15s.

Advices from the Intermountain regions show that stronger prices may continue throughout the year in response to a moderate improvement of export demand and a seasonable increase in consumption of the metal. As a usual thing there is a good deal of buying in November and December for spring delivery to manufacturers. Another encouraging factor is the consumption of the excess supply of copper at the rate of 40,000,000 lb. per month, instead of 25,000,000 lb. as had been expected when the mines were closed down early last April.

The British government has announced the sale of its stock of brass scrap, totaling, it is said, about 150,000 tons. To this transaction is attributed the break in the London copper market. It is felt in some quarters that a good portion of this brass may reach this country. Exports to date this month have been good. A price of 13 cents f.a.s. prevails.

Possibility of lowered freight rates may account for lack of buying for December shipment. Prospect of a rail tie-up has affected buying little, as a strike would prevent movement of copper products as well as copper.

NEW YORK METAL MARKET PRICES

	Oct 11, 1921	Oct 18 192
Copper	£ s d	£ s
London standard spot	69 7 6	65 15
	Cents per Pound	Cents per Pou
Prime Lake	13 00 — 13 25	13 00
Electrolytic	13 00	13 00
Casting	12 62½	12 37½
Wire base	14.50	14 50
Lead, Am. S. & R. Co. price	4.70	4 70
Antimony	5 00	4 90
Nickel, ingot	41 00	41 00
Sheet zinc, f.o.b. smelter	10 00	10 00
Zinc, spot	5 12½	5 15—5 20
Tin, Straits	27 25	28 00
Aluminum, 98 to 99 per cent	24 50	24 50

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	10 00 —10 75	10 50 —10 87½
Brass, heavy	4 75 — 5 25	5 00 — 5 50
Brass, light	4 50 — 4 75	4 50 — 5 00
Lead, heavy	3 50 — 3 87½	3 50 — 4 00
Zinc, old scrap	2 25 — 2 37½	2 25 — 2 37½

THE WEEK
IN TRADE

Prices When Quoted Are Those Prevailing at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for all Eastern Points

CONTINUED improvement in virtually all sections of the country is the dominant note not only of the electrical industry but of general business conditions. Wire is, of course, leading in business booked, but there also has sprung up a heavy demand for all sorts of small heating appliances. A Chicago jobber this week reports a shortage of flatirons and curling irons, and sales of air heaters have improved there also. The beginning of the rainy season is pushing sales of heating appliances on the Pacific Coast.

Sales of storage batteries for road trucks are reported improving in New England. Retail sales are picking up in Boston, New York, St. Louis and in the Far West, and this buying is reacting immediately on jobbers and manufacturers.

The construction outlook has improved in Chicago, while the number of building permits granted in San Francisco and Los Angeles indicates a building boom in that section. Atlanta reports better collections in September than for any month since February, and St. Louis lists improvement in the Southwest. Collections in Boston are on a sixty-day basis. Chicago jobbers report some improvement.

NEW YORK

Conditions in the electrical trade continue gradually to improve, and jobbers generally report an increasing volume of business. Buying is still more or less of the hand-to-mouth nature, contractors purchasing their wiring supplies as the work in hand requires. Orders, however, are coming in to the jobbers more often and stocks are moving much better. The fact that several jobbers have found it necessary to increase their clerical force to take care of the increase in the number of orders is a good indication of the trend of business. Prices remain unchanged since last week, although there is some buying of rubber-covered wire and armored conductor because of the increased quotations on basic materials.

An active demand is reported for single-unit commercial and industrial fixtures. Salesmen working on this class of business have developed a considerable market through replacing old types of fixtures in commercial and business buildings. Of the two types, the commercial lighting unit is more in demand. Air heaters have moved well during the past week, and jobbers who carried stocks over from last year are well satisfied with the results. Other heating appliances show more activity than heretofore, and some orders for the holiday trade have appeared.

Collections appear to be improving slightly, jobbers reporting current credit sales on a thirty to sixty-day basis.

Conduit.—Orders continue to be for moderate quantities with the demand steady, but there seems to be no inclination on the part of contractors to lay in stocks. Prices quoted this week were as follows: For ½-in. black pipe in 2,500-ft. lots, $54 to $55; ¾-in., $69 to $71, and 1-in., $99 to $101. Galvanized pipe in the same sizes was quoted at $59 to $62, $76 to $81 and $110 to $116. Jobbers' stocks are fair to good in most sizes.

Flexible Armored Conductor.—Demand for this material continues strong. In addition to the sales to contractors for their immediate requirements there is considerable buying based on the belief that armored conductor will command a higher price in the near future. No price changes were reported this week. No. 14, two-wire, single-strip, is quoted at $43 per 1,000 ft., and double-strip at $44.50 per 1,000 ft., in lots of that quantity. Jobbers have fair stocks.

Rubber-Covered Wire.—Demand is moderate and orders for small quantities, although prices are stiffening and an advance is looked for. In lots of 5,000 ft. No. 14 rubber-covered is quoted at $6.35 to $6.60 per 1,000 ft. Stocks generally are good to large.

Lamp Cord.—Sales are a little better and silk cord is in demand for holiday business. Prices remain as last quoted, No. 18 cotton, twisted, selling for $12.30 per 1,000 ft. and No. 18 parallel at $14.90 per 1,000 ft.

Heating Appliances.—Buying is better than heretofore, and the appliances other than flatirons and toasters are beginning to move. There is still a shortage of some makes of flatirons, toasters and curling irons, although jobbers' stocks of other items are fair to good. Some orders for grills, percolators, stoves and similar appliances for holiday business have appeared.

Loom.—The demand is small and jobbers' stocks are limited. In 1,000-ft. lots the 7/32-in. size sells for $19.25 and the ¼-in. size for $21 per 1,000 ft.

Heaters.—The cool weather has stimulated the sale of heaters and jobbers report an active demand. The carry-over from last year has been partially disposed of and stocks are moderate.

CHICAGO

Coincident with the strengthening of copper prices, jobbers here report much better sales of weatherproof and rubber-covered wire and flexible armored conductor. This has changed the tone of jobbing opinion to one of mild optimism. Another indication of at least fair business during the pre-holiday months is seen in the activity of small heating appliances, such as flatirons, curling irons and air heaters. One large jobber already has reported some shortage of flatirons and curling irons. An improvement in collections during the week is reported, a few jobbers having got them down to a forty-day basis on current sales.

The labor situation has changed little during the week, and there is confidence that the factors concerned will reach a fair settlement before very long. Building permits continue to gain over last year, those for the week ended Oct. 13 showing an increase of 129 over the similar period in 1920, with a listed value $1,656,800 greater.

Chicago utilities are in a very good position as far as their coal supply is concerned, and the threatened railroad strike is not causing much worry on that score. The Commonwealth Edison Company has a thirty-day to thirty-five-day reserve, while that of the Public Service Company of Northern Illinois is even better.

Wire.—The bare-wire base this week ranges from 15 to 16 cents, showing a strengthened market. Weatherproof prices also are ranging from 15 to 16 cents per pound in 1,000-lb. lots. The demand for No. 14 rubber-covered wire is strong, and it is quoted at a price varying from $6.50 to $6.75 per 1,000-ft. in 5,000-ft. lots. Jobbers report their stocks ample.

Rigid Conduit.—Quotations continue on about the same basis as last week. Jobbers report demand fair and stocks good in all sizes. The following are representative prices: ½-in. black pipe in 2,500-ft. lots, $48 to $50 per 1,000 ft.; ½-in galvanized, $51 to $53.

Flexible Armored Conductor.—Prices have stiffened, and No. 14 two-wire, single-strip, is quoted from $50 to $52.50 per 1,000 ft. in 5,000-ft. lots. Movement is good, and stocks are easily sufficient to handle the demand.

Dry Cells.—Little has developed recently on this item, movement being slow but comparatively steady. Stocks are about normal. The standard cell is quoted at $30.65 per 100 in barrel lots.

Lamp Cord.—No. 18 cotton twisted is quoted at $15 per 1,000 ft. Demand continues steady and jobbers' supplies are easy.

Tape.—Prices on this item are holding exceptionally well, owing probably to the recent flurries of the cotton market. There has been little increase in activity.

Heating Appliances.—Flatirons and curling irons still lead heating devices in number of sales although the demand for percolators, toasters and grills has increased noticeably during the last few weeks. Air-heater sales have been very good with prices varying from $10 to $11 per unit.

High-Tension Equipment.—The demand for this material is increasing constantly and local manufacturers report good production.

BOSTON

Trade is gradually picking up in most lines, and distributers are feeling more hopeful as the diversification of orders is broadened. No large buying movement to replenish stocks lowered by months of liquidation is yet apparent, but demands upon manufacturers are increasing, and this is not all due to seasonal activity. Collections are reported better, and some houses are working on a sixty-day basis. Prices held stable in most lines last week, barring weakness in some large commitments due to close competition. Betterment work in industrial plants is showing a little more life, and central-stations are intensively cultivating loads within reach of their present systems, with occasional ventures into the extension field. Building operations are absorbing considerable material, and suburban residence construction is very active in some districts. There is a general disposition to discount the adverse effects of a railroad strike, sentiment in New England being strongly against a walkout.

Motors.—Inquiries are improving decidedly, and sales reflect better conditions. The last six weeks have shown a much healthier tone, although the demand is still too light to put much pressure on producers. Motors of 50-hp. rating and below are in chief demand, though occasional sales of larger units are now taking place.

Radio Apparatus.—Since midsummer business has been very active. September was the best month a leading manufacturer in this district ever had, sales being maintained equally well this month. Prices are 10 to 15 per cent lower than in the early fall on representative products.

Wire.—Moderate sales continue, and prices reflect close competition. No. 14 rubber-covered sold at $6.25 per 1,000 ft. in 5,000-ft. lots Monday, and prices were quoted at $6 f.o.b. factory on 25,000-ft. lots, per 1,000 ft. Labor difficulties, which held up production in one district, are reported to be over. Weatherproof is moving slowly, base price being 15½ cents.

Storage Batteries.—Sales for road-truck service, notably for Rhode Island bakery and ice-cream delivery use, are improving perceptibly. Industrial truck batteries are quiet, and it is reported that about fifty industrial trucks have been sold in New England this year.

Porcelain.—"Nail-It" knobs are moving better, barrel-lot price being $18.50 per 1,000. Tubes are also in better demand, and the 3-in. x ½-in. tube sells for about $6.20 per 1,000 in barrel lots. Stocks are satisfactory.

Flexible Armored Conductor.—No. 14 single strip sells for $44.68 to $45 per 1,000 ft. in 5,000-ft. lots. Demand is fairly good, and stocks are easily meeting it.

Loom.—Prices continue weak, notwithstanding the increased cost of cotton. The $\frac{7}{32}$-in. size is quoted around $16.50 per 1,000 ft. in 5,000-ft. lots.

Appliances.—Washers and cleaners are a little more active, and socket devices for table use are showing better movement. Stocking for fall trade is slow to materialize, but it is expected that more active movement will be noticeable in the next few weeks.

ATLANTA

Though there is little marked change to be reported in the section for the week, a continued general betterment in business conditions is in evidence. Building permits in Atlanta for the first week in October exceeded $250,000 in value, while bank clearings were more than $5,000,000 in excess of the prior week and the largest for any week since January. Postal receipts are reported very largely increasing, the heaviest day in this city's history being recorded last week. The larger contracting firms, whose business has been somewhat dull for a considerable period, report a reawakening in the activity in the industrial field which has resulted in a large number of inquiries being received by jobbing firms for quotations on materials entering into construction for this class. The smaller contracting business continues to show a well-maintained volume, and purchase of line material by central-station companies is increasing quite satisfactorily. A general survey of the situation seems to indicate that the last four weeks have witnessed an increase of 25 per cent in the volume of bona-fide business. Money realized from crops is beginning to be in evidence, and all wholesale lines report their collections for September as having been the best for six months past.

Flexible Armored Conductor.—Low and somewhat unstable quotations on this article have materially stimulated sales. Stocks are ample with the price of No. 14, two-wire, at $55 per 1,000 ft. in 1,000-ft. lots.

Stamped-Steel Boxes and Covers.—Considerable activity is to be noted, one order alone this week amounting to 14,000 boxes, the largest single order since 1914. There have been no changes in prices in the past four weeks. Stocks are ample in all standard sizes.

Rigid Conduit.—Sales are holding up satisfactorily, especially in the ½-in. size, in which there existed a temporary shortage, but which was relieved this week by prompt factory shipments. The black seems at present to have a shade the better popularity. No recent price changes are reported, but there has been some price cutting in the slower-moving sizes.

Printing-Press Equipment.—This line has again become active, especially in motor sizes of 7½ hp. and under. Sales of the three-phase type amount to approximately 90 per cent of the business, most of the single-phase type going to the Florida territory. Stocks of alternating type are in fairly good shape, while local stocks of the direct-current class are being steadily reduced to absolute minimum because of a general slackening in the demand.

Oil-Engine Generating Sets.—Manufacturers report a number of recent sales in this line for sets of 100 kw. and over, this apparatus going to municipalities in southern Alabama, Florida and Georgia. Shipments are on a thirty-day basis and prices are steady. A number of inquiries are still in hand awaiting final action.

Air Heaters.—The recent cold snap has caused a brisk movement in the retail field of this line, one dealer alone having disposed of 200 in this city in the last few days. Jobbers' stocks are heavy, and there is little likelihood of their reordering in the near future.

Industrial Motors.—Sales are becoming quite active. The larger power companies' requirements for power-factor correction are causing an increased movement in the synchronous types, mostly in the 550-volt and 2,300-volt, three-phase variety.

Portables.—Fall shipments for holiday stocks are beginning to be received, and retailers expect an excellent holiday season in this line, which is stimulated by price reductions of from 50 per cent to 75 per cent under prices of last year. Sales to date are confined mostly to the larger cities.

ST. LOUIS

Dealers and contractors until recently made purchases in only very moderate amounts and maintained stocks at levels much lower than would be the case normally for the volume of business prevailing, but now, with stocks depleted and with confidence somewhat restored, they are placing orders for larger quantities and are building up their stocks to a more normal basis. This feature of the market accounts to a large extent for the gradual improvement in jobbers' business, which continued to show advancement last week. To no class of goods is especial favoritism being shown.

The same effect is noticed in business generally in this territory, and as a result industrial plants are becoming more active. During the week one of the largest steel mills in the district resumed operations after a four-month shutdown and a large glass plant, which had been closed since about the first of the year, started its furnace fires. The shoe factories are running at about 80 per cent of capacity and the two tire factories here at full capacity. The metal industries have increased production somewhat, but their business is still very quiet.

Credit conditions show little change, the average basis of collections remaining at about sixty days. The long-outstanding accounts are being slowly liquidated and new obligations are being quite promptly met. Some improvement in the South is observed, but because of the vast amount of indebtedness in that section it will be a considerable time before credit conditions there can approach normal.

Heaters.—The principal activity this week was in this line. Some of the jobbers' stocks have been exhausted, and orders are being placed with the manufacturers. The dealers are playing closely and are buying only for short-term requirements.

Flatirons.—Excellent movement is reported, one jobber having no stock and a large amount of back orders. Of the heating appliances, flatirons are by far the best sellers this season.

Ranges.—Movement is very quiet, though some improvement is found in Kansas and Missouri owing to the lower prices and more active work on the part of the dealers Very little range business is being done in St. Louis.

Lamps.—Owing to the slack industrial demand sales ar somewhat less than normal, though the recent price reduction has aided buying.

Safety Switches.—Particularly good demand is found for a new type of two-wire entrance switch, which is selling for $1 retail. All other entrance switches are selling well, but there is very little call for the industrial styles. A representative type of three-wire entrance switch is selling for $1.88.

Wire.—The demand for the small sizes of rubber-covered is maintained. A representative quotation this week is $6.30 per 1,000 ft. in 10,000-ft. lots. In the industrial sizes, especially 250,000-circ.mil and larger, virtually no sales are being made. There was a small demand during the week for weatherproof wire. The base on weatherproof and bare is from 15½ cents to 16 cents per pound. Ample stocks are found in all but No. 14 rubber-covered, where some are scant.

Dry Cells.—Strong demand continues, with the regular cell quoted at 31 cents and the igniter at 32 cents, both in barrel lots. Dealer stocks are rather low, but ample stocks are in the hands of the jobbers.

Metal Molding.—Though municipal wiring requirements are conducive to better demand, the small amount of construction work has kept the volume of sales low. Stocks are light but complete. The three-wire size is being priced at $5.70 per 100 ft.

Motors.—Some improvement in the call for fractional sizes is found, but their movement is still quiet. Further improvement in sales of sizes from 5 hp. to 50 hp. is reported for the week.

SAN FRANCISCO

Business is steadily improving, and it is noticeable that even in the Mission district of San Francisco, where most of the union men affected by the long building strike live, there is a better retail business. All dealers report a marked increase in the number of small jobs, evidently because of the new lower labor charge of $1.75 an hour. A rail strike would cause a serious dislocation of business to the Pacific Coast, which depends upon Central and Eastern factories for its supplies and whose manufactures are not in their sum total well proportioned.

Los Angeles is increasing its headlong rate of building, while San Francisco shows a normal increase over last year. The following fiures for building permits for September, 1921, are self-explanatory: San Francisco, $2,577,889; Los Angeles, $8,303,665; Oakland, $1,478,739. The corresponding figures for September, 1920, were: San Francisco $2,053,446; Los Angeles, $7,231,440; Oakland, $798,169.

Ironers.—The average ironer now retails for from $150 to $170, there having been a drop of about 10 per cent. There is a marked increase in the popularity of electrically heated ironers.

Heating Devices.—There is a temporary slump in sales, especially for higher-grade irons. Some small disk stoves are being featured because of their price. There is also an increase in waffle-iron sales, and this device has now become a regular instead of a rather special stock iron for the dealers. Toasters and percolators are moving rather slowly.

SALT LAKE CITY—DENVER

The old characterization of business conditions, "about the same," has clearly given way to the more hopeful response, "showing slight improvement." The change in comment is so universal as to warrant a belief that we have passed the lowest point of depression and are now slowly on the upward trend. Better times are reflected in a slight easing of the money market, better liquidation of outstanding paper and a freer tendency to buy on the retail market. As a consequence of the better demand retail electrical merchants are stocking in better quantities, affording a much-needed relief to jobbers. A summary of the metal market, so important in this region, shows some encouraging features this week.

Vacuum Sweepers.—The fall sales and advertising campaigns are stimulating considerable trade. Dealers still confine their orders to small consignments, three to six sweepers being the average number. Stocks are more than ample. Prices show a tendency to hold.

Washers.—Recent reductions on the retail prices of washers average about 10 per cent. The market is somewhat disappointing. Many of the jobbers are overstocked.

SEATTLE—PORTLAND—SPOKANE

The one outstanding event of the week was the meeting in Seattle of the port authorities of America. One of the concrete results of interest to the West Coast which seems fairly well assured is the linking of the Eastern and Western ports and their proper development for the economical handling of Western lumber shipped East via the canal route. Lumber during the past two weeks has experienced the most active market of the past two years. Lumbermen generally, however, are not inclined to the opinion that this improved condition will be lasting.

Of particular interest in electrical circles was the opening of the first "Home Electrical" in the Northwest, under the direction of the Northwest Electrical Service League, in Astoria, Ore., on Oct. 15. Electrical interests of Portland report the volume of business as continuing good. The rainy season has started and is acting as a stimulus in the movement of lamps, air heaters and other seasonal goods. Jobbers of Seattle continue to be optimistic and seem well satisfied with the trend of business in electrical supplies. The number of sales is showing a healthy increase, as is also the total volume of business. Orders are for the most part small, with large single orders conspicuously absent. Collections, which follow sales closely, are slightly better.

Prices have remained steady during the week, with copper showing a tendency to strengthen further. Bare copper in large sizes is reported difficult to get since manufacturers are inclined to look for a better market. Ironers are moving well. Portland jobbers report a scarcity of No. 14 rubber-covered wire. A slight price advance has been put into effect.

Contractors of Portland report business good, the greatest activity being in residence wiring and wiring of the smaller business places, although some large jobs are in prospect. Competition is very keen on medium-sized jobs, and contracts are being made on a very small margin. One contractor says that the average residence being wired at present has from six to eight baseboard receptacle outlets and that, owing to the demand for more convenience outlets as well as more lighting and switch outlets, a residence wiring contract is no longer a single-coil job. Dealers find business improving somewhat.

Manufacturers' Activities

Devoted to the Business Side of Manufacturing, Distribution and Sales, News from Jobbers and Foreign Fields and a Record of New Devices and Trade Literature

I. R. Nelson Company Opens New Department

The I. R. Nelson Company, Bond Street, Newark, N. J., announces the opening of a new department for the sale of electrical supplies to industrial concerns. The company will handle electrical supplies including wire, fuses, brushes, friction tape, insulating materials, sockets, Mazda lamps, etc. The company also does an electrical repairing and manufacturing business.

Manufacturers' Representatives Discuss Motors

More than 100 central-station men, contractor-dealers and industrial-plant electrical department employees from points in southern New Hampshire met at the Chamber of Commerce Rooms, Manchester, N. H., on the evening of Oct. 5 to listen to talks on various aspects of motor design and application by Leon E. Smith, George A. Wortman and E. A. Hancock of the General Electric Company. E. C. Foster, president of the Manchester Traction, Light & Power Company, welcomed the delegation to Manchester, and George H. Sander, commercial manager of the company, presided. Following the addresses the motion-picture reels "The Conquest of the Forest" and "The Light of a Race" were shown under the direction of M. R. Griffeth.

Employee Training Plan Perfected by Penn State College

Pennsylvania State College has worked out a plan for employee training which appears nearer to the ideal than anything yet attempted. The methods adopted by this institution have long since passed the experimental stage and are in operation in a large number of plants in Pennsylvania, where it has been demonstrated that an efficiency far beyond that of ordinary class instruction can be obtained.

For ten years past a staff of highly trained men in industrial education has been maintained at the college, and large sums of money have been spent in studying methods of conducting apprentice schools and night classes in the industries. This staff, known as the engineering extension division of the college, has personally organized and operated hundreds of classes in the best-known plants in Pennsylvania, such as iron and steel, electrical equipment, machines and tools, automobile parts, textiles and others common to the state. Each such enterprise was accompanied by an intensive study as to the characteristics which entered into its success or failure. The natural result has been that improved methods were continually adopted until it can now be virtually assured that a company can inaugurate a general training policy with far more success than is generally believed possible.

Special textbook material has been prepared for shopmen. The lessons were prepared after an intensive study as to requirements and cover almost every subject which has a daily use in industry. Upward of thirty lesson pamphlets have been prepared and are not only being used widely by the shops but by school boards, Young Men's Christian Association classes and other organizations having an interest in the educational welfare of their community. This lesson material is available at almost cost price to any who are interested in industrial education.

A. L. Cushman Buys Back Cushman Electric

On Oct. 15 A. L. Cushman consummated the purchase of the Cushman Electric Company, Concord, N. H. As was noted in the Aug. 20 issue of the ELECTRICAL WORLD, A. L. Cushman had then become vice-president, Garrett M. Ross president and Alexander P. Achimore manager of the newly organized company, continuing the name of Cushman Electric Company.

Mr. Achimore's health recently has been such that it has been necessary for him to retire from business for the time being, and both he and Mr. Ross have sold their interests in the company to Mr. Cushman. Mr. Achimore, however, expects to return to the power engineering department of the Western Union Telegraph Company on his recovery. Mr. Ross is continuing his business as formerly at 255 Greenwich Street, New York City. The special products of the Cushman Electric Company are motors for typesetting machinery and motor-generator sets for telegraph use.

Westinghouse Lamp in Midst of Store-Lighting Campaign

The Westinghouse Lamp Company, 165 Broadway, New York City, has put on an extensive sales campaign for the period of Oct. 15, 1921, to Jan. 1, 1922, under the title "Restoring the Store." This competition is open to all salesmen of the Westinghouse Lamp Company and is put on to stimulate lamp sales in stores now wired by improving and increasing the illumination, to introduce electric lighting in stores now using other forms of illumination, to improve and install new equipment for show-window lighting and to increase intensities of store lighting to 5 to 12 foot-candles. The company states that in a survey in a metropolitan center the fact was revealed that out of 23,000 stores of various kinds, 25 per cent have a lighting intensity of more than 5 foot-candles. Only 6 per cent of the stores have intensities of illumination of 8 to 12 foot-candles. From this it is taken that eleven out of every twelve stores offer opportunities for the electrical contractor-dealer.

The mediums which the salesmen will use are circular letters, newspaper advertisements, window displays and personal contact. Preliminary arrangements comprise contact with B agents, A agents, the central-station company and the fixture manufacturer. The advertising activity comprises a portfolio illustrating and describing the mailing program of the agents, including window display, blotter, folder, lantern slide, newspaper electros, circular letter campaigns and newspaper advertising. The sales activities comprise agents' canvass of stores, assistance by the Westinghouse Lamp Company and demonstrations and trial installations. Much of the success of the campaign depends upon the co-operation between the Westinghouse salesmen, the B agents and the A agents served by the B agent.

The advantages pointed out to the A agent are an increase in the sale of lamps and other electrical material, the attracting of more attention and prestige to his establishment and greater publicity for his services. The answer to the campaign, of course, will not be limited only to increased sale of lamps but also to increased sale of store and window-lighting equipment and wiring devices entering therein.

Export Association Opposes American Valuation Plan

The American valuation plan as part of the proposed tariff bill came in for its share of criticism during the sessions of the American manufacturers' Export Association held at the Waldorf-Astoria in New York City on Oct. 5 and 6. Considerable discussion took place on this phase of the tariff bill, which was the subject assigned to Thomas J. Doherty of the National Council of American Importers and Traders. The other side of the question was championed by Judge John F. Zoller, General Electric Company. As an outcome, however, a resolution was adopted opposing the American valuation measure on the ground that, being a new system, it would add to already unsettled world conditions.

"How to Retain and Increase Export Trade" was the theme of the convention, and among the topics discussed were "Some Present-Day Conditions in Argentina, Brazil and Uraguay," "Problems of Exchange," "Foreign Credits and Investments" and "Our Relation to the Present European Situation." Special attention was given to the tariff with Cuba, and a resolution was adopted recommending to Congress and to the Secretary of State a most careful consideration of the effect on trade between the United States and Cuba of an undue increase in the tariff.

For the coming year the following new officers were elected: President, Myron W. Robinson of the Crex Carpet Company; vice-presidents, H. S. Demarest of Greene, Tweed & Company, J. S. Lawrence of Lawrence & Company, E. M. Heinz of the Fort Dearborn National Bank, Frank H. Taylor of the S. S. White Dental Manufacturing Company, Julius Goslin of the Jubert & Goslin Machine and Foundry Company, and V. H. Pinckney of the California Packing Company; treasurer, Philip B. Kennedy of the First Federal Foreign Banking Association.

For a period of three years the following directors were elected: W. S. Gavin, E. I. du Pont de Nemours Export Company; J. Walter Drake, Hupp Motor Car Corporation; M. A. Oudin, International General Electric Company; F. K. Rhines, General Fireproofing Company, and E. W. Droosten, Robbins & Myers Company.

Westinghouse Establishes Branch at Huntington, W. Va.

The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., is planning to establish a new branch at Huntington, W. Va., to supply the demands of its patrons in the states of West Virginia, Ohio, Kentucky and Tennessee. This branch will occupy a three-story building, 100 ft. square, located at the corner of Ninth Street and Second Avenue.

Appleton Electric Takes Over Anderson Company

A. I. Appleton of the Appleton Electric Company, 1703-13 Wellington Avenue, Chicago, manufacturer of boxes, bushings, fuses, etc., has acquired the controlling interest in the Anderson Electric & Equipment Company, 154-160 Whiting Street, Chicago, from B. J. and O. E. Grigsby. Among the products of the Anderson company are the "Auto-Reelite" and "Reelite" extension automobile and electric lighting devices.

Schedule Out on Electric Motors for Gaseous Mines

Information regarding the conditions under which electric motors designed for use in gaseous mines may be submitted by manufacturers for testing by the United States Bureau of Mines is contained in Schedule 2-B, "Procedure for Establishing a List of Permissible Electric Motors," which has just been issued. The Bureau of Mines is prepared at its Pittsburgh experiment station to conduct tests of motors and their electrical accessories, such as are used in gaseous mines to operate conveyors, coal-cutting machines, electric drills, pumps, coal-loading apparatus and similar equipment, for the purpose of determining the permissibility of such motors and their accessories and approving them as permissible for use in gaseous mines or dust-laden atmospheres. Copies of the schedule may be obtained by addressing the Director of the Bureau of Mines, Washington, D. C.

Westinghouse Lamp B Agents to Hold Second Meeting

When the second meeting of the B agents of the Westinghouse Lamp Company was called at the factory in Bloomfield, N. J., on Oct. 5, to extend over the succeeding two days, it was found that B agents from as far west as Waterloo, Iowa, and even Portland, Ore., were present. The attendance at the meeting numbered forty-six. The principal result of the meeting was the vote of confidence in the stability of the lamp business which was given by those present and the assertion by virtually all of the representatives that their lamp business had fallen off less than any business which they handled.

MANY SECTIONS OF COUNTRY REPRESENTED AT WESTINGHOUSE LAMP B AGENTS' MEETING

Special emphasis was put upon stock turnover of lamps. Although these are a consigned commodity, they are considered the sugar of the trade, and energy must be spent to turn them over the maximum number of times possible in a year. To facilitate the maintenance of stock, the company has discontinued its scattered warehouses, and it is now concentrating its lamp stocks at Bloomfield, Indianapolis and San Francisco.

In the education of the dealer in lamp activity it was brought out that the jobber was the actual educational factor in this work and that it was up to him to help out his dealers in building up their lamp market. In the publicity line it developed that it would be necessary in the future for dealers to be more explicit in their orders for dealer help in advertising.

Too much has been taken for granted in lamp sales, and much of the business is being allowed to drift in of its own momentum. In order to get the real business the jobbers' salesman must act as lamp salesman and must really know illumination.

A New Line of Wiring Devices Brought Out By the General Electric Company

A new line of wiring devices comprising several types of switches and connectors for household electrical appliances and motor-driven devices has been developed and placed on the market by the General Electric Company, including a compound through-cord switch; a new miniature single-pole flush tumbler for use on motor-driven devices, such as automobile lighting and ignition systems, washing machines, adding machines, signals, etc.; a miniature cord connector for use wherever a small separable connection is desired on motor-driven devices; a series tap connector, which is particularly applicable for attaching electrically-operated sewing machines; an attaching plug for connecting the cord in the handle of vacuum cleaners to the motor; a motor plug for use in the body of motors; the G. E. thumb button switch, adapted for vacuum cleaners, portable hand drills, vibrators, etc.

The F. D. Lawrence Electric Company, 219 West Fourth Street, electric supply jobber, has increased its capital stock from $50,000 to $300,000.

The Cutter Company, Philadelphia, manufacturer of the "Re-Lite" circuit breakers, announces that Maxwell B. Cutting, formerly of its Chicago office, has established a branch at 1318 Chemical Building, St. Louis.

G. E. Wise, Detroit, dealer in electric equipment, has removed his office from 845 Book Building to the General Motors Building.

Foreign Trade Notes

THE EUGENE F. PHILLIPS ELECTRICAL WORKS, LTD., Montreal, Que., manufacturer of copper electric wire, is planning to erect a plant at Brockville, to cost about [illegible]. The proposed plant will utilize 3,000 electrical horsepower and will give empoyment to about 600 people.

GERMAN COMPETITION IN ELECTRICAL GOODS IN PERU.—Electrical goods are suffering slightly from German competition in Peru, according to an economic report submitted by Trade Commissioner W. E. Dunn from Lima, under the date of Aug. 29, in which he states that German competition in regard to electrical goods, and especially in heavy industrial machinery, does not seem to be serious. Prices offered are a little more favorable, if any, than those of American manufacturers, but there does not seem to be sufficient reason for dealers to change to German goods. American machinery has a very good reputation in Peru and is generally considered superior to the German product. Two notable exceptions, however, are known where German firms have secured two large contracts; one for new equipment for the Paramonga Sugar Estate, the business involved amounting approximately to $300,000; the other a contract for hydro-electric equipment for the Sociedad Industrial de Huancayo, amounting to about $60,000. In both cases the German quotations were considerably under the lowest American bid.

INTERNATIONAL ELECTRICAL EXHIBITION AT AMSTERDAM, HOLLAND.—An international electrical exhibition will be held at Amsterdam, Holland, from Nov. 25 to Dec. 26, 1921. The exhibition is organized by the Amsterdam Department of the Netherlands Society of Electrotechnical Employers, its committee having been formed under the patronage of the Dutch government. It will be divided into the following sections: generation and transmission of electricity, electric lighting, electrolysis, heating, installation material, traction and transport, electric apparatus in all varieties, for domestic purposes and small industry, telegraph and telephone, medical instruments, education and statistics. Further information can be secured from the Bureau of Foreign and Domestic Commerce by referring to file No. 48,523.

INCREASING DEMAND FOR ELECTRICAL EQUIPMENT IN INDIA.—According to R. A. Lundquist, chief of electrical division, the use of electrically driven machinery is rapidly increasing in India. On the west coast the cotton mills, which center about Bombay, are being equipped for electrical operation in conjunction with the construction of a large hydro-electric system. On the east coast, in the vicinity of Calcutta, the jute industry with its numerous large mills is turning to electric drive, and in addition to individual mill installations several groups of mills are planning or have under way several power schemes. One of these projects, which is to supply a group of mills, contemplates a central station with an ultimate capacity of 40,000 kw.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

An inquiry has been received from a business man in Canada (No. 150) for the purchase of serviceable street-lighting lamps and gas street-lighting appliances.

TENDERS FOR ELECTRIC PLANT FOR HUMANSDORP, SOUTH AFRICA.—Tenders will be received by the town clerk, Corporation of Humansdorp, Cape Province, South Africa, until Nov. 30, for construction of an electric light plant including water turbine and generator, switchboard, accumulators, etc.; material for street lighting system with overhead distribution; ferro-concrete pipe line, concrete tank and buildings.

PROPOSED ELEVATED ELECTRIC RAILWAY IN OSAKA, JAPAN.—The Osaka Hanshin Kyuko Electric Railway Company, which operates a railway between Osaka and Kobe, according to *Electrical Industries*, is planning to construct an elevated electric railway between Osaka and Kobe, and also to double the present lines, at a cost of about 3,000,000 yen. The company also contemplates building an underground railway from its Kobe terminus to Motomachi, to cost approximately 7,500,000 yen.

MUNICIPAL ELECTRIC PLANT PLANNED FOR KYOTO, JAPAN.—The construction of a large electric power station (steam-driven) to cost about 4,300,000 yen, to be completed within three years is under consideration by the municipality of Kyoto. The equipment will include two generators of 5,000 kw. each.

ELECTRIC LIGHTING SYSTEM FOR SAN FERNANDO, TRINIDAD.—Plans are under way to inaugurate an electric lighting system, according to Consul Henry D. Baker, Trinidad, in the town of San Fernando, Trinidad, as soon as possible. At present kerosene lamps are used for lighting, except in the case of larger buildings, which have individual electric lighting plants. Complete specifications as furnished by the town engineer of San Fernando are on file in the office of the Electrical Equipment Division, Bureau of Foreign and Domestic Commerce, Washington, D. C., and copies may be obtained by referring to file No. 37,302.

PROPOSED NEW POWER PLANTS IN ITALY.—The erection of a series of three power stations in connection with three groups of mines has definitely been decided upon by the Associated Miners Company of Siena, Italy. Lignite is to be used for fuel, and part of the total capacity will be in steam units and part in producer-gas sets. Further information may be obtained by addressing L'Unione Esercenti Miniere di Siena, Siena, Italy.

New Apparatus and Publications

VIBRATOR—The P. A. Geier Company, Cleveland, announces a new "special" model of its royal vibrator.

X-RAY APPARATUS—The International X-Ray Corporation, 326 Broadway, New York City, has issued a technical paper by Montford Morrison, chief consulting engineer, on "A Precision X-Ray Apparatus," describing the company's latest improvement in X-ray interruptionless rectifying apparatus.

IGNITION TESTER—The Westinghouse Lamp Company, 165 Broadway, New York City, is marketing a neon-tube "Spark-C" ignition tester for gasoline engines.

SWITCHBOARD METERS—The Sangamo Electric Company, Springfield, Ill., has issued bulletin No. 57 (suspending No. 49) on "Switchboard Meters, Alternating-Current, Direct-Current and Ampere-Hour."

ASBESTOS INSULATION—The De Ferroized Asbestos Corporation, Railway Exchange Building, Chicago, has developed a sheet asbestos for insulation purposes.

GRINDER—Forbes & Myers, Worcester, Mass., has placed in the market a new small motor-driven grinder for general light work.

HYDRAULIC TURBINES — Publication 1640-A, entitled "A New Type of Hydraulic-Turbine Runner for Low-Head Developments," has been issued by the Allis-Chalmers Manufacturing Company, Milwaukee.

UPHOLSTERY CLEANER—The Wisconsin Electric Company, Racine, Wis., has put on the market a new "Dumore" electric upholstery cleaner.

DRILL AND VALVE GRINDER—A combination electric drill and valve grinder has been put on the market by the Wisconsin Electric Company, Racine, Wis.

AIR HEATER—The Carmean Electric Company, Kansas City, Mo., has just placed on the market its new "Carmean" portable motor-driven air heater and fan.

FURNACE — The Repel-Arc Furnace Company, Indianapolis, Ind., has issued bulletin 301, on the "Repel-Arc Furnace."

STARTING SWITCH—The Allen-Bradley Company, Milwaukee, has issued bulletin J-1552, describing its new automatic starting switch for induction motors.

STORE LIGHTING—The Macbeth-Evans Glass Company, Pittsburgh, is distributing a folder entitled "Good Light for Stores."

TACHOMETER—The Jones hand tachometer, type H-2, is described in a bulletin of the Consolidated Instrument Company of America, 461 Eighth Avenue, New York City.

WASHING MACHINE — The [illegible] Manufacturing Company, St. Louis, has [illegible] electric clothes washer.

SCHOOL LIGHTING—"Macbeth-Monax for Modern School Lighting" is the title of a leaflet distributed by the Macbeth-Evans Glass Company, Pittsburgh, describing the Macbeth-Monax globes for lighting purposes.

TUBE WELDING MACHINERY AND FABRICATING EQUIPMENT—The Davis-Bournonville Company, Jersey City, N. J., is distributing a booklet covering its tube-welding machinery and fabricating equipment.

TOASTER.—The Security Electric Manufacturing Company, 1463 West Ohio Street, Chicago, has placed on the market an electric toaster stove with interchangeable tray and pan.

FIREPLACE HEATER. — The Sparling Electric Products Company, 195 Dearborn Street, Buffalo, has brought out an electric fireplace heater known as "Hotglow."

ELECTRIC WATER HEATER. — The Majestic Electric Development Company, 656 Howard Street, San Francisco, has placed on the market an electric instantaneous "Majestic" water heater of the portable type.

SHOE-SHINING MACHINE.—The Hermes Manufacturing Company, 448 North Wells Street, Chicago, has placed on the market an electric shoe-shining machine.

FARM-LIGHTING PLANTS. — A 1-kw and a 1½-kw. farm-lighting and power plant has been placed on the market by the Main Electric Company, 1131 East One Hundred and Thirteenth Street, Cleveland.

AIR COMPRESSOR. — A small motor-driven air compressor of the automatic type has been placed on the market by the Olsen-Boettger Manufacturing Company, 108 East Third Street, St. Paul, Minn.

TIPLESS MINIATURE LAMP-SEALING MACHINE. — A tipless miniature lamp-sealing or splicing machine has recently been developed by Charles Eisler, 15 Kirk Place, Newark, N. J.

New Incorporations

THE GUARANTEED BATTERY MANUFACTURING COMPANY, New York, N. Y., has been incorporated with a capital stock of $150,000 to manufacture electric batteries and parts. The incorporators are P. Probst, D. Smith and E. Harris. The company is represented by Sidney Nordlinger, 489 Fifth Avenue.

THE SYRACUSE (N. Y.) OIL BURNER COMPANY has been organized by F. W. J. McKibbin, A. H. Mallory and R. H. Carhart, 623 Oneida Street, to manufacture oil-burning, electric and gas appliances. The company is capitalized at $[illegible]

THE NEBO (KY.) LIGHT COMPANY has been incorporated by J. M. O'Bryan, L. J. Morrow, T. H. Smith and others. The company is capitalized at $3,000 and proposes to furnish electricity for lamps and motors.

THE CYNOSURE ELECTRIC ADVERTISING CORPORATION, New York, N. Y., has been incorporated with a capital stock of $12,000 to manufacture electric displays. The incorporators are E. and J. Rojo and S. S. Goldberg, 350 Broadway.

THE FARAD ELECTRIC COMPANY, New York, N. Y., has been incorporated with a capital stock of $15,000 to manufacture electrical specialties. The incorporators are F. Richold, F. Landau and W. [illegible]. The company is represented by Barbieri & Zerilli, 313 West Forty-second Street.

THE TITAN MINIATURE LAMP COMPANY, Orange, N. J., has been incorporated by George Anderson, A. E. Jackson and D. G. Littell, Bloomfield, to manufacture electric lamps. The company is capitalized at $[illegible]

THE ELECTRICAL MERCHANDISING COMPANY, [illegible] has been organized [illegible] to manufacture electrical specialties. The incorporators [illegible] P. Moore, 811 Shipley Street, Wilmington, Del., represents the company.

THE BLACKEY (KY.) LIGHT & POWER COMPANY has been incorporated with a capital stock of $[illegible] by F. [illegible] Persall and others to furnish electricity in [illegible] for lamps and motors.

Record of Electrical Patents

Notes on United States Patents

(Issued Sept. 20, 1921.)

15,199 (Reissue). MOLDING COMPOSITION: James P. A. McCoy, Milwaukee, Wis. App. filed Nov. 13, 1920. Inert fillers united into solid mass by resinous binders.

1,390,984. CIRCUIT CLOSER FOR MUSICAL INSTRUMENTS; Ralph Conover and Leo Hull, Terre Haute, Ind. App. filed April 26, 1919. For pianos, etc.

1,390,998. SHOE-HEATING DEVICE; Thomas Lund, Beverly, Mass. App. filed Feb. 19, 1920. Heating shoe parts to soften or to dry them.

1,391,006. HALF-DUPLEX ALTERNATING-CURRENT TELEGRAPH SYSTEM; Ralzemond D. Parker, Brooklyn, N. Y. App. filed Sept. 8, 1919. Lines composited for Morse or other telegraph operation.

1,391,041. SIZING TESTER; Henry G. Boon, Appleton, Wis. App. filed Aug. 23, 1920. For testing the character of paper.

1,391,046. LIGHTNING ARRESTER; Wallace L. Cook, Chicago, Ill. App. filed Sept. 12, 1919. Cross-arm arrester of the air-gap type.

1,391,085. TROLLEY WHEEL; John A. Wendell, Montgomery, W. Va. App. filed March 7, 1921. Portions subjected to wear are readily removable.

1,391,089. STORAGE BATTERY; Edward S. Adams and Walter H. Adams, Columbus, Ohio. App. filed July 12, 1920. An improved connection.

1,391,093. METER; Joseph W. Bickel, Chicago Heights, Ill. App. filed Jan. 28, 1921. Maximum-demand meter.

1,391,113. ELECTRIC HEATER: Andrew J. Holmes, Tacoma, Wash. App. filed Aug. 27, 1920. Uniform heating of air.

1,391,135. SEMI-AUTOMATIC TELEPHONE SYSTEM; George E. Mueller, Aurora, Ill. App. filed Nov. 16, 1907. Simple means for distributing incoming calls.

1,391,136. TELEPHONE-EXCHANGE SYSTEM; George E. Mueller, Aurora, Ill. App. filed June 20, 1908. Automatic and semi-automatic systems.

1,391,137. WIRE SPLICER; Joseph O. Mulligan, McKee's Rocks, Pa. App. filed April 30, 1921. For application to overhead trolley wires.

1,391,191. TROLLEY GUARD AND FINDER; Patrick J. Kelley, Detroit, Mich. App. filed June 14, 1921. Can be mounted on the existing trolley.

1,391,206. TELEGRAPHIC INDICATOR; Sherman G. Nye, Denver, Col. App. filed Oct. 23, 1919. Indicator for telegraphic instruments.

1,391,211. DRY-CELL MATERIAL AND METHOD OF MANUFACTURE; Otto E. Ruhoff, Madison, Wis. App. filed Jan. 31, 1920. Constituent of depolarizing material.

1,391,241. LOCKOUT RELAY; George A. Burnham, Saugus, Mass. App. filed Dec. 8, 1917. Prevents closing oil switch under overload conditions.

1,391,244. TYPEWRITER ATTACHMENT; Guillermo Castellanos, Los Angeles, Cal. App. filed July 2, 1919. Traveling solenoid for moving the carriage.

1,391,289. REGENERATIVE MOTOR-CONTROL SYSTEM; Samuel T. Webster, St. Louis, Mo. App. filed April 7, 1911. Regenerated current automatically controlled.

1,391,295. MOTOR-CONTROLLER; Thomas E. Barnum, Milwaukee, Wis. App. filed July 23, 1917. For starting a polyphase motor.

1,391,296. ELECTRIC IRON; Reuben B. Benjamin, Chicago, Ill. App. filed Dec. 8, 1919. Means for automatically opening the circuit.

1,391,393. CONNECTOR; Harry A. Douglas, Bronson, Mich. App. filed Aug. 9, 1917. Edisonian socket.

1,391,370. SUPPORT FOR TELEPHONE RECEIVERS; Charles M. Clarke, Sewickley, Pa. App. filed Aug. 13, 1918. To obviate necessity of waiting to replace receiver in fork after call has been answered over another instrument.

1,391,377. CURRENT-GENERATING PLANT; Oliver P. Fritchle, Denver, Co. App. filed Nov. 15, 1920. For supporting a plant on windmill, whose wheel drives the generator.

1,391,387. TROLLEY FINDER; Ludwik Karandyszewski, Schenectady, N. Y. App. filed May 5, 1921. Spiral-cam trolley wheel.

1,391,392. TROLLEY-RESTORING MECHANISM; George A. Lafontaine, Los Angeles, Cal. App. filed Nov. 7, 1918. To catch on wire whenever the trolley wheel jumps.

1,391,400. ORE SEPARATOR; John J. Neville, Clifton Forge, Va. App. filed June 18, 1921. For separating iron ore from non-magnetic materials.

1,391,442. CALL-SENDING DEVICE; Albert Andersen, Chicago, Ill. App. filed Aug. 8, 1914. Impulse transmitters controlled by a single keyboard.

1,391,507. METHOD FOR THE PRODUCTION OF IRON AND STEEL; Elfego Riveroll, Los Angeles, Cal. App. filed May 11, 1920. For electrical smelting of iron sponge.

1,391,522. ELECTRIC CONTROLLER; Richard Amberton, London, England. App. filed March 3, 1920. For cutting in or out resistances in electric circuits.

1,391,529. ELECTRICAL DRIVING; Henry Crochat, Paris, France. App. filed Aug. 17, 1916. For the driving wheels of motor vehicles.

1,391,552. REPEATER CORD CIRCUITS; Owen H. Loynes, Woodbridge, N. J. App. filed Sept. 23, 1919. Supervisory signaling arrangements.

1,391,576. INSULATING UNIT FOR ELECTRIC SUSPENSION CHAINS; Lucien E. T. Perrin, Paris, France. App. filed Oct. 22, 1920. For high-tension lines.

1,391,586. ELECTRIC TRANSLATOR; Frank M. Slough, Rochester, N. Y. App. filed June 23, 1917. Movement of electric switches.

1,391,587. SUBSCRIBER-OPERATED TELEPHONE SYSTEM; Frank M. Slough, Rochester, N. Y. App. filed Jan. 28, 1918. Automatic switches.

1,391,588. TELEPHONE-SERVICE SYSTEM; Frank M. Slough, Rochester, N. Y. App. filed Nov. 1, 1918. Selective indication and registration.

1,391,622. COMBINED FIRE-ALARM BOX AND HYDRANT; Edward E. Ferguson, Portsmouth, Va. App. filed Nov. 18, 1919. Avoids opening valve without turning in alarm.

1,391,631. EXTENSION ELECTRIC LIGHT FIXTURE; Alfred F. Hammersmith, Chicago, Ill. App. filed Aug. 6, 1918. Adjustable reel.

1,391,652. ELECTRICAL TRANSMISSION SYSTEM; Elemer Meitner, Brooklyn, N. Y. App. filed Oct. 3, 1917. Step-by-step or impulse transmission systems.

(Issued Sept. 27, 1921.)

1,391,671. THERMIONIC VALVE FOR USE IN WIRELESS TELEGRAPHY AND TELEPHONY; Horace St. John de Aula Donisthorpe, London, England. App. filed March 23, 1921. Hollow hemispherical plate and grid electrodes in combination with a straight or loop filament.

1,391,672. ELECTRICAL CONDENSER; William Dubilier, New York, N. Y. App. filed Aug. 1, 1918. To decrease as much as possible leakage between adjacent plates.

1,391,673. ANTENNA-SHORTENING DEVICE; William Dubilier, New York, N. Y. App. filed March 7, 1919. For inserting capacity to shorten wave length.

1,391,684. ALARM APPARATUS; Aage H. Jorgensen, Lyngby, near Copenhagen, Denmark. App. filed April 11, 1919. For use in connection with previously installed telephone lines.

1,391,741. TROLLEY WHEEL; Christian E. Lebenberg, Essington, Pa. App. filed July 22, 1920. Guard to keep contact member in the neighborhood of the wire and facilitate its restoration.

1,391,762. THERMOMAGNETIC THERAPEUTIC APPLIANCE; John H. Dequer, Kansas City, Mo. App. filed May 1, 1920. To provide both a magnetic field and a heating zone.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

SKOWHEGAN, ME.—Work will be completed this fall on the high-tension transmission line of the Central Maine Power Company from Skowhegan to Guilford. The company also plans to erect a line from the mills of the General Slate Company in Monson to the plant of the Monson Slate & Product Company in Blanchard.

TORRINGTON, CONN.—Plans are being prepared for the installation of an ornamental lighting system in the business section of Torrington, to cost between $13,000 and $17,000.

Middle Atlantic States

PENN YAN, N. Y.—An appropriation of $24,000 has been authorized to provide for extensions to the municipal electric light plant.

ROSSIE, N. Y.—The Rossie Electric & Manufacturing Company is considering improvements to its plant and system, including the installation of a 250-kw. generator, an additional waterwheel, and the erection of transmission lines. The present building is adequate to accommodate the new machinery.

JERSEY CITY, N. J.—Plans are under consideration for the construction of a new one-story power house at the Brunswick Laundry, 222 Tonnelle Avenue.

NEWARK, N. J.—Bids will be taken at once, it is reported, by the Igoe Brothers, Poinier Street, manufacturer of wire nails and other wire products, for the construction of a one-story addition to their plant. A power house will also be built.

VERONA, N. J.—The installation of a new refrigerating plant at the Essex Mountain Sanatorium at Verona, to cost about $60,000, is under consideration.

ASHLAND, PA.—Arrangements are being made by the Lehigh Valley Coal Company for the installation of an electrically operated, 3,000 gallons per minute pumping unit at its Buck Mountain mine, near Mahonoy City.

HARRISBURG, PA.—Plans are being prepared by the Harrisburg Railways Company for an addition to its power plant, to cost about $75,000.

HARRISBURG, PA.—The Union Ice & Coal Company, Forster Street, is considering the construction of a new ice-manufacturing plant, to cost, with machinery, about $200,000. The company also contemplates the construction of a cold storage plant.

LANSDALE, PA.—Application has been made by the Philadelphia Suburban Gas & Electric Company to the Public Service Commission for permission to extend its system to Lansdale. At the present time the section is being served by the municipal electric plant.

PHILADELPHIA, PA.—The Forrest Laundry, 1225 Columbia Avenue, it is understood, contemplates the construction of a power and mechanical laundry at 1704-12 North Fawn Street.

PITTSBURGH, PA.—Arrangements have been made by the West Penn Power Company for an issue of $1,500,000 in bonds for its subsidiary, the Allegheny Pittsburgh Coal Company, the proceeds to be used for extensions, etc.

SMETHPORT, PA.—J. C. Backus is reported to have organized a company for the purpose of erecting a transmission line from the power plant at Portville, N. Y., to Smethport, Pa., to furnish electricity to the latter village.

WILKES-BARRE, PA.—The Pennsylvania Power & Light Company has purchased the property of the Wilkes-Barre Company. Surveys are under way preliminary to the construction of transmission lines to connect the Wilkes-Barre plant with the high-tension system of the Pennsylvania Company. William H. Conyngham is president and E. A. Wakeman is general manager of the Wilkes-Barre Company.

BALTIMORE, MD.—The Cooknut Corporation, Paca and Lexington Streets, is planning the construction of a one-story powerhouse to be used in connection with its proposed plant for the manufacture of lard substitutes, to cost about $85,000.

DORFEE, W. VA.—Plans are under consideration by the Kanawha White Ash Collieries Company for the installation of electrical and other machinery at its properties. E. M. Burns, Ebensburg, Pa., is president.

FAYETTEVILLE, W. VA.—Application has been made by C. B. Hawley, 456 Munsey Building, Washington, D. C., and associates for permission to build a hydro-electric generating plant at Sandstone Falls, on the New River, at Fayetteville, W. Va. The initial capacity of the plant will be about 4,000 hp.

YORKTOWN, VA.—The Bureau of Yards and Docks, Navy Department, Washington, D. C., is having plans revised for additions to the power plant at Yorktown, Va., including the installation of new equipment. New bids will be called for at an early date.

WASHINGTON, D. C.—Bids will be received at the office of the Chief Signal Officer, U. S. Army, Washington, D. C., for furnishing the following: Until Oct. 25, circular PR-4754-A-1CP, 750 hand generators. Until Oct. 26, circular PR-8723-1CP, 2,000 ft. 12 pair armored rubber insulated subterranean cable and 6,000 ft. 25 pair paper insulated submarine cable; circular PR-7500-1CP, 9,400 dry batteries SC type BA-1. Until Oct. 28, circular PR-8771-1CP, one 3-unit, 5-kw. motor generator set, motor to be 15 hp. For further information address as above.

North Central States

GRAND RAPIDS, MICH.—Plans are under way for the installation of an electric lighting plant in Hotel Pantlind, to be operated in connection with its heating plant. The cost is estimated at $40,000.

NILES, MICH.—Work has been started on the construction of a new power house at the plant of the French Paper Company, to cost, with equipment, about $75,000. J. Parker is manager.

OTSEGO, MICH.—Plans are being prepared by the Mac Sim Bar Paper Company for the construction of a one-story power plant, 80 ft. x 140 ft., to cost about $300,000, including machinery. Billingham & Cobb, Press Building, Kalamazoo, are architects. A. B. Thomas is president and general manager.

CLEVELAND, OHIO—The City Council has authorized the installation of electric lamps on sections of East Sixty-fourth and East Sixty-sixth Streets, Worsley Avenue from East Sixty-fourth to East Seventy-first Street, Gertrude Avenue from East Fifty-seventh to East Sixty-fifth Street, and on Hosmer Avenue from East Fifty-seventh to East Sixty-Fifth Street.

CLEVELAND, OHIO—The City Council has authorized an issue of $40,000 in bonds, the proceeds to be used for the construction of electric light works in connection with the municipal lighting system.

LAKEWOOD, OHIO—The City Ice & Fuel Company, East Twenty-second Street, Cleveland, has had plans prepared for the construction of a one-story ice manufacturing plant at Fisher and Warren Roads, Lakewood, to cost about $100,000.

PIKEVILLE, KY.—The Kentucky & West Virginia Power Company, Land Title Building, Philadelphia, Pa., is planning the construction of an additional power house in the Big Sandy District, and the erection of transmission lines from this point and high-tension tie lines to connect with other power houses. Francis R. Weller, Hibbs Building, Washington, D. C., is consulting engineer.

BEDFORD, IND.—The local plant of the Interstate Public Service Company was recently destroyed by fire. Arrangements have been made to obtain electricity for light and power service from Seymour, Ind., until a new plant can be built.

SPRINGFIELD, ILL.—The Springfield Gas & Electric Company is contemplating extensions and improvements. The company was recently granted a twenty-year [illegible] franchise. A. D. [illegible] is general manager.

ANTIGO, WIS.—Arrangements have been made, it is understood, by E. A. Forbes of the Rhinelander (Wis.) Electric Light & Power Company for the purchase of the plant of the Antigo Electric Company. Mr. Forbes contemplates the erection of a high-tension transmission line from Rhinelander to Antigo next spring. The transmission line will also serve to provide emergency service for Rhinelander from the steam power plant in Antigo.

EAGLE RIVER, WIS.—The Village Board is considering the installation of a new generator in the municipal electric power plant and other city improvements, to cost about $15,000.

GILLETT, WIS.—The Northern Wisconsin Power Company, recently incorporated with a capital stock of $75,000, contemplates the erection and operation of hydro-electric generating plants. J. A. Read, A. L. Kreutzer and W. C. Smith are interested in the company.

MILWAUKEE, WIS.—The American Hide & Leather Company, 658 Commerce Street, is contemplating the construction of a tannery, including main building, power house and bark house, to replace the plant recently destroyed by fire, causing a loss of about $1,500,000.

MILWAUKEE, WIS.—Contract has been awarded by the Luick Ice Cream Company, 177 Ogden Avenue, to Theodore Stark & Company, 425 East Water Street, for the construction of a five-story addition, 60 ft. sq., to cost complete about $100,000. Additional generating equipment, refrigeration tanks, motors, etc., will be required. Brust & Philipp, 405 Broadway, are architects.

WAUKESHA, WIS.—Inquiries are being made by the Manitowoc Church Furniture Company, it is understood, for steam generating equipment for a power plant under construction to cost about $30,000 complete.

KANSAS CITY, MO.—Plans are being prepared by the Superior Ice Company, Lee Building, for the construction of a three-story plant at Second and Main Streets, to cost about $145,000, including machinery. A. L. Williams is interested in the company. B. B. Ryan, care of the company, is architect and engineer.

KANSAS CITY, MO.—The City Council contemplates improvements to the lighting system on Walnut, Tenth, Twenty-fourth and Twenty-seventh Streets and Prospect Avenue.

ST. LOUIS, MO.—Plans are under way by the Polar Wave Ice & Fuel Company, Grand and Olive Streets, for the construction of a new ice manufacturing plant to cost, including machinery, about $500,000. H. G. Clymer, Wainwright Building, is architect.

KANSAS CITY, KAN.—Plans have been prepared by the City Engineering Department for the construction of a power plant at the Quindaro pumping station for the waterworks system, to cost about $25,000. Ross & Peterson, Barker Building, are architects. Howard Payne is city clerk.

McCRACKEN, KAN.—Bonds to the amount of $35,000 have been voted for improvements to the municipal light and water plant.

WICHITA, KAN.—The Kansas Gas & Electric Company is considering increasing its output to 40,000 kw.

Southern States

CARTHAGE, N. C.—The power house at the plant of the Spencer Lumber Company was recently destroyed by fire. The building, it is understood, will be rebuilt.

CHARLOTTE, N. C.—Plans are under consideration by the City Council for extensions to the lighting system on Fourth Street. Electrical service is furnished by the Southern Power Company.

PERRY, GA.—The City Council is considering improvements to the light and water systems, to cost about $15,000.

SAVANNAH, GA.—The Savannah Electric & Power Company was recently organized with a capital stock of $4,800,000 to acquire and operate the power plants and property of the Savannah Electric Company. The company has also arranged for an issue of $1,750,000 in bonds, the proceeds to be used for extensions, etc. A. A. Lawrence is president.

LITTLE ROCK, ARK.—The Dixie Power Company, Title Guarantee Building, St. Louis, Mo., has applied for authority to construct a new hydro-electric generating plant on the Buffalo River, in the vicinity of Little Rock, Ark., to have an initial capacity of about 20,000.

RUSSELLVILLE, ARK.—The Council is considering the installation of a new street-lighting system in the business district.

ARDMORE, OKLA.—Plans are under consideration by the Magnolia Petroleum Company, Dallas, Tex., for the construction of a new gasoline manufacturing plant in the vicinity of Ardmore, Okla. The work will include the erection of an electric power plant. J. A. Nicholson, Heraldton, Okla., is engineer.

MANCHESTER, OKLA.—Bonds to the amount of $27,000 have been voted for the erection of a transmission line from Manchester, Okla., to Anthony, Kan. W. Blecha is city clerk. W. B. Rollins, Railway Exchange Building, Kansas City, Mo., is engineer.

CORPUS CHRISTI, TEX.—The Gulf Coast Power Company, recently incorporated with a capital of $100,000, it is reported, is considering establishing a central power plant. The present plans provide for rehabilitating an electric light and power plant and ice plant.

EDINBURG, TEX.—Bonds to the amount of $30,000 have been approved by the Attorney General's Department, Austin, for the installation of an electric light system in Edinburg.

WACO, TEX.—Plans are under consideration by the City Commission for the installation of a street lighting system on sections of the River Driveway and Washington Avenue.

Pacific and Mountain States

EVERETT, Wash.—Surveys are being made by the Puget Sound International Railway & Power Company in connection with a project to furnish electricity for light and power in the outlying districts.

OROVILLE, WASH.—The Okanogan Valley Power Company, Brewster, it is reported, is considering the installation of a second hydro-electric unit on the Simulkameen River next year. Eugene Enloe is president

ALBANY, ORE.—The city authorities are planning extensive improvements to its fire-alarm system, which will require the installation of a motor-generator, batteries, switchboard and rewiring of the overhead circuits.

MILTON, ORE.—The town authorities have applied to State Engineer Cupper for permission to appropriate 82 sec.-ft. of water from Walla Walla River to develop 1,700 hp. under a head of 190 ft. The project includes a forebay, dam and pipe line.

ROSEBURG, ORE.—At an election to be held Nov. 1 the proposal to issue $500,000 in bonds for the purpose of acquiring a light, power and water system will be submitted to the voters.

LONG BEACH, CAL.—Plans are being prepared for the installation of a lighting system on Anaheim Street from Temple to Loma Avenue.

RED BLUFF, CAL.—An expenditure of $24,000 is planned by the Pacific Gas & Electric Company for improvements to its system in Red Bluff.

Canada

MONTREAL, QUE.—Plans are under consideration by the Commission of Electrical Services of the city of Montreal to resume work on the municipal underground conduit system.

VANCOUVER, B. C.—The mill of the Canadian Lumber & Timber Company, operated in the name of the Vancouver Export Lumber Company, was recently destroyed by fire, causing a loss, including machinery and power equipment, of about $125,000.

Miscellaneous

BOQUILLAS, MEXICO.—The Canada Power Company [illegible] hydro-electric plant at Boquillas to a number of additional towns and mining districts. Below the water storage reservoir of the company are about 200,000 acres of land which are susceptible to reclamation by means of irrigation. The state and federal governments are considering the matter of building a system of canals and ditches to utilize the water from the dam to irrigate the lands and to colonize them.

Electrical World

New York, Saturday, October 29, 1921

How Long, O Lord! How Long?

BEFORE the people of the United States today there stand some of the most serious, complex and pressing problems that any nation has ever faced. They call for honest analysis, for balanced judgment, for positive decision, for constructive legislation and for prompt action. In Washington are ninety-six senators and four hundred and thirty-five representatives, each one selected, empowered and paid to do this job—and Congress talks and talks and talks.

The country is burdened with an unjust system of taxation that is hard to pay. People are sick of it. They know that a different arrangement—preferably the sales tax—will produce the needed revenue and yet make taxes easier. The administration has promised it. The country waits. But Congress talks and talks.

The old economic relationships between America and Europe are turned topsy-turvy. Our export trade has gone to pieces. The tariff must be readjusted. Business needs it. The administration has promised it. The country waits. And Congress talks.

The railway systems of the country cannot pay the dividends their stockholders are entitled to. They cannot even maintain their equipment and replacements. They are powerless to better these conditions until they receive a settlement from the government. This settlement will loosen a flood of railway orders that will bring tremendous stimulus to business everywhere. The administration has promised it. The country waits. But Congress talks and talks.

America has a huge fleet of merchant ships. A few are profitable. Many are running at a loss. Hundreds upon hundreds are tied up idle. They cannot operate under our existing shipping laws in competition with foreign flags. The administration has promised to right the situation. The country waits. And Congress talks and talks and talks.

How long, O Lord! how long?

America today is pleased with its administration. President Harding and his well-chosen cabinet have the confidence of the country. These men are doing their utmost to work out these and our other problems, to support our industries and to restore good times—while in Congress this one orates about the glory of the Republican (or Democratic) party and that one declaims about the perfidy of the honorable gentlemen on the other side.

The ELECTRICAL WORLD believes that the situation has reached a stage where it has become the duty of business executives and individuals to call upon their senators and representatives in Congress by letter, by wire and in person, and ask them flatly: "What have you done or even said to hurry through the work we pay you for?"

James Remsen Strong

President of the National Association of Electrical Contractors, now serving his fourth term, to whom the industry is indebted for far-sighted guidance in association organization and governance.

SIXTY years ago Friday of this week James R. Strong was born in the city of New York. He stands today among that small group who have made their earnest work the development and organization of the electrical contractors of the country, and along these lines he has done much for the industry. Mr Strong has a peculiar genius for association organization and the framing of the machinery of constitutions and by-laws. He has made his hobby the study of effective measures for advancing the interests of the electrical contractor-dealer through associated work, and his foresight in discerning not alone the functions and the opportunities of such a body but the limitations of safety in its activities has been a guiding influence through the years.

Mr. Strong was a charter member of the National Associat'on of Electrical Contractors and has been four times elected its presiding officer. It is primarily to him that the association owes its constitution and the molding of its plans to meet the changing times. With Earnest McCleary, Mr. Strong has served on the constitution committee for many years, and in 1917, when it was decided to broaden the scope of the organization to include all retailers of electrical merchandise, this committee carried through the problem in a way that was truly constructive.

The work which Mr. Strong has done for the electrical industry has not been spectacular, but it has been fundamental. His temperament leads him to apply himself quietly, modestly and without ostentation, but he is a constant worker, absolutely dependable and everlastingly on the job. There are few men in the industry who have so consistently applied themselves to the service and advancement of the electrical community, with whole-hearted devotion, the sacrifice of personal time and interest and the actual achievement of beneficent results of permanent value. He has almost unlimited capacity to accept responsibility and broadly carry on the association work which for so many years has flowed to him. Because of what he has done Mr. Strong has won the confidence and affection of the electrical contractors of the country to a remarkable degree. His keen sense of fairness, his clear-thinking impartiality, his good business judgment, his ability as an executive and administrator, and above all, his readiness to face facts and conditions as they are, have made him a natural source of strength and guidance through the rapid evolution of the field of his chosen work. Mr. Strong has been prodigal in his gift of time and effort to the electrical contractors of America. He has devoted himself also to the work of the church and furtherance of many charities and campaigns for civic betterment with equal zeal.

James R. Strong was born in New York, Oct. 28, 1861, and was graduated from Trinity College, Hartford, Conn., in 1882. For four years he was employed by the Watt-Campbell Corliss Engine Works and the United States Electric Lighting Company in Newark, N. J. He was next superintendent of the construction department of the United States Illuminating Company in New York. Since [illegible] he has been president of the Tucker Electrical Construction Company. He served as president of the National Association of Electrical Contractors and Dealers from [illegible] until [illegible] and is once more serving as president this year.

Electrical World

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The Evolution of the Private Dwelling

THE housing situation, trying as it is, is not without its bright side to electric public utilities, particularly in the larger cities of the country. These cities abound with solidly built-up private dwellings block after block. Because of the inability to obtain servants, and for other reasons, these houses are being converted into small apartments or flats, so that where formerly but one family was supplied with electricity, there are now many. Moreover, the type of apartment evolved is particularly adapted to the use of electricity. Most of them are not equipped for housekeeping, and in preparing breakfast and light lunches wide use is made of electrical cooking devices. Thus the electrical load per house has increased from fourfold to tenfold and the income from it proportionately. Inasmuch as this business does not call for additional outlay on the part of the utility, it is particularly attractive and welcome. It makes for greater use of investment and should be sought and encouraged.

The Crumbling of the Railroad Strike

TRULY the people rule in the United States when they assert themselves. The railroad workers called a general strike intended to throw countless millions out of work, despite the unemployment situation, and to paralyze the business of the country at a time when it can least withstand the blow, because they do not want their wages cut in line with general deflation. The American people, hearing what they had to say, decided that if regulation is fair for the railroad companies, it must be no less fair for the brotherhoods and expressed this judgment calmly and flatly through the press. So, at the time of writing, eight unions, numbering one-half of the two million men ordered to strike, have announced that they will not go out. The brotherhoods and telegraphers stand alone, shorn of support and sympathy, and are apparently looking for a way to save their face. The strike is clearly crumbling.

It is a most unfortunate thing that all this should have happened. For the sympathy of the public naturally flows to the laboring man, and the brotherhoods have sacrificed a precious thing in forcing the public to decide against them on an issue so ill considered. If the Interstate Commerce Commission and the Federal Labor Board are to guide and regulate the railroads and workers and are to act in harmony and serve the interests of the country, they must make such decisions and issue such orders as their best judgment shall direct—and the railroads and the workers must obey them. Neither side can refuse to obey on the ground that the other government regulating body has not taken the same action with the other side at the same time. As prices and costs come down and the dollar creeps back toward its old-time value the brotherhoods must accept still lower wages and the railroads must accept still lower rates as lowered cost of living makes it right, and both must trust the fairness of the public to see that an even balance is maintained between them. The railway workers are apparently about to comply. Now we must have lower freight rates. For on lower freight rates hinge lower costs of food and cheaper building materials. Public opinion is demanding all this with no less conviction than it has demanded lower wages.

Maintaining Service Ideals Through Interconnection

DEMONSTRATIONS of the importance of continuity of electric service are becoming more and more frequent as demand for service continues to exceed station capacity in fast-growing sections. By utilities and customers alike the fundamental soundness of interconnection of adjacent transmission systems is being realized. This is especially true where advantage can be taken of diversity of load and the existence of different watersheds. The tying in this week of the transmission system of the Alabama Power Company with the transmission systems of Georgia and North and South Carolina is a case in point, for it has brought relief to the customers of the Carolina Light & Power Company, which, owing to low water, has been short of power for some time. In this case the surplus energy literally passes through the hands of four organizations and represents a co-operation of which the customers benefited should know the extent and the true meaning. To render this service over something like a thousand miles of high-tension lines changes are necessary, together with certain inconveniences to normal service on each system which cannot be evaluated in dollars and cents. The service is rendered on the basis of a co-operation in which all concerned may need to partake at some other time, and therefore, after all, it will reap its reward by protecting the ideal of continuous service to small and large customers alike, wherever situated. This ideal all central-station companies guard as one of their greatest assets and at all times try to protect.

An Interesting Rural-Service Contract

THE latest move in the rural-line situation comes from Iowa in the form of a service contract that is designed to place the responsibility for the construction and maintenance of the lines on the consumer and yet give the utility the necessary supervision and responsibility to insure proper construction and maintenance and avoid future difficulties similar to those encountered in the rural telephone field. A discussion of the contract by W. J. Greene of the Iowa Railway & Light Company is printed elsewhere in this issue.

In the features mentioned the application of the contract will produce virtually the same results that have been realized under other well-thought-out plans for providing the service. The success of the plan is largely dependent on the ability of the company to get the farmer to approve it and to hold him in line year after year.

The form of rate is the most interesting part of the contract. Owing to the nature of the agreement the items of construction, fixed charges and maintenance do not enter into the rate but are paid independently. The rate, therefore, becomes uniform for the entire territory and, except for the coal clause, is independent of the rates in the adjoining communities. Furthermore, it concentrates all the service and capacity charges in a fixed charge for which the farmer understands that he is getting no electricity. Except for a small amount of energy, the consumer gets a very low rate that encourages him to use the service in the largest possible way. The rate form as expressed is rather awkward and may be difficult to explain to the farmer. This, however, is a matter that could be easily remedied if found necesary. It is one of the first consistent attempts that have been made to get away from the older forms and put into practice a theory of rates for the encouragement of rural business that a great many have discussed but not yet had the courage to try. The effort will not only be watched with interest but merits close study.

Higher Standards in Street Lighting

IN THE current issue of the ELECTRICAL WORLD W. D. Jennings gives an account of the new street-lighting system at Stamford, Conn. This is not a case of replacement of an old and bad system, but of the improvement of a thoroughly good system by better fixtures, better distributed, and the addition of a large amount of useful light. The lighting was good, but there was not enough of it, and the city in making a new contract wisely undertook to do the work more thoroughly. To this end 150 6.6-amp. magnetite lamps were installed in ornamental paneled globes mounted on well-designed posts on each side of the streets to be lighted. The spacing on each side is at about 100 feet, and the posts are staggered as respects the two sides of the street. At this spacing and with these powerful lights comment on the quality of the illumination is needless. Eighty lamps of the earlier plant were retained for the outer zone of the new arc-lighted area. Incidentally the 60-cp. vacuum incandescent lamps formerly employed there were changed to 100-cp. gas-filled lamps, which of itself was a decided improvement.

The especially interesting features of the new arc system lie in the methods of supply and the methods of control. The lamps are operated on two independent circuits, one for each side of the street, so that after midnight one circuit can be cut out and the streets still be left well lighted for the needs of the late hours. As regards the method of feeding, the general supply is through banded steel-armored cable. This cable was laid in narrow trenches just on the street side of the curb. These trenches were excavated by machinery, the cable was laid in and covered with wood strips, and then the trenches were filled in with concrete flush with the street surface of vitrified brick. In this way the entire new service was inaugurated without any serious tearing up of the streets, and it is believed that the system will stand up well in continuous use. The whole equipment is thoroughly modern and efficient as respects the type of lighting, one toward which up-to-date cities are steadily moving.

Insulation of Machinery a Constant Problem

STANDARD forms of machines have now been with us for so long that we have unconsciously come to regard them as being inherently reliable. This confidence is apt to cause one to overlook the constant vigilance and effort necessary on the part of the manufacturer in guarding and improving insulation. Insulation is the Achilles heel, the almost invariable point of failure of electrical machinery. It is an irony of nature's laws that insulation, necessarily composed of the most delicate and perishable materials, should usually be that part of the electric structure which is subjected to the severest mechanical treatment. Particularly is this the case in rotating machinery.

From the very beginning of construction insulating materials are subjected to treatment tending to destroy their properties. First they must be applied closely to coils of the most varied shapes, having short turns and sharp edges. Then the coil itself after being insulated must usually be bent in placing it on the armature or field of the machine, and finally it is either driven or wedged into its proper location, which generally results in jamming or scraping across the sharp edges of laminations. Then when put into operation the vibration due to rotation, together with the air clearances between windings and metal, creates the worst possible condition for the preservation of the qualities of insulation. If one looks still further at machinery subjected to worse conditions than normal, as, for example, machines in steel mills and industries in which abrupt changes of load occur and machines which operate under abnormal temperature conditions, it is seen at once that the demands upon the mechanical structure of the insulation are severe indeed. The wonder is that it is possible to construct machinery which will stand up and live under the conditions imposed upon the insulation. The success that has been reached is due to elaborate study and experiment, both in the selection of materials and the design of the insulating structure, and to the utmost care in methods of assembly.

The two most serious dangers being the actual destruction of the material under excessive temperature and mechanical breakage due to vibration, it is interesting to note the two broad lines of defense which have been adopted. Obviously, as regards temperature, those materials which possess the flexibility requisite for assembly are not able to withstand high temperatures. This fact has resulted in the limiting figure of temperature permitted by the Standardization rules of the American Institute of Electrical Engineers for machines in which this character of insulation is used. Mica is about the only substance which possesses high insulating power together with temperature-proof qualities. Consequently, although its mechanical properties are not ideal for assembly on complex shapes of coil, it is nevertheless relied upon almost exclusively for the insulation of those machines which must operate under extreme temperature conditions.

As regards the dangers from vibration and distortion of insulation under the action of the rotation of the machine, the significant fact in the attack of this difficulty is the effort to insure as nearly as possible absolute unity and rigidity of structure between the insulated windings and the frame of the machine. A close fit of the coil in the slot, rigid bracing of the ends of the coils, and often a thorough saturation of the exposed parts of the winding with a compound solidifying to a stiff body, are the usual methods adopted in this particular. It is worth noting that there is considerable evidence that if a rotor with assembled winding is submitted as a whole to the modern processes of drying and impregnation, the life of its winding can be greatly increased. The objection to this method of treatment is probably that it adds to the difficulty of repair. It therefore seems probable that if this method cannot be followed, manufacturers must for the present at least continue to retain some of their best engineering talent and the most constant vigilance in the shop on the problem of shutting out the possibility of mechanical movement of the assembled winding.

Fair Return on Value of Property Used and Useful in Public Service

THROUGHOUT the sessions of the annual meeting of the National Association of Railway and Utilities Commissioners in Atlanta, Ga., unanimous approval, either spoken or implied, of the frankness, broad vision and fair spirit displayed by Commissioner Perry of Georgia in his presidential address was manifest. He said, for instance:

"Dating from two years ago, there is no doubt that many commissioners throughout the country made the common mistake of holding light, power, gas and street-railway companies to rates that were too low, hoping that the immediate future would justify the rates prescribed, but this hoped-for condition was not realized."

This utterance will not only be welcome to many utilities that are facing agitation for rate reductions, but it will serve as a fundamental principle that can well be put forward in rate discussions for some time to come; for if there shall be any reduction, it must come with sufficient slowness to protect the quality of electric service and offer no hindrance to its expansion at a rate in keeping with the business needs of the communities served.

Another interesting point touched upon by Mr. Perry in his address, which appears elsewhere in this issue, has to do with capitalization in rate making. Although it has been possible to show that no overcapitalization now exists in utility financing, it is refreshing to have a confirmation of this fact from so high an authority as the National Association of Utility Commissioners. The assertion that "A fair return on the value of property used and useful in public service and just compensation for the use of property owned by utilities is a constitutional right which cannot be denied" will bear frequent repetition in this particular form as embodying a fundamental element of simple, adequate service to the public. With commissioners everywhere accepting it and following Commissioner Perry's suggestion that regulatory bodies shall forthwith publish the truth when newspapers attack utilities and publish untruthful statements concerning their earnings, the day will soon arrive when the utilities will be free from suspicion and a welcome factor in the business plans and community development programs.

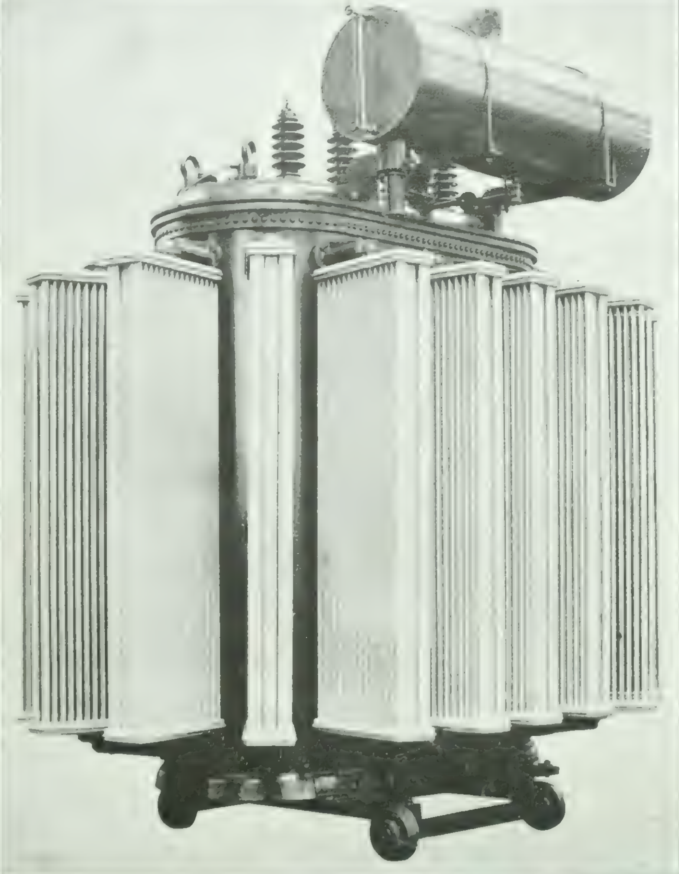
Fundamentals in Studies of Power Factor

THE power-factor problem is fundamentally an economic and not an engineering one. Although the final answer must take an engineering form, the real question is the increase in cost that a decrease in power factor makes in the service rendered a consumer. At the present time power-factor discussions are clouded by a lack of agreement as to the results that must be obtained in the measurements taken as a basis for billing. The kilovolt-ampere demand, kilovolt-ampere-hour, a combination of the two and various combinations of these with the present accepted energy units have been proposed. The confusion arises largely from a lack of sufficient data on which to base conclusions, since the plant with its peak load during the lighting hours of the day presents a different problem from the plant with a peak load caused during the daytime by an industrial power load. The consumer's maximum kilovolt-ampere demand may come during the maximum-load hours or it may not. Even if it comes during the off-peak hours, it may have characteristics that are embarrassing from the standpoint of other classes of service. Although the off-peak kilovolt-ampere demand may not affect the power-house investment required to serve the consumer, it may seriously affect the distribution or transmission system investment, which may be roughly estimated at half total average investment cost.

The greatest practical hindrance so far in obtaining adequate data has been the lack of meters that are really practical for general use. The various methods or combinations that have been used involve so much complication that the operator has hesitated to put them into general service. As a result the data so far available are confined to the so-called large consumers and are yet so meager that no broad conclusions can be drawn. The big class of small power consumers has been barred from consideration by the utter lack of suitable meter equipment together with other difficulties that have so far seemed insurmountable, and the relation of the lighting consumer to the problem has had little or no thought. The big need of the moment in the study is for data from widely scattered sources and from thousands of consumers of all classes that will provide a basis for determining the effect of power factor on both the power-house and the distribution or transmission-line investment. In this study central-station engineers and manufacturers must co-operate.

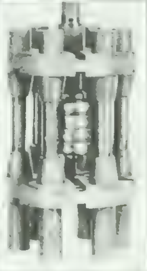
Good Records a Step Toward Economy

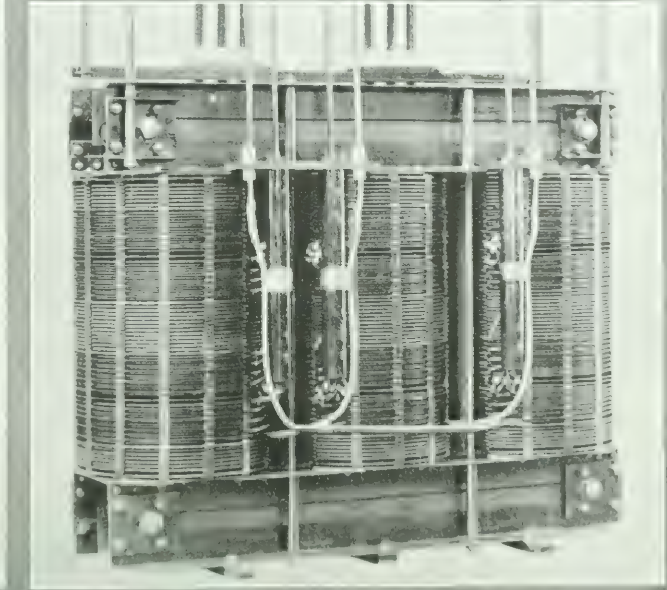
A GOOD set of records on transformer ratings and loads carried is an excellent basis on which to apply economical methods in the handling of a distribution system. If kept up to date, such records should pay for themselves in facilitating the planning of new construction and addition of new services. However, it should not be forgotten that the adoption of an effective record system is only a step in the economical handling of a distribution system. Thorough groundwork and costs and determination of annual charges on equipment and accurate calculation of energy losses can produce the result that is wanted. A correct practice, based on such studies, is made possible of application by the possession of records that will indicate what is happening on the system and give a basis for planning improvement.



10,000-Kva. Self-Cooled Transformer

THROUGH the use of radiators, oil conservators and externally operated ratio adjusters, transformer manufacturers have overcome some design and operating difficulties of long duration. At the left is a 10,000-kva. self-cooled transformer, which is good evidence that there are virtually no limitations to the size in which such units can be built and transported. The conservator, which maintains a static head on the oil in the tank prevents the accumulation of combustible gas and also the sludging caused by contact of the hot oil with air. Where the necessity of taps on large high-voltage transformers outweighs their objections the externally operated ratio adjusters, shown installed on the transformer below and in detail above, will eliminate the inconvenience of opening transformers and drawing down the oil to change connections.





Steel-Clad Rectifier Merits Attention

In Europe They Have Been Developed for Outputs Up to 900 Amp. at 800 Volts—With Slight Changes They May Be Adapted to 2,500 Volts—Efficiencies and Power Factor Are Very Attractive

By J. H. MILLIKEN
Midstates Engineering Company, Chicago, Ill.

WITH a record of 100,000 kw. of installed capacity in Europe, the large power rectifier has reached a point where it merits consideration in American practice. The war period interfered with the usual international intercourse, and the introduction of other problems has also played its part in delaying consideration of the introduction of apparatus under new conditions and the experimental work necessary thereto. The development work in Europe has been carried on and the apparatus brought to its present state of operating efficiency by Brown, Boveri & Company of Baden, Switzerland. A description of European practice on which this article is based may be of interest to any American engineers who wish to consider its use in this country.

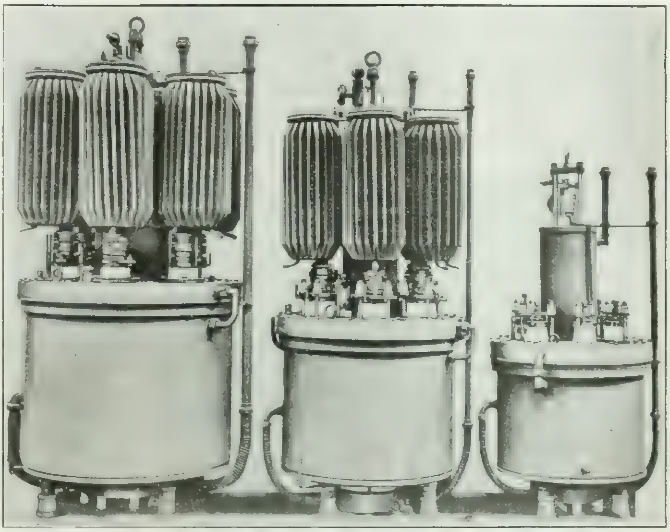


FIG. 1—THREE STANDARD UNITS DESIGNED FOR DIRECT-CURRENT OUTPUT OF 300, 600 AND 900 AMP. AT ANY VOLTAGE UP TO 800. WITH SLIGHT CHANGES RECTIFIERS MAY BE EASILY ADAPTED TO HIGHER VOLTAGES UP TO 2,500

The negative electrode resistance phenomenon of the electric arc in mercury vapor, permitting current rectification, is thoroughly familiar, as are the various adaptations of this arc in single-phase rectifiers for battery charging, operating arc lamps, etc., and will not need discussion.

In constructing the large power rectifier the results obtained from the glass-bulb type are of little assistance as the aspect of the problem is entirely changed. One of the principal problems connected with this apparatus, but one which with the bulb type was quite simple, has been to make a tank of sufficient capacity that would be absolutely tight under all conditions. This has been the subject of much experiment by various manufacturers. Without going into detailed description, it is sufficient to say that in the apparatus under the present state of development the problem of sealing has been solved so satisfactorily that the steel tank has actually maintained a vacuum equivalent to a mercury-column measurement of 0.01 mm. to 0.001 mm. over long periods with virtually no operation of the vacuum pump after the first evacuation.

The rectifier consists of an arc chamber or cylinder having a cylindrical extension at the top, both cylinder and extension being built of steel plate. The cover and the base of the cylinder are also made of thick steel plate. The mercury cathode is contained in a dish-shaped recess in the bottom, and the anodes are inserted into the arc chamber through the cover. The cylindrical extension acts as a condenser for the mercury vapor which arises from the cathode, the condensed mercury returning to the cathode to be again vaporized.

The arc chamber is surrounded with a water jacket for circulating cooling water. There is also a water jacket arranged to cool the anode plate and another for the mercury cathode in the bottom of the tank, and these are connected to the circulating system, which is usually arranged as a closed and insulated system using radiators for recooling. Circulation can be arranged on the thermosiphon principle or be actuated by a small pump. When direct-current voltage of less than 600 is used and the system is not grounded clean service water may be used. The anodes through which the current from the transformers is led to the arc are inserted into the cylinder through specially designed insulators and arc guides. The arc guides serve to restrict the play of the arc within a definite area. The anodes on the larger sizes are water-cooled and provided with self-contained radiator and circulating system. The vacuum in the cylinder is established after installation and maintained as occasion may require by a small vacuum-pump unit which accompanies each station equipment. The cylinder unit is insulated and supported on a suitable base, as is also the vacuum-pump outfit. The entire equipment is in all cases totally inclosed in a protecting guard.

The arc operates in the arc chamber between the main anodes, of which there are six when six-phase connection is used, and the cathode or body of mercury in the bottom. The arc is started by an auxiliary ignition anode which automatically makes contact with the mercury cathode when the circuit through a solenoid operating this anode is energized. In making contact with the mercury the solenoid coil is short-circuited, which allows the separation of the ignition anode from the mercury by spring action and starts an arc at that point. This small arc at any time vaporizes sufficient mercury to establish the main arc. A small auxiliary arc fed from a single-phase exciting transformer connection through a choke coil and resistance stabilizes the arc when load is widely fluctuating or drops to zero.

Supplying each rectifier bank or individual cylinder as the case may be there is a stepdown transformer suited to the conditions of primary voltage on the supply line and delivering current to the rectifier at a voltage suited to the required direct-current output. This requirement is similar to that of rotary convertors, though the ratio of secondary voltage to the direct-current voltage differs from that of either the three-ring or the six-ring convertor.

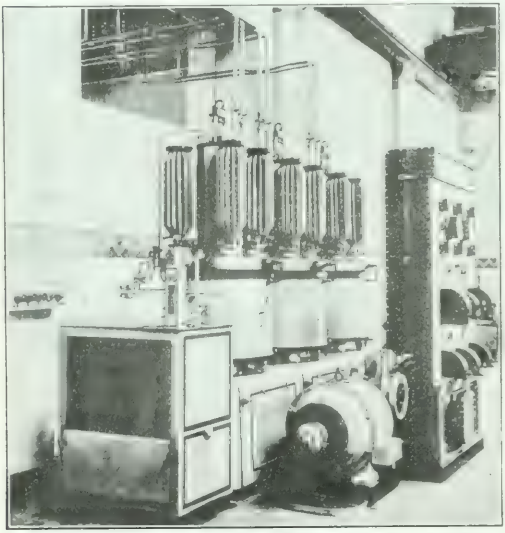


FIG. 2—INSTALLATION OF THREE 600-AMP. UNITS, SHOWING COMPACT LAYOUT POSSIBLE WITH THIS TYPE OF APPARATUS

The rectifier economizes floor space as the cylinder unit need not be accessible for operating attention, all operating being done from the switchboard. The cylinder unit is not heavy and has no moving parts, so foundations are not required and it may be placed on galleries or on floors in buildings not especially designed for substations. If erected in the center of the room, ducts or conduit for cable or bus must be provided in or below the floor slab.

The simplicity and ruggedness suit it especially to automatic and portable substation uses. The attendants in a non-automatic substation need have no more skill than would be demanded for a transforming station, as the operating functions are no more involved than switching. Standard single units in production and use:

Type	Amperage	For Voltages Up to
G 3/16	300	800
G 4/6	600	800
G 5/6	[illegible]	800
HG 3/6	300	1,200

The units work perfectly when banked in parallel, anode reactance coils being used if they are fed from a common transformer. They can be worked also in parallel with any type of direct-current apparatus such as rotary convertors, motor-generators or storage batteries. The parallel operation in bank with proper distribution of load is fixed so that no adjustment of voltage is necessary when putting on or taking off units. Compounding is provided as required to take care of voltage change to meet changing load. Adjustable output voltage through a wide range is possible by the imposition of an induction regulator upon the alternating-current supply.

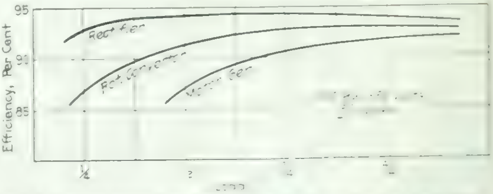


FIG. 3—COMPARISON OF EFFICIENCY OF STEEL-CLAD RECTIFIER, ROTARY CONVERTOR AND MOTOR-GENERATOR OVER LOAD RANGE

A most pronounced advantage of the rectifier, particularly for peak, mill and railway work, is its remarkable overload capacity. Short-time overload capacities:

Duration of Overload, Minutes	Per Cent of Normal Rating Permissible
2	300
5	200
10	150
30	125

There is no flashing over or damage to the rectifier from external short circuits. Momentary short circuits do not affect the apparatus at all, and severe ones are, of course, cleared by the usual protecting breaker.

The characteristics of the units evidence high power factor over all, very high unit and over-all efficiency at all loads, and excellent regulation with compounding where required. The power factor averages around 95 per cent, and the efficiency at full load varies from 92 to 98 per cent, depending on the direct-current output voltage utilized.

The efficiency of a cell itself does not change with the load current, but in taking account of complete plant, transformer and auxiliaries must be included.

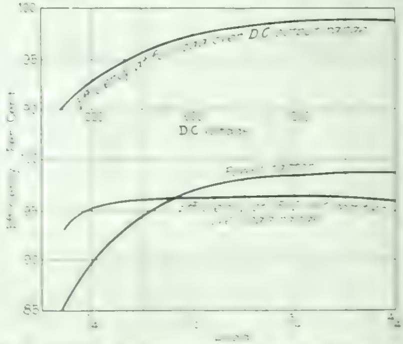


FIG. 4—SOME CHARACTERISTICS OF STEEL-CLAD RECTIFIER

From the accompanying curves it will be seen that the efficiency remains virtually steady down to one-quarter load, when these fixed losses have a marked lowering influence on the curve. It may also be seen that the rectifier has considerable advantage over the rotary at less than full load and somewhat better efficiency at full load. The very high and almost flat efficiency curve of a rectifier supplying 1,500 volts direct current is shown in one of the curves.

The records of a number of stations that have been in service for a sufficient length of time for observation indicate that the apparatus gives reliable performance with very small maintenance cost. The performance of a substation supplying heavy steel-mill service is of particular interest, this being one of the earliest installations. This station was put into service six years ago and has been attended solely by women operators since that time. The station was recently shut down for inspection and all units were opened. No evidence of deterioration was found.

A New Form of Rural Service Contract

Iowa Company Employs Contract Under Which Consumers Furnish Line and Company Assumes Responsibility for Maintenance—Unusual Form of Rate with Low Energy Charges

By W. J. GREENE
Iowa Railway & Light Company, Cedar Rapids, Iowa

A NEW form of rural service contract that reaches the same general results as do the rules in several states where the farmer is required to advance the money for construction purposes and deed the line to the central-station company is being put into use on the properties of the Iowa Railway & Light Company, with headquarters in Cedar Rapids, Iowa. The principal features of the contract are as follows:

1. The farmer constructs the line in accordance with specifications furnished by the central-station company. The company may refuse to connect if the line in its judgment is not in accord with the specifications. Ownership remains with the farmer.

2. The central-station company takes charge of the maintenance of the line under the contract and bills the consumers for the expense. In making the rate no depreciation charge is included as it is expected that maintenance will keep the line at a point where the cost of reconstruction will be spread over a long enough period to avoid excessive charges at any one time.

3. The rate carries a service and capacity charge which varies with the demand and transformer capacities respectively of the individual consumers. The energy rates consist of a high primary-base rate that is designed to cover the capacity charges for the first kilowatt of load and an unusually low excess-energy rate. The rate is designed to put all the consumer and excess demand charges in a monthly fixed charge and prevent the attitude of mind that the consumer usually takes with the minimum-charge form of rate. Under the form of rate used, the cost of energy used for other purposes than lighting comes at a very little increased cost, thus encouraging the farmer to use the service he has already paid for freely. The schedule includes a coal clause on which the energy rates will be adjusted as the cost of coal fluctuates.

Following is the contract form and rate used for the individual consumers. At the end of this is also given the rate for service to a rural corporation. It is taken from a contract which is similar in form and requirements to the one for the individual consumer.

INDIVIDUAL RURAL ELECTRIC SERVICE CONTRACT

Memorandum of agreement made in multiple this —— day of ——, A. D. 192 , by and between the Iowa Railway & Light Co., an Iowa corporation, hereinafter called the "producer," and the undersigned individuals, hereinafter called the "consumers":

Witnesseth: That for and in consideration of the agreements of the parties hereto, hereinafter set forth, and the performance of said agreements, it is mutually understood and agreed by and between said parties as follows:

1. The consumers shall provide a —— volt, —— phase, —— cycle rural distribution system constructed in accordance with specifications furnished by the Board of Railroad Commissioners of the State of Iowa or other legally authorized body, or in the event specifications have not been provided by any such legally authorized body, in accordance with specifications furnished by the producer. Said distribution shall begin at —— and end at the meters on the consumers' premises. The consumers shall furnish the producer with an accurate map of the said distribution system and all extensions made thereto. Said distribution system shall be known as the —— line. If, in the judgment of the producer, the construction of said distribution system is not in accordance with the specifications, the producer may refuse to make connection with said distribution system until the construction complies with the specifications or the producer has been ordered to make connection by the said Railroad Commission or other legally authorized body.

2. The producer shall maintain and operate the said rural distribution system, and the consumers shall pay the producer for the service of said maintenance and operation the schedule of charges filed in the office of the manager of the division in which the consumers are located. The charges for said maintenance and operation shall be apportioned equally among the consumers, unless otherwise authorized by a written notice signed by all the consumers. Each consumer shall make payment for the service of maintenance and operation within ten days after rendition of a bill therefor.

3. The producer shall, except during construction, protect, defend and indemnify the consumers against any and all claims for damages growing out of the maintenance, operation and ownership of said distribution system, provided the consumers give by telephone immediate notice of all accidents to the division office of the producer followed by personal or written notice with fullest information obtainable. All claims for said damages shall be forwarded immediately to the office of the general manager of the producer at Cedar Rapids, Iowa. The consumers shall forward to the producer every summons or other process served upon them in any suit, however groundless, on account of any claim. The consumers shall, except in a pecuniary way, render to the producer all reasonable co-operation and assistance in the protection of the producer of its or the consumers' interests. Each consumer shall pay for said protection the sum of $—— in advance for the first year of this agreement and annually in advance thereafter the sum necessary for said protection.

4. The producer shall use due diligence and exert every reasonable effort to provide uninterrupted service, but shall not be liable for damages resulting from interruptions of service.

5. The producer shall furnish electric service, and the consumer shall use and pay for such service in accordance with the terms and conditions of this agreement and the rules, regulations and charges of the producer. The rules, regulations and charges effective at the date of this contract are given in Exhibit A, attached hereto and made a part thereof.

6. The undersigned consumers shall form an electric farm line corporation or association upon written notice from the producer whenever there are more than ten individuals who will contract for service from the said distribution system or any extension thereof. This agreement will be terminated on the date the agreement between the producer and such electric farm-line corporation or association becomes effective.

7. The failure of either of the parties hereto to enforce from time to time the strict performance of any of the covenants and agreements herein contained, or the waiving from time to time of a default on the part of either of the parties hereto shall not be construed as a waiver of any containing or subsequent default or defaults nor impair the right of either of the parties hereto subsequently to require the strict performance of each and every covenant, agreement and undertaking herein contained.

8. The consumers shall give or secure permission for the producer to do the necessary pruning of trees along the right-of-way of the rural distribution system and to do other things essential to the efficient and safe operation of the said rural distribution system.

9. Each consumer shall obligate a grantee or lessee of the premises of the consumer to become a party of this agreement as a consumer.

10. Wherever the word consumer is used in this agreement, it shall mean each signer hereto as a consumer and such others as may become consumers by the execution of a proper form of rider to be attached hereto or by a supplemental agreement.

11. The rules, regulations and charges of the producer affecting the consumers may be revised by mutual consent of both parties. In the event that either part shall, by written notice, request a revision of said rules, regulations and charges, and such revision shall not have been effected by mutual agreement within sixty days after the date of said written notice, either party may submit the matter to any legally authorized body as provided in Article 12, or in the absence of such body, either party may bring an action in equity in any court having proper jurisdiction.

12. The foregoing terms and conditions of this agreement and the rules, regulations and charges of the producer shall be subject to revision by any legally authorized body which may be given jurisdiction thereover by the State of Iowa.

Individual Service Rate

A primary base rate of 10 cents per kilowatt-hour for the first 30 kilowatt-hours used per month, plus

An excess base rate of 3 cents per kilowatt-hour for all electricity used in excess of the first 30 kilowatt-hours used per month, plus

A monthly service charge of $1 per consumer, plus 12 cents for each tenth of a kilowatt of demand in excess of 1 kw., plus the amount shown below opposite the size of transformer used by the consumer. When two or more consumers use a transformer in common the said amount will be apportioned among them by the ratio that the demand of each bears to the sum of the demands.

Size of Transformer Kva.	Amount	Size of Transformer Kva.	Amount
1	$0.45	7	$1.50
1	.60	10	1.90
2	.75	15	2.50
3	.90	20	3.10
5	1.10	25	3.75

The primary and excess base rates will be increased or decreased beginning with January 1 and July 1 of each year for the next six months' period at the rate of 1 mill per kilowatt-hour for each 30 cents or major portion thereof variation above or below $5.50 per ton for the cost of coal burned in the previous six months' period. The cost of coal burned to include all the costs that are chargeable to the accounts of fuel, boiler-room labor and water for power at the —— power plant.

The demand of a consumer will be determined by the manufacturer's rating of the consumer's largest electricity-consuming device or by measurement at the option of the company. Minimum demand, 1 kw. (Note: One motor horsepower will be taken as the equivalent of one kilowatt.)

No consumer shall install, without notifying the producer, any device that has a larger kilowatt rating than that indicated opposite his name in the following table:

[A form is provided here for the listing of consumers contracting for service.—Editor.]

Rules and Regulations

1. *Metering Equipment.*—The producer will furnish, install and maintain the metering equipment, but the consumer shall provide a suitable place for such equipment in accordance with the specifications of the producer.

2. *Installation and Maintenance.*—All wiring, equipment and apparatus must be installed and maintained in accordance with the legally authorized code.

3. *Protection of Service.*—Consumers shall not use the producer's service for operating wireless equipment or other equipment that will affect the service of the producer, without complying with the producer's rules governing such equipment.

4. *Testing and Removal of Meters.*—Consumers shall allow the producer's agents to enter the consumer's premises at reasonable times to read, test or remove the meters.

5. *Meter Loop.*—Consumers shall furnish and install the meter loop and cutout in accordance with the specifications of the producer.

6. *Charges for Installation and Removal of Meters.*—The first installation of a meter for a consumer is covered in the service charge, but a charge of $1.50 will be made for each subsequent installation for the same consumer.

7. *Correcting Meter Errors.*—In case a meter is found to be incorrect by more than 2 per cent plus or minus, the consumption for the two billing months preceding the test shall be adjusted to conform to the correct amount based on said test.

8. *Stopped Meters.*—Should a meter fail to register during all or part of a month, the bill for the month shall be calculated equitably from the previous or succeeding month or from known load and hours of consumption.

9. *Reading Meters.*—The producer will read meters on or about the same day each calendar month, except in cases where it elects to furnish the consumer with stamped and addressed meter cards, in which case the consumer shall mark the position of the meter dial hands as they exist at such times as the producer may request and mail the card promptly to the producer.

10. *Rendition of Bills.*—The producer will render a bill or bills to the consumer for electricity and such other services as may be due the producer on or about the same day of each calendar month. Rendition of a bill shall be the mailing or delivery of the bills to the address designated by the consumer.

11. *Non-Payment of Bills.*—In the event that a consumer has not paid all of the money due the producer for electric service within ten days after rendition of a bill or bills, the amount due shall be increased by 10 per cent. If said bill or bills plus the 10 per cent increase is not paid within twenty days after rendition, the producer reserves the right to discontinue service until all amounts in arrears are paid in full.

12. *Continuity of Service.*—The producer will use due diligence to furnish continuous and uninterrupted service, but the producer shall not be liable for damages caused by any interruptions of service.

13. *Applications and Contracts.*—Those desiring service of the producer will be expected to sign a written application where open rate tariffs apply and a contract for all other classes of service.

14. *Deposits.*—Any consumer may be required to deposit $5 or more with the producer. Interest will be allowed on such deposits at the rate of 7 per cent per annum.

Corporation Rural Electric Service Rate

The following rate schedule is used for service to rural corporations with a similar form of contract:

An energy base rate of 2.5 cents for all electricity used per month, plus a monthly demand charge of $5 per kilovolt-ampere of demand, plus a monthly service charge of $——.

The energy base rates will be increased or decreased beginning with Jan. 1 and July 1 of each year for the next six months period at the rate of 1 mill per kilowatt-hour for each 30 cents or major portion thereof variation above or below $5.50 per ton for the cost of coal burned in the previous six months period. The cost of coal burned to include all the costs that are chargeable to the accounts of fuel, boiler-room labor and water for power at the —— power plant.

The monthly demand shall be the highest average number of kilovolt-amperes recorded in a fifteen-minute period during the month, unless said monthly demand is less than 75 per cent of the highest monthly demand established during the preceding twelve months, in which event the monthly demand shall be 75 per cent of such preceding highest monthly demand.

Appeal for Reason in Utility Regulation

An Encouraging Message for Public Service Companies from the Recent Annual Convention of the National Association of Railway and Utility Commissioners

By JAMES A. PERRY
Member of the Railroad Commission of Georgia and President of the Association

FOR many years there has been a nation-wide agitation looking to the abolition of the rights of the different states to regulate railroads in any manner. The climax of this agitation came with the transportation act of 1920, as construed by the Interstate Commerce Commission. The construction of this act by the Interstate Commerce Commission outlaws state regulation and strikes at the very fundamentals of our system of government. . . .

I have not the slightest doubt that one of the chief financial troubles of the carriers of the country today is the fact that rates, both freight and passenger, are so high as to result in an aggregate loss rather than a gain as contemplated. High freight rates, especially in cases of short hauls, have done more for the growth of motor transportation of freight than has all the progress of motor transportation itself, which necessarily results in a loss to the railroads. . . .

If the construction of the transportation act of 1920 by the Interstate Commerce Commission is to remain the law of the land, a most hurtful blow has been given our dual system of government—a form of government that has stood the test of time, and chiefly because its form provides for representation of the people, for the people and by the people. The provision that it is by the people is, so far as concerns the regulation of our commerce, partially defeated and the right of local self-government is destroyed in the present construction of the transportation act. . . .

It has always been with the individual states that we have gone forward in the first efforts of any new idea pertaining to our commerce. If proved good in one state, other states can take it up, and finally it becomes national in its scope. Far better that one state try it, should it be unwise, than for our entire country to be subject to an expensive experiment. State regulation of rates meets the demands of local traffic conditions, where an intimate knowledge can be quickly applied, whereas at one common center the truth in most cases will never be known. Remove, if you will, the state lines and you still have the problem of reasonable local rates, and to be fixed by one central body that can never have more than a smattering idea of the real local conditions. . . .

Rates that are higher than the traffic will bear stop the movement. All over the country, for comparatively short hauls, essential commodities are costing less than the freight to move them to market, with the result that in many intrastate movements motor power is hauling a good percentage of short-haul freight. . . .

Railroad property is as much the property of stockholders who put their money into it as your home and my home is property of ours. And when it is dealt with by any consideration other than that obtaining when the rights of private property are being considered, a wrong is done, first, to the man who has invested his money in the particular railroad; second, to the public, who, in the end, cannot hope to have the service, regardless of rates, if in the meantime the property has been destroyed by prohibitive operating costs and unremunerative rates.

There has been too much misunderstanding between the public and the railroads in this country. I am not unmindful that railroads here and there throughout the country have been guilty of the foolishness of seeking and receiving unnecessary benefits from legislatures now and then—only to serve their purpose for a while, with the result that an outraged people rise up to correct the wrong and, as is often the case, go so far as to do a real injustice to the railroad that ends with a loss to the public and the railroad alike. The railroads of this country can no more carry on their business in this country without the co-operation of the people they serve than they can get along without equipment, and this business of seclusion by centralization of all regulation of service and rates at Washington is going to prove the greatest hurt to the railroads and the commerce of this country that either has ever experienced. . . .

MISTAKE IN HOLDING TO LOW RATES

The question of rates for utility properties has been one of nation-wide concern for several months. Dating from some two years ago, there is no question to my mind that any regulatory commissions throughout the country made the common mistake of holding light and power, gas and street railway companies to rates that were too low, hoping that the immediate future would amply justify the rates prescribed. This hoped-for condition was not realized. The experience was just the opposite of what we had expected to see. The raw materials going into the manufacture of the products sold steadily increased in price. Finally, when business generally became depressed, public utilities had been required to do business on such small returns that they were not in a position to withstand, even for a short while, an increase in actual losses already sustained.

The public at once took the position that public utilities should not expect normal returns, but should endure with other business enterprises slight or no returns at all and, if need be, increased losses.

The law by which regulatory commissions are governed required them to prescribe just and reasonable rates, and the courts throughout the country have declared that a just and reasonable rate is one that with competent management will afford the utility a reasonable return upon the fair value of its property being used in the public service. Just compensation for the use of private property by the public is a constitutional right which cannot be denied. It is the fair value of the physical property devoted to the service that must control, and it does not matter whether it came as a gift from earnings of years past, actual investment or otherwise. . . .

The public is interested in the utility having such rates as will insure a reasonable return upon the fair value of its property, thus guaranteeing not only an unimpaired service, but such development from time to time as will always be sufficient to meet the requirements of constantly increasing demands for service.

At the present time, in many instances, a utility files an application with the regulatory board of the state in which it operates. This done, a copy of such application is served on the municipality affected by the change proposed. It makes no difference what the relief asked for may be, the mayor and council meet and promptly vote to instruct the city attorney to oppose the granting of the relief sought. No investigation is made as to the justice of the relief petitioned for, the city attorney is directed to oppose it, not to investigate and ascertain the truth, as information for the mayor and council, before action is taken one way or the other.

Regulated Monopolies on Trial

We seldom hear of a municipality under such circumstances making an investigation and ascertaining if there is any merit in the claim of the utility company. Seldom investigations are made, little information is had, and seemingly none is desired.

This, of course, is an unfortunate situation. In the end it will be overcome, but not without loss to the utility and the public while such a condition prevails. Competitive business had its day and failure. Regulated monopolies are now on trial. The public is still paying 100 per cent more for some merchandise than the same article sold for four or five years ago, but the thought of paying 50 per cent increase in utility rates as compared with prices for such service three and four years ago meets with scant sympathy. . . .

The public is vitally concerned in the expansion of utilities because a city can never grow faster or extend further than her utilities reach. The utilities of a community are the greatest developers any city ever had. No city can build beyond the lines of her street railroads, and this is true to a degree in comparison with the area covered by gas mains.

Will Capital be Forthcoming?

Few sections of this country can finance utility development of any kind from local capital. The financial necessities of development, therefore, carry us to foreign fields for money. Is there a man anywhere, regardless of his business interest, with surplus money for utility investments, who is going to send his money into communities where there exists a citizenry hostile to foreign capital for such investment? Even worse, will such a man send his money into a state for such investments where the state regulatory board refuses rates that will earn even less than the lawfully prescribed rate of interest as a return for utility service? Will such money find its way into a state where condemnation of such property is the talk of the day?

The public should see to it that such conditions do not exist. It has an interest greater than the selfish interest of the few who would stop the utility development of every community while their political ambitions are satisfied or a personal grouch is assuaged. It is a sad picture to see a community of inflamed citizens following the leadership of one man, or even several men, in an effort to handicap or destroy a local utility, all because of selfishness on the part of the few self-appointed leaders. This kind of thing has got to stop in this country, otherwise the public will pay the high price of stagnation in such growth, with a breaking down of the service now rendered.

What the people desire most is efficient service, so long as it is furnished at a reasonable price. This they are willing to pay. They have a right to expect both efficient service and reasonable rates at the hands of regulatory commissions. Is it not high time that the public and utility companies throughout the country were coming to a better understanding? . . .

The public is concerned in seeing that light and power companies, both steam and hydro-electric, are built in such large units and so connected as to cover a radius sufficient to overcome the interruptions in service resulting from high and low water, storms, breakdowns and other causes, all of which come at intervals and in spots; and by a proper arrangement for exchange of output between such large companies interruptions in service longer than the time consumed in throwing in a switch would never be heard of. . . .

The time has come when the public must have a broader vision in handling these questions if we are to keep pace with our opportunities for growth and development. We have got to get away from a local consideration of services of this kind. Far better for us that the lights we use in our homes and the power we use in our local enterprises be derived from power even hundreds of miles away from us, with such an interrelation of service as has just been mentioned, if by such an arrangement we have an added guarantee of continuous service.

Security Holders Must Increase in Number

I cannot believe the public will stand for a reactionary program that will certainly carry us back to crude methods, with less service and at higher rates. We may halt, temporarily, here and there over the country, but in the end electric power supply, as well as other utility services, is going to be carried on in a wholesale manner. Any other method is squarely in the teeth of the very fiber of our people and form of government. There are 1,450,000 citizens of our country who have invested in the securities of the electric light and power companies of America. This number should be increased many times. Indeed, such a new class of investors may in the end become the only solution of the problem of financing the present needs of our utility companies—saying nothing of the future—if such companies are to keep pace in development and expansion as the public needs require. Either the public will have to assume and practice a more friendly attitude toward capital belonging to the other fellow or the public will have to put up the cash, and from a class who have heretofore studiously avoided such investments.

This brings us face to face with the issue confronting the public utilities of the nation today. They have not the financial strength of expansion, and in many cases this came to be so from the fact that they have been required by regulatory boards to operate on rates that were too low. This issue should be presented to the public that it may decide for itself the manner in which such financing hereafter shall be done. If private citizens refuse to furnish the money, then the public must inform the other fellow that efforts at condemnation or confiscation of his property will not be tolerated.

Cost of Improved Street Lighting Not the Deciding Factor

Civic Pride of Stamford, Conn., and Belief that Traffic Accidents Would Be Decreased by Better Illumination Were Factors in Increasing Yearly Lighting Expense More Than 50 per Cent

By W. D. JENNINGS

IF CITY officials are not interested in improving their street lighting because of civic pride, they will at least be interested because of the definite bearing that proper illumination has on traffic accidents. When the subject of improved lighting is properly placed before the various business organizations there will seldom be any protest against the additional expense. This was found to be true at Stamford, Conn., where one of the best and most artistic ornamental street-lighting systems in the East has recently been placed in operation. The Stamford Gas & Electric Company assumed the entire cost of the equipment and installation, but the new street-lighting contract will cost the city $47,575, as against the previous expenditure of $30,680 yearly. Although the use of luminous-arc lamps for ornamental street lighting is well established and they continue to hold the field where high intensities and low maintenance costs are chiefly considered, there are several interesting features regarding the Stamford installation which merit recording.

The previous lighting equipment was in no sense obsolete, showing lighting intensities of 0.27 foot-candle on the principal business street. In the business and in part of the residential section 134 direct-current 6.6.-amp. series pendent luminous-arc lamps of the Boston type were installed, equipped with opal globes and mounted two on a pole in the business section and singly in the secondary business district. The lamps were on one side of the street only. The price paid per lamp per year was $90 for overhead construction, $120 for underground, for 4,000 lighting hours. Eighty of these pendent-type lamps will be retained in service in the outskirts of the new lighting zone.

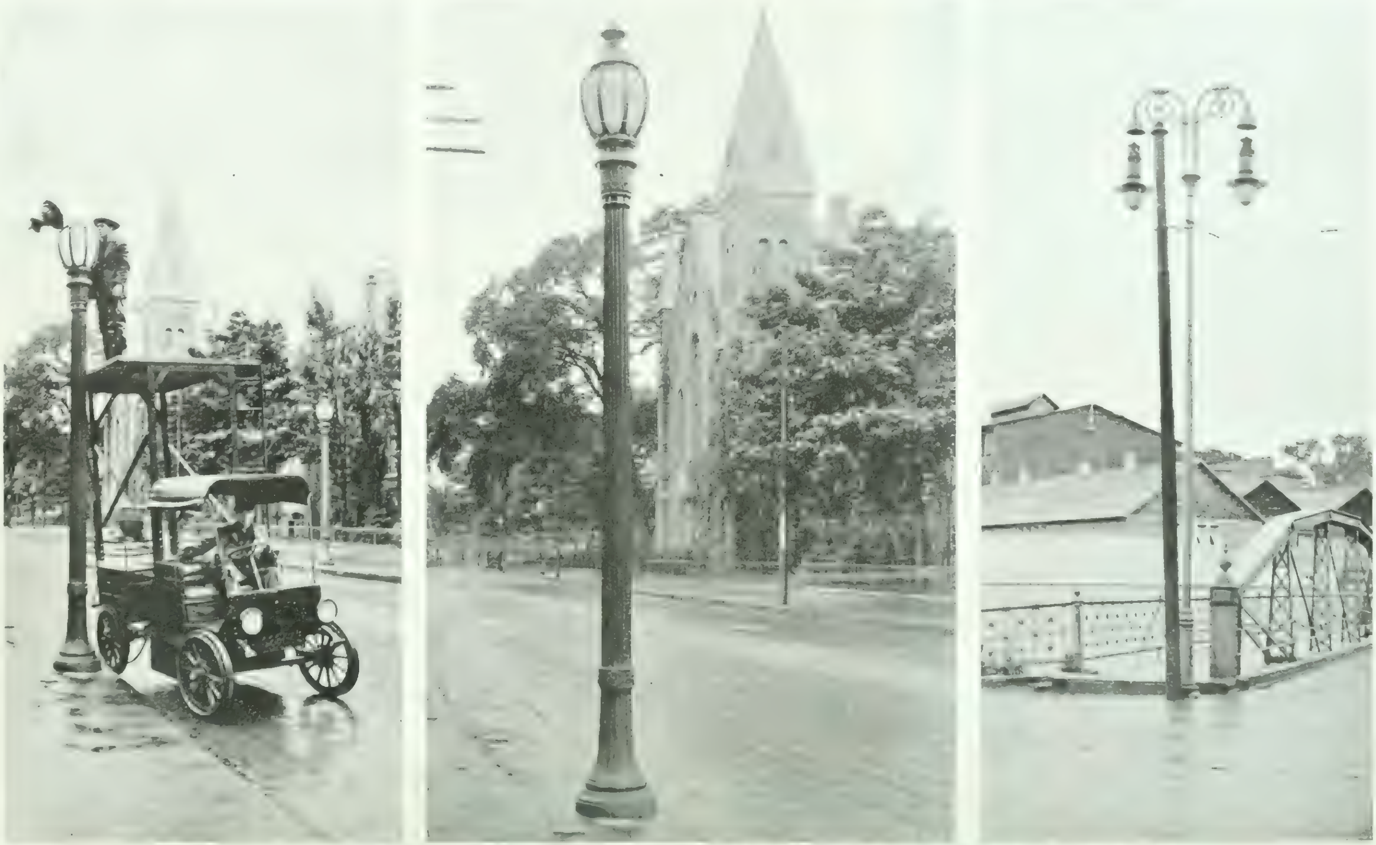
The new equipment consists of 150 direct-current 6.6-amp. series ornamental luminous-arc lamps, equipped with eight-panel alabaster globes of pleasing design. The lamps are mounted on the top of ornamental posts with a mounting of 14 ft. 6 in. (4.35 m.) to the light source.

The standards are erected approximately 100 ft. (30 m.) apart on each side of the street in a staggered arrangement. The lamps are operated from two circuits, so that those on alternate sides of the street can be extinguished after midnight, with the exception of lamps adjacent to the Town Hall, which burn all night. Each lamp has a series absolute plug cut-out installed in the base of the ornamental pole. When the plug is removed all connection between lamp and line is absolutely broken.

For convenience in trimming, a 750-lb. (340-kg.) electric truck was converted into a tower wagon. This has been found almost indispensable when changing arc lamps or cleaning the globes, and in addition it is used for renewing burned-out series incandescent lamps.

The new system employs the latest improvements in design of arc lamps for street-lighting service. In principle these lamps are the same as the older forms of pendent and ornamental luminous-arc lamps, although a number of detail changes have been made in order to provide better electrical insulation and make the lamp

Modern Lighting Is a Great Help in Adorning City Streets and Preventing Accidents



ORNAMENTAL POSTS WITH EIGHT-PANEL ALABASTER GLOBES INCLOSING 6.6-AMP. SERIES LUMINOUS-ARC LAMPS REPLACED THE OLD PENDENT LAMPS SHOWN AT THE RIGHT. THE PENDENT TYPE, HOWEVER, IS RETAINED IN THE OUTSKIRTS OF THE LIGHTING ZONE. AT THE LEFT IS SHOWN AN ELECTRIC TRUCK USED FOR TRIMMING, CLEANING, ETC.

easier to maintain and also more reliable in service. The electrodes used in these lamps are, of course, the vital feature around which the lamp has been developed. The upper electrode, which operates as positive, is a solid rod of copper and is relatively non-consuming—8,000 hours to 10,000 hours' life being obtained from a single electrode. The lower, or negative, electrode is composed of metallic oxides packed into an iron tube and in these lamps burns for about 125 hours. The principal ingredients of the electrodes are natural oxide of iron, titanium and chromium. The purest of ores are used, and the greatest care is exercised in purifying and grinding them.

The calculated illumination value on the street surface along the center line of a street is an average of 0.350 foot-candles. On referring to the night view the even distribution and absence of shadows will be observed.

Affords Better Vision

In addition to the general pleasing effect produced by the soft whiteness of the light from the luminous arc, it also seems to afford better vision along the street than the yellow tones of light. Particularly is this noticeable as contrasted with the ordinary yellowish light in store windows. Instead of reducing the apparent brilliancy of the window, the difference in color serves to introduce a contrast that accentuates both the street illumination and the window display.

The luminous-arc lamps are operated from series mercury-arc rectifiers, but to insure continuity of operation the duplicate double-tube rectifier was specified. This outfit consists of a seventy-five-light rectifier, two tubes in series, of standard construction, but with a special tube tank. The tank is so modified that each tube has a duplicate tube on a separate holder connected in multiple with it. Glass inserts in the tube-tank lids enable the operation to be observed without raising the lids. A guiding arrangement facilitates inserting the tube-holder pin into the shaking mechanism. The advantage of this design lies in the fact that operation is not suspended when a tube fails, as the tube in multiple will carry the load while replacement is being made. The price per lamp per year is $120 for about 3,000 lighting hours. The contract covers ten years from date of installation.

In addition to the ornamental lighting, the series incandescent system was improved by replacing about 931 60-cp. 6.6-amp. "Mazda B" series lamps, furnished at $20 per lamp per year for 4,000 lighting hours, with 960 100-cp., 6.6-amp. "Mazda C" series lamps, at $25 per lamp per year underground for 4,000 lighting hours.

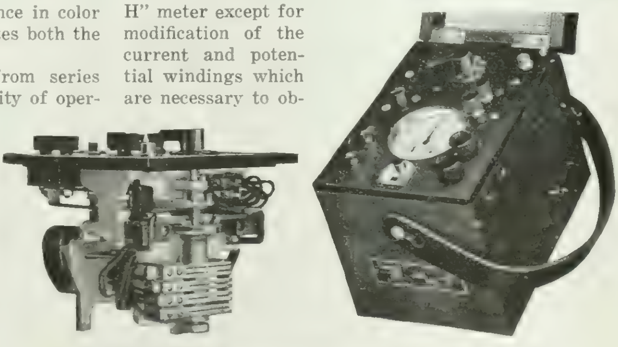
Not the least important part of any ornamental system is the manner of supplying the energy, which in most cases is through underground circuits. Because of the use of band-steel armored cables it was unnecessary to tear up the streets. Without the slightest annoyance or inconvenience to traffic, there was placed underground 9,000 ft. (2,740 m.) of No. 6 stranded and 8,000 ft. (2,430 m.) of No. 6 two-conductor varnished-cambric, lead-covered, band-steel-armored cable. For connecting the old underground cables with the new ones single-conductor and duplex-conductor varnished-cambric, lead-covered cable was used.

The armored cable was laid close to the street side of the curb, and the trench was prepared by the use of a specially designed gasoline-engine compressor, mounted on a truck body for portability. The compressor was of sufficient capacity to operate six "guns." After the desired length of trench was opened, the cable was laid in, covered with wooden strips, and concrete which was prepared by a power-driven mixer was poured flush with the street surface, which is of vitrified brick.

The luminous-arc lamps, cut-outs, cables and mercury-arc rectifier equipment were furnished by the General Electric Company, Schenectady, N. Y.; the ornamental poles by the Union Metal Manufacturing Company, Canton, Ohio, and the installation work was done by the Central Station Equipment Company, New York.

Portable Device for Testing Watt-Hour Meters Without Stop Watches

A PORTABLE test meter for checking the accuracy of a service-type watt-hour meter has been developed by the Sangamo Electric Company which requires no indicating instruments or stop watches and automatically compensates for variations in load and voltage. The moving system of this meter is essentially the same as that used in the standard Sangamo "type H" meter except for modification of the current and potential windings which are necessary to obtain the various ranges of the standard. The meter is designed for various ratings, the changes being effected by rotation of a drum controller operated by a dial switch on the cover.



DRUM CONTROLLER AND EXTERIOR OF PORTABLE TEST SET

Contrary to the usual practice, the current for heavy loads is carried by multiple-leaf brushes bearing down on two sides of a flat disk with considerable pressure. This arrangement provides a greater contact area, which, with the pressure exerted, minimizes the contact resistance and possibility of heating. For the lower capacities the usual leaf brush is utilized.

The standard meter is arranged for 110-volt and 220-volt operation, the changes from one voltage to another being accomplished by means of a rotating switch. When additional voltage ranges are required, multipliers are used.

The register is of the three-pointer type. The larger circle represents a single revolution of the disk and is divided into hundredths. The two smaller pointers make one revolution for each ten and each hundred revolutions of the disk respectively. A resetting device is provided consisting of a small button on the top of the case so aranged that upon applying a slight pressure the hands are immediately returned to zero.

Practical Method for Calculating Operating Characteristics of Magnet Coils

An Analysis of the Fundamental Considerations in Estimating the Current-Time Relations in Magnet Coils and the Distribution of Energy in the Electric and Magnetic Circuits, with Examples Showing the Applications of the Method

By CHARLES R. UNDERHILL
Consulting Electrical Engineer

THE object of this article is to provide a method for quickly estimating the current-time relations in an electric circuit containing only resistance and inductance, as well as the distribution of energy in the electric and magnetic circuits. Examples are given to show the applications of the method. Then follows the mathematical demonstration of the principles involved. The accompanying tables are unnecessarily accurate for ordinary calculations, but their accuracy will be appreciated in special cases.

At the instant the terminals of an electromagnet, or the primary of an induction coil, are connected to the terminals of a storage battery, for instance, so that the emf., E, of the battery, impressed upon the coil tends to cause a current of instantaneous strength, i, to flow in the turns of wire in the coil, the current strength tends to increase at a time-rate

$$di/dt = E/L \text{ amp. per second,} \qquad (1)$$

wherein L is the inductance, in henries, when the current strength, i, approximates zero. But after a comparatively small time interval the current strength will approximate a maximum, I, as limited by the resistance, R, of the coil, and then the time-rate of change in the current strength approximates zero. During the time interval while i is changing from 0 to I the electrical energy abstracted from the battery and applied to the coil is converted into

a — magnetic energy; stored in the magnetic circuit.
b — thermal energy; distributed heat.
c — potential electrical energy; stored in the dielectric or insulation between the turns of wire in the coil.

If no relative motion occurs between any of the parts of the electromagnet, no mechanical work will be done, and this is the condition assumed in this article. The permeability of the magnetic material in the electromagnet changes as the current strength increases from 0 to I, thus causing the inductance (and the permeance) of the electromagnet to vary. Heat is developed in the wire of the coil, owing to the phenomenon of resistance; in the magnetic circuit of the electromagnet, owing to magnetic hysteresis, and in all metal parts interlinked with the magnetic field, owing to eddy currents.

In consequence of the distribution of the energy in the electromagnet, originally obtained from the battery, the familiar equation

$$i = \frac{E}{R}\left(1 - \frac{1}{\epsilon^{Rt/L}}\right) \text{ amp.} \qquad (2)$$

does not correctly express the relations between the instantaneous current strength, i, and any time interval, t, because the inductance, L, is variable and the effects due to hysteresis, eddy currents and the distributed capacitance of the coil are not considered in the equation. However, equation (2) holds approximately in cases where the inductance is fairly constant, as in electromagnets designed to pull light loads with relatively weak magnetizing forces and to start their loads moving after the lapse of a brief time interval from the instant the electric circuit is closed.

Tables I and II have been calculated as aids in quickly estimating the current strength, i, at the end of any time interval, t, or to estimate the time interval required for the current to attain a given strength after the instant the electric circuit is closed. In this method there is provided a time interval, T, which is used as a standard with which to compare any other time interval, t, thus making it possible to prepare tables wherein ratios t/T may be compared with ratios i/I, and *vice versa*. This standard time interval, T, is equal to ten times the time interval required for the current strength, i, to attain one-half of its maximum, I, and is equal to 6.9315 times the ordinary time-constant, L/R. Therefore,

$$T = 10\,L/R \text{ logh } 2 = 6.9315\,L/R \text{ second} \qquad (3)$$

represents a time interval during which the instantaneous current strength, i, increases from 0 to 0.99902 I;

TABLE I—VALUES OF i/I ARE CALCULATED FROM EQUATION (6) BY ASSUMING VALUES FROM 0.01 TO 1.00 FOR t/T

t/T	i/I	t/T	i/I	t/T	i/I
0.01	0.066967	0.36	0.917531	0.71	0 992711
0.02	0.129449	0.37	0.923054	0.72	0 993199
0.03	0.187748	0.38	0.928206	0.73	0 993654
0.04	0.242142	0.39	0.933014	0.74	0 994079
0.05	0.292893	0.40	0.937500	0.75	[illegible]
0.06	0.340246	0.41	0.941685	0.76	[illegible]
0.07	0.384428	0.42	0.945591	0.77	[illegible]
0.08	0.425651	0.43	0.949234	0.78	0.995513
0.09	0.464113	0.44	0.952634	0.79	0.995813
0.10	0.500000	0.45	0.955806	0.80	[illegible]
0.11	0.533484	0.46	0.958765	0.81	0 996355
0.12	0.564725	0.47	0.961527	0.82	0 996599
0.13	0.593874	0.48	0.964103	0 83	[illegible]
0.14	0 621071	0 49	0.966507	0.84	0 997040
0.15	0.646447	0.50	0.968750	0.85	[illegible]
0.16	0.670123	0.51	0.970843	0 86	0 997423
0.17	0.692214	0.52	0.972795	0 87	0 997595
0.18	0.712825	0.53	0 974617	0 88	0.997756
0.19	0.732057	0.54	0.976317	0 89	0 997907
0.20	0.750000	0.55	0.977903	0 90	[illegible]
0.21	0.766742	0.56	0.979383	0.91	0 998178
0.22	0.782362	0.57	0.980763	0 92	0 998300
0.23	0.796937	0.58	0.982052	0 93	0 998414
0.24	0.810535	0.59	0.983254	0 94	0 998520
0.25	0.823223	0.60	0.984375	0 95	0 998619
0.26	0 835062	0.61	0.985422	0.96	0 998711
0.27	0.846107	0.62	0 986398	0.97	0 998798
0.28	0.856413	0.63	0.987309	0.98	0 998878
0.29	0.866028	0.64	0.988159	0 99	0 998953
0.30	0.875000	0.65	0.988952	1.00	0.999023
0.31	0.883371	0.66	0.989691		
0.32	0.891181	0.67	0.990382		
0.33	0.898470	0.68	0 991026		
0.34	0.905268	0.69	0.991627		
0.35	0.911612	0.70	0.992188		

that is, to $i/I = 0.99902$. For purposes of ordinary calculations i may be considered equal to I at the end of the standard time interval, T. It is to be noted that, whereas the instantaneous current strength, i, approaches the steady current strength, I, as a limit or asymptote, there is no limit to the time interval, t, which may become greater than the standard time interval, T.

Let it be assumed that a circuit contains only resistance and inductance and that both are constant during the time interval when the current strength is changing from 0 to I and that the effects of hysteresis, eddy currents and capacitance are absent. The current-time relations will then be correctly expressed by equation (2). Further assumptions are that the resistance, in ohms, and the inductance, in henries, are known.

TABLE II—VALUES OF t/T ARE CALCULATED FROM EQUATION (5) BY ASSUMING VALUES FROM 0.01 TO 0.9999 FOR i/I

i/I	t/T	i/I	t/T	i/I	t/T
0.01	0.00144996	0.36	0.0643856	0.71	0.178588
0.02	0.00291463	0.37	0.0666576	0.72	0.183650
0.03	0.00439435	0.38	0.0689660	0.73	0.188897
0.04	0.00588938	0.39	0.0713119	0.74	0.194342
0.05	0.00740006	0.40	0.0736965	0.75	0.200000
0.06	0.00892672	0.41	0.0761213	0.76	0.205889
0.07	0.0104698	0.42	0.0785875	0.77	0.212029
0.08	0.0120294	0.43	0.0810966	0.78	0.218442
0.09	0.0136062	0.44	0.0836501	0.79	0.225154
0.10	0.0152003	0.45	0.0862496	0.80	0.232193
0.11	0.0168123	0.46	0.0888969	0.81	0.239593
0.12	0.0184424	0.47	0.0915936	0.82	0.247393
0.13	0.0200913	0.48	0.0943417	0.83	0.255639
0.14	0.0217591	0.49	0.0971431	0.84	0.264386
0.15	0.0234465	0.50	0.100000	0.85	0.273697
0.16	0.0251539	0.51	0.102915	0.86	0.283650
0.17	0.0268817	0.52	0.105889	0.87	0.294342
0.18	0.0286304	0.53	0.108927	0.88	0.305889
0.19	0.0304006	0.54	0.112029	0.89	0.318442
0.20	0.0321928	0.55	0.115200	0.90	0 332193
0.21	0.0340075	0.56	0.118442	0.91	0.347393
0.22	0.0358454	0.57	0.121759	0.92	0.364386
0.23	0.0377070	0.58	0.125154	0.93	0.383650
0.24	0.0395929	0.59	0.128630	0.94	0.405889
0.25	0.0415037	0.60	0.132193	0.95	0.432193
0.26	0.0434403	0.61	0.135845	0.96	0.464386
0.27	0.0454042	0.62	0.139593	0.97	0.505889
0.28	0.0473933	0.63	0.143440	0.98	0.564386
0.29	0.0494110	0.64	0.147393	0.99	0.664386
0.30	0.0514573	0.65	0.151457	0.9999	1.32877
0.31	0.0535332	0.66	0.155639	....	....
0.32	0.0556393	0.67	0.159946	....	....
0.33	0.0577767	0.68	0.164386	....	....
0.34	0.0599462	0.69	0 168966	.	....
0.35	0.0621488	0.70	0.173697	..	.....

EXAMPLES THAT EXPLAIN THE USES OF TABLES I AND II

Example 1.—The maximum current strength, I, as determined by dividing the constant continuous impressed emf., E, in volts, by the resistance, R, in ohms, is 0.5 amp., and the quotient obtained by dividing the inductance, L, in henries, by the resistance, in ohms, is equal to 0.015, which is the ordinary time constant. What will be the instantaneous current strength, i, 0.025 second after the electric circuit has been closed?

Since $T = 6.9315\ L/R$, and $L/R = 0.015$,

$$T = 6.9315 \times 0.015 = 0.104 \text{ second.}$$

Therefore, $t/T = 0.025/0.104 = 0.2404$.

Referring to Table I, when $t/T = 0.24$, $i/I = 0.81$, and, since it is known that $I = 0.5$ amp., $i = 0.81 \times 0.5 = 0.405$ amp. Therefore, under the conditions imposed in this example, the instantaneous current strength will be 0.405 amp. after the circuit has been closed for 0.025 second.

Example 2.—With the same values for inductance, resistance and maximum current strength, I, as given in Example 1, find the time required for the current to attain 50 per cent of its maximum strength; that is, for i to become equal to $0.5I = 0.25$ amp.

Referring to Table II, when $i/I = 0.5$, $t/T = 0.10$. But $T = 0.104$ second, as in Example 1. Therefore, $t = 0.1T = 0.0104$ second. Consequently, after the electric circuit has been closed for 0.0104 second the current strength will be 0.25 amp.

In this method either table may be used in the calculation of either i/I or t/T. Also, interpolation may be made when conditions require it.

Example 3.—Let it be assumed that the current strength, i, must be 2 amp. after a constant continuous emf., E, has been impressed upon a coil for a time interval, t, of 0.010 second. What will be the proper value of L/R? From equation (3), $T = 6.9315\ L/R$ second. Therefore, in this case,

$$t/T = 0.010R/6.9315L = 0.0014427\ R/L,$$

and

$$L/R = 0.0014427/(t/T) \text{ second.}$$

If the values of the constant continuous impressed emf. and the resistance are such that the maximum current strength would be, say, 10 amp., then $i/I = 0.2$. Referring to Table II, when $i/I = 0.2$, $t/T = 0.0322$. Therefore,

$$L/R = 0.0014427/(t/T) = 0.0014427/0.0322 = 0.0448 \text{ second.}$$

In other words, the time constant of the circuit must be 0.0448 second, and the inductance and resistance must be proportioned accordingly.

The upper curve shown on page 874 graphically expresses the principles involved and is sufficiently accurate for ordinary use. There are 199 points in this dotted curve, and each represents one of the co-ordinates as given in these tables.

To find the total energy, W_t, in joules abstracted from the electric circuit at the end of any time interval, t, first find $T = 6.9315\ L/R$, and obtain the value of the ratio t/T. From Fig. 2, find the value of Q/Q_T corresponding to t/T. Then multiply the value of Q/Q_T thus found by $5.91LI^2 = 5.91IE(L/R)$.

The magnetic energy in joules stored during the time interval t, is equal to $\frac{1}{2}\ Li^2$. The value of i is found as explained in Example 1.

The energy in joules converted into heat during the same time interval is equal to the difference between the total energy in joules abstracted from the electric circuit and that converted into magnetic energy. Therefore, to find the energy in joules converted into heat in the electric cricuit, subtract $\frac{1}{2}\ Li^2$ from the total electric energy in joules abstracted from the electric circuit during the time interval t.

Example 4.—The inductance of a circuit is 0.1 henry and the resistance is 5 ohms. If a constant continuous emf. of 10 volts is impressed upon this circuit, what will be (a) the total electrical energy delivered to the electric circuit and reconverted into magnetic energy and heat at the end of a time interval of 0.03 second? and (b) how much of this energy will be converted into magnetic energy and how much will be converted into heat?

TABLE III—ELEMENTS UPON WHICH DATA OF TABLES I AND II ARE BASED

$\frac{i}{I}$	$\frac{I}{I-i}$	$\frac{t}{(L/R)}$	$\frac{t}{T} = \frac{t/(L/R)}{10 \text{ logh } 2}$
0.	1	logh 1 = 0	0
0.5	2	logh 2 = 0.69315	0.1
0.75	4	logh 4 = 1.38630	0.2
0.875	8	logh 8 = 2.07945	0.3
0.9375	16	logh 16 = 2.77260	0.4
0.96875	32	logh 32 = 3.46575	0.5
0.984375	64	logh 64 = 4.15889	0.6
0.9921875	128	logh 128 = 4.85204	0.7
0.99609375	256	logh 256 = 5.54519	0.8
0.998046875	512	logh 512 = 6.23834	0.9
0.9990234375	1,024	logh 1,024 = 6.93150	1.0

(a) The time constant is $L/R = 0.1/5 = 0.02$ second. Therefore, $T = 6.9315\ L/R = 0.13863$ second, and $t/T = 0.03/0.13863 = 0.2164$. Referring to Fig. 2, when $t/T = 0.2164$, $Q/Q_T = 0.124$ (about). Multiplying this value of Q/Q_T by $5.91LI^2$ gives $0.124 \times 5.91 \times 0.1 \times 4 = 0.293$ joules (approximately) as the total electrical energy delivered to the electric circuit.

(b) Referring to Table I, when $t/T = 0.21$, $i/I = 0.7667$, and when $t/T = 0.22$, $i/I = 0.7824$. Therefore, when $t/T = 0.2164$, i/I has a value between 0.7667 and 0.7824. A difference in $t/T = 0.22 - 0.21 = 0.01$ produces a corresponding difference in $i/I = 0.7824 - 0.7667 = 0.0157$. Consequently, a difference in $t/T = 0.2164 - 0.21 = 0.0064$

produces a difference in $i/I = (0.0157/0.01) \times 0.0064 = 1.57 \times 0.0064 = 0.01$. Hence, when $t/T = 0.2164$, $i/I = 0.7667 + 0.01 = 0.777$ (approximately). $I = E/R = 10/5 = 2$ amp. Therefore, $i = 0.777I = 1.554$ amp. at the expiration of the 0.03-second time interval. The magnetic energy abstracted from the electric circuit during this time interval is equal to $\frac{1}{2}Li^2 = (0.1 \times 1.554^2)/2 = 0.05 \times 2.415 = 0.121$ joule. Therefore, the energy abstracted from the electric circuit and converted into heat during the time interval of 0.03 second is equal to $0.293 - 0.121 = 0.172$ joule.

The above method is based upon the following principle:

Rearranging equation (2),

$$t = \frac{L}{R} \operatorname{logh} \frac{1}{1 - (i/I)} \text{ second.} \qquad (4)$$

Therefore,

$$\frac{t}{T} = \frac{\operatorname{logh} \frac{1}{1 - (i/I)}}{10 \operatorname{logh} 2},$$

or

$$\frac{t}{T} = 0.1 \log_2 \frac{1}{1 - (i/I)}. \qquad (5)$$

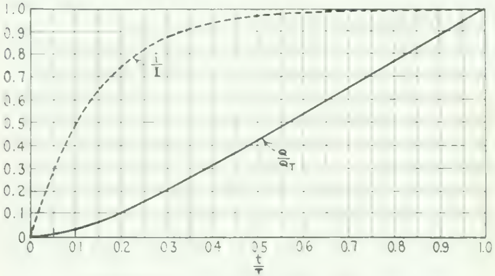
By rearranging equation (5),

$$\frac{1}{1 - (i/I)} = 2^{10(t/T)}, \quad 1 - (i/I) = 2^{-10(t/T)},$$

and

$$i/I = 1 - 2^{-10(t/T)}. \qquad (6)$$

The values of i/I in Table I have been calculated from equation (6) by assuming values from 0.01 to 1.00 for t/T, while the values of t/T in Table II have been calculated from equation (5) by assuming values from 0.01 to 0.9999 for i/I. In order to perform these calculations, it is convenient to use the logarithmic base 10.



RELATIONS OF i/I AND Q/Q_T WITH t/T

Relation between i/I and t/T plotted from values in Tables I and II. Relation between Q/Q_T and t/T obtained by planimetering the dotted curve and dividing the results by 0.853.

Referring to equation (5),

$$\log_2 \frac{1}{1 - (i/I)} = \frac{\log_{10} \frac{1}{1 - (i/I)}}{\log_{10} 2} = \frac{\log_{10} \frac{1}{1 - (i/I)}}{0.30103}.$$

Substituting this value of $\log_2 \frac{1}{1 - (i/I)}$ into equation (5),

$$\frac{t}{T} = \frac{0.1}{0.30103} \log_{10} \frac{1}{1 - (i/I)},$$

or

$$\frac{t}{T} = 0.332193 \log_{10} \frac{1}{1 - (i/I)}. \qquad (7)$$

Rearranging equation (7),

$$\frac{1}{1 - (i/I)} = 10^{3.0103(t/T)}, \quad 1 - (i/I) = 10^{-3.0103(t/T)},$$

and

$$i/I = 1 - 10^{-3.0103(t/T)}. \qquad (8)$$

Equation (8) may be written,

$$i/I = 1 - 10^{-(0.30103)(10t/T)}. \qquad (9)$$

Table III clearly shows the principle upon which Tables I and II (particularly Table I) are based.

Rearranging equation (4),

$$t = (L/R) \operatorname{logh} [I/(I - i)]. \qquad (10)$$

Therefore, when $i = 0.5I$, $t = (L/R) \operatorname{logh} 2 = 0.1T$.

The expression $\epsilon^{(R/L)t}$ in equation (2) is equal to E/e_L wherein

$$e_L = L(di/dt) \text{ volts} \qquad (11)$$

is the emf. of self-induction, which is equal to E at the instant the electric circuit is closed, but decreases to 0 by the time that the current strength, i, has attained its maximum, I (theoretically, after an indefinite time interval), and the time-rate of change in the current strength is 0.

The active emf.,

$$e_R = iR \text{ volts} \qquad (12)$$

is equal to the difference between the constant continuous impressed emf., E, and the emf. of self-induction, e_L, or

$$e_R = E - e_L \text{ volts} \qquad (13)$$

and varies from 0 at the instant that the electric circuit is closed, to E by the time the current has attained its maximum strength.

The induced emf., $-e_L$, is numerically equal, but opposite in sign, to the emf. of self-induction, which is expressed as e_L.

Substituting E/e_L for $\epsilon^{(R/L)t}$ in equation (2),

$$i = \frac{E}{R}\left(1 - \frac{e_L}{E}\right) = \frac{E - e_L}{R} = \frac{e_R}{R} \text{ amp.} \qquad (14)$$

whence,

$$e_R = iR \text{ volts.} \qquad (15)$$

The time rate at which electric energy is converted into magnetic energy is

$$P_m = e_L i \text{ watts,} \qquad (16)$$

and the magnetic energy stored at the end of any time interval, t, is

$$W_m = \int_0^t P_m dt = \int_0^t e_L i\, dt = \tfrac{1}{2}Li^2 \text{ joules.} \qquad (17)$$

The time rate at which electrical energy is converted into thermal energy, or heat, in the wire of the coil is

$$P_R = e_R i \text{ watts,} \qquad (18)$$

and the heat stored in the coil at the end of any time interval, t (provided that no heat escapes), is

$$W_R = \int_0^t P_R dt = \int_0^t e_R i\, dt \text{ joules.} \qquad (19)$$

The total energy abstracted from the electric circuit during any time interval, t, is

$$W_t = W_m + W_R = E\int_0^t i\, dt = EQ \text{ joules,} \qquad (20)$$

wherein W_m is the magnetic energy, W_R is the thermal energy and Q is the quantity of electricity, in coulombs, which has flowed during this time interval, t.

The total area under the dotted curve indicates that the total quantity of electricity, Q_T, which would flow through a plane in the cross-section of the electric circuit during a time interval $T = 6.9315\ (L/R) = 1$ second, with a maximum current strength, $I = 1$ amp., would be equal to 0.853 coulomb (approximately); that is, when $I = 1$ amp.,

$$Q_T = \int_0^{T=1} i\, dt = 0.853 \text{ coulomb (approximately).}$$

The full curve shows the relation of Q/Q_T to t/T. This was obtained by planimetering the dotted curve, which was plotted on cross-section paper, and dividing the results by 0.853. Forty equidistant points were selected on the axis of time, the average of several readings being taken for each point. Consequently, when $Q/Q_T = 1$, $t/T = 1$.

When I and T have values other than unity,

$$Q_T = 0.853\, IT = 0.853\, I \times 6.9315\, (L/R) \qquad (21)$$
$$= 5.91\, I\, (L/R) \text{ coulombs.}$$

The maximum amount of energy abstracted from the electric circuit at the end of the standard time interval, T, is

$$W_T = EQ_T = 5.91\, EI(L/R) \text{ joules,} \qquad (22)$$

and, since the induced emf. then is so small that it may be neglected,

$$E = IR \text{ volts.} \qquad (23)$$

Substituting this value for E in equation (22),

$$W_T = IRQ_T = 5.91\, LI^2 \text{ joules.} \qquad (24)$$

The energy abstracted from the electric circuit at the end of any time interval, t, is

$$W_t = W_T(Q/Q_T) = 5.91\, LI^2\, (Q/Q_T) = EQ \text{ joules} \qquad (25)$$

Substituting this value of W_t into equation (20), and rearranging,

$$W_R = 5.91\, LI^2\, (Q/Q_T) - W_m$$
$$= 5.91\, LI^2\, (Q/Q_T) - \tfrac{1}{2}\, LI^2 \text{ joules} \qquad (26)$$

or

$$W_R = L\, [5.91\, I^2 (Q/Q_T) - 0.5\, i^2] \text{ joules,} \qquad (27)$$

or $$W_R = (L/2)\, [11.8\, I^2 (Q/Q_T) - i^2] \text{ joules.} \qquad (28)$$

Light and Power Industry in South Africa*

Central and Isolated-Plant Generator Installation 320,736 Kw.—Output in 1918, About 849,542,280 Kw.-Hr.—Connected Motor-Load, 548,195 Hp.

Although there are only about eighty-one central and isolated electrical power stations in the Union of South Africa, and not more than four in Rhodesia, yet, when the comparatively small white or essentiallly productive population is taken into consideration, the total installed rating of the power stations is rather impressive. The total generator installation at the beginning of 1917 was 320,736 kw., or an average installation of 0.25 kw. per white inhabitant, which is about twice the central-station generator installation per inhabitant in the United States. The total output of these light and power stations in 1918 was 849,542,280 kw.-hr., of which 52,000,555 kw.-hr. was direct current and 797,541,725 kw.-hr. was alternating current. Of the total output 696,179,817 kw.-hr., or 82 per cent, was used for mining purposes. In addition 153,873,180 compressed-air units were sold to mining companies by electric light and power plants, the Victoria Falls & Transvaal Power Company making the sale and distribution of compressed air a large part of its business. There are also many small electric power plants operated by mining companies, and the output of these has not been included in the above figures. Table I gives the output of the four provinces during 1918.

TABLE I—OUTPUT OF SOUTH AFRICAN ELECTRIC LIGHT AND POWER PLANTS DURING 1918

Provinces	Direct Current, Kw.-Hr	Alternating Current, Kw.-Hr	Total Output, Kw.-Hr.
Transvaal	23,652,205	743,920,960	767,573,165
Cape	21,359,723	28,964,813	50,324,536
Orange Free State	890,936	2,544,813	3,435,749
Natal	6,097,691	22,111,139	28,208,830
Total	52,000,555	797,541,725	849,542,280

On account of the large coal deposits in South Africa steam power predominates among the central and isolated plants. About 90 per cent of the prime movers in the stations are steam turbines, steam engines being used only in the smaller plants. Fuel oil is high, and only a very few gas engines are installed at the present time. South Africa offers small opportunity for water-power development, there being only three plants operated solely by water power and two or three that have a small amount of their capacity in hydro-electric units. The Victoria Falls offer large water-power possibilities, but development of this power site will not be warranted for many years to come on account of lack of a suitable market for the power generated.

In 1917 there were 11,744 motors connected with the electric power plant lines, representing a total load of 548,195 hp. Of this number 4,367 were direct-current motors, totaling 85,347 hp., and 7,377 were alternating-current motors, with a total rating of 462,848 hp. Table II gives the distribution of the generators and motors among the various industries. Under "industrials" are included the light and power companies furnishing energy for lighting purposes.

TABLE II—STATISTICS OF GENERATORS AND MOTORS IN SOUTH AFRICA, 1917

	Generators						Motors					
	Direct-Current		Alternating-Current		Total		Direct-Current		Alternating-Current		Total	
Industries and Districts	No.	Kw.	No.	Kw.	No.	Kw.	No.	Hp.	No.	Hp.	No.	Hp.
TRANSVAAL:												
Gold mining	151	23,759	75	43,866	226	67,625	581	34,457	5,132	363,163	5,713	397,620
Diamond mining	5	1,347	4	3,000	9	4,347	119	8,126	...	....	119	8,126
Coal mining	20	815	14	3,300	34	4,115	46	915	79	1,578	125	2,493
Base mineral mining	8	266	13	1,891	21	2,157	26	542	108	2,636	134	3,178
Industrial and lighting	200	11,348	55	169,813	255	181,161	838	8,034	937	68,617	1,775	76,651
CAPE:												
Diamond mining	28	1,399	6	9,896	34	11,295	207	1,890	279	11,774	486	13,664
Coal mining	2	300	.	. . . .	2	300	13	205	......	......	13	205
Base-mineral mining	9	801		.	9	801	79	1,345	......		79	1,345
Industrial and lighting	142	9,937	22	6,656	164	16,587	1,414	16,410	384	4,175	1,798	20,585
ORANGE FREE STATE:												
Diamond mining	13	1,136	5	1,100	18	2,236	62	1,118	28	1,661	90	2,779
Coal mining	6	924	1	225	7	1,149	45	1,009	..	....	45	1,009
Industrial and lighting	44	623	15	3,342	59	3,965	53	421	184	3,507	237	3,928
NATAL:												
Coal mining	30	2,326	2	503	32	2,829	93	1,851	12	612	105	2,462
Industrial and mining	124	10,058	28	12,111	152	22,169	791	9,025	234	5,125	1,025	14,150
GRAND TOTALS:												
Transvaal	384	37,535	161	221,870	545	259,405	1,610	52,074	6,256	435,994	7,866	488,068
Cape	181	12,437	28	16,546	209	28,983	1,713	19,850	663	15,949	2,376	35,799
Orange Free State	63	2,683	21	4,667	84	7,350	160	2,548	212	5,168	372	7,716
Natal	154	12,384	30	12,614	184	24,998	884	10,875	246	5,737	1,130	16,612
Union of South Africa	782	65,039	240	255,697	1,022	320,736	4,367	85,347	7,377	462,848	11,744	548,195

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*The above data are based on a report by R. A. Lundquist, trade commissioner of the Bureau of Foreign and Domestic Commerce.

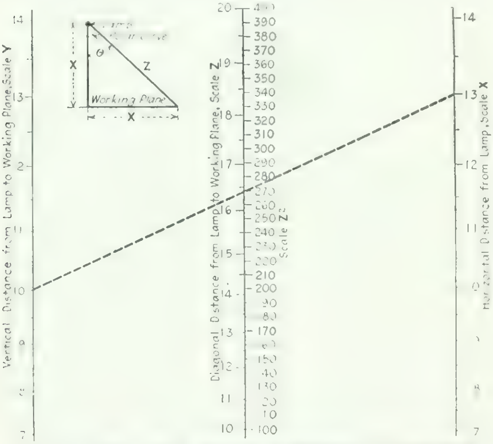
Letters from Our Readers

This is a readers' forum. Comments on questions before the electrical industry presenting economic, financial, engineering or commercial aspects and new or supplementary viewpoints on published articles are cordially invited

Simple Chart for Illumination Calculations

To the Editors of the ELECTRICAL WORLD:

I have had pleasure in reading several articles relative to the art of illumination that have appeared in the ELECTRICAL WORLD, and the curves produced by I. W. Gross* concerning the relation between candlepower, intensity of illumination on the horizontal plane and the distance from the unit measured have particularly interested me. I believe that the curves in the form presented by Mr. Gross are very unwieldy and hard to handle. The eye can more readily follow a system of straight lines than a system of curves and straight lines.



STRAIGHT-LINE CHART FOR ILLUMINATION CALCULATIONS

EXAMPLE: To find candlepower of lamps at angle θ, $Y = 10$, $X = 13$, $E_1 = 10$ cp. Then $Z = 16.4$ (from chart), $Z^2 = 269$ (from chart), $I = EZ^2$, $E = E_1Z/Y$, $(10 \times 16.4) \div 10 = E = 16.4$, $I = EZ^2 = 16.4\ (269) = 4{,}420$ cp.

I have attempted to produce a chart correcting the conditions just mentioned and at the same time reading in three variables; namely, height of lamp above the working plane (Y), horizontal distance from lamp (X), and the distance (Z) and distance squared (Z^2) from the unit to the point measured, in feet. On the chart the values of Z and Z^2 are plotted for ready determination from values of X and Y.

Let I be the candlepower of the lamp, using fixed values of X, Y and Z. Also let E be the intensity of illumination in foot-candles measured on a plane normal to the line Z and at the distance Z from the lamp. Then $I = EZ^2$, and by knowing the value I or E the value of the other can be found by simple multiplication or division. The component of light falling on the horizontal plane is equal to $E_1 = E(Y/Z)$; also the component of light falling on the vertical plane is equal to $E_2 = E(X/Z)$, thereby placing all calculations in the form of simple multiplication and division and eliminating all calculations involving the square, square root, sine and cosine functions.

The values on the chart may not extend far enough for all calculations, but it can be used for greater values by multiplying each variable (X, Y or Z) by a common number, for example, 2, 3 or 4, which will result in an increase in the range of the chart of two, three and four times.

The average photometer cannot be read any nearer than the Z value of the chart, so that it would be unwise to carry out the calculations to a closer degree of accuracy.

R. H. COOK.

Detroit, Mich.

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[*] ELECTRICAL WORLD, June 19, 1920, p. 1423.

Outdoor Meter Installations Satisfactory

To the Editors of the ELECTRICAL WORLD:

Referring to G. C. Langdell's experience with meters on porches, as recounted in his letter appearing in your issue of July 23, I would say that we have been putting all of our residence meters on the back porch for more than fifteen years and have found the practice very satisfactory. Of course, our climate is considerably different from that of Michigan. Some of these meters are now inside the house, owing to extensions having been built which inclosed them, and nearly all of our trouble with "skips" is caused by these. We do not have any more trouble from meters "going bad" on the porches than we do with those inside and in business houses.

F. V. GALLAUGHER.

Lake Charles Railway, Light & Water Works Company,
Lake Charles, La.

Measurement of Volt-Amperes

To the Editors of the ELECTRICAL WORLD:

The editorial in the Sept. 24 issue of the ELECTRICAL WORLD on the "Adjustment of Price to Meet Production Costs" showed an unusually comprehensive grasp of the rate situation in regard to power factor. However, I believe that some of your readers will receive the wrong impression from the following statement in that editorial:

"If the precaution is taken of so adjusting matters that any small error committed by the instrument will be in the customer's favor, we do not see how any public service commission could in the least object to this scheme of operations."

This language is unfortunate in that it makes it appear questionable whether or not the error in using a wattmeter to measure volt-amperes, as described in my article, is always in favor of the customer. The point was definitely covered in the article (page 609, bottom first column). It is comparatively simple to show that this result must necessarily follow. The quantity measured by any wattmeter is $EI \cos \phi$, as is well known. It is also well known that the quantity $\cos \phi$ can never be greater than one. It follows that the quantity $EI \cos \phi$ can never be greater than EI (volt-amperes), no matter how the wattmeter is connected. A connection which will give a quantity greater than volt-amperes (EI) is impossible.

P. M. LINCOLN,
Consulting Engineer
Lincoln Electric Company,
Cleveland, Ohio.

Industrial and Station Practice

Installation, Operation and Maintenance of
Generating and Distribution Equipment and Economical Utilization of Electrical Energy
in Mills and Factories, Including Testing and Repair Methods

Remote-Control Station Makes Small Stream Development Profitable

A REMOTE-CONTROL hydro-electric station has recently been placed in service by the Georgia-Alabama Power Company, which offers a solution of the problem of developing limited-flow streams that could not otherwise be utilized profitably.

The plant in question has a single 300-kva. direct-connected unit and utilizes the full flow of Omussee Creek without pondage. It was constructed as an auxiliary to a somewhat larger plant, containing two 450-kva. units, situated 2 miles higher up on the same stream and possessing the advantage of considerable pondage.

The lower plant is operated without an attendant, being started up, placed in parallel with the upper plant (which feeds transmission lines to nearby cities), and when required disconnected and shut down through the medium of six control lines joining the two plants and strung on the same poles as those which carry the main 2,300-volt leads. Necessary adjustments of the load are also controlled in this manner.

The cycle of starting the remote unit and placing it into service is substantially as follows:

By means of two of the control lines a small solenoid is energized from the exciter circuit of the upper plant which lifts the pilot valve of the governor against the retarding action of a dashpot to prevent a too rapid opening of the gates. The unit comes slowly up to speed, bringing with it the belt-driven exciter, and since the latter is permanently connected to the generator slip rings the generator also builds up its voltage. When the unit approaches within a few per cent of normal speed it comes within the regulating range of the hydraulic governor, which assumes control of the speed. As a means of obtaining control over the generator voltage before synchronizing a Tirrill regulator was installed in the remote plant and the circuit of its alternating-current coil was extended to the upper plant through two control lines, a dial rheostat being inserted in the circuit at that point. Variations of this resistance weaken or strengthen the regulator coil, and this is reflected in increased or decreased generator voltage.

Final close adjustments of speed of the units are made through the usual small synchronizing motor with a range of approximately 5 per cent in speed adjustment above and below normal. This latter motor is energized through the last two control lines, using one of the starting solenoid lines as a return. Synchronizing is then carried out at the upper plant and division of load and adjustment of voltage is carried out as outlined above.

The unit is usually operated at a fixed load to utilize the full volume of water discharged by the upper plant, the principal variations of load being assumed by the upper plant; but complete control of the load on the remote unit is always in the attendant's hand through the medium of the governor motor as explained above.

Consideration was given to elimination of the hydraulic governor and substitution of motor-operated headgates, but this was rejected owing to the small capacity of the upper units and their inability to handle maximum-load peaks, some of which must be thrust on the remote unit. There are doubtless many instances under which an even simpler scheme of complete remote control may be applied than was found to be expedient in this case. Where the size of the remote unit or the value placed on its continuous operation will justify, consideration should be given to the provision of differential relay protection as a safeguard against self-destruction on the occurrence of trouble in its windings, and to bearing thermostats and a centrifugal overspeed device to meet the emergency of runaway or overheating bearings. Any one of these devices may be so interlocked with the starting solenoid on the governor as to shut the unit down in the event of trouble.

Had the load to be served by the two plants contained enough synchronous equipment to furnish the necessary exciting current, an induction generator might have been used and both exciter and governor eliminated, resulting in the utmost simplicity of equipment obtainable.

L. H. Hardin,
Electrical Engineer.

Mees & Mees, Consulting Engineers,
Charlotte, N. C.

Phase-Rotation and Synchronizing Tests for a New Alternator

THE consequences of paralleling a new or rewound alternating-current generator without first having made a careful check of the synchronizing connections and relative phase rotation of the new unit and bus may be serious and should never be risked. The procedure outlined herein has been prepared for field superintendents of Stone & Webster, Inc.

In cases where two buses with selector oil circuit breakers, or a bus-tie breaker, are available it is a simple matter to check rotation by means of transformers and a small motor or a phase-rotation indicator. To avoid possibility of error, the connections should be so made that it will be unnecessary to change them while rotation is being checked from each source.

In single-bus installations difficulties in following this method may be met. This is particularly true of the installations of higher voltage where small-capacity transformers and motor may not be available. Moreover, by this method it is necessary to do a part of the switching by means of disconnecting switches, which is inadvisable. The following procedure has been prepared for such cases and presupposes that the generator has been dried and subjected to a potential test and is otherwise prepared for service. This scheme considers a two-phase, 6,600-volt, four-wire generator (see A), but may be adapted to a three-phase generator (see B).

Connect one 6,600/110-volt potential transformer (fused on high-tension side) across each pole of the generator oil circuit breaker, having this breaker blocked in the open position. Connect one 110-volt lamp across the low-tension side of each transformer.

Run the generator at approximately synchronous speed and regulate the voltage to correspond to the bus voltage, then close generator disconnecting switches.

If the leads of the generator are properly connected to the circuit breaker, all four lamps will vary in brilliancy in like manner; *i.e.*, all lamps will be bright or all lamps will be dark at the same instant.

In case two lamps on one phase are bright and the other two are dark at the same instant, one phase of the generator is reversed. Should this condition be found, stop the generator, open the disconnecting switches and interchange the two leads of one phase on the generator side of the breaker and reconnect. Then repeat the test. All lamps should now vary in brilliancy in like manner, indicating that the phase connections are correct and that the phase rotation of the new unit and the bus are identical. Stop the generator, open the disconnecting switches and disconnect the four test transformers from the oil circuit breaker.

Procedure for Checking Correctness of Synchronizing Connections

I. By magneto or lamp circuit trace carefully the potential lead used for synchronizing from the synchronizing receptacle on the generator panel back to the potential transformer. Note the 6,600-volt bus to which the corresponding (adjacent) high tension lead is connected (see C).

II. Next trace similarly the other synchronizing lead from the generator synchronizing receptacle to the bus potential transformer, in order to make certain that the adjacent high-tension lead corresponding to this synchronizing lead is connected to the same 6,600-volt bus as found when checking the generator synchronizing lead. In case synchronizing is done between generators it will be necessary to trace in similar manner the synchronizing lead from another generator panel back to 6,600-volt bus (see D).

III. Disconnect the new generator cables at the most convenient point between the generator terminals and the oil circuit breaker (x in C and D). This point must be so chosen that the generator potential transformers will be connected to the cables between the point of disconnection and the breaker. Carefully tape and support (at the point of disconnection) the end of each cable connected to the breaker.

IV. Move the pointer of the synchronism indicator off the neutral (vertical upright) position so that it forms an angle of approximately 15 deg. with the vertical. This may be accomplished by gently tapping the instrument case or by removing the cover. The following procedure assumes that generators are synchronized to the bus and that connections are made for lamps *dark* at synchronism.

V. Close the generator disconnecting switches and oil circuit breaker. Determine by the use of the voltmeter plug whether potential is indicated on each phase of the generator potential transformers.

VI. Next insert the synchronizing plug. The pointer of the synchronism indicator should "jump" to the neutral (vertical upright) position and the synchronizing lamps be dark, provided that the synchronizing connections are correct. This is an absolute check, as both sets of potential transformers are energized from the same source.

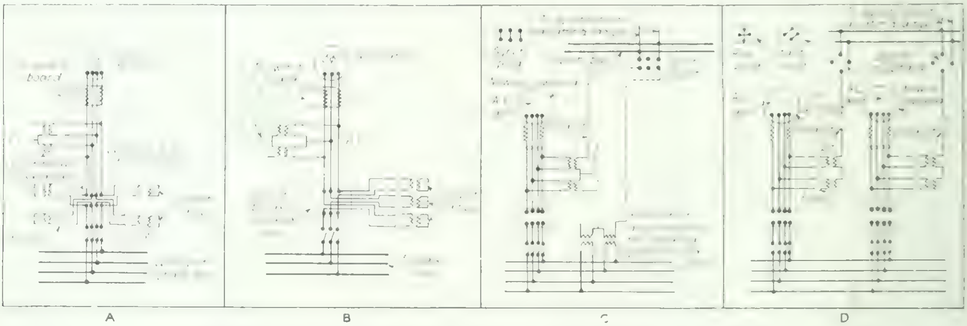
VII. Should the synchronism indicator, on the insertion of the plug, take the vertical downward position and the lamps show bright, opposite polarity of the generating and bus potential transformers is indicated. In this event disconnect the bus potential transformer used for synchronizing and determine the polarity, additive or subtractive, as outlined by the Standardization Rules of the A. I. E. E. Determine also the polarity of the generator potential transformer used for synchronizing. These determinations will show the polarity of one potential transformer opposite to that of the other. The secondary leads of the generator potential transformer must be reversed and the test repeated. Results outlined in Section VI should now be obtained.

In case synchronizing is done between generators instead of generator to bus, substitute the following for Section VI. Insert running plug in the receptacle of any generator in service and starting plug in the receptacle of the new generator. Results identical with Section VI or VII will follow the insertion of the second synchronizing plug.

After the synchronizing connections have been proved correct, open the oil circuit breaker and disconnecting switches, reconnect the generator cables and insulate the joints, and the unit is in condition to be synchronized and placed in service.

Note—In certain types of synchronism indicator it is difficult to make the pointer stand at any other than the vertical upright position, Section IV. In this case, if synchronizing is done between machines, the pointer will tend to creep from the vertical upright position on the insertion of the first plug and will "jump" to the neutral position when the second plug is inserted. Similar results may be obtained where a six-point receptacle and one plug is used by inserting a bent wire jumper in one pair of holes of the synchronizing receptacle, causing the pointer to creep, then inserting a second jumper in the other pair of holes.

A. H. Sweetnam,
Construction and Engineering Division.
Stone & Webster, Inc.,
Boston, Mass.



DIAGRAMS FOR CHECKING PHASE-ROTATION AND SYNCHROSCOPE CONNECTIONS

A—Two-phase system. Generator terminals are diagrammatic only. Test must be made to determine which terminals correspond to each phase. B—Three-phase system. C—Checking synchronizing connections between generator and bus. D—Checking synchronizing connections from generator to generator on a two-phase system.

Starting 6,600-Volt Motor-Generator Without Compensator

During the war period of high production our power house became inadequate to carry the load and immediate relief had to be obtained. A motor-generator set was decided upon as being the quickest and most reliable unit inasmuch as our shop drive is 220 volts direct current and power is supplied from the United Illuminating Company at 6,600 volts alternating current. The only machine readily available was a 700-hp. motor-generator set consisting of a 6,600-volt synchronous motor directly connected to two 250-kw., 115-volt, three-wire generators. As no starting compensator could be purchased with this set, the machine was started from the direct-current end and the alternating-current machine was synchronized daily with the line. Since the delivery on all electrical material was exceedingly long, most of the starting apparatus was improvised and made from material at hand.

The direct-current connections are shown in Fig. 1, both armatures and both shunt fields being connected in series. A special change-over field switch was used, as shown in Fig. 3, to shift from separate excitation to self-excitation without breaking the field current. Care was used to make temporary connections as easily removable as possible so that a quick change-over could be effected when the alternating-current starting compensator arrived. A direct-current starting rheostat was made by connecting several resistance grids in parallel and using a three-pole, single-throw knife switch to short circuit these steps of resistance as the machine came up to speed. A rating of 400 amp. for two minutes was allowed. This switch was mounted with the reversing switch on the ammeter on a separate panel next to the main panel. As shown in Fig. 1, this resistance was simply connected across the line-switch lugs.

The ammeter reversing switch was used so that the current at starting and running could be read. The accuracy was slightly impaired, but since heavy loads were read the error was not appreciable. As the direct-current panel was one of several, one voltmeter and one voltmeter plug were used for all by making an eight-point receptacle of the same spacing as the standard four-point outfit. With this, the voltage across each machine and the two in series for paralleling could be read.

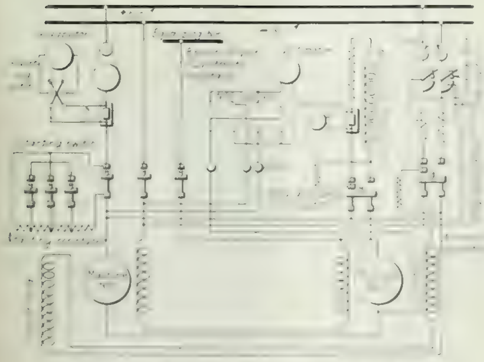


FIG. 1—DIRECT-CURRENT CONNECTIONS FOR MOTOR-GENERATOR SETS

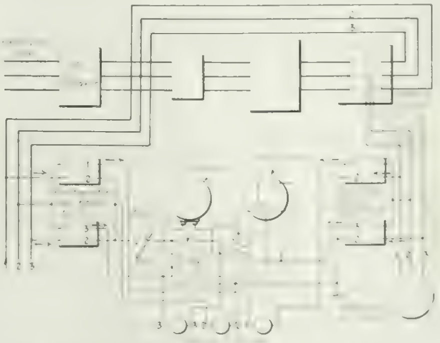


FIG. 2—SYNCHRONIZING CONNECTIONS FOR 6,600-VOLT MOTOR-GENERATOR SET

The field of the synchronous motor was run at 115 volts and was connected across one armature. When the current in the armature reverses owing to the driving load being taken by the synchronous motor, the current in the field does not reverse, but remains steady, changing very slightly as the machine is put on the line.

The special direct-current machine field switch had to be used, because the direct-current machines must be separately excited at the start (running as motors), and if they were to remain so when the machine is running alone on the bus and the circuit breaker were to blow, the alternating-current machine would have its armature across the line without field excitation. After the machine is synchronized the operator throws these switches to the self-excited position. Fuses on a field circuit are bad practice, but heavy fuses were placed on the starting side because if the operator should pull both these switches at the same time the armature would be thrown across the line and produce a short circuit. The fuses were made extra-heavy, and as they were only used during starting no trouble was experienced.

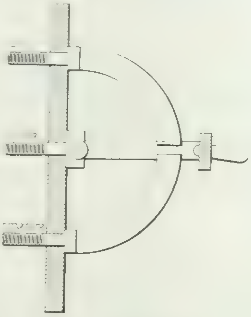


FIG. 3—CHANGE OVER FIELD SWITCH

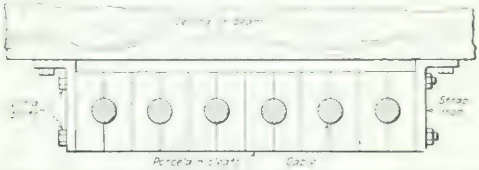
The phasing and synchronizing connections on the alternating-current machine are shown in Fig. 2. No synchronizing receptacles or double-voltage transformers could be secured. A wooden panel was wired using a voltmeter, synchroscope, three-pole single-throw knife switch, two-pole double-throw knife switch, single-pole single-throw knife switch and four lamp receptacles, three with 110-volt lamps and one with a 220-volt lamp. Four 6,600 110-volt potential transformers were used, extreme care being exercised to get the proper polarity or relation of instantaneous voltages. The arrows and figures show these directions and corresponding phases. This connection is equivalent to establishing two three-phase circuits similar to the primary circuit in all respects except voltage. All three lamps thus dim and brighten together when the phase rotation of the machine and the line is the same. The single-pole single-throw switch remains open when the lamps are being used and is kept closed afterward, otherwise one lamp would be short-circuited by the common connection to the ground. If the machine rotation is reversed as shown by individual flashing of the lamps, this can be easily corrected by reversing the alternating-current leads or the direct-current machine field leads. As soon as the correct rotation is established one potential transformer of each set can be removed, the single-pole single-throw switch permanently closed and the three lamps removed. It is well to check the lamps and synchroscope first, however. At the point of synchronism the starting switch was thrown in, the equalizer on the direct-current board and the direct-current armature voltage being raised until the required load was carried.

This machine was started in this manner for six months until the compensator was installed in the place provided. No accident of any sort occurred.

Bridgeport Brass Company, H. Y. **Blodgett,**
Bridgeport, Conn. Electrical Engineer.

Support for Several Cables

INSTEAD of using the ordinary straps or cleats put up in the ordinary manner for supporting several large cables on a ceiling or wall run, the writer assembles the cables between cleats as shown in the accompanying drawing. They are supported on long rods which are in turn run through iron straps bolted to the ceiling or wall. This makes a neat job and saves the time of fastening up a large number of straps or cleats.

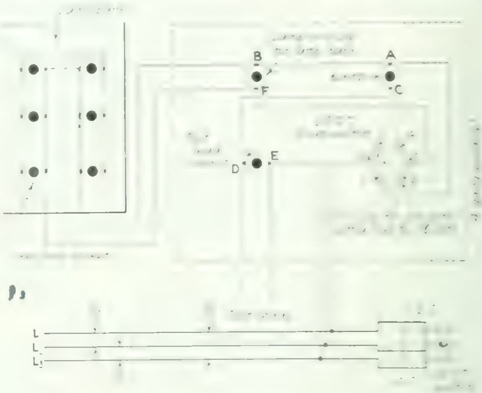


METHOD OF SUPPORTING CABLES WHICH OBVIATES ATTACHING THEM BY INDIVIDUAL SUPPORTS TO CEILING

W. A. **Harris.**
New York, N. Y.

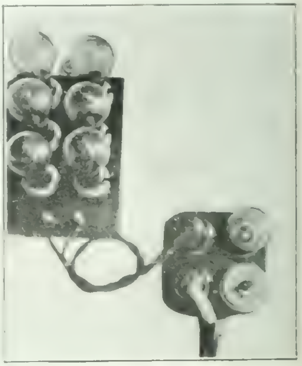
Neat and Inexpensive Test Set for a Repair Bench

A BENCH test set suitable for testing commutators, making bar-to-bar tests and for other "lighting-out" purposes is shown in the accompanying illustrations. It consists of a switch, two resistance lamps and a plug receptacle for the test leads, all of which are embodied in a four-gang condulet. Several of these fixtures are mounted along the wall at the back of a bench. The system is made of standard conduit fittings, ½-in. conduit carrying three No. 14 rubber-covered wires from one section to the other, with T condulets inserted at each point where a fixture is required. The three wires run from a three-pole, double-throw switch which gives either alternating current or direct current of 110 and 220 volts. These wires feed into the fixtures. Each fixture is a Paiste horizontal four-gang, pipe taplet, type GGH, No. 4369, having three sockets No. 4257, with three covers No. 651, and one double-pole, double-throw snap switch No. 2623. The wires are fed in through one ¾-in. to ½-in. reducing bushing and one ½-in. T condulet. The snap switch is mounted in the lower corner of the fixture and in the two upper corners are screwed lamps. A receptacle for receiving the plug of the test leads is inserted in the lower left-hand socket. In place of the upper left-hand lamp a plug may be inserted as shown, connected to an additional lamp bank of six lamps, which is hung on the wall near by. The lamp bank has five key sockets and one keyless socket, and the leads are inserted in the two binding posts as shown. By the use of one keyless socket there will always be one lamp in circuit on the lamp bank. Thus, when 220 volts is used, this lamp and the lamp in the fixture will always be in series. When the snap switch is in the position shown by the full lines, 110 volts is obtained on the last leads. When it is in the position shown by the dotted lines, 220 volts is on the leads, with the lamps, of course, in series.



CONNECTIONS FOR COMPACT SET FOR TESTING WITH LAMPS IN SERIES ON 220 VOLTS AND 110 VOLTS

Following out the circuits, it will be noticed that there is always one lamp in series on 110 volts and that any number up to seven lamps may be put in parallel. On 220 volts two lamps are always in series. If the lamp bank is connected to one of the sockets, there may be danger of impressing too high a voltage on the lamp in the condulet when 220 volts is being used. This is possible if the test leads are connected to a fairly low resistance and more than one lamp is turned on in the lamp bank in series with the one lamp which is in the condulet.



COMPACT TEST SET MOUNTED BACK OF REPAIR BENCH

Lamp bank may be removed by pulling out plug and a single lamp substituted.

It must be noted that one of the test leads is connected directly to the line, and therefore this line should be properly fused. A. C. **Roe.**

Detroit, Mich.

Remedies for Troubles of Induction Motors

Although an induction motor is an exceedingly efficient and rugged piece of machinery, there are certain troubles which may develop. In the accompanying table is a list of symptoms of troubles together with their causes and the proper procedure for their elimination.

This information should be quite useful to the industrial plant's electrical department in determining the nature of troubles in the shortest time.

Provincial Paper Mills,
Port Arthur, Ont.
H. E. Stafford,
Electrical Engineer.

Troubles of Induction Motors and How to Remedy Them

Symptom	Trouble	Cause	Remedy
1 Bearing too hot to touch, or smoking	a. Bearing dry.	Not sufficient oil. Oil rings not working.	Refill with clean oil after first washing the bearing with kerosene.
	b. Bearing dirty.	Grit in oil.	Same as above.
	c. Bearing tight.	Cause 1 and 2 above, causing particles of metal to be sheared off and deposited at other parts	Scrape bearing and shaft or replace bearing.
	d. Oil rings not working.	Rings out of slots.	Replace rings, making sure no metal adheres to sides of slot. If ring sticks or runs slowly, bevel it at either top or bottom with a fine file.
	e. Bearing binding.	Shaft out of true.	Place shaft in a lathe and true and renew bearing.
	f. Bearing out of true.	Too much strain on pulley.	Bearing should be shimmed with pieces of tin, as a temporary measure, or replaced with new bearing.
	g. Loose bearing.	Vibration.	Tighten set screws holding bearing in journal.
2 Bearing hot, but no hotter than other parts of motor.	Heat transferred from rotor or stator of motor.	Overload on motor.	Decrease load or increase size of motor.
3 Smoke issues from windings. Part of windings hot while remainder cool. Wedges over coils charred.	Displaced air gap or rotor not centered in stator.	Bearing worn on one side.	If noticed before coils are damaged, realigning the bearing and inserting new wedges will correct the fault; otherwise coils will need to be replaced.
4 Every second coil in a two-phase motor and every third coil in a three-phase motor hotter than adjacent coils.	a. Not enough resistance in phase which is hottest, causing unbalanced currents in phases.	One or more coils of one phase short-circuited within themselves.	Replace short-circuited coil or "jump" the coil* as a temporary expedient.
	b. One phase grounded.	Dampness or damage by foreign material.	Remove ground by lifting coil and re-insulating. One ground not serious if motor is not overloaded, when delta-connected. If star-connected, there may be unequal currents between phases. If two phases are grounded, a short circuit is the result.
5 Motor runs hot, and on examination it is found the groups of two-phases of a star-connected motor, and the groups of one-phase of a delta-connected motor are hotter than other groups.	Motor running single-phase.	One fuse blown or one overload relay out of order.	Replace fuse or adjust relay and take ammeter readings of each phase.
6 Motor runs hot and explosions, accompanied sometimes by fire, occur in windings.	Temporary ground or short circuit.	Due to dampness which causes circulating currents between coils and between any coil and ground.	a. Bake motor until all dampness disappears and dip or brush with insulating varnish. b. If coils are punctured, replace with new coils. c. If motor is needed at once, the punctured coils can be cut out, if not too many, as a temporary expedient.*
7 Motor runs hot with all stator coils the same temperature.	Motor usually overloaded.	Motor overloaded.	Test each phase with an ammeter, and if readings are high, reduce the load or increase the size of the motor.
8 One or more phases hot in spots, while cool in others.	Part of windings inoperative.	Short circuits between adjacent stator coils.	Replace short-circuited coils, as they will usually be found badly charred.
9 Motor refuses to start with starter handle in starting position, although the motor issues a humming sound.‡	a. Motor tries to run single-phase.	One fuse blown or one overload relay out of order.	Replace fuse or adjust relay.
	b. Air gap displaced.†	Bearing out of true.	Shim the bearing or replace with a new one.
	c. Open circuit in stator windings.	Caused either from a short circuit, which might puncture a coil or from rough handling.	Insert new coil or "jump" the damaged one.*
10 Motor starts and runs, but rotor heats up while the stator is cool.	Abnormal currents in rotor	Rotor bars loose or grounded.	Tighten set screws holding rotor bars to short-circuiting rings and solder or weld them, and remove grounds. In the more up-to-date types of rotors having cast-on end rings, this trouble is seldom encountered.
11 Motor issues a peculiar sound when running light, as if a heavy load were thrown on periodically with a slight slackening of speed at these intervals	One coil in one phase reversed	Due to wrong connection when being repaired or reconnected.	Connect coil to its proper group and in proper polarity.
12 Motor issues a buzzing sound when fully loaded	Loose connection on rotor bars.	Overheated bars or rings.	Same as for symptom No. 10

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* Care must be used in "jumping" a coil, and the following points should be observed. Where a phase-boundary coil is cut out or "jumped" care must be taken that no interconnection of phases or wrong groups takes place. In one-layer windings, if the insulation is badly burnt, the coil will have to be completely taken out, since, if only disconnected, circulating currents will be produced which will heat up the "jumped" coil and damage adjacent coils. This is due to there being only one coil side per slot. If more coils than one per phase are burnt, care must be taken that there are enough left to offer enough resistance to keep the current low on account of excess heating.

† Where the rotor is not centered in the stator, it is possible that a motor cannot develop sufficient torque, and consequently will not run, although all fuses are intact. The motor will hum and the rotor will probably turn an inch or so. The symptom is the same as that of a motor trying to run single-phase. In a case of this kind insert a feeler between the rotor and stator, and the trouble will show up as an irregular air gap.

‡ The following hints will be found useful in locating the trouble. If a motor does not start, (1) examine the fuses, (2) examine the relays, (3) look over the starter carefully as outlined in a previous article in the ELECTRICAL WORLD, Aug. 6, 1921, page 276, (4) inspect air gap with a feeler, (5) remove belt or coupling, as the case may be, to find if motor is overloaded, (6) test out motor windings with a magneto or bank of lamps. One of these suggestions should locate the trouble, and by applying the proper remedy the difficulty is soon solved.

Management and Policy

Embracing Central Station Commercial Organization and Management,
Customer and Trade Relationships, Public and Financial Policies, Advertising,
Selling and Service Methods

An Emergency Policy—"Pay as You Sell"

By William Gould

*Commercial Manager Massachusetts Lighting Companies,
Boston, Mass.*

THE imperative need of the electrical industry today is to break away from the present Micawber-like policy of "Waiting for something to turn up." It is my opinion that the "pay-as-you-buy" methods are doing much to retard the recovery of business and that what we need at this time is to adopt the plan of "pay-as-you-sell." This plan has very recently been put into effect among the ten gas and electric utilities under the management of the Massachusetts Lighting Companies interests. Manufacturers and jobbers are allowing us to pay for appliances as we later sell them, instead of buying outright in quantity of appliances or placing blanket contracts for the estimated seasonal requirements. The plan has been in use only a few weeks, but even this short trial shows conclusively that the sale of appliances is being strikingly increased. The plan is not a consignment method, but a straightforward attempt to concentrate sales activities upon products arranged in "mass formation" in the light of day, right in the salesroom, instead of being demobilized in the unfrequented recesses of the manufacturer's or the jobber's stockroom.

WILLIAM GOULD

By the "pay-as-you-sell" method the utility—and the contractor-dealer of approved credit and commercial qualifications—agrees to adopt a definite sales policy for the appliance, including a definite advertising, show-window and display space for it, backed by the united effort of the entire organization to get it into service. Instead of buying on a hand-to-mouth basis, with low production, heavily stocked warehouses and small volume of business, it means larger and more widely distributed buying by the public and by the sales organizations. It may mean the carrying of substantial stocks by the jobber in order to meet the demands of growing business, but it will mean a more rapid turnover for both the jobber and the retailer, and it will mean increased output for the manufacturer.

The electrical industry has been severely handicapped in the last few years by increasing costs of labor, material and capital. Manufacturers have also materially reduced their selling organizations, and a lack of life in selling campaigns and efforts is all too evident.

Successful appliance-selling campaigns can be revived if this large investment in money in hidden stocks can be liquidated by the "pay-as-you-sell" plan. Stocks of finished goods now "eating their heads off" in fixed charges in warehouses can be moved into the retail showroom and vigorously merchandised from quantities large enough really to impress the public. Convenient payments, under the installment principle, can be utilized as hitherto between the ultimate purchaser and the retailer. Cash payment, however, will prove a big factor. The desire to complete partial payments long before the term of the agreement is up closes probably 60 per cent of such accounts. The public utility can therefore well afford to make the full payment to the jobber or manufacturer upon recording the ultimate sale.

This plan will make it easier for many small companies to enter actively into the merchandising field and will aid in teaching them how to sell goods. It will result in the creation of many new selling agencies in hitherto inactive quarters and without the heavy initial investment usually required.

Before-the-war methods of financing are changing to meet present conditions, and a small customer who buys regularly is proving better than a big one who buys intermittently. The new plan may not be needed in normal times, when industries are running at full speed, but it has worked well in the sale of lamps and it offers a way to remove the present barrier to selling activity. It will bring large and small companies and concerns into step for better times and create new revenue for every branch of the industry.

Utilities Must Advance, Says Nova Scotia Board of Commissioners

"A PUBLIC utility cannot stand still; it must either advance or go backward," says the annual report of the Board of Commissioners of Public Utilities of Nova Scotia. "To advance it must procure capital cheaply or on fair terms in order to finance its undertaking and meet demands for larger and better service. Clamor against public service corporations undoubtedly makes this financing more difficult and will continue to do so until the public or the customer of the utility comes to realize that it reacts upon the customers and has the effect of causing the man with capital to look askance upon public utility investments and securities. The more unattractive the investment is made to appear the greater the inducement or premium which has to be offered. Such increased premium must sooner or later be reflected in rates, and ultimately the constituency which by its hostility and criticism made the securities of the utility unattractive to the investor is itself called upon to pay either by submitting to service incomplete and unsatisfactory if capital expenditures are not made or in the increased outlay or premium for capital obtained and expended."

Omaha Electrical Family Launches Strong House-Wiring Campaign

SUCCESS in a house-wiring campaign depends more on preparation than any one other thing, in the opinion of W. S. Byrne, sales manager of the Nebraska Power Company of Omaha. Before launching the house-wiring drive there, now in full swing, a survey was made of the entire city and a new list built up totaling 4,500 unwired houses. Through the good relations existing between the central-station company and the telephone company it was possible to develop direct from the file of the telephone company 2,500 selected names of homes using a telephone but not electric light.

"We then went to the electrical contractors of Omaha through their organization," says Mr. Byrne, "and pointed out that there was in the neighborhood of $600,000 worth of wiring business available in the territory. A number of them agreed to participate in a direct mail and house-to-house solicitation of this business based on a unit cost per outlet for the wiring.

"The campaign is quite too young to give a definite estimate of the results, but we are most optimistic from the returns of the first three days of the canvass. Postal cards and first letters, which, by the way, carried an actual sample of wire, were sent out to 176 'prospects' and were followed by calls by the contractors' representatives on 116 of them. Eleven contracts were immediately obtained, and sixty-two were, in the opinion of the salesman, 'live prospects' whom they believed could be persuaded to wire within a very short time."

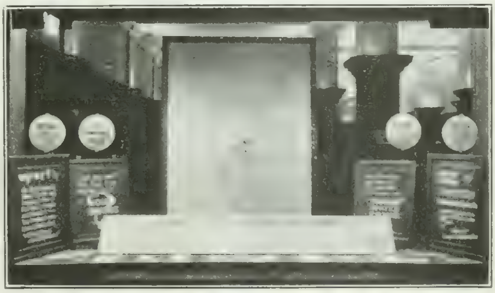
Boston Lighting Bureau Aids Equipment Sales

PURCHASES of industrial lighting equipment have been stimulated in New England by the exhibit of the Bureau for Better Illumination at 491 Boylston Street, Boston, according to a preliminary statement by J. Daniels of the engineering department. As recently outlined in the ELECTRICAL WORLD, this exhibit is being maintained by co-operating representatives of all branches of the electrical industry, and in the four months of its service sixteen major meetings have been held, besides a number of private meetings. More than 600 persons have examined the display, which is declared on good authority to be the most complete thus far assembled in the country. During the summer visitors from the electrical industry predominated, but steps are now being taken to bring manufacturers to the exhibit, and with good results.

Following a visit of fourteen executives to the exhibit, the American Printing Company, Fall River, Mass., purchased several thousand dollars worth of improved lighting apparatus. The Mead-Morrison Company, East Boston; Gillette Safety Razor Company, South Boston; Farrington Manufacturing Company, Roxbury, and Security Mills, Newton, Mass., are a few of the local factories which are making or have made changes as a result of viewing the display. Other betterment work is reported from Revere, Salem and Lowell, Mass., Manchester, N. H., and Providence, R. I. During "No Accident Week," when the tenth annual congress of the National Safety Council was held at Boston, representatives from various manufacturing companies demonstrated the exhibit to attending visitors, the display being kept open day and night. Mr. Daniels states that so far not a single visitor has failed to state definitely that he is "sold" on the idea of good lighting as a result of seeing the exhibit.

Picture of Minneapolis Company's Growth Helps Sell Stock

THIS customer-ownership window display of the Minneapolis General Electric Company bears out the old saying that nothing succeeds like success. On a map of the company's territory different-colored tacks are inserted representing the number of stockholders, customers and towns served. Below the map is a record of the company's growth telling how in the period from 1912 to 1921 the towns served have increased from 36 to 290, the customers served from 48,000 to 151,000, the connected load from 92,000 hp. to 359,000 hp. and the shareholders from 2,000 to 16,000. This constant growth of business and the evidence of confidence shown by the increase in shareholders stimulated numerous inquiries from prospective stockholders. T. C. Erringer, manager of the company's securities department, says: 'The display attracted a great deal of attention and brought many callers into the office, resulting in quite a few sales. It is beyond doubt one of the most effective window exhibits we have had."


CONVINCING CUSTOMER-OWNERSHIP WINDOW DISPLAY OF MINNEAPOLIS COMPANY

"Airplane Movie" of Utility's Property to Boost Customer Ownership

BELIEVING that stock can be sold more readily to an investor when he is familiar with the physical property of the industry in which he is asked to become a partner, the Northwestern Electric Company of Portland, Ore., is preparing an "Airplane movie" for use in its stock-selling campaign. This exhibition will give a graphic picture of the company's property to prospective stockholders. It will consist of a series of motion pictures of the company's hydro-electric development, power plants and transmission lines taken from an airplane.

Flights are now being made in the mountains and along the White Salmon River in Washington in the vicinity of the company's hydro-electric plant. A motion-picture operator is filming scenes of the mountainous country and along the river, showing where its power is converted into electric energy and then carried over transmission lines to the many consumers in Portland. The pictures will be exhibited at local motion-picture theaters in Portland and be an excellent means of stimulating interest in the company's preferred stock.

Small Company Sells Fifty-eight Washing Machines in Ten Days

TO SELL fifty-eight washing machines in ten days in a community with 2,500 residence customers, one-fourth of whom live in a district just then emerging from a six months' strike, about 800 residing in an industrial section where the factories were operating only three or four days a week, and the remainder being farmers at the height of the crop season, was the achievement of the Northern Connecticut Light & Power Company, Thompsonville, Conn. This was accomplished by newspaper and direct-mail advertising of machines obtained from an overstocked distributer and offered at a reduction of $60.25 from the former price of $160. Both the installment and the cash-payment plans were used. Twelve of the thirty homes represented by electrical department employees are users of electric washers. Walter P. Schwabe is general manager and John A. Ryan is in charge of the merchandise and new-business department of the company. The department consists of three people, a manager, one clerk in the appliance store and one outside salesman.

Temporary Floodlighting Installation Profitable in Two Ways

PROFITABLE business and public good will can frequently be secured by central-station companies from temporary lighting loads. An interesting example comes from the Louisville (Ky.) Gas & Electric Company in the floodlighting of the new Merchants and Manufacturers' Building at the Kentucky State Fair grounds. This was the first large floodlighting job in Louisville, and as the building is now the largest in the state it attracted a great deal of attention and much interested comment. More than 200,000 persons visited the building during the fair. The entire lighting for the state fair, held recently, was furnished by the Louisville company. The demand was between 500 kw. and 600 kw. and was used about five hours a night for the week.

The floodlighting equipment was designed and installed under the supervision of George M. Miller, superintendent of the electrical construction and distribution department of the Louisville Gas & Electric Company.

What Other Companies Are Doing

San Diego, Cal.—Business of the San Diego Consolidated Gas & Electric Company has expanded so rapidly that an addition to its power plant will be built to house a new 15,000-kw. turbine. Even with the additional capacity provided by the purchase of the street-railway company's generating station last winter, available power is no longer adequate to meet the demands upon the company for service.

Pasco, Wash.—The Pasco branch of the Pacific Power & Light Company recently held a successful "Dollar Day" sale at which some very special bargains were offered in the way of old-stock lighting glassware. R. B. Bragg in writing of the sale says: "We recommend this means to any company that is still carrying on its books stocks left from ill-advised purchases several years ago. This sale left us with only four shades on our hands, and one customer paid us a dollar for two of them to use for hanging baskets."

San Francisco, Cal. — Merchandise sales of the Pacific Gas & Electric Company and the Great Western Power Company, serving the territory in and around San Francisco, have been limited almost exclusively to electric ranges, small appliances being left entirely to dealers. The Pacific Gas & Electric Company thus far this year has sold 250 ranges and the Great Western Power Company 177, principally during the last two or three months. At the present rate, under an intensive campaign for the sale of ranges, they expect to sell 175 to 200 more before the close of the year. The Pacific Gas & Electric Company has also sold 175 water heaters.

Providence, R. I.—The Narragansett Electric Lighting Company maintained its total appliance sales in dollars within 5 per cent of last year's record for the first six months of 1921 compared with the corresponding period of 1920. For the first five months of 1921 the total was 98.7 per cent of the January-May figures a year ago. Such figures are heartening indeed, A. H. Alcott, manager of the merchandise sales department, points out, when one considers the shrinkage in prices recently experienced by the trade and the disposal of 1919 left-over stock purchased on a rising market. To June 1 this year the lamp sales of the company exceeded the sales of the corresponding 1920 period by 8.2 per cent.

FLOODLIGHTING OF MERCHANTS AND MANUFACTURERS' BUILDING AT KENTUCKY STATE FAIR

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
of the World

Generators, Motors and Transformers

Controllers for Direct-Current Motors.—W. J. JOHN.—Advantages and disadvantages of the face-plate type, the drum type and the contactor type of controllers are given. Relative costs are shown in the accompanying table.—*Beama* (British Electrical and Allied Manufacturers' Association), September, 1921.

Circle Diagrams for Closed Slots.—H. P. WHITEHORN.—A test of a 20-hp. motor with closed slots to bring out the difference between them and semi-closed slots in three-phase induction motors. The most important effect of a complete bridge on the slot is a decrease in the power factor which is equivalent to a displacement of the center of the circle diagram below the base line by an amount depending upon the thickness of the bridge.—London *Electrician*, Sept. 16, 1921.

Lamps and Lighting

Lighting the Modern Cannery.—WARREN ALDEN.—Proper illumination as a factor in increasing production in the canning industry is described in this paper. Gas-filled lamps rated at 220 volts in RLM reflectors are the choice for some of the installations mentioned.—*Journal of Electricity and Western Industry,* Aug. 15, 1921.

Specifications for Large Incandescent Lamps.—For the fiscal year that began on July 1, 1921, new specifications were adopted which include important changes in the test procedure for tungsten lamps. The most notable of these changes is the abandonment of the long-established provision that the life of test lamps shall be considered as ended when the candlepower has fallen to 80 per cent of the initial value. The specification of such an end point is convenient and reasonable in the testing of carbon lamps, because those lamps will often burn for a long period after they have become so blackened that they should not be continued in use. In tungsten lamps, however, means have been found to prevent excessive blackening of the bulbs, so that the lamps normally burn out before their efficiency has fallen enough to justify replacing them. The new tests will therefore be based on the total life to the time of burnout, thus conforming more nearly to actual practice in the use of lamps.—*Circular 13, Bureau of Standards* (ninth edition).

Generation, Transmission and Distribution

Condensation in Turbine Rooms.—L. J. TOWNE.—Information on this subject indicates that condensation difficulties will be eliminated or minimized by (1) providing an inclosed ventilated air space below the roof slab; (2) insulation of the roof slab by some non-conductor of heat; (3) reducing steam leakage to a minimum; (4) providing wall radiation for large exposed wall and window surfaces; (5) adjusting the generator air-cooling system to maintain a positive pressure in the building in connection with natural ventilation; (6) providing an independent heating and ventilating system for the turbine room itself, when a self-contained generator cooling system is used.—*Stone & Webster Journal,* September, 1921.

Ground Current in Theory and Practice.—L. LICHTENSTEIN.—The paper contains mathematical derivations of formulas for the determination of the distribution and magnitude of currents traveling through the ground, such, for example, as those between steel towers with faulty insulators.—*Elektrotechnische Zeitschrift,* Aug. 4, 1921.

Electrical Transmission Versus Coal Transportation.—HAROLD W. SMITH.—An analysis is made of the cost of transmitting large amounts of energy from coal-mine districts to industrial centers, and these costs are compared with the cost of shipping coal.—*Electric Journal,* September, 1921.

Water-Power Resources of Canada.—A compilation of the available and developed water power in Canada. The figures in the accompanying table are based on known data and do not include the power of many unsurveyed falls.—London *Engineer*, Sept. 2, 1921.

AVAILABLE AND DEVELOPED WATER POWER IN CANADA

	Available Twenty-four-Hour Power at 80 per Cent Efficiency		
Province	At Ordinary Minimum Flow, Hp.	At Estimated Flow for Maximum Development Hp.*	Turbine Installation, Hp.
British Columbia	1,931,142	5,103,460	304,535
Alberta	475,281	1,137,505	32,492
Saskatchewan	513,481	1,087,756	....
Manitoba	3,270,491	5,769,444	83,447
Ontario	4,950,300	6,808,190	1,052,048
Quebec	6,915,244	11,640,052	925,972
New Brunswick	50,406	120,807	21,180
Nova Scotia	20,751	128,264	35,774
Prince Edward Island	3,000	5,270	1,933
Yukon and Northwest Territories	125,220	275,250	13,199
Total	18,255,316	32,075,998	2,470,580

*Dependable for six months

Traction

Electric Traction in Switzerland.—A review of the development of electrification since the war on some important sections of the Swiss railways. Descriptions of the engines, substations and other equipment are given.—London *Electrician*, Sept. 9, 1921.

Giornico Substation of the Swiss Federal Railways.—C. COHEN.—This is one of two substations feeding the Gotthard tunnel line with single-phase current at 16⅔ cycles and 15,000 volts from the 60,000-volt trunk line from the Ritom power house. The station contains two 5,000-kva., single-phase, 16⅔-cycle transformers, with room for a third unit. The machines are oil-cooled, the oil for each transformer being circulated by electrically driven centrifugal pumps and forced through two coolers. The design of the coolers is identical with that of the "BBC" surface condenser as used in steam practice. An oil filtering and boiling system is permanently installed and connected to the transformers. The substation serves solely for the supply of the railway.—*Brown-Boveri Mitteilungen*, September, 1921.

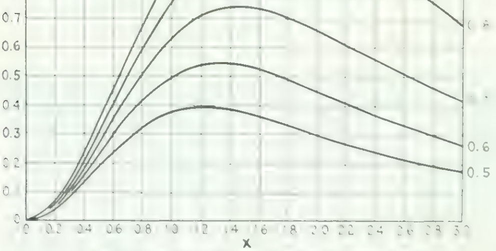
Automatic Safety Apparatus for Train Control.—M. Gouineau.—The Regan automatic train-blocking system, used in America on the Chicago, Rock Island & Pacific line, has been slightly modified and adapted to French railway service. It is in very successful operation on the Paris-Dieppe branch. Photos, drawings and connection diagrams accompany the paper.—*Revue Générale de l'Electricité*, Sept. 24, 1921.

Installations, Systems and Appliances

Electrical Auxiliary Machinery for Ships.—S. E. Glendenning.—Points to consider in the design and manufacturing of auxiliary electric machinery for use on a ship are enumerated. It is stated that direct current at 220 volts holds the field as standard practice. Ventilation of machines on ships must be especially provided for, and the machinery must be as light as possible, especially that located on the upper decks. One of the most important installations on board a ship is that of fans. Often these are arranged for several speeds. Electrically driven deck winches form a very large part of the auxiliary equipment. In all electrical equipment on shipboard special attention must be given to insulation, and nothing that will not stand 2,000 volts alternating current should be allowed. Careful attention must be paid to painting and enameling metal parts of motors; aluminum must not be used on account of corrosive effects of salt water.—London *Electrician*, July 29, 1921.

Electrophysics and Magnetism

The Effect of the Short-Circuit Winding in Alternating-Current Electromagnet.—L. Dreyfus.—The author examines in detail the field conditions in an alternating-current magnet where part of the core is surrounded by a short-circuited metal frame (damper) in order to obtain a time lag in the magnetic induction of this part of the core. The results are shown in a number of curves, one of which is reproduced here. F is the ratio of minimum pull with damper to the average pull without damper. X is the ratio of resistance to leakage reactance for the short-circuited frame, and Z is a parameter $= v^2 f(2a/b)$, where a is the breadth of that part of the core which is surrounded by the frame, and b the total core breadth, while f is a correction factor, depending on the induction, and v is the ratio of quadratic average to arithmetic average of core induction within the damper frame. The value of f is about 0.95 and v is very nearly 1 in ordinary cases. The curves show that a/b should be taken rather high; that is, the damper should surround almost the entire core cross-section. It is interesting to note that for $a/b = 0.8$ a maximum value of $F = 1$ may be obtained; *i.e.*, the damper is increasing the pull so that minimum pull with damper equals average pull without damper. It is very important, however, that a proper resistance ratio X be chosen, and in certain cases it may be advantageous to use an open frame and external rheostat.—*Teknisk Tidskrift, Electroteknik*, June, 1921.



RATIO OF MINIMUM PULL WITH DAMPER TO AVERAGE PULL WITHOUT DAMPER

Electrochemistry and Batteries

Electric Furnaces in Laboratory Types.—Ezer Griffiths.—A description of the arc, induction, high-frequency-induction, vacuum-cathode-ray and other furnaces.—*Beama* (British Electrical and Allied Manufacturers' Association), September, 1921.

Resistance Type of Electric Furnace in the Melting of Brass and Other Non-Ferrous Metals.—T. F. Baily.—The various features to be considered in making an electric furnace installation for melting non-ferrous metals are discussed.—Paper presented before American Electrochemical Society, Sept. 30, 1921.

Electric Furnace Melting of Nickel-Silver.—F. C. Thompson.—Advantages of melting nickel-silver in the externally heated electric furnace are discussed.—Paper presented before American Electrochemical Society, Sept. 30, 1921.

Units, Measurements and Instruments

Developments in Power-Station Meters.—A description of British instruments used for measuring steam, flue gas and other temperatures. The method of employing these instruments for increasing economies in generating plants is discussed.—London *Engineer*, Sept. 16, 1921.

Direct-Reading Wave Meter.—H. Thurn.—A new wave meter, based upon the dynamometric principle, is described in detail, its function is explained, and several exterior and interior views of it are shown. The instrument can be used with proper shunts for the widest range of wave lengths. It is manufactured by the C. Lorenz company of Berlin.—*Jahrbuch der Drahtlosen Telegraphie und Telephonie*, August, 1921.

Telegraphy, Telephony and Signals

Testing Thermionic Valves.—H. J. Lucsa.—With multistage amplifier and transmitter sets a considerable degree of uniformity in the valve employed is required. This article describes tests which may be made to determine the characteristics of valves which are to be used together.—London *Electrician*, Sept. 30, 1921.

Frequency Meter of Telephonic Range.—A. E. Kennelly and C. Manneback.—An instrument which is easily constructed and enables quick measurements to be made, with the consumption of little power and a large range of frequency, is described in this paper. This meter consists of a fine steel wire fastened at one end to the top of a cathetometer and soldered at the other end to a known weight. The wire is supported in front of a telephone electromagnet energized by the alternating current whose frequency is to be determined. This instrument measures frequency ranging from 250 to 1,750 cycles per second.—*Journal of Franklin Institute*, September, 1921.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

Definite Progress Being Made in Ford Negotiations for Muscle Shoals

FOLLOWING a conference in Washington on Oct. 24 between the Secretary of War, the Secretary of Commerce, Brig.-Gen. Harry Taylor, W. B. Mayo and Col. J. W. Worthington, Secretary Weeks declared that definite progress is being made and that the divergence between the estimates of the army engineers and the Ford engineers on the cost of the completion of the Wilson Dam and the construction of Dam No. 3 has been narrowed materially. Secretary Weeks stated that no bargaining was attempted at this conference as that will be done between Mr. Ford and himself soon after he has looked over the project personally, but his attitude indicated plainly that he is much more favorably impressed with the proposition in its present form than at any previous time.

Secretary Weeks left Washington Oct. 25 on a Southern trip and expected to spend Friday in a personal inspection of the Wilson Dam and the nitrate plants. He will return to Washington Oct. 30 and expects to "get down to figures" with Mr. Ford a few days thereafter.

Secretary Weeks took pains to point out that a portion of the difference between the estimates of the cost of completing the Wilson Dam and the construction of Dam No. 3 can be accounted for by the difference in costs at the times the estimates were made and by the fact that the army estimates cover a better type of construction than is absolutely necessary. He said that there is the greatest eagerness on the part of contractors to undertake work at this time and that, as a result, very advantageous arrangements can be made.

Although Secretary Weeks agreed that the reopening of the work would put smoke in many chimneys and would help the employment situation, he said that he could not agree with statements attributed to Mr. Ford as to the extent that active work on this project will stimulate industry.

National Parks Association Protests Against the Walsh Bill

A BILL to dam Yellowstone Lake introduced into the United States Senate by Senator Walsh of Montana is characterized by the National Parks Association as "perhaps the most dangerous blow ever aimed at American conservation." The association is at this time sending out literature urging readers to insist that their senators and representatives in Congress "soundly defeat the Walsh bill." A further extract from the statement is as follows: "If Congress grants one single irrigation privilege in any national park, no matter how inconspicuous the dam or how little it injures the park, it destroys the historic principle of complete conservation which alone differentiates national parks from national forests. It opens the door. Entire commercialization of all national parks logically and inevitably will follow the passage of the Walsh bill."

Ohio Utility Valuations Increased

THE Tax Commission of Ohio has boosted the valuations of Ohio utilities until the gain for 1921 over 1920 is two and one-half times the gain of 1920 over 1919. The increase is 8.2 per cent over 1920. Electric light and power companies received the biggest increase, the total valuation being $93,285,450, an increase of $15,187,530 over the 1920 figures. This represents an increase of 19.4 per cent as against an increase of 8.5 per cent for the telephone companies and 5.8 per cent for the natural-gas companies. Electric railways received the smallest increase in percentage, with a figure of 5.3 per cent. In addition to the taxes on this valuation the companies must pay a state excise tax of 1.2 per cent on gross receipts and the federal taxes.

Stockholders of Pacific Gas & Electric Company Told Company's Plan

THE Pacific Gas & Electric Company has held the first of a series of twenty or twenty-five stockholders' meetings which are planned for various locations in that company's territory. The first meeting was held in San Francisco and was attended by 500 stockholders who were told of the general plans of the company. The meeting was addressed by W. E. Creed, president, J. A. Britton, vice-president and general manager, and A. F. Hockenbeamer, vice-president and treasurer, who explained in detail the policy and program of power development. Mr. Creed opened the meeting and said in part:

"This meeting marks a pioneer movement in corporate management. The Pacific Gas & Electric Company is holding a series of meetings of its stockholders in various sections of the state for the purpose of acquainting them directly with the conditions and progress of the company and its function in the development of the state and in service to its people.

"In 1912 the State of California adopted a policy of state regulation of public utilities, and under that policy an unprecedented growth has followed. The state has grown not only in population but both industrially and agriculturally, and this growth has followed the growth of the Pacific Gas & Electric Company and other utilities. An idea of the extent of the growth of the public utilities can be gained from the fact that since the establishment of state regulation about a billion dollars has been invested in the public service industries in the state.

"The financial structure of the Pacific Gas & Electric Company is sound and conservative. The construction program of the company is based solely upon the needs of the state for gas and electricity and is adequate to meet those needs as far as they can now be ascertained. The estimate of future demands is deemed to be a conservative one and the 'service' ideal of the company requires that the program be carried out. Close analysis of the gas and power demands of the present and the future indicates that the increased facilities are fully justified and will insure for the company a return upon the investment made to provide them."

J. A. Britton outlined the ten-year program of electricity and gas development which the Pacific Gas & Electric Company has before it today. He said the stockholders were entitled to know what the company was doing and why it was found necessary to spend an enormous amount of money during the next few years.

Mr. Hockenbeamer said that hundreds of millions of dollars would have to be raised in order to meet the demand for power that must surely grow proportionately to the constant growing developments in industrial and agricultural activities, to say nothing of population. He told of the methods and cost of raising money and other matters concerning the company's finances of which the public generally has but a vague knowledge.

More Licenses and Permits Are Issued by Federal Power Commission

A LICENSE to extend for fifty years has been granted by the Federal Power Commission to the Southern Sierras Power Company of Riverside, Cal. The license covers a transmission line and appurtenant structures in the Angeles National Forest. It requires that construction work must begin before Jan. 1 next and be completed before Jan. 1, 1923. In connection with the granting of this license it was stated that James Hulne, W. E. McKinnon and Albert Piepenburg relinquished all their rights of prior application in view of an arrangement whereby the power company will serve their mining operations.

A preliminary permit to extend for two years was granted the Connecticut River Company of Windsor Locks, Conn., covering a power project at the Enfield Rapids of the Connecticut River. A condition of the permit was that the company must collect stream gage and flow records of the Connecticut, Chicopee and Westfield Rivers and so design its works as to utilize to best advantage the flow of the Connecticut River without undue interference with other interests. A conflicting application by A. P. Connor of Springfield, Mass., was rejected.

A preliminary permit to extend for two years was granted to the town of Petersburg, Alaska, covering a power project on Crystal Lake in the Tongass National Forest. The power is intended for public utility use. A license was applied for, but owing to uncertainty as to when the proposition could be financed the commission granted a preliminary permit only.

A two-year preliminary permit was granted to Charles B. Hawley of Washington, D. C., covering a power project on New River at Sandstone Falls, Raleigh and Summers Counties, West Va.

Applications were received by the Federal Power Commission during the week ended Oct. 15 as follows, the name and address of the applicant, the type of application, a brief description of the project, the proposed use and the horsepower involved being shown:

J. G. Galvin, 620 Alaska Building, Seattle, Wash.; preliminary permit; power project involving the erection of a 100-ft. dam and a power house on Aaron's Creek on the mainland east of Wrangel Island; pulp and paper manufacture; power capacity, 10,000 hp.; installed capacity, 12,500 hp.

Southern California Edison Company, Los Angeles; preliminary permit; dam and power house in Boulder Canyon, dam and power house in Pyramid Canyon, Colorado River, Mohave County, Ariz., and Clark County, Nev.; public utility; power capacity, 900,000 hp.; installed capacity, 1,200,000 hp. (This application is in conflict with the application of Edward L. Bayard of Seligman, Ariz., and with the application of the City of Los Angeles.)

Mitchell Terzich, Sonora, Cal.; license; diversion of water from Eagle Creek through a flume to develop 8 hp.; house lighting.

Commissioner Favors "Public Financing" to Obviate Excessive Rates

SPEAKING to his fellow commissioners and the members of the commission staff recently, Chester H. Rowell of the California Railroad Commission declared that "regulation will survive only if it can continue to protect the public against extortion and exploitation and at the same time keep the utilities able to render their service and finance themselves to expand that service." Public ownership, Mr. Rowell declared, was the only alternative of regulation, and he recognized the unfitness for this responsibility of governmental bodies as at present constituted.

While there are still many problems in public service regulation, the basic principles of rate fixing are well established, Mr. Rowell said. He went on to assert that a fair return is one computed on a property and not an investment basis. In discussing the contention of many utilities that financial needs should be the basis for return, the speaker objected that this might lead to sustaining private financing even after the cost of that financing has become so great that the proper remedy lies not in still higher rates but in public financing. In explanation of this he instanced the case of the Spring Valley Water Company in San Francisco, saying:

"San Francisco will soon need more water than the present Spring Valley plant can supply and will need it before it can be supplied from Hetch-Hetchy or the municipal plant. But Spring Valley, under existing conditions cannot finance the necessary additional investment except at a cost which would necessitate rates unfairly high to consumers. The obvious remedy is, of course, for the city to take over the existing plants and finance the additions and refund the present financing at the cheaper rates which the city can obtain."

Moderate Improvement in Business Persists, A. W. Douglas Says

PERSISTING improvement, though of a moderate character, in business conditions in nearly all sections of the country is seen by Archer Wall Douglas, chairman of the committee of statistics and standards of the Chamber of Commerce, whose views are expressed monthly in *The Nation's Business*.

Such change as is apparent in industrial life generally is rather for the better, Mr. Douglas asserts. Textiles are in fair shape and leather maintains both its demand and appreciation in prices. There is some increase in the output in steel and iron products, but the recent rise in prices may not last. There is better demand for lumber at somewhat higher figures. The belief is general that next spring will usher in renewed construction activity.

Electrical Industry Prepared to Meet Railroad Strike

LITTLE or no worry is being indulged in by the electrical industry over the possible railroad strike. The utilities have laid in their winter surplus of fuel, and the trade feels that there is enough local stock to take care of demand so long as the strike lasts. The general feeling, however, seems to be that there will be no strike. A canvass of the situation was made this week by the ELECTRICAL WORLD.

NEW ENGLAND AND MIDDLE ATLANTIC STATES

Electric utilities and industries in New England face the threatened railroad strike with utmost confidence in their ability to maintain supply of energy to the public and to furnish the trade with necessary products. The opinion is widespread that no general tie-up of railroad transportation is likely. James J. Storrow of Boston, who was fuel administrator for New England during the world war, estimates that from six to eight weeks' coal supply is stocked in New England. Only where local hydro-electric plants of smaller size have been hard hit by protracted drought does there appear cause for anxiety, and it is probable that relief can be had in these cases through co-operative effort. Many central-station companies are supplied with enough coal or fuel oil to carry them well beyond the maximum probable duration of a strike. The falling off of power loads in central New England because of the now receding business depression has not yet been overcome, and this reduces the immediate demand for fuel by perhaps 25 or 30 per cent. If a strike comes, interconnection of electric systems will win fresh laurels through skillful handling of loads where unbalanced fuel conditions temporarily exist.

Electrical jobbers are not worrying so far as the ELECTRICAL WORLD can find out. Stocks are still large enough in most lines to meet several weeks' requirements, especially if supplemented by rush shipments by motor truck or trolley express from New England factories and by water from New York and New Jersey districts. Manufacturers of electrical products in New England are ready to meet the situation, having plentiful stocks of raw material in the main.

In the Middle Atlantic States there was no evidences of worry. Coal stocks are ample and in one instance run up a four months' supply. Besides, most of the larger stations are situated on the water and are by no means dependent upon rail transportation.

Jobbers' stocks are ample and none have been stocking up in anticipation of a tie-up, nor have dealers been making any unusual demands on the jobbers.

INDIFFERENCE IN THE MIDDLE WEST

Indifference marks the attitude of the Middle West toward the strike situation to an astonishing extent. Whether this is due to an expectation that the strike will not materialize, or if it does will not be serious, is hard to determine, but the general talk seems to indicate a belief that there is a great deal of bluffing being indulged in on both sides and a possibility that government action will force an abandonment of the strike. The central stations of the Middle West are in a favorable position as to fuel, especially the larger ones. Storage against winter contingencies is at least normal and in most cases above normal.

The larger utilities have storage that can carry them for thirty to ninety days at full load. In most cases no difficulty is expected from a complete shutdown until after the middle of December or the first of January, and in one or two cases until the first of February. The utilities in Kansas and Oklahoma close to the oil fields will suffer least of all, as most of those depending on oil are also equipped to use gas, which is piped directly into the plants. The smaller plants in the parts remote from oil supplies depend on coal and normally carry somewhat less than a month's supply ahead. They will probably begin to suffer in two to three weeks. This holds generally true all over the Middle West, though one Nebraska operator in close touch with the situation asserts that the small utilities in that state will not suffer until after the midddle of December. The same authority expresses a hope that a complete showdown will come and the trouble be settled for good and all.

It is probable that a real strike causing a complete shutdown would so reduce the industrial and other loads of consumers that many of the utilities would be able to operate longer than the above figures indicate because of reduced demands. Utilities close to the lake port storages in the Northwest and along the western side of Lake Michigan are favored to some extent by their proximity to supplies that in emergencies can be handled without rail hauls. The situation in Ohio and Indiana seems to be about the same as in the territory farther West. One peculiar feature of the situation is the reports in Chicago Wednesday morning that indicate an actual drop in the demand for coal and seem to indicate no fear on the part of the buyers that there is any real emergency ahead. Dealers attribute the slump to the warm weather occurring the early part of the week.

Jobbers and dealers generally take the attitude that there will be no strike, and as stocks are rather generally on a thirty-day to sixty-day basis and the demand is below normal there is nothing to worry about at present. In Chicago the supplies to retailers near by would be handled by trucks. Some of the manufacturers that have been doing a fairly good business would be handicapped because their trade extends over a larger territory and they are not in possession of storage space to permit them to continue manufacture of equipment that cannot be shipped. High-tension equipment manufacturers report the shipment of considerable amounts of apparatus this week in anticipation of the strike.

NO ALARM IN SOUTH OR SOUTHWEST

Up to date the strike has not been considered in the South to be sufficiently imminent to warrant material preparations for handling the situation. A preliminary organization is being discussed to meet the situation in case a strike occurs, but unless it shall appear that a strike is inevitable little actual preparation will be made by the electrical trade in that territory.

The contemplated strike is causing no particular concern to central-station companies and the electrical trade in the Southwest. Some of the smaller utilities have built up coal stacks to a slight extent, but in St. Louis because of water-power from Keokuk and the fact that coal can be obtained from nearby mines in spite of a strike, no special measures are being taken to insure coal delivery. Electrical consumption will not be affected unless the strike is protracted. Jobbers and dealers will continue to buy in regular manner pending development.

PACIFIC COAST STATES RELY ON CANAL

Electrical interests in the Northwest are not much concerned over the threatened disturbance, first, because they feel that the backbone of the strike has been broken and, second, because it would not seriously affect that district if it occurred, because a large part of the shipments now come by water through the Panama Canal and the rest could very easily be diverted. Some jobbers and manufacturers have already diverted shipments to the water route and others are making plans to do so. Stocks of jobbers and manufacturers are in most cases in good shape to withstand a temporary tie-up. A surprising thing about the situation is that virtually no attempt has been made on the part of users of electrical material to fortify themselves against a possible suspension of freight traffic, an indication that the trade generally does not look upon the situation with any great alarm.

The threatened railroad strike will have little or no effect on the electrical industry of the southern Pacific Coast because the stocks on hand are quite satisfactory and also because, just as in the Northwest, the majority of shipments are already being received via the Panama Canal. If necessary, all material can be supplied by this route. The distribution of supplies from the receiving centers is well in hand. Out of San Francisco the inland rivers offer an uninterrupted route to two of the principal central cities of the state, while the others may be readily served by motor trucks.

The utilities are also in a very good position. The steam stations receive their supply of fuel oil through pipe lines connecting through to the oil fields. Therefore the fuel supply will be uninterrupted. With but a few exceptions there are no large pieces of apparatus en route by rail at this moment, and the delay of these would not be serious. The most important of them is the material for the Pit River plant of the Pacific Gas & Electric Company. This job would be halted during the strike, and if it were long continued the working forces would have to be reduced with material loss in organization. All other apparatus and supplies may be received by water and distributed by motors.

A. S. M. E. to Talk About Education and Elimination of Waste

ELIMINATION of industrial waste will have especial attention at the annual meeting of the American Society of Mechanical Engineers, to be held in New York City, Dec. 5-9. The report of the American Engineering Council's committee on elimination of waste in industry will provide the basis for the discussion, which will emphasize the engineering phases of the waste problem. The leading session will point out the necessity for waste elimination and develop essential principles of standardization and stabilization. The professional sections will consider in technical fashion the steps that can readily be taken more effectively to utilize our national resources.

The tentative program shows an intimate relation between the leading session and the technical sessions of the professional division. Two sessions on education will be held, one under the auspices of the committee on education and training in the industries, which will present a program pointing ont the great need for education in the industries. Dean R. L. Sackett of the Pennsylvania State College will present in one of the papers a résumé of the status of industrial education throughout the country. Another paper, by D. C. Buell of the Railway Education Bureau, Omaha, Neb., will relate the steps taken by the railroads of the country for the training of their men. The second session on education will be a joint meeting with the Society for the Promotion of Engineering Education. Prof. Dugald C. Jackson is in charge of the program, which will give an opportunity for mechanical engineers to discuss with teachers the requirements of an adequate technical school training in mechanical engineering.

New Southern Interconnection Relieves Power Shortage in the Carolinas

RELIEF for the power shortage in the territory served by the Carolina Power & Light Company in South Carolina, as reported in the ELECTRICAL WORLD for Sept. 17, page 583, and Sept. 24,, page 633, has been brought about through a liberal exchange of energy by three large Southern companies, the Alabama Power Company, the Georgia Railway & Power Company and the Southern Power Company.

On Oct. 23 arrangements were completed to interchange energy between the system of the Alabama Power Company and the Georgia Railway & Power Company over a tie line which was recently completed between Gadsden and Lindale, Ala. Energy is now being transmitted from the Lindale substation of the latter company to the Boulevard substation in Atlanta over a 110,000-volt circuit. Use is being made of the double-circuit power line, which has heretofore been operated at 38,000 volts. A second circuit at 110,000 volts completes the direct line at this voltage from Lindale substation to the Boulevard substation in Atlanta. This energy is being absorbed by the system and its equivalent delivered to the Southern Power Company through the connection between that company and the Georgia system at the Tallulah Falls station. The Southern Power Company then delivers to the Carolina Power & Light Company the amount originally absorbed by the Georgia company, so that the interchange of energy through high-voltage trunk lines is now completed over a distance of something like 1,100 miles through four Southern states. The general plan in the interchange is to shift the distribution of load centers so as to absorb the energy exchanged at the service points nearest to the point where energy is received.

The Gadsden-to-Lindale tie line is a simple circuit with No. 3/0 aluminum conductors on the Alabama side and No. 4/0 aluminum conductors on the Georgia side, giving a capacity of 20,000 kw. At the present time the demand is fluctuating, ranging up to 10,500 kw. The entire interchange will be in the order of 150,000 kw.-hr. to 200,000 kw.-hr. a day. Besides taking power from the Alabama system, the Georgia Railway & Power Company furnishes about 10,000 kw.-hr. in the daytime to the Columbus (Ga.) Power Company and at night obtains 20,000 kw.-hr. It also takes about 2,500 kw. demand from the Tennessee Power Company, which in turn is obtained from the Maryville (Tenn.) plant of the Aluminum Company of America.

Report Submitted on Cost of Columbia River Project

THE report of the board of engineers commissioned by the Umatilla Rapids Power Site Association to inquire into the results and probable cost of constructing a dam in the Columbia River about 3 miles east of the town of Umatilla, 180 miles east of Portland, Ore., and utilizing the head of water thus obtained for hydro-electric power and irrigation purposes, was submitted recently to the association at a meeting held at Pendleton, Ore. The report was prepared by John H. Lewis, former State Engineer, with the assistance of a number of other engineers of prominence. The cost of the report was borne by the association, aided by appropriations by the State Legislatures of Oregon and Washington.

Besides canalization of the Columbia River for navigation purposes above the dam site, it is proposed to develop irrigation facilities by pumping water for the irrigation of 270,000 acres of land within 45 miles of the dam and to develop from 125,000 hp. to 500,000 hp. for railroad operation, irrigation pumping, municipal and domestic supply and for industries within the Columbia basin extending from Spokane and western Idaho to Puget Sound and Portland.

The height of the proposed dam will be 30 ft., backing the water up in the Columbia nearly to its junction with the Snake River. The estimated cost of the project varies from $12,000,000 to $27,960,000, according to the extent of the work. It is proposed that the development shall be a federal government undertaking carried through in co-operation with state and local community effort.

Pacific Gas & Electric Will Get Energy from Irrigation Districts

THE California Railroad Commission has approved an agreement between the Pacific Gas & Electric Comapny and the Sierra & San Francisco Power Company with the Turlock and Modesto irrigation districts enabling the latter to proceed with the Don Pedro storage project. Under the terms of the agreement the irrigation districts acquire the La Grange power plant and Tuolumne River water rights, owned by the Sierra company and under lease to the Pacific company. As a consideration the irrigation districts agree to furnish to the power companies 10,000,000 kw.-hr. of electrical energy a year for twenty-five years. This power is to be developed at a generating plant to be built by the districts in connection with the storage dam. It was necessary for the districts to acquire the La Grange plant, as the proposed storage reservoir will submerge several miles of the company's ditch supplying the plant' and the agreement reached by the respective interests avoids the condemnation proceedings.

In passing on the application the commission defines the transaction as substantially a sale of public utility property on an installment basis of payment and finds that the agreement is to the advantage of both parties. At a rate of 4 mills per kilowatt-hour and an interest rate of 8 per cent the present value of the power covered by the contract is placed at $427,000. From the viewpoint of the Sierra company and its consumers the price is entirely adequate, the commission says, and it adds:

"While it is not a subject for consideration by the commission, it is of interest that by passing through its power plant the water which would otherwise be used by the Sierra company, the irrigation districts can generate enough power to satisfy the requirements of this contract and that the cost of the additional generating machinery required will be less than the additional cost of the gate tower, gates, trash racks, etc., that would be required if water were to be passed through the dam to supply the existing canal and power plant."

Nightly Illumination of Utah State Capitol Has Brilliant Effect

AN INTERESTING example of the remarkable effectiveness of electric lighting is the illumination each night of the exterior of the Utah State Capitol at Salt Lake City. This beautiful building, at the head of State Street, with a commanding view of the entire Salt Lake Valley, now maintains its prominence after dark as well as in the daylight. The electric lights which blaze forth from its dome, cupola and colonnade have transformed its gray outline against the darkened sky into an inspiring picture. Starting at the top, the ball on the dome is surmounted by a cluster of fourteen 200-watt lamps. On the cupola are four 250-watt lamps. Around the upper circle of the dome are twenty-four 60-watt white tungstens, and the lower circle of the dome is lighted by twenty-five 100-watt clear tungstens. Straight under the colonnade there are ninety-six 100-watt clear tungsten lamps, extending around three sides of the building—twenty-four lamps on the east side, forty-eight on the south and twenty-four on the west.

New England Division, N. E. L. A., Names New Chairmen

FOUR special section chairmen have been named for the New England Division, National Electric Light Association, following the recent annual convention at New London, Conn.: Accounting Section, F. J. Stanwood, Boston, consulting accountant; Commercial Section, Fred H. Smith, assistant general manager Worcester Electric Light Company; Public Relations Section, Edwin A. Barrows, president Narragansett Electric Lighting Company, Providence; Technical Section, Roy F. Whitney, manager Fall River (Mass.) Electric Light Company.

Bonds Must Be Backed Substantially with Junior Securities

JOHN B. MILLER, president of the Southern California Edison Company, with headquarters at Los Angeles, is a born optimist. He and his efficient staff have, through the exercise of indomitable ambition and unflagging energy, placed the name of their company high up in the records of electric public utilities for progressiveness, growth and public performance. Mr. Miller himself is a notable example for the emulation of any aspiring public utility operator. No man is better acquainted than he with the conditions, faults and requirements of modern electric light and power systems, particularly as regards financing, and therefore he speaks on this subject with a full measure of authority. When he was in the East early in October conferring with New York and Boston bankers on the enlarged financial program of the Southern California Edison Company, there was no question in his mind of lack of financial support for the immense hydro-electric development his company has in hand or in contemplation, nor had he any doubt of the ability of his organization to dispose of the additional billions of kilowatt-hours of energy which would be made available. Considering that the Southern California Edison Company is one of the biggest operators in the world and its building program is perhaps larger than that of any other utility in the country at the present time, Mr. Miller's confidence in the electrical outlook is as reassuring as it is refreshing.

J. B. MILLER

When asked to discuss the crucial question of public utility financing Mr. Miller reverted to the history of his own company and confirmed the frequently expressed conviction of investment bankers and others that electric light and power companies should raise from 30 to 40 per cent of the money needed for new work through the sale of junior securities and the remainder through the sale of bonds. In Mr. Miller's estimation, it is no longer possible to build power plants entirely from the proceeds of bonds and it is now imperative to provide each bond with an ample margin of equity through the sale of stock, as well as to safeguard the company and its operations through wider and more democratic ownership of the property. Mr. Miller remarked that proficiency in the latter accomplishment, with all that it implies in the important matters of public relationship, service, rates, etc., is just as much a necessity as the efficient operation of the plants themselves.

For the greater part of its funds the Southern California Edison Company still looks to the investment bankers. While naturally the company would be pleased to have all of its bonds in the hands of residents of the State of California, it is content to rely on the initiative and experience of the bankers themselves in placing such securities. When it comes to the sale of junior securities, however, the company has a more direct and personal interest than the bankers in raising funds by this means. Obviously the bankers are pleased to have the company assume the obligation since it can appeal to a clientèle beyond the reach of the ordinary banker or broker and self-interest will prompt it to do the job well.

Mr. Miller is obsessed by the urgency and importance of building up a feeling of good will for the Southern California Edison Company, particularly among its patrons. As a prerequisite he first interested the employees of the company by taking them in as partners through the sale of stock on deferred payments. Having lined up the organization so that every man was as enthusiastic as himself over the plan, the next move was to interest patrons of the company and the general public. The results obtained were truly remarkable.

Since Jan. 24, 1921, and up to Sept. 30, the Southern California Edison Company, through its own employees, sold to the people in the territory which the company serves in southern and central California $10,474,800 par value of its common stock. This stock has been purchased by 20,790 individuals. On Oct. 1 3,373 of the company's own employees were stockholders. Although the company has a small department expressly equipped to supervise the sale of its junior securities to the public in the territory served by the company's lines, the actual sales are made by the employees, every one of whom, in addition to his regular duties, is a stock salesman.

Department of Greater Service

Recently the company has established a department of greater service whose function is to ascertain at first hand the attitude of the public toward the company and to create in turn an interest in the company's affairs. The men intrusted with this diplomatic work have, of course, a pleasant approach and are thoroughly familiar with the history, organization, operation, practice and aims of the company, as well as with the broad questions of public policy and the relationship and importance of electric public utilities to the general advancement and development of the community and state. By this means the Southern California Edison Company has evolved a public relationship of immense value to it. To quote Mr. Miller: "Our customers now know in a more personal and intimate way just what we are and what we stand for. Moreover, they are pleased with the attention and courtesy shown them, and when they are invited to become part owners of the property a great many of them gladly accept. I need hardly dwell on the importance of this to any utility company and on the element of strength which customer ownership imparts to it, but a phase which appeals to me greatly is the effect all of this has on the officers and employees of the company itself. So keen is the interest of each employee in the stability and continued growth of the company that more than 90 per cent of them own stock. Every employee of the company is a salesman of its securities. He first 'sells' himself and then his neighbors and friends, thereby creating an entirely new group of investors. No investment banker could reach this class so thoroughly and effectually and no broker could command the confidence which impels a man who never before in his life made an investment to trust his savings with a company whose employees, policies and savings are as an open book to him. It is all a question of winning the public and keeping faith with them."

Southern Operating Men Hold Meeting

THE American Association of Operating Engineers held its last meeting for the year on Oct. 6, 7 and 8, in the Southern Club Building at Birmingham, Ala., with fifty present. Owing to the absence of H. L. Wills, G. A. Iler of the Georgia Railway & Power Company acted as chairman. An address of welcome was given by R. A. Mitchell, vice-president of the Alabama Power Company. It was decided to hold the next meeting at Columbus, Ga., by invitation of the Columbus Power Company.

A committee was appointed at the suggestion of Mr. Mitchell to take up with the Southeastern Section of the National Electric Light Association the feasibility and advisability of affiliating the A. A. O. E. with the N. E. L. A. Discussions were had on the advantages and disadvantages of the use of choke coils on high-tension lines, the correct location of lightning arresters, the half-soling of wooden poles used for high-tension transmission, the operation of superpower zones, and a number of other equally interesting subjects. A lecture, with a blackboard diagram, was given by James McC. Oliver of the Alabama Power Company. Mr. Oliver is an authority on correct relay protection.

C. E. Bennett spoke entertainingly on choke coils and surge arresters and their proper application, giving a demonstration with working models of the way in which high-tension transmission lines are protected from direct strokes of lightning and from inductive influence caused by flashes in the neighborhood, as well as from surges due to switching operations and arcing grounds.

On the evening of the second day the Alabama Power Company gave a banquet to the association, and Mr. Mitchell acted as toastmaster.

Directory of Manufacturers and Users of Electric Heating Equipment

IT IS officially announced that the industrial heating division of the Power Sales Bureau of the National Electric Light Association is about to compile a directory of manufacturers and users of industrial electric heating equipment, including steel furnaces, non-ferrous furnaces, heat-treating furnaces, japanning ovens, drying ovens, core ovens, bread-baking ovens (commercial), welding and rivet-heating equipment and electrochemical appliances. Manufacturers of such equipment are invited to supply data upon it to R. T. Kaighin, in care of the Cleveland Electric Illuminating Company.

Stone & Webster Managers Dedicate Organization to Greater Service

MANAGERS of public utilities administered by Stone & Webster, Inc., devoted the week beginning Oct. 10 to a vigorous and enthusiastic convention at the home office in Boston, 117 representatives being present from all parts of the continent. A keen sense of the opportunities for greater service through the best public relations in the central-station, gas and railway industries was manifested at the meetings. Delegates returned homeward more than ever convinced of the wonderful prospects for further development of electric service companies administered in accord with popular friendship and participation by the public in security ownership. Forty-three utilities, with a total capitalization of $219,000,000 face value, were represented.

The principal speakers, Harry H. Hunt presiding, were Charles A. Stone, president American International Corporation, New York, whose topic was "The Relation Between International Affairs and Public Utilities"; Edwin S. Webster, "The Principles of Our Organization"; Russell Robb, "Post-War Economic Conditions"; H. G. Bradlee, "The Management Contract"; H. A. Lemmon, "The Little Things"; C. W. Kellogg, "Public Relations"; Henry R. Hayes, New York office, "Street Railway Publicity"; G. O. Muhlfeld, "Achievement of the Engineering Division"; F. P. Royce, "Relations of Securities Department to Management"; Samuel M. Kennedy, vice-president Southern California Edison Company, Los Angeles, "Public Relations and Greater Service"; A. S. Pratt, "Relations of the Manager to the Firm"; H. T. Edgar, "Team Play and Employees' Clubs"; L. C. Bradley, Houston, Tex., "District Co-operation"; H. L. Rogers, "Development of the Division of Construction and Engineering"; F. S. Pratt, "New Developments"; H. B. Sawyer, "Taxation Conditions and Problems"; George Harrington, manager Chicago, Wilmington & Franklin Coal Company, Chicago, "Coal-Mining Activities"; J. T. Ingle, Haverhill, Mass., "Humanizing Company Forms"; J. A. Hunnewell, Lowell, Mass., "Training Employees for Contact with Customers"; N. H. Daniels, "Development of the Statistical Department," and Leonard Buchanan, "Lumber Activities." At a luncheon over which W. H. Blood, Jr., presided, George J. Baldwin, New York, spoke on "Stone & Webster and Hog Island"; M. C. Brush, New York, "How I Joined the Circus," and Elliot Wadsworth, Assistant Secretary of the Treasury, Washington, on "Government Finances."

STONE & WEBSTER MANAGERS GATHERED AT BOSTON CONVENTION

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Narragansett Company Increases Generating Capacity.—To meet the demands imposed by a rapidly growing load the Narragansett Electric Lighting Company of Providence, R. I., has built an addition to its turbine building designed to house a unit rated at 45,000 kw., which will raise the total generating capacity of the station to 125,000 kw.

Long-Distance Telephony in China.—Work, it is reported, has begun on a telephone line between Shanghai and Pekin. This line will connect with the 100-mile system now in operation between Pekin and Tientsin. The new line, which is to be completed before 1922, will be constructed according to American standards at a cost approximating half a million dollars. The total number of telephone subscribers in Chinese cities is put at 55,000.

Chicago Police Adopt Radio Telephony.—The radio telephone has been called upon by the Chicago police and fire departments to aid their work by enabling the chiefs of the forces to keep in communication with their subordinates. The cars of both departments are to be equipped with wireless instruments that will enable the occupants to receive messages spoken from headquarters, miles away. A trial in the police department gave entirely satisfactory results.

Progress at Logan, W. Va.—Upward of $2,250,000 is being expended, according to a report in the *Manufacturers' Record*, in the construction of an additional generating plant with a capacity of 30,000 kw. at Logan, W. Va., by the Kentucky & West Virginia Power Company; plans are being made for erecting about 100 miles of additional transmission lines in Kentucky and West Virginia to supply coal mines and other industries, and the building of an additional power house in the Big Sandy district of Kentucky is contemplated.

Electrically Driven Ferryboat Accommodates More Vehicles than Old-Type Boats.—The Poughkeepsie & Highland Ferryboat Company, which operates a ferry service across the Hudson River between Poughkeepsie and Highland, N. Y., is soon to operate an electrically propelled "hull-fin" ferryboat which marks an advance in the construction of such craft. Electric motors are mounted next the propellers, and the water projected is prevented from readily rising to the surface by the unusual width of the hull, which contains all the boat's machinery. The space thus gained permits of four driveways instead of two, as in the old boats. The largest ferryboats now in use have a length of 225 ft. and a width over beams of 60 ft., giving 110 sq.ft. for the accommodation of vehicles. The "Poughkeepsie," as the new boat has been christened, has a length of only 140 ft. and is 52 ft. over beams, but has an area of 472 sq.ft. for accommodation of cars and trucks.

Electric Enameling.—What is said to be the only electric furnace in the country for enameling stove parts has recently been put into operation by the Galusha Stove Company, Rochester, N. Y. The furnace was largely an experiment, but its product is said to be far superior to that enameled in any other way. The furnace takes 115 kw. and supplies an off-peak load.

How Electricity Helps Clear the Atmosphere. — By means of a tank equipped with a two-cylinder compressor driven by a motor rated at 0.5 hp., explains *Factory*, the air in textile and knitting mills is freed from lint and bits of thread which would otherwise accumulate in sewing machines, motor windings and the bearings of the line shafting and necessitate frequent stopping of the plant for cleaning. The outfit employed to blow this dust away is portable and produces an air pressure of from 60 lb. to 90 lb. With this equipment one man can clean twenty-five motors of from 2-hp. to 5-hp. rating, nine sewing machines, seventy-five electric fans and the shafting. In knitting mills, however, where every machine must be cleaned several times daily, there is a central compressor plant with pipe lines carrying the air to each machine.

The Scottish Water Powers. — That the scheme for linking up the small water powers of Scotland has possibilities of magnitude is the opinion of experts as recorded by the London *Electrician*, which abstracts a recent paper by Prof. F. G. Baily on this subject. The scheme proposed is to utilize the rapid streams and waterfalls of the high uplands and the rivers of the long, gently sloping valleys by numerous small hydro-electric stations so that the rainfall will pass through a succession of turbines in its passage from the gathering ground to the sea and yield up a fair proportion of its energy. The substations must be small, probably from 50 hp. to 300 hp., in order to avoid the need for large dams and long pipe lines. The central station it is proposed so to design that it will make up the irregularities of the load and supply the magnetizing current for the small dynamos. In some districts much of the power from the small stations will never reach the central station, for the collecting mains will also act as distributers to the adjacent countryside, which will thus be supplied with light and power. Each little station will be independent of the others and not affected by additions. Hence the financial risk will not be great.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

Providence Section, A. I. E. E.—This section will meet on Friday, Nov. 4, at 8 p. m. W. I. Middleton, electrical engineer Simplex Wire & Cable Company, will speak on the manufacture of insulated wire and cable.

Philadelphia Section, A. I. and S. E. E.—The topic already announced for the Nov. 5 meeting of this section, "Operation and Care of Power Transformers," will be discussed by J. G. Corrin of the Pittsburgh Transformer Company, Pittsburgh.

Providence Engineering Society.—A meeting of the power section of this society is scheduled for Tuesday, Nov. 1, when G. R. Rowland and W. F. Osborne of the Texas Company will speak on "The Manufacture and Application of Lubricating Oils." The American Society of Steel Treating will meet at the Engineering Society's rooms on the following evening, Wednesday, Nov. 2.

N. E. L. A. Committee Meetings.—Technical national section meetings of the N. E. L. A. are scheduled for November as follows: At Cleveland—Nov. 14 and 15, main groups of committees on inductive interference, meters and underground systems; Nov. 16 and 17, sub-groups of committees on electrical apparatus, overhead systems and hydraulic power; Nov. 17 and 18, main groups of committees on prime movers and safety rules. At San Francisco—Nov. 14 and 15, sub-groups of committees on inductive interference, meters and underground systems; Nov. 16 and 17, dual groups of committees on electrical apparatus, overhead systems and hydraulic power; Nov. 17 and 18, subgroups of committees on prime movers and safety rules.

Coming Meetings of Electrical and Other Technical Societies

Industrial Relations Association of America—New York, Nov. 1-5.

A. I. E. E. Providence Section—Providence, Nov. 4.

A. I. and S. E. E. Philadelphia Section—Philadelphia, Nov. 5.

N. E. L. A. Pacific Coast Section—Del Monte, Cal., Nov. 11.

Electric Power Club—Cleveland, Nov. 14-15.

A. I. E. E. and Society of Naval Architects and Marine Engineers—New York, Nov. 17.

American Physical Society—Chicago, Nov. 25-26.

Electrical Supply Jobbers' Association—Pacific Division, Del Monte, Cal., Nov. 10-12; Atlantic Division, Cleveland, Nov. 30, Dec. 1-2.

American Institute of Chemical Engineers—Baltimore, Dec. 6-9.

American Physical Society—Toronto, Canada, Dec. 27-31.

American Association for the Advancement of Science—Toronto, Canada, Dec. 27-31.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies

Commission Has No Power to Compel One Company to Supply Another.—Finding, in Village of St. Clairsville vs. Public Utilities Commission, that the commission may allow a gas company to discontinue service to a municipality if satisfied that the company has no longer a supply of gas, the Supreme Court of Ohio also decreed that the commission has no power to compel one such company to supply another in order to enable the latter to comply with a contract to serve. (132 N. E. 151.)*

City Cannot Enjoin Rates Specified in Schedule Filed with Commission.—Declaring that under the statutes a city cannot sue as a consumer of gas and electricity to enjoin the collection of rates specified in a schedule filed with the Public Service Commission, the Supreme Court of New York dismissed the complaint in City of Oswego vs. People's Gas & Electric Company of Oswego. The law authorizing the commission to investigate complaints made by the mayor of a city does not authorize a municipality to maintain an action in the courts to enjoin the collection of rates alleged to be excessive. (190 N. Y. S. 39.)

Judicial Functions and Judicial Powers.—The Natatorium Company, which furnishes hot-water service, having sued the Public Utilities Commission of Idaho, which the company sought to prohibit from interfering with it until it could be judicially determined whether the company is or is not a public utility, the Supreme Court of Idaho has denied the writ sought, declaring that in the exercise of its statutory powers the commission must in every instance pass upon the question of its own jurisdiction and that in so doing it does not exercise a judicial power but only a judicial function. (200 Pac. 348.)

City Violating Commission Order Not Liable for Damage Where Company Occupied Street Without Franchise.—Singerney vs. City of Los Angeles was a damage suit brought by a brakeman who while climbing his car was injured by contact with a street-lighting pole. The Supreme Court of California has reversed the lower court, which held the city liable because of its violation of a Railroad Commission order prohibiting the placing of poles within a certain distance of railroad tracks. The upper court holds that this violation was not negligence because the railroad company was using the street without a franchise and was therefore a trespasser, and the plaintiff, being a mere licensee, could not complain of the unsafe condition of the premises where he was injured. (200 Pac. 380.)

Acceptance of City Franchise Does Not Invalidate Former Franchise.—The Supreme Court of California in an action brought by the city of Oakland against the Great Western Power Company has found that where an electric light and power company furnished electricity for lighting under a constitutional franchise it did not surrender that franchise by bidding for and accepting a franchise under a city charter. The acceptance of the city charter was held not to necessitate payment of a percentage of receipts from electricity furnished for lighting purposes contrary to the terms of the prior franchise. (200 Pac. 395.)

Commission Must Dismiss Application Affecting Rights Involved in Pending Suit.—On application of the New Bremen-Minster Gas Company the Public Utilities Commission of Ohio granted the company leave to withdraw its service and facilities from the municipalities it had supplied, it being alleged that the natural gas depended upon was exhausted. The village of New Bremen thereupon brought suit against the commission, and the Supreme Court of Ohio has reversed the decision on the ground that the matter was already involved in litigation and that therefore it was the duty of the commission to dismiss the application. (132 N. E. 162.)

Contract Prohibiting Change of Rates Invalid.—The United States Court of Appeals has reversed the Nebraska District Court in City of Kearney vs. Central Power Company, the upper court holding that a contract between the city and the company precluding the company from increasing or decreasing rates during the life of the franchise—twenty-five years—is invalid as infringing the statutory provision that power to regulate rates shall not be abridged by ordinance, resolution or contract. The provisions of such a contract, the court holds, are unenforceable against the company for want of mutuality. (274 Fed. 253.)

Right of Appeal from Commission.—The jurisdiction of the Oklahoma Supreme Court over commission decisions, as laid down by the court in Atchison, Topeka & Santa Fé Railway Company vs. State, is merely, on appeal being made to it, "to consider and determine the reasonableness and justness of the action of the commission appealed from or any other matter arising under such appeal. The order of the commission or rate fixed by it shall be regarded as prima facie just, reasonable and correct. If in the opinion of the court the evidence taken before the commission and certified to the court overcomes this prima facie presumption, it is then the duty of this court to make such order or fix such rate as it deems just, reasonable and correct." (200 Pac. 232.)

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities

Powers of Michigan Commission.—Complaint made by a customer of the Peninsular Electric Light Company that the company charged rates in excess of those fixed by contract has been dismissed by the Michigan Public Utilities Commission, which declares that it has all the power over rates which the Michigan Railroad Commission had before its supersession, including the power that had been exercised in the case under review—that of eliminating discriminatory features from rate contracts.

Valuation of Company Serving Small Villages.—In ordering a reduction of the rates charged by the Katonah Lighting Company in the hamlets of Katonah, Bedford, Bedford Hills and Bedford Center, the New York State Public Service Commission made the following decisions: The value of a steam generating plant not in actual use on account of a three-year contract by which the utility received energy from a wholesale supply company was included as an item of fixed capital; no allowance was made for organization and general overhead expense, on the ground that the books should include all capital expenditures, the utility having been under commission control virtually since its inception; working capital should include what is necessary for materials and supplies and also a sum large enough to enable the company to operate until its current dues have been received; a transmission loss of 38.2 per cent of current is excessive; a return of 8 per cent is reasonable.

Non-Operative Electrical Companies Forfeit Charters in Pennsylvania.—Declaring that a charter issued to a company two years ago had been forfeited because no use had been made of it, the Public Service Commission of Pennsylvania recently, over the protest of the original company, authorized the issue of a charter for the same territory, in Jefferson County, to the Snyder Township Light, Heat & Power Company. There are said to be many cases in central and western Pennsylvania where charters have been granted to "paper" companies which have failed to exercise their rights under these instruments, some of the companies having been merged into larger enterprises and others holding the charters for future exploitation. The decision of the commission in the Snyder Township case foreshadows a policy on its part that will make non-exercise of franchise rights automatically invalidate them in the case of these rural supply companies. The state law requires work to be done within two years.

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*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System

Men of the Industry

Changes in Personnel—Responsibilities and Association Appointments of Men Engaged in Professional, Executive, Operating and Commercial Branches of the Industry

FRED NORCROSS

Fred Norcross, secretary and manager of the Home Gas & Electric Company, Greeley, Col., who was elected president of the Colorado Electric Light, Power & Railway Association at its recent convention at Glenwood Springs, started his career in the electrical industry as a telegraph operator in 1889. Later he became a train dispatcher with the Union Pacific Railroad, afterward chief dispatcher for the Colorado & Southern Railroad, and then chief dispatcher and trainmaster and later assistant superintendent of the St. Louis & San Francisco Railroad. In 1913 he was appointed to his present post.

Harold L. Geisse, who has gone to Wausau, Wis., as the assistant general manager of the Wisconsin Valley Electric Company, operating at Merrill, Wausau, Stevens Point and intermediate communities, is a graduate of the University of Wisconsin, class of 1905. Subsequent to his graduation he was statistician of the Railroad Commission of Wisconsin. He was with the American Light & Traction Company at San Antonio, Tex., for five years and then returned to Wisconsin to serve again as statistician of the Railroad Commission and later as secretary. He then became associated with the Insull interests in Chicago, first as assistant to the president of one of the property groups and then as secretary and treasurer of the Wisconsin River Power Company, the Southern Wisconsin Power Company, the Wisconsin Power, Light & Heat Company, the Central Wisconsin Utilities Company and the Mineral Point Public Service Company and as secretary and treasurer and general manager of the Janesville Electric Company.

L. Broadus Moore has taken charge of the operation of the plants in Georgia of the Georgia Alabama Power Company. Mr. Moore was formerly manager of the Alabama division of the company.

Albert L. Couch has succeeded L. Broadus Moore as manager of the Alabama Division of the Georgia Alabama Power Company. For several years Mr. Couch was superintendent of the water and light plant at Lexington, N. C., and later built and managed the Franklin District plant of the Georgia Railway & Power Company. He was later engaged in manufacturing in Memphis.

W. S. HALL

W. S. Hall, the new president of the Association of Iron and Steel Electrical Engineers, is the electrical engineer of the Illinois Steel Company, Chicago. Mr. Hall was graduated from the electrical engineering course at Purdue University in 1905. Soon after graduation he became associated with the Willard Storage Battery Company at Cleveland. In 1907 he joined the Baker Motor Vehicle Company as wireman and later was promoted to be foreman. He left this company in 1910 and joined the engineering organization of the American Steel Foundry at Hammond, Ind. After staying there a year, he moved to Chicago and entered the South Chicago works of the Illinois Steel Company. Working his way up through the ranks, he was appointed electrical engineer in February, 1917. Mr. Hall has been an active worker in all departments of the Association of Iron and Steel Electrical Engineers and has served as director of this association. He is also a member of the A. I. E. E.

HAROLD WRIGHT

Harold Wright, chairman this year of the National Electric Light Association committee on commercial service and relations with customers, was born in Schenectady, N. Y., in 1882. In 1890 his family moved to Chicago and he was educated in the Chicago schools. In 1900 he obtained a position in the Northern District office of the Commonwealth Electric Company. When the consolidation of this company and the Chicago Edison Company resulted in the formation of the Commonwealth Edison Company he was transferred to the main office of the new company, where he soon was made chief clerk of the contract department. Through him the application bureau of the contract department was established, which permitted application for electric service to be made by telephone, and at present he is in charge of that bureau. He has served as a member of several committees in the company section of the N. E. L. A. and was vice-president of the section in 1915-1916. He has served as a member of the committee on commercial service and relations with customers of the N. E. L. A. since 1917 and, as already mentioned, is chairman of that committee for 1921-1922.

John E. Harvell has been made general manager of the Richmond-Petersburg division of the Virginia Railway & Power Company, succeeding C. B. Buchanan, resigned. In addition to his new duties Mr. Harvell will continue to have full charge of the company's light and power business throughout the entire system. Mr. Harvell has had thirty-four years' experience in the public utility field, working his way up from the position of lineman with the Upper Appomattox Company, a pioneer developer of hydro-electricity. When the Virginia Railway & Power Company was organized in 1909 Mr. Harvell was continued in charge of the operation of the interurban and Petersburg railways that were taken over and later assumed in addition supervision over the companies' light and power properties at Weldon and Roanoke Rapids, N. C. In 1918 he was appointed general superintendent of all the light and power divisions of the system, including Richmond, Norfolk, Portsmouth and Suffolk. During the war Mr. Harvell constructed a high-tension transmission line between Richmond and Norfolk in remarkably quick time and under trying conditions.

Oswald Dale has resigned from the Irvington Varnish & Insulator Company, of which he was vice-president and general manager. He had been with the company for five years. He was previously with the General Electric Company for eleven years, nine years of which were spent in the department of supervision of production and two years in the insulating division. For two years prior to that he had been in charge of the heating-device production of the Cutler-Hammer Manufacturing Company. Mr. Dale has just returned from a nine weeks' trip in England and France, where he has been investigating the market for insulating materials.

OSWALD DALE

A. M. Lockett, president of the A. M. Lockett Company, has been appointed to a two-year term on the board of Port Commissioners of New Orleans by Governor John M. Parker. Mr. Lockett started the business in which he is now engaged in 1899, having been previously assistant general sales manager of the Worthington Pump & Machinery Company. He is a mechanical and electrical engineer and a graduate of Stevens Institute, Hoboken, N. J.

Herbert S. Evans, who for twenty years has been connected with the General Electric Company, the past ten of which he served as an executive in its foreign department, has become president of the "Bleh" Company, New York City, commercial adviser to manufacturers. Mr. Evans writes that he has felt for a long time that certain American manufacturers of electrical goods, particularly the smaller ones, were in need of expert advice which would make it possible for them properly to market and distribute goods for which there is actual need, and it is in this work that he will be more especially engaged.

Obituary

Senator Frederick Nicholls, chairman of the board of directors of the Canadian General Electric Company, who, as noted in last week's "Men of the Inductry," recently underwent a serious operation, died in Toronto on Tuesday of this week. Senator Nicholls was born in England in 1856 and was educated in Stuttgart, Germany. After going to Canada in 1874 he was for seven years secretary of the Canadian Manufacturers' Association, and until 1893 he was editor and proprietor of the *Canadian Manufacturer*, which he founded. The first electric lighting company in Canada, the Toronto Incandescent Light Company, which was established in 1889, was the result of Senator Nicholls' efforts. This company subsequently obtained the exclusive Canadian rights to the Edison lighting system, and it was amalgamated with the Toronto Electric Light Company in 1891, giving way to the Toronto Construction & Electrical Supply Company, which acted as Canadian agent for the Thomson-Houston Company. From this amalgamation sprang the Canadian General Electric Company, organized in 1892, of which Senator Nicholls became president in 1913, resigning that office only last spring to become chairman of the board. Senator Nicholls' abounding activities were not limited to one company however important. He was keenly interested in the promotion of the first electric street railway system and the first interurban railway of the Dominion, and he built the hydro-electric system of the Electrical Development Company of Ontario, with its power house at Niagara Falls and an 85-mile transmission line to Toronto. He had been president, vice-president or director of about thirty large Canadian manufacturing or commercial companies and took a prominent part in electrical development at Rio de Janeiro and Sao Paulo, Brazil. He was an honorary lieutenant-colonel of the Canadian military forces, took a prominent part in activities connected with the war, and in 1917 gained his title of Senator by appointment to the Upper House at Ottawa. In 1896 Mr. Nicholls was elected president of the National Electric Light Association, he having been the only president ever elected from beyond the United States.

FREDERICK NICHOLLS

Col. Spencer Borden, president of the Fall River (Mass.) Bleachery, and for three years identified with the early development of the electric lighting supply business in New England under Thomas A. Edison, died Oct. 17 at Woodstock, Vt., as announced in the ELECTRICAL WORLD of Oct. 22. Colonel Borden was one of the most prominent men in the New England textile industry, but his activities in this direction never caused him to lose interest in electrical development, although he had borne no active part therein for more than a generation. He was born at Fall River in 1849 and was graduated in 1868 from the Brooklyn Polytechnic Institute, specializing in chemistry. He studied for several years in France and on returning to America entered the textile field. In 1872 he organized, planned and built the Fall River Bleachery, at that time being elected a member of the American Association for the Advancement of Science. His work at Fall River attracted the attention of Mr. Edison and in 1881 he was made New England district manager for Mr. Edison's various interests, engaging chiefly in the direction of the commercial installation of isolated plant and mill lighting systems. From these beginnings and because of the knowledge Mr. Borden and his associates had of the textile industry developed in large measure the success of the General Electric Company in mill-power engineering. Upon the death of a brother, Mr. Borden resigned his connection with the electrical industry in 1884, returning to Fall River and continuing for the remainder of his life to exert a powerful influence upon textile affairs.

SPENCER BORDEN

Trade and Market Conditions

Business Reviews, Together with Market Letters from Important Trade Centers, on the Supply, Demand and Prevailing Prices of Electrical Apparatus and Supplies

Hardware Association Recommends Price Cuts to Pre-War Levels

IN VIEW of the fact that store and building hardware is distributed in much the same way and reaches largely the same consumers as electrical supplies, it is interesting to note that the executive committee of the National Hardware Association, in convention at Atlantic City last week, recommended that all hardware prices be cut to pre-war levels as a help toward readjustment. If the recommendation is carried out, the new scale of prices will be the same as in 1914 plus the differences due to increased costs and transportation. However, inasmuch as the advances were originally made necessary by mounting costs for labor, material and transportation, it is doubtful whether price cuts can be very startling while rates and material costs remain at their present levels. Every drop in cost so far has been immediately followed by a drop in price, a policy dictated by the competitive market.

Electrical supplies and wiring materials are in much the same position. It would be wise to cut to pre-war levels if only to get building started and business going, but prices at present are practically on a 1914 basis plus differences in cost of production and transportation. There have been fairly large decreases in raw material and labor costs of electrical supplies, but at no time has price failed to follow cost. It will be seen, then, that there is little room for hardware and, even less for electrical supply prices to move independently. However, any effect that the recommendation of the National Hardware Association may have cannot fail to be a good one. Even a further price reduction of a few per cent would be attractive to the building public.

Signs of Improvement in Collections

ADVICES from various sections of the country as noted by the National Electrical Credit Association indicate that the collection situation is experiencing a healthy improvement. While a few sections are still bad and others show only slight betterment, the general trend seems to be good and losses on new accounts are at a minimum. The year, nevertheless, will be one of the costliest from the standpoint of bad debts ever experienced by the industry. This condition is due almost entirely to accounts opened in the first few months of the year. Since June 1 there has been the necessity of scrutinizing all new credits closely, and as a result losses for the last part of the year will compare favorably with the average of other years. In the case of one large jobber the collection rate all over the country for the first seven months was more than 50 per cent higher than that of last year. This high average did not obtain for all jobbers, but conditions now show improvement over the early part of the year. At the present time the agricultural sections are perhaps slightly worse off than the industrial districts. On the Pacific coast low prices still rule the lumber market; in the Southwest cattle and oil are still comparatively low, and grain sections are still financially embarrassed. In the South cotton price increases have come to the rescue of business and a corresponding improvement is reported.

A report from Texas says that collections are getting slightly better, owing to cotton advances. Credits are rigid. Trade acceptances and notes are not generally being offered in settlement. Collections in Louisiana are on a sixty-day basis with improvement expected. Trade acceptances are not particularly desired. Atlanta reports contradictory statements on collections, some sections improving while in others planters are holding the cash received from cotton. St. Louis reports collections at sixty days and credits tight, and Omaha and Sioux City have noticed slightly easier collections.

Improvement has been shown in the East and particularly in the industrial districts. Detroit is still slow, but automobile production is picking up there and collections are better. Akron, Ohio, is reported to be showing very little betterment. Philadelphia, Pittsburgh and New York are considerably better than was the case ninety days ago as far as rate of collections is concerned. The collection basis still remains at sixty days. In the East there is a more general use of trade acceptances, and some jobbers feel that this has helped a great deal, resulting in a decrease in overdue investment and an increased turnover.

Value of September Electrical Exports Shows Decrease

THE stated value of electrical exports for September, 1921, is $4,878,883, showing a decrease of $2,429,210 as compared with September, 1920, and a decrease of $1,178,606 from the preceding month this year, but it is felt that the volume of exports has not fallen off in the same ratio. The difference in value between this year and last can be accounted for by the fact that many of the important items are much lower in price at present, while some articles are approximately even with pre-war levels. The stated value for the month, however, remains one of the lowest since October, 1919.

An encouraging factor is the showing of the first nine months of the year as compared with the same period last year, this year's total being $81,172,702 against $68,330,440 to Oct. 1, 1920. Only six articles show drops for this period, including batteries, carbons, interior wiring supplies, arc lamps, rheostats and controllers, and magnetos. Batteries registered the largest decrease, the figure being $1,627,629. Twelve totals show increases, some of the most important being dynamos and generators, fans, insulated wire and cable, meters and measuring instruments, motors, and transformers. Motors and transformers have the greatest increases, being respectively $4,573,508 and $3,999,810 ahead of the nine months' total last year.

ELECTRICAL EXPORTS FOR SEPTEMBER AND FOR FIRST NINE MONTHS OF YEAR

	September		Nine Months Ended September	
	1920	1921	1920	1921
Batteries	$607,936	$271,232	$4,885,262	$3,257,633
Carbons	119,233	42,402	1,085,831	347,306
Dynamos and generators	461,673	855,419	4,655,037	6,004,816
Fans	70,489	21,129	930,990	1,183,065
Heating and cooking apparatus	95,986	95,699	1,260,863	1,419,445
Insulated wire and cable	635,641	270,145	5,298,293	7,621,996
Interior wiring supplies	241,042	55,761	2,334,168	1,558,163
Arc lamps	1,033	455	1,764	62[illegible]
Carbon-filament lamps	4,402	2,448	70,955	115,396
Metal-filament lamps	244,047	76,187	2,756,484	2,815,163
Magnetos, spark plugs, etc.	271,177	66,509	2,664,864	1,129,733
Meters and measuring instruments	190,331	191,411	1,868,300	2,347,921
Motors	1,230,408	537,558	8,899,123	13,472,631
Rheostats and controllers	33,309	45,304	1,161,604	886,628
Switches and accessories	281,635	159,690	3,047,824	3,670,045
Telegraph apparatus	38,093	65,563	481,434	886,173
Telephones	246,841	262,052	2,594,939	4,072,155
Transformers	208,493	353,033	2,980,186	6,979,976
All others	2,326,304	1,506,876	21,336,636	23,369,024
Total	$7,308,093	$4,878,883	$68,330,440	$81,172,702

A close comparison is possible between September and August of this year. Twelve items have fallen off while six have increased as compared with the previous month. It is interesting to note that transformers show the best increase here also, while fans show the largest drop from August values. Among the articles showing increases are batteries, carbons, dynamos and generators, heating appliances and meters.

As contrasted with September, 1920, exports there have been decreases on such items as fans, insulated wire and cable, metal-filament lamps, motors and switches, while dynamos and generators, meters, rheostats and controllers, telephones and transformers show gains.

Figures in the accompanying table have been received from the Bureau of Foreign and Domestic Commerce, Washington, D. C.

Unsettling Conditions Again Invade Copper Market

THE copper market, after the very encouraging activity of September, during which quotations rose to 13¼ cents, has again become quiet. The prime factor in the almost total cessation of buying since Oct. 15 has been the threatened railroad strike. In some quarters in the beginning the possibility of a rail tie-up was looked on more or less as a temporary embarrassment, but according to the opinion of an authority on the copper situation, as expressed to ELECTRICAL WORLD, the mere possibility of impeded transportation is having an effect which will be felt in the copper market for several months to come.

The first result has been the curtailment of buying to the point of negligibility, while producers' prices have tumbled to 13 cents per pound. Second hands who in reality possess only a small amount of the metal are able to supply what little demand there is at 12⅞ cents. The opinion is general, however, that under no circumstances will prices drop to the level set during the latter part of August.

The real harm will come in connection with the reduction of surplus stock, which was proceeding at a very satisfactory rate during July and August and was as high as 60,000,000 lb. in September. On the first of September it was estimated that the surplus amounted to 1,250,000,000 lb., and had sales continued the rest of the year at the pace set in September, there is little doubt that the surplus would have been reduced to approximately 1,000,000,000 lb. by Jan. 1. From this total could have been deducted 340,000,000 lb. which has been financed for export and may, for all practical purposes, be disregarded as an actual factor. This would leave a free surplus of about 640,000,000 lb., of which about 300,000,000 lb. to 400,000,000 lb. would be considered in transit. In this way had sales continued in their September volume the first of the year would have seen little more than a normal surplus, and producers could have confidently begun to recruit their scattered mining and smelting forces.

As a matter of fact, October sales to the eleventh of that month were ahead of those for the same period of September, and the resumption of mining and refining might have occurred even slightly ahead of optimistic estimates. The cessation of buying, however, has put an entirely different face on the matter, and the re-establishment of mining activities as a consequence will have to be considerably postponed. At the present time mining in the United States is being carried on at 11 per cent of normal, while in South America it is at 46 per cent of normal. Mine and smelter forces have been widely scattered, and some authorities believe that it will be the summer of 1922 before normal refining can be resumed.

Thus far there have been no changes in finished copper and brass products to correspond with the let-down in demand. Large jobbers continue to quote No. 14 rubber-covered wire in 5,000-ft. lots at from $6.30 to $6.60. Weatherproof also has maintained its advance. Provided that copper producers are successful in their present attempt to maintain a price of 13 cents, wire prices are also expected to hold.

Encouragement Shown in Steel Poles and Towers

FROM reports received from producers of steel poles and towers for transmission lines there is considerable encouragement shown in certain quarters. Reports from other directions, however, indicate that business is not such as to hold up a very bright outlook for the coming winter. The business is spotty. Although it is true that the utilities have been very successful this year in floating securities, it is evident that not a great deal of this capital has been expended in towers to date. But the quality of the inquiries shows the future business now in contemplation. All classes of steel poles and towers have been considered in this brief survey. Another feature of the market is that while one month may be good the next may be off. Foreign business is providing a good market in some directions, notably the Far East and South America. Particular promise is held forth in the possibilities offered by electrifications of railways in Chile and Brazil, although it is expected that as much local labor and material as possible will go into this work.

Tower and pole prices are on lower quotations now than they were a month ago, in general. Five per cent is a representative price reduction, while in one instance it goes as high as 10 per cent. Late in September fabricated-steel prices suffered a reduction of about $2 to $3 per ton. The wireless field is providing an attractive market for fabricated towers, and with the development of this branch of the electrical industry a promising future is foreseen.

Further Reductions Announced on Iron Conduit and Outlet Boxes

RIGID iron conduit and outlet boxes have reflected the general trend in the iron and steel market by a further drop in prices. The new discount allows an additional 5 per cent from the price as figured on Card 48, which went into effect on Sept. 16. A new card has not yet been issued by conduit manufacturers, but these figures are approximately the same as were in effect in December, 1916, showing that pipe is back to where it was nearly five years ago.

Outlet boxes have dropped about 10 per cent. The new discounts in lots of 1,000 are 64 per cent for black boxes and 59 per cent for galvanized as compared with previous discounts of 57 and 53 per cent respectively.

Metal Market Situation

THERE has been little change in the metal market during the past week with the exception of a drop on steel rails of $7 per ton and the slight weakening of other steels. Lead demand has dropped off, but the New York price is unchanged on account of limited supply. The only movement in copper has been a ¼-cent drop on electrolytic, which is quoted now at 12¾ cents. Tin has achieved a small advance in the last two weeks in spite of the fact that the visible supply of tin has increased recently.

NEW YORK METAL MARKET PRICES

	Oct. 17, 1921			Oct. 24, 1921		
Copper	£	s	d	£	s	d
London, standard spot	65	15	0	66	2	6

	Oct. 17, 1921 Cents per Pound	Oct. 24, 1921 Cents per Pound
Prime Lake	13 00	13 00
Electrolytic	13 00	12 75
Casting	12 37½	12 37½
Wire base	14 50	14 50
Lead, Am. S. & R. Co. price	4 70	4 70
Antimony	4 90	4 85
Nickel, ingot	41 00	41 00
Sheet zinc, f. o. b. smelter	[illegible]	10 00
Zinc, spot	5 15—5 20	5 10—5 15
Tin, Straits	28 00	28 50
Aluminum, 98 to 99 per cent	24 50	24.50

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	10 50—10 87½	10 50—11 00
Brass, heavy	5 00—5 50	5 00—5 50
Brass, light	4 50—5 00	4 75—5 00
Lead, heavy	3 50—4 00	3 75—4 00
Zinc, old scrap	2 25—2 37	2 25—2 37½

THE WEEK
IN TRADE

Prices When Quoted Are Those Prevailing at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

The shadow of the threatened railroad strike spread itself over the electrical industry this past week and buying as a consequence has been spotty. Chicago reports fair business in wire but quietness in other lines. Residence lighting-fixture business is good there, one utility having three times the normal number of unfilled orders. Steady though gradual improvement is noted in New York with less hand-to-mouth buying. Better demand for heating appliances is in evidence.

Jobbers in Atlanta are beginning to stock toys and holiday goods, but dealers are not placing orders yet. Stocks of heating appliances, dry cells and porcelain are low in St. Louis. Jobbers there report satisfactory business compared with other lines. Uneven improvement is noted in Boston, but it is encouraging to note that last week's building permit total was the best in twenty years. Better conditions are reported in the Northwest, the Intermountain region and in San Francisco. Holiday orders in the last-named place are comparatively light so far.

In no section of the country do jobbers seem to be worried about the railroad strike. Wherever possible shipments by water and truck are being planned. By some jobbers the possibility of a strike is being discounted, and there seems to be little stocking up in preparation for a freight tie-up.

NEW YORK

Trade continues to hold up well, and jobbers report that they can see a steady, although very gradual, improvement from week to week. An encouraging indication of greater confidence on the part of buyers is the fact that individual orders are increasing in size. There is not quite so much hand-to-mouth buying, and there is further evidence of dealers stocking up in anticipation of increased prices on some of the staple items.

Three important price changes were noted this week. Flexible armored conductor, for which there has been a strong demand for the past six weeks, has been advanced $2 per 1,000 ft. for No. 14, two-wire, single-strip. Iron conduit has been reduced 5 per cent by manufacturers and outlet boxes an average of 10 per cent.

A better demand for heating appliances is being shown, and jobbers report considerable buying for holiday trade. Air heaters are moving fairly well, and there appears to be more activity than there was a year ago.

Collections are reported to be on the basis of thirty to sixty days for current billings, but there is a general sentiment that conditions are improving.

Conduit.—An additional discount of 5 per cent on rigid iron conduit went into effect the first of this week. Jobbers have not issued a revised list of prices to conform with the new discount, but are quoting 5 per cent off on the following: For $\frac{1}{2}$-in. black pipe in 2,500-ft. lots, $54 to $55; $\frac{3}{4}$-in., $69 to $71, and 1-in., $99 to $101 per 1,000 ft. The same discount applies to galvanized pipe, which for the same sizes was quoted at $59 to $62, $76 to $81 and $110 to $116. Demand continues steady with few orders for large quantities. Jobbers' stocks are good.

Flexible Armored Conductor.—Jobbers generally have advanced their prices on this material about $2 per 1,000 ft. No. 14, two-wire, single-strip, which was quoted last week at $43, has been increased to $45 per 1,000 ft. There has been an active demand for this material for the past month. Much buying has been done in anticipation of the increase as well as for current requirements. Jobbers' stocks are rather spotty and one leading manufacturer is said to be 2,000,000 ft. short of the orders on hand.

Outlet Boxes.—An additional reduction of about 10 per cent in the price of outlet boxes has been announced. Black boxes in standard package lots are quoted at 64 per cent off list and galvanized boxes in the same quantity at 59 per cent off list. Previous discounts were 57 and 53 per cent.

Metal Molding.—Price on the three-wire size remains unchanged at $5.60 per 100 ft. as previously quoted. Demand is light and orders are for small quantities.

Loom—Jobbers' stocks are kept low to meet the limited demand of this territory. Prices are unchanged. In 1,000-ft. lots the $\frac{7}{32}$-in. size sells for $19.25 and the $\frac{1}{4}$-in. size for $21 per 1,000 ft.

Heating Appliances.—Heating appliances are moving better than for some months past. Jobbers, however, report that their sales are not up to former years. This they attribute partially to stocks remaining in dealers' hands.

Air Heaters.—There continues to be an active demand for heaters, and in view of the moderate demand for other appliances jobbers seem well satisfied with sales thus far.

CHICAGO

With copper prices remaining on the same level as last week, jobbers report fair sales on weatherproof and rubber-covered wire. Other lines have been a little quiet, owing to the possibility of a railroad strike. The threat of a general railroad strike seems to worry most jobbers very little. Some dealers, however, fear that a serious shortage of materials would occur if a strike should be called. Several dealers interviewed expressed the feeling that activity in the electrical industry will keep up throughout the fall and winter in view of the fair start it has received.

Although there are plenty of plans for construction in the city, they have been delayed by one thing or another, but chiefly by the labor disagreement. Although the labor situation is still subject to argument and delay, a tone of improvement has been noticed following the acceptance of the Landis decision this week by several unions.

Wire.—The market has not changed much since last week. The bare-wire base is still at 16 cents. Sales of No. 14 rubber-covered are reported steady at prices ranging from $6.50 to $6.75 per 1,000 ft., in 5,000-ft. lots. In lots of 1,000 ft or less it sells for $7. Weatherproof is moving moderately on a base of 16 cents.

Flexible Armored Conductor.—The activity of this material continues to be fair, with jobbers reporting prices for No. 14 two-wire, double-strip, at $50 per 1,000 ft. in 5,000-ft. lots. Stocks are on approximately a thirty-day basis.

Schedule Material.—This material is moving well and no price reductions have occurred. Key sockets are quoted at $18.15 per 100 in 500-box lots. Pull sockets sell for $33 per 100 in 500-box lots.

Lighting Fixtures.—One large Middle Western public utility, in a part of its territory including mining, industrial and agricultural load, reports its connect orders not yet filled to be three times normal. This is due in some degree to orders being allowed to pile up, but to a large degree to activity in the building industry, principally residence construction. Jobbers interviewed stated that their orders for residential lighting fixtures were excellent and they are in good condition to fill all orders.

Fuse Plugs.—Movement of this line is fair, and jobbers have sufficient stock on hand to supply the trade. A representative price is $27.50 per 1,000 plugs in lots of 1,000 for fuses up to 30 amp.

High Tension Equipment.—Activity in indoor disconnecting switches has induced one manufacturer to increase his working time from eight hours per day to nine hours. Another manufacturer reports a sale of high-tension equipment for two 1,000-kw. outdoor substations in the West Virginia coal-mine district.

BOSTON

Continued improvement of business is reported by distributers, marked by uneven buying and scattered absorption of products. Little fear of a transportation tie-up was evident locally early in the week, and jobbers were not increasing their purchases on this account. Boston houses are well situated to receive material by water and by motor truck in case of a rail strike, but confidence in well-maintained railroad service is strong in this section. Building and engineering contracts for the week ended Oct. 18 totaled $7,902,000, against $5,800,000 for the corresponding week last year. This is the best week's total for this period in the past twenty years, according to the Dodge tabular summaries. Paper, textile and leather industries are gaining business in New England, and it is reported that the clothing manufacturers have won a complete victory for the open-shop principle, after several months of radical labor strikes. Some shoe factories in this section are sold up to early spring. A little buying for the Christmas trade is evident in jobbing circles, a few dealers having begun to stock up.

Motors.—Further improvement in inquiries is noted and buying is a little better among the smaller sizes. Stocks are ample and prices steady. Textile mill buying is relatively active.

Wire.—Rubber-covered No. 14 is selling at $6.25 per 1,000 ft. in 5,000-ft. lots with fair demand and good stocks. Weatherproof base is 16 cents, with light demand. Central-station construction is dull, and many companies appear to have failed to take advantage of the wire market, which jobbers declare has been unusually favorable to purchasers this fall.

Appliances.—Washing machines and electric ironing machines are moving slowly this week, but table devices are selling more briskly. Electric radiator sales have required moderate purchasing from manufacturers, some jobbing stocks having run pretty low. Toasters and irons are selling with the usual staple demand and stocks are easily meeting current requirements.

Flexible Armored Conductor.—This material is relatively active compared with loom and rigid conduit. No. 14 in 5,000-ft. lots sells around $44.68 to $45 with some shading under sharp competition. No difficulty is noted in meeting current needs.

Sockets.—Trade is a little more active and prices are unchanged, but some comment is heard to the effect that fluctuations may appear. Pulls in case lots sell for 31½ cents net. Increased building activities are absorbing this class of material.

Lamp Cord.—Prices have advanced about 7½ per cent this week, owing to the increased cost of cotton. On No. 18 cotton-covered cord, type C, a price of $1.45 per 100 ft. is quoted in 1,000-ft. lots, $1.75 per 100 ft. in coil lots and $2.20 per 100 ft. in less-than-coil lots. Prices are open on 5,000-ft. lots. Discounts on portable cord range from 35 to 55 per cent according to quantity, and on silk cord they are from 40 to 55 per cent off list.

Outlet Boxes.—A reduction of about 5 per cent went into effect this week. On stamped steel boxes and covers discounts range from 40 to 60 per cent from below $10 list to $250 list, the corresponding discounts on galvanized boxes ranging from 35 to 55 per cent. On gang boxes and switch boxes 30 per cent off is quoted on less than 100, black, and 25 per cent on galvanized; on 100 or over, 40 and 35 per cent respectively with demand light. Steady prices prevail on rigid conduit.

ATLANTA

Reports from mercantile establishments throughout the section indicate considerably increased activity, though little or no credit is being extended. Collection reports seem somewhat contradictory, some sections reporting a considerable improvement while others state that money realized from crop sales is being closely held by the producers, who are paying cash for purchases but not liquidating old accounts. Apparently this is caused by the fear that after liquidation new credits cannot be obtained. Taken as a whole, however, the financial condition throughout the section is very much improved.

Electrical jobbers report their business continuing to hold the increase registered in the month of September, while socket appliances and house-wiring devices show even greater activity, this being the reflection from the large number of residences and small stores under construction. Jobbers are beginning to accumulate their goods for holiday trade on the basis that there will be approximately 75 per cent of last year's business in the portable line and 80 per cent in the toy line. Orders on manufacturers for toys, however, will be only 50 per cent of last year as jobbers had heavy carry-overs in this specialty. Retailers are not yet placing orders for Christmas requirements,

The possibility of the general railroad strike is subject for much discussion, but as yet no heavy preparations are being made to meet the situation.

Radio Outfits.—Considerable interest is being displayed both in and out of the cities in the smaller types of radio apparatus, with the result that sales have shown a very satisfactory increase and prospects are bright for a sustained activity. Local stocks for normal requirements are in good shape.

Flexible Non-Metallic Conduit.—There has been no reduction in price since the cut of 10 per cent two weeks ago. Retailers are placing quite satisfactory orders, and this has served to somewhat deplete local jobbers' stocks.

Lock Nuts and Bushings.—The market in this line is quite active, the sales keeping pace with the movement of armored conductor and rigid conduit. Local stocks are in very fair shape, though prices are somewhat unsteady. One of the largest jobbers reports his stock depleted and a large order was made on a manufacturer this week.

Fuses.—There is the normal fall increase in the demand for fuses, industrial plants placing quite satisfactory orders for the renewable type, while orders by central stations and municipalities for plug fuses are very steady. No recent price changes are reported.

Schedule Material.—The movement of this line has been well sustained for several weeks, with key sockets, rosettes, knobs and tubes leading in popularity. Items throughout the entire line are on hand in sufficient quantities to meet current demands.

ST. LOUIS

Though the railroad strike seems imminent, jobbers here are not inclined to stock up in expectation of slow deliveries, for it is felt that movement to dealers would be equally slow.

Some betterment in the demand for electrical goods was in evidence last week. Several items are finding good call, principally heating appliances, stocks of which are low. The utilities are doing a fair amount of buying and the railroads showed some improvement last week, but the industrial demand remains comparatively dull. Dealers and contractors are in general buying very conservatively and maintaining stocks at a minimum. However, in those items that are priced abnormally low, such as wire and porcelain, there is a tendency to buy considerably in excess of immediate requirements.

Electrical jobbers are getting their share of the obtainable business. Net profits are somewhat better than a few months ago because of the more stabilized prices. A representative jobber says that if the volume of business should increase by 20 per cent, his business would be yielding a good profit, one which could be considered as normal.

Wire.—Prices are holding steadily, No. 14 rubber-covered selling for $6.50 per 1,000 ft. in 5,000-ft. lots and for $6.40 in lots of 10,000 ft. or more. The base on bare and weatherproof varies from 15½ cents to 16 cents per pound. Stocks on the smaller sizes of rubber-covered are low, interchange among the jobbers being required to meet the call. Weatherproof continues to sell in better quantities. There is a marked tendency to buy in excess of immediate requirements because of the present favorable market.

Porcelain.—Strong demand and low stocks prevail. Contractors and dealers are building up heavier stocks. "Nail-it" knobs are selling for $17.50 per 1,000; 2½-in. tubes for $5.25 per 1,000, 3-in. tubes for $5.75 per 1,000, and two-wire and three-wire unglazed cleats for $13 per 1,000, all prices being for barrel lots.

Dry Cells.—The railroads made rather large purchases last week. The demand from other sources also showed improvement, and as a result stocks in jobbers' hands are becoming somewhat low. The regular cell is priced at 31 cents and the igniter at 32 cents, both in barrel lots.

Heating Appliances.—Definite improvement in demand was felt last week by a number of jobbers. The most active items continue to be air heaters and flatirons, stocks of which are extremely low. Good demand and low supply also prevail for curling irons. A small amount of goods is being ordered for the Christmas trade.

Farm-Lighting Outfits.—The disposal of the fall crops by the farmers is resulting in a marked increase in sales, the volume being much better than at the same period last year. Special drives are being conducted in Missouri and Illinois.

Meters.—A fair demand continues. Utilities in the South are buying in better quantities than they have for some time. The residential lighting type is virtually the only one in demand. Stocks are good.

Transformers.—Utilities are still buying good quantities of the distribution type, principally to take care of the new residential lighting business. The construction of dwellings throughout the entire territory is progressing well, and indications are that transformers to serve them will be in good demand for several months. Stocks are in satisfactory shape.

SAN FRANCISCO

Export business is somewhat better as evidenced by the increase in the number of orders and inquiries. The consolidation of firms with parallel organizations and territories will also produce better conditions, and this has occurred in several lines already. During the period from Nov. 19 to Dec. 10 a large industrial exposition will be held in San Francisco showing the development and prospects of the industries of that city and the surrounding territory. This exposition is a part of the Rastall program of industrial exploitation. The Electrical Development League has arranged to take forty out of the 250 booths available.

The threatened railroad strike seems to be decidedly unpopular among the rank and file of Pacific Coast employees. However, the railroads are preparing to meet the emergency, although the strike is generally regarded as unlikely. Shippers, too, are preparing for the prospective shortage, should the strike develop, by wiring in emergency orders to be shipped by short rail haul to a seaport, whence they will come by boat to San Francisco.

Washers.—Decreases coupled with small initial payments have resulted in a good movement. It may be said, however, that generally poor results are attained by special price campaigns and that consistent selling and conscientious demonstration are attracting the public as much as price campaigns.

Heating Appliances.—Local stocks are good. The holiday orders placed by jobbers are comparatively light. In fact, this field is markedly quiet, with little evidence of last year's enthusiasm. It will be remembered that the last holidays promised very well up to December 1 and then dropped off. It was felt that the retail solicitation of the public was begun too soon, and this year the same mistake will not be made.

Fuses.—Jobbers' stocks are well maintained in fairly even quantities, although the stock maximums have been reduced about 25 per cent from the figures of last year. Dealers' orders are usually placed so as to secure the standard-package price for full cartons of designated sizes, and their buying of the larger sizes is distinctly of a hand-to-mouth character. The present prices on new code standard fuses up to 30-amp. size, 250-volt, average about 12 cents each in cartons and 11 cents each in packages.

SALT LAKE CITY—DENVER

Money realized from recent sales of grain and lambs, two staples of the Intermountain Region, has brought considerable relief, enabling country banks to liquidate to a moderate degree. The sugar industry has been granted a new lease of life with promise of permanent stabilization, by a grant of $10,000,000 in loans to producing companies. This comes as a timely relief as there have been rumors that beet growers could not expect immediate cash payment on delivery of the season's crop. Announcement of the loan is good news to all concerned about Western industry.

The unusual spell of open weather seems to have come to an end, and builders predict the slowing up of construction work, with a corresponding falling off in demand for lumber, hardware and electrical wiring materials. The employment situation is a long way from solution, but there are no disturbing labor troubles.

With the coming into circulation of money realized from crops, electrical merchants are intensifying their selling efforts. Many are reviving their advertising after a lapse of months, and some effective campaigns are already launched with particular emphasis on hollow ware, grills and toasters.

Schedule Materials.—Manufacturers have announced reductions that range from 30 to 50 per cent. Jobbers have passed on the advantage of the new rate to their dealers in the hope that lowered costs will stimulate building.

Conduit.—Jobbers' stocks are heavier than the general conditions and volume of business warrant. Price quotations are lower than they have been for years.

Wire.—There is only moderate activity in wire, the demand being at a rather low ebb. The recent small reduction has had no particular effect on the market.

Pole-Line Hardware.—There is no new construction under way and little repair work. Business in pole-line hardware is almost at a standstill.

SEATTLE—PORTLAND—SPOKANE

Announcement has just been made that lumber rates to Eastern markets have been reduced so that Northwest shippers can now compete in Eastern markets with Southern lumber interests. This, together with the big building program now on and the heavy export business, will mean a speedy recovery to normal of the lumber business of the Northwest, one of the primary industries of this region. Wheat exports continue in large volume, and a cargo of 80,000 boxes of apples is being loaded for shipment to Europe.

Jobbers report business continuing good, owing primarily to the large amount of building and the usual fall improvement. It is reported that large buyers are apparently covering themselves in some lines against the announced railroad strike. It is not anticipated, however, that the strike will have any very serious effect as most shipments are now coming by water through the canal. Some jobbers have already diverted shipments to water while others are making plans to have shipments come by water in case of a tie-up. This covering action has caused some stocks to become somewhat short, but shipments are on the way and due to arrive before Oct. 30, both to replenish these stocks and to handle satisfactorily a two months' ordinary business. The temporary shortage on No. 14 rubber-covered wire, due partly to heavy buying on account of the low price of wire before the last increase, has been overcome.

Reports from contractors indicate that not much large contracting business is in sight, and a depressed condition for this line of work will probably exist throughout the winter. Contracting in small work ranging from $500 and under seems to be good, though the prices at which it is taken are very close. Fixtures are very active.

Jobbers quote the following prices: No. 14 rubber-covered wire, $7 and No. 12, $9.20 per 1,000 ft. in 5,000 ft. lots. Black conduit is quoted at $7.50 for ½-in., $9.80 for ¾-in. and $14.10 for 1-in. in 10,000-ft. lots. Quotations for galvanized are $8 for ½-in., $10.45 for ¾-in. and $15.15 for 1-in.

Manufacturers' Activities

Devoted to the Business Side of Manufacturing, Distribution and Sales, News from Jobbers and Foreign Fields and a Record of New Devices and Trade Literature

Washing Machine Reversing Clutch Patent Upheld

A decision in the case of the Conlon Electric Washer Company, Inc., Cicero, Ill., against the Brokaw-Eden Company (now Gillespie-Eden Corporation) has been handed down in the United States District Court, at Springfield, Ill., sustaining the plaintiff and declaring its patent infringed. The Conlon company, manufacturer of Western Electric washing machines, had brought suit against the Brokaw-Eden Company on the ground that it had infringed a patent on a "combination of rotary driving and driven members and intermediate driving connections, including a positively acting motion-reversing clutch and a frictional connection, the latter serving to permit slippage and thus prevent shocks due to the reversal of the action of such clutch and the resulting reversal of the direction of rotation of said driven member." The application of the patent depended on the use of the frictional clutch, which had been designed to protect washing machines of the oscillating type.

The patent, known as the Neswold patent, was purchased by the Conlon company. The Brokaw-Eden Company pleaded prior art and cited prior patents on methods of permitting slippage in the drive of various other oscillating machinery.

It was held by the court, however, that "Neswold's conception eliminated the belt-driven machine for the operation of a rotating drum and gave to the art a combination of old elements, producing a new result, through a direct-connected unit."

This case has been followed with a good deal of interest by the washing machine industry as it involved a tested principle of oscillating machine practice. No announcement has been made by either party to the suit in regard to further procedure.

Quigley Fuel Department Taken Over by Hardinge Company

The Quigley Furnace Specialties Company, 26 Cortlandt Street, New York City, has announced the sale of its pulverized-fuel department to the Hardinge Company, 120 Broadway, New York. The transfer, it is stated, will in no way affect the refractory specialties business of the Quigley company, which manufactures high temperature cement and insulating refractory brick. According to the announcement, the Hardinge Company will make no change in the method of conducting the business at its offices, as the personnel of the Quigley company's engineering department has been taken over practically intact. According to officials of the Quigley company, the sale was made necessary by the rapid growth of the refractory specialty business, making it advisable for the organization to devote its entire attention to that branch of the work.

Automatic Electric Heater Increasing Distribution

Warren F. Clark, general manager of the Automatic Electric Heater Company, Warren, Pa., is making a trip to the Pacific Coast for the purpose of establishing a factory branch to handle Sepco electric water-heater business in Western territory. The business of the company is developing rapidly, authority having been given at a recent directors' meeting for the erection of another building adjoining the main factory to be used for material storage and increased shipping facilities.

Kellogg Company Completing New Jersey City Plant

The M. W. Kellogg Company, with headquarters at 90 West Street, New York, manufacturer of pipe, fittings and power equipment, has moved into a section of its new plant in the Droyer's Point section of Jersey City and will have the remainder of the plant completed and in operation by early spring, according to the announcement of L. H. Harbison, vice-president. The construction of a three-story building for offices is being planned to start in the very near future.

Another Plant for Witherbee Storage Battery

Plans have been matured by the Witherbee Storage Battery Company, manufacturer of storage batteries, 649 West Forty-third Street, New York, for the closing of its plant at North Bergen, N. J., and the concentration of its manufacturing in New York. In preparation for this move the company has purchased the property of the United Filters Corporation at 355-73 Cortlandt Street, New York. The property consists of a two-story factory and a number of one-story buildings on a site 200 ft. x 150 ft. A few changes will be made in the plant, and production will start as soon as equipment can be transferred from the old to the new location.

Plan Better Lighting Week for Fixture Convention

In preparation for the joint convention of the National Council of Lighting Fixture Manufacturers, the Lighting Fixture Dealers' Society of America and the illuminating Glassware Guild to be held in Milwaukee Jan. 30 to Feb. 4, a committee composed of representatives of all branches of the industry in that city is drawing up plans for a "better lighting week" to draw the favorable attention of the public to the industry. F. A. Coffin, chairman of the "better lighting week" committee, is new-business manager of the Milwaukee Electric Railway & Light Company. Others on the committee are F. A. Raatz, Cutler-Hammer Manufacturing Company; H. Trester, Electrical Association of Milwaukee; F. A. Vaughn, Engineering Society of Milwaukee; H. C. Hutton and Phil Polacheck, Milwaukee Contractor-Dealers' Association; M. Massino, Retail Dealers' Society, and J. A. Sable, Manufacturers' Council. According to present expectations, the national lighting fixture market will be attended by from 4,000 to 5,000 members of the three societies interested.

Association Formed to Study Industrial Friction Drive

A new professional association, the Friction Drive and Engineering Society, organized for the purpose of making a study of questions involved in design of successful friction drives, will hold its second meeting at the plant of the Rockwood Manufacturing Company, Indianapolis, on Nov. 3. The society was formed at an initial meeting at Newark, N. J., held Sept. 20. The following temporary officers were elected: C. A. S. Howlett, Divine Brothers, Utica, N. Y., president; W. D. Hamerstadt, Rockwood Manufacturing Company, vice-president, and C. W. Kelsey, secretary and treasurer.

The society will attempt to further the use of friction drives by studying methods of improving the materials and mountings and by compiling complete engineering data, and, in general, will endeavor to aid any manufacturer using the drive.

At the meeting to be held on Nov. 3 the permanent organization will be completed. There will be two papers presented, one covering the "History of Friction Drives and Friction Materials," by W. D. Hamerstadt, and the other on "A New Form of Friction Wheel," by C. A. S. Howlett.

New Appliance Association Formed

Announcement has been made of the organization of the Electrical Appliance Distributers' Association, the charter members of which are among the large household appliance dealers of New York City. The prime purposes of the association are to further the interest of the entire appliance industry, to maintain relations with manufacturers and jobbers, to educate salesmen and to see that in contact with the public high standards are maintained. It has also been suggested that the association establish a yearly appliance show.

A number of ways were suggested in which dealers could help manufacturers and jobbers, among which was assistance in getting out the proper sort of advertising to appeal to the public in certain territories. At the present time the constitution of the society is so worded that manufacturers and jobbers may not hold membership in the association, but a proposal has been made that the constitution be amended to permit them to hold associate membership.

Officers elected at the first meeting were: James McClymont, Laun-Dry-Ette Sales Company, president; Samuel Kimball, Kimball Electric Company, vice-president; J. N. Adam, Hoover Suction Sweeper Company, treasurer, and I. Bailey, Eureka Vacuum Cleaner Company, secretary.

Meetings of the association will be held on the first Wednesday of each month.

General Electric Jobbers May Merge

Efforts are being made, it is reported, to establish a basis upon which to merge three New York distributers and one Newark distributor of the General Electric Company. The merger, if completed, will include E. B. Latham & Company, Royal Eastern Supply Company, Sibley-Pitman Electric Corporation, all of New York, and the Tri-City Electric Company, Newark, N. J. The name of the company has not been decided upon, but from application made for registration it would indicate that the consolidation will ultimately bear a name symbolic of its sales market along the Atlantic Seaboard.

The merger would represent a very high capital investment. The lamp distribution controlled by the company averages approximately $4,000,000 a year. According to officials of the interested companies, the consolidation will not take place before the end of the year or may be postponed indefinitely, provided it is found impossible to reach a basis satisfactory to all concerned.

Foreign Trade Notes

ELECTRIC SYSTEM FOR POLISH PETROLEUM BASIN.—A group of petroleum companies at Boryslav, according to the *Journée Industrielle*, is planning to construct a large electric power station to supply electricity for boring of soundings and operating pumps. The Minister of Industry and Commerce has promised the co-operation of his department for the purpose of creating an electric system for the whole of the basin.

PROPOSED HYDRO-ELECTRIC DEVELOPMENT IN INDIA.—Tata Sons & Company, according to *Electrical Industries*, have obtained a license for the proposed Nilgiri (British India) hydro-electric project.

PROPOSED NEW ELECTRIC PROJECT IN JAPAN.—Applications have been made to the Department of Communication of Japan by nine electric companies, according to the *Japan Chronicle*, for permission to utilize the waters of the Tenryu River, which flows into the bay of Totomi through Nagono and Shizuoka Provinces. It has been decided that the applicants should amalgamate with a capitalization of 50,000,000 yen (about $25,000,000). Petitions so far received will develop 200,000 kw. in all.

PROPOSED ELECTRIC RAILWAY PROJECT IN INDIA.—A large supply of electrical energy will be required, according to *Electrical Industries*, in connection with the proposed electrification of the suburban lines of the G. I. P. To insure the supply of electricity it is proposed to interconnect the Andhra Valley, the Tata power and the hydro-electric companies. It will require nearly 17,000,000 units per annum to operate the railway from V. Terminus, to Kurla; when extended to Thana, 29,000,000 units, and when extended to Kalyan, 36,000,000 units.

EXTENSION OF USE OF ELECTRICITY IN COLLIERIES IN SOUTH WALES. A scheme to extend the use of electricity in its collieries, according to *Electrical Industries*, is now being carried out by the Powell Duffryn Coal Company, South Wales, the cost of which is estimated at more than £1,000,000. The power house at Bargoed when completed will have a generating capacity of about 30,000 kw. The transmission line, which will be about 15 miles long, will supply electricity for lamps and motors to all the collieries in the Rhymney, Aberdare and Deri Valleys and at [illegible]. The chief object of the plan is to effect economy in the working of the collieries and also to substitute electricity for steam power.

TO REGULATE THE USE OF ELECTRICITY IN MINES OF BELGIUM. — A permanent advisory committee of nine members to deal with the applications of electricity to mines and the regulations governing the use of electricity, etc., has been appointed by the Belgian Mines Department. Among the members of the committee are M. Lebacqz, director-general of mines, Brussels; Prof. O. De Bast, Liege, and M. Wattiez, electrical engineer, Charleroi.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

A mercantile firm in Sweden (No. 177) desires to purchase or secure an agency for the sale of X-ray and electric lamps.

MATERIAL FOR CITY OF AUCKLAND ELECTRICITY SCHEME.—The city engineer of Auckland, New Zealand, according to *Electrical Industries*, estimates the cost of material for the electricity scheme during the next two years as follows: Meters, £10,000; 60 miles of distributing lines, £30,000; substation and feeder extensions and switchgear, £26,000.

EQUIPMENT FOR ELECTRIC TRAMWAYS, NEWCASTLE, AUSTRALIA. — A preliminary installment of £120,000, according to *Electrical Industries*, is being put on the estimates for the next financial year by the city of Newcastle, New South Wales, Australia, to provide for contract for plant and material required in connection with the proposal to electrify the tramway system.

EXTENSIONS TO TRAMWAY SYSTEM IN AUCKLAND, NEW ZEALAND.—The City Council, according to *Electrical Industries*, has authorized extensions to the tramway system in the suburbs involving an expenditure of £82,000. Seven new cars will be required.

LONG-DISTANCE TELEPHONE SERVICE IN COLOMBIA.—The establishment of a long distance interurban telephone service to be operated in connection with the telegraph system, which is owned by the government, according to *Electrical Industries* is under consideration by the government of Colombia, South America. The proposed work is to be carried on under the supervision of the Director-General de Telegrafos, Bogota, from whom any further information which is desired may be obtained.

IMPROVEMENTS TO ELECTRIC AND TELEPHONE SERVICE IN BARRETOS AND OLYMPIA, BRAZIL.—The Empresa Orion de Barretos Electric Light Company, with headquarters in Sao Paulo, Brazil, is advertising a public loan of 2,000,000 milreis, the proceeds to be used for improvements to the electric power and telephone service in the municipal districts of Barretos and Olympia, State of Sao Paulo.

New Apparatus and Publications

SAFETY SWITCH—The United Metal Box Company, 514 West Forty-sixth Street, New York City, has recently placed on the market an externally operated safety switch.

BURGLAR ALARM CLOCK—The Midnight Alarm System, 6411 Mack Avenue, Detroit, has recently developed a control switch and lock for burglar alarm installations.

WIRELESS APPARATUS—A crystal detector radio receiving station "A B C", has recently been placed on the market by the Jewett Manufacturing Corporation, 32 Austin Street, Newark, N. J.

OUTLET BOX—A new type of outlet box, made in two sizes, one for concrete setting and the other for brackets, receptacles, switches and extension rings has been developed by the J. G. Knight Company, 1034 Dean Street, Brooklyn, N. Y.

LAMP SOCKET—A socket designed to maintain constant contact has been brought out by the Diamond Electric Specialties Corporation, 101 South Orange Avenue, Newark, N. J.

BENDER—A bender to use with its "Wiremold" conduit has recently been developed by the American Wiremold Company, Hartford, Conn.

CHRISTMAS TREE OUTFIT — The United States Electric Manufacturing Corporation, 476 Broadway, New York City, has recently placed on the market a Christmas tree lighting outfit.

IRONING MACHINE—The Quaker Manufacturing Company, 140 North Dearborn Street, Chicago, has placed on the market an electric ironing machine.

VACUUM CLEANER — The Wisconsin Electric Company, Inc., Racine, Wis., has placed on the market a vacuum cleaner ("Dumore") designed primarily for cleaning upholstery of closed cars.

SIGN LAMPS — A sign lamp which operates without a filament has been placed on the market by the Neon Lamp Works, Inc., 62-70 West Fourteenth Street, New York City.

ELECTRIC HEATER AND TOASTER — L. Plaut & Company, 432 East Twenty-third Street, New York City, have developed a "Double Ray" combined electric heater and toaster.

New Companies

THE PHILLIPSTOWN (N. Y.) ELECTRIC CORPORATION has been chartered to operate a local electric light and power plant. H. C. Denham and W. M Benjamin, Phillipstown, are interested.

THE DALITE LAMP COMPANY OF NEW JERSEY, Jersey City, N. J., has been organized by A. Carrell and Warren Dixon, 665 Newark Avenue, to manufacture electric lamps. The company is capitalized at $50,000.

THE MOOREHEAD ELECTRIC MACHINERY COMPANY, Pittsburgh, Pa., has been incorporated to manufacture electrical machinery and parts. I. R. Moorehead 3417 Kedzie Avenue, is treasurer.

THE OHIO GENERATING COMPANY, Red Lion, Pa., has been organized to manufacture farm lighting plants and systems. The directors of the company are C. S. LaMotte, president; and Charles C. Meads secretary, both of Red Lion.

THE RAY BATTERY COMPANY, Detroit, Mich., has been chartered under the laws of the State of Delaware by Joseph S. McDowell and M. J. Holliday, Detroit. The company is capitalized at $1,000,000 and proposes to manufacture electric batteries and other electrical products. The Corporation Trust Company of Delaware, Equitable Building, Wilmington, Del., represents the company.

Record of Electrical Patents

Notes on United States Patents

(Issued Sept. 20, 1921)

1,390,907. AUTOMATIC CALL SYSTEM FOR HOTELS; Albert H. Heyroth, Duluth, Minn. App. filed Jan. 19, 1921. Master clock in combination with an annunciator cabinet.

1,390,921. LOOM PLATE AND HANGER; Adolph Olevin, Detroit, Mich. App. filed Jan. 28, 1921. Suspended from a cleat hanger or overhead track.

(Issued Sept. 27, 1921)

1,391,791. SUSPENSION APPARATUS; Norman F. Rutherford, East Falmouth, Mass. App. filed May 16, 1919. For suspending a power transmission line.

1,391,808. SYSTEM OF MOTOR CONTROL; Hermon L. Van Valkenburg, Milwaukee, Wis. App. filed April 14, 1920. Compensator starting switch.

1,391,831. ELECTRIC LANTERN; Louis A. Hornburg, Omaha, Neb. App. filed March 25, 1921. For use as railway signal and switch light.

1,391,855. WIRELESS TRANSMITTING SYSTEM; Henry K. Sandell, Chicago, Ill. App. filed Nov. 28, 1919. By undamped or continuous waves.

1,391,868. LOCKING DEVICE FOR INCANDESCENT LAMPS; Leon M. Topoosian, Springfield, Mass. App. filed Aug. 9, 1919. For preventing removal of lamp from socket.

1,391,903. TROLLEY-WHEEL FOR ELECTRIC STREET CARS; Julio S. Navarro, Havana, Cuba. App. filed April 9, 1921. Made in three or more separate disks.

1,319,904. CLUSTER LAMP SOCKET; Thomas O'Donnell, Ironwood, Mich. App. filed Nov. 12, 1919. Readily separated and asembled.

1,391,911. GROUND DETECTOR; Ernest J. Simon, Guantanamo, Cuba. App. filed July 8, 1918. Not easily thrown out of adjustment.

1,391,944. RELAY; Frank L. Dodgson, Rochester, N. Y. App. filed March 31, 1917. Arrangement of parts which insulate binding posts from supporting panel.

1,391,960. ELECTRIC HEATER; Richard G. Ledig, Philadelphia, Pa. App. filed Oct. 25, 1920. Reflector type.

1,391,996. CONTROL FOR ELECTRIC FURNACES AND THE LIKE; Edgar F. Collins, Schenectady, N. Y. App. filed Nov. 14, 1918. Predetermined temperature automatically reached and maintained.

1,392,022. DYNAMO-ELECTRIC MACHINE; Charles A. Parsons and Jessel Rosen, Newcastle-upon-Tyne, England. App. filed Feb. 10, 1919. Heating lessened.

1,392,032. ELECTROMAGNETIC BRAKING DEVICE; Clifford A. M. Weber, Edgewood Park, Pa. App. filed Nov. 3, 1916. Quick, positive and readily adjusted.

1,392,03[illegible]. OUTLET BOX; William H. Wood, Darien, Conn. App. filed Jan. 17, 1920. Applied to walls of buildings already plastered.

1,392,039. DYNAMO-ELECTRIC MACHINE; John L. McK. Yardley, Pittsburgh, Pa. App. filed April 11, 1913. Synchronous-booster rotary converters and means for improving the commutating conditions.

1,392,052. FLASHOVER-SUPPRESSING MEANS FOR ROTARY-CONVERTER SYSTEMS; Frederic C. Hanker, Wilkinsburg, Pa. App. filed June 17, 1918. Simple, effective and inexpensive.

1,392,056. CONTROL SYSTEM; Henry D. James, Edgewood Park, Pa. App. filed May 27, 1918. Motor-accelerating system.

1,392,057. CONTROL SYSTEM; Henry D. James, Edgewood Park, Pa. App. filed Aug. 10, 1918. Reversing system for electric motor.

1,392,058. MOTOR-CONTROL SYSTEM; Henry D. James, Edgewood Park, Pa. App. filed Jan. 8, 1919. Motor-accelerating system.

1,392,059. CONTROL SYSTEM; Henry D James, Edgewood Park, Pa. App. filed Jan. 8, 1919. Motor-accerlating system

1,392,060. CONTROL SYSTEM; Henry D. James, Edgewood Park, Pa. App. filed May 12, 1919. Motor-accelerating systems.

1,392,073. END BELL; Emil Mattman, Wilkinsburg, Pa. App. filed April 4, 1916. Turbo-generator.

1,392,076. SYSTEM OF EXCITATION FOR SYNCHRONOUS-BOOSTER ROTARY CONVERTERS; Frank D. Newbury, Pittsburgh, Pa. App. filed Dec. 13, 1917. Proper commutating field supplied throughout wide changes in load.

1,392,084. FIELD-CONTROL SYSTEM FOR SYNCHRONOUS-BOOSTER ROTARY CONVERTERS; Marvin W. Smith, Wilkinsburg, Pa. App. filed Jan. 16, 1919. For controlling interpole-field strength.

1,392,086. MEANS FOR REDUCING COMMUTATOR FLASHING; Norman W. Storer, Pittsburgh, Pa. App. filed Nov. 23, 1917. Simple, inexpensive and highly effective.

1,392,087. MEANS FOR SUPPRESSING FLASHOVERS IN ROTARY-CONVERTER SYSTEMS; Norman W. Storer, Pittsburgh, Pa. App. filed July 25, 1918. For suppressing flashovers in rotary-converter systems.

1,392,088. MEANS FOR REDUCING COMMUTATOR FLASHING IN ROTARY CONVERTERS; Norman W. Storer, Pittsburgh, Pa. App. filed March 13, 1921. To dissipate the energy of the machine in an external circuit.

1,392,091. ELECTRIC FITTING; George B. Thomas, Bridgeport, Conn. App. filed Dec. 4, 1918. Combined electric lamp socket and attachment-plug receptacle.

1,392,135. TYPEWRITING MACHINE; Oskar Fischer, Berlin-Wilmersdorf, Germany. App. filed March 19, 1914. Electrically operated.

1,392,137: CIRCUIT INTERRUPTER; Charles LeG. Fortescue, Pittsburgh, Pa. App. filed Oct. 6, 1916. To reduce the voltage on field-magnet winding when a ground or short circuit occurs.

1,392,152. MULTIPLE-STATION TRANSMISSION CIRCUITS; William H. Harden, New York, N. Y. App. filed Dec. 13, 1918. Service to a number of stations bridged across the line at various points.

1,392,163. ELECTRIC POCKET LAMP; Oscar Hoffmann, Stuttgart, Germany. App. filed Jan. 11, 1921. Battery replaced in easiest possible manner.

1,392,176. DUPLEX LAMP SOCKET; William J. Koenig, Brooklyn, N. Y. App. filed Jan. 20, 1920. Resilient contact carrier.

1,392,179. OPERATOR'S TRUNK CIRCUIT; George W. Kuhn, Brooklyn, N. Y. App. filed Sept. 5, 1918. Trunk circuits leading to special positions.

1,392,182. MEANS FOR PREVENTING COMMUTATOR FLASHING; Benjamin G. Lamme, Pittsburgh, Pa. App. filed June 17, 1918. For minimizing or preventing flashing.

1,392,193. SHORT-CIRCUITING AND BRUSH-LIFTING DEVICE FOR DYNAMO-ELECTRIC MACHINES; Chester B. Mills, East McKeesport, Pa. App. filed April 9, 1918. For use with rings of induction motors of wound-rotor type.

1,392,198. PROTECTIVE APPARATUS FOR DYNAMO-ELECTRIC MACHINES; Charles McL. Moss, Pittsburgh, Pa. App. filed June 29, 1918. Means for reducing commutator flashing.

1,392,199. ELECTRIC MEASURING INSTRUMENT; Alfredo Muratori, Rome, Italy App. filed Dec. 9, 1916. For use on systems where consumer is charged under a differential tariff.

1,392,232. SECONDARY OR STORAGE BATTERY; Edward W. Smith, Philadelphia, Pa. App. filed Sept. 4, 1915. Wood separator.

1,392,2[illegible]. PIVOTAL MOUNTING; Allen A. Tirrill, Pittsburgh, Pa. App. filed Aug. 11, 1917. For vibratory members such as armatures of electrical relays.

1,392,250. CONTROL SYSTEM; Ray E. De Camp, Wilkinsburg, Pa. App. filed Aug. 26, 1918. Motor starting.

1,392,252. SYSTEM OF ELECTRICAL DISTRIBUTION; [illegible], New York, N. Y. App. filed July 21, 1920. To storage-battery-charging systems.

1,392,255. MOTOR-CONTROL SYSTEM; Edwin S. Lammers, Jr., Wilkinsburg, Pa. App. filed June 13, 1917. Operation of series of electromagnetic switches in predetermined sequence.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

LOWELL, MASS.—The Boott Manufacturing Company, it is reported, has applied to the Department of Public Works for authority to build a hydro-electric power plant on the Merrimack River.

PAWTUCKET, R. I.—The Board of Education contemplates the construction of a new manual training and industrial arts school on Fountain Street, to cost more than $1,000,000. Electrical equipment machine tools and other apparatus will be required.

MIDDLETOWN, CONN.—The Portland Silk Company is considering the construction of a one-story power house at its plant.

Middle Atlantic States

JORDAN, N. Y.—The Jordan Electric Light & Power Company has applied to the Public Service Commission for approval of charters to operate in parts of the towns of Elbridge and Van Buren not at present supplied with electricity.

POUGHKEEPSIE, N. Y.—The Central Hudson Gas & Electric Company is asking for bids on an 8½ mile, 66,000 volt., single-circuit, two-conductor transmission line.

UTICA, N. Y.—Bids will be asked soon by the State Hospital Commission, Capitol Building, Albany, for the construction of a two-story cold storage plant, 70 ft. x 110 ft., at the Marcy Division State Hospital, Utica, to cost about $130,000. L. F. Pilcher, Capitol Building, is state architect.

ASBURY PARK, N. J.—Plans are under way by the Richelieu Corporat[illegible] tison Avenue, for the constr[illegible] plant on Asbury Avenue, for t[illegible] ture of automobiles and parts [illegible] unit will include a one-story a[illegible] building, 80 ft. x 200 ft., with [illegible] to cost about $200,000 with machinery. Samuel A. Reeves is president.

LONG BRANCH, N. J.—The Board of Commissioners have authorized the installation of a new lighting system on parts of North Lincoln, Second, Third and Atlantic Avenues, Elberon Square and part of Ocean Park grounds.

TRENTON, N. J.—The Trenton & Mercer County Traction Corporation contemplates the installation of an underground conduit system on Lincoln Avenue, to cost about $25,000. Rankin Johnson is president.

BEAVER FALLS, PA.—Plans are under consideration for the installation of an ornamental lighting system on Seventh Avenue from Fourth to Seventeenth Street. Electrical service is supplied by the Beaver County Light Company, New Brighton.

FOXBURG, PA.—Surveys are under way by the Clarion River Power Company, Foxburg, for the construction of a hydro-electric generating plant on the Clarion River near Foxburg, to cost over $2,000,000. The work is being financed by H. D. Walbridge & Company, 14 Wall Street New York City, who will supervise the preparation of plans

JOHNSTOWN, PA.—Arrangements have been made by the Penn Public Service Corporation for an issue of $[illegible] in bonds, the proceeds to be used for extensions and improvements to its electric power plants and system.

OXFORD, PA.—The [illegible] Oxford Electric Company and the New London Electric Company have been acquired by [illegible] H. Ware, Jr., and associates, to operate electric light and power plants in that section.

PHILADELPHIA, PA.—[illegible] & Company, [illegible], manufacturers of iron and steel products, will [illegible] on the construction of a new plant at D Street and Erie Avenue, including main iron-working plant, power house, foundry, etc. The [illegible].

PHILADELPHIA, PA.—Plans have been prepared [illegible] Ice Company.

[illegible] Bonde Street for the construction of a [illegible] power house.

PITTSBURGH, PA.—Plans have been prepared by the Duquesne Light Company, Pittsburgh, for the construction of a [illegible] power house in Mount Lebanon Township to furnish electricity in that district.

READING, PA.—Arrangements have been made by the Metropolitan Edison Company for an issue of $216,500 in bonds and [illegible] in stock, the proceeds to be used for extensions, etc.

SCRANTON, PA.—The Lackawanna Railroad Company, 90 West Street, New York, N. Y., is having estimates of cost prepared in connection with the electrification of its Scranton division. The present plans provide for power plants, electric locomotives and other equipment. Upon completion of the project, electrication of other divisions of the road will be followed, particularly in New Jersey.

SCRANTON, PA.—Bids will be asked soon for the construction of a one-story power house at Mount St. Mary's Convent, 2300 Adams Avenue. John J. Hawley, Traders' Bank Building, is architect.

BUCKAHANNON, W. VA.—The Buckahannon Light & Water Company has filed notice of an increase in capital stock from $25,000 to $50,000.

GRAFTON, W. VA.—The Kentucky & West Virginia Power Company, 30 Church Street, New York City, has acquired the power plant of the Grafton (W. Va.) Power & Electric Company, and contemplates extensions and improvements to the system, including the installation of new equipment. The plant will be operated in conjunction with the generating system at Logan, W. Va., as well as Caddell near Kingwood, W. Va. The cost of the proposed improvements is estimated at $1,500,000. N. M. Argabrite is vice-president and general manager.

MAN, W. VA.—The Man Power & Lighting Company, recently incorporated with a capital stock of $10,000, has applied for a franchise to furnish electricity in the city and vicinity for light and power purposes.

Central States

[illegible], MICH.—The construction [illegible] electric light plant in Dimon[illegible] about $13,000 is under con[illegible] the village authorities.

MARLETTE, MICH.—Plans are being prepared by R. L. Blackman for the construction of a new municipal power plant in Marlette. Bids for construction, it is understood, will be asked early in 1922.

WEBBERVILLE, MICH.—Work will be started soon by the Detroit (Mich.) Edison Company on the construction of a substation in Webberville to supply electricity in the towns in this vicinity.

CLEVELAND, OHIO.—The City Council has authorized an expenditure of a sum not to exceed $130,000 for extensions to the municipal electric light and power system.

CLEVELAND, OHIO.—The Council has authorized the extension of the lighting system on West Boulevard from Lorain Avenue south to Linnet Avenue, to cost about $[illegible].

CLEVELAND, OHIO.—Resolutions have been adopted by the City Council providing for the installation of an ornamental lighting system in Central Avenue from East Fourteenth to East Fifty-fifth Streets, to install necessary electric lamps on East [illegible] Street, on West 113th and West 114th Streets, north of Detroit Avenue, and on Ludlow Avenue; and to replace gas lamps with electric lamps on a number of streets.

TOLEDO, OHIO.—The Toledo Railways & Light Comhany has been reorganized under the name of the Toledo Edison Company. Notice has been filed of an increase in capital stock from $[illegible] to $[illegible], the proceeds to be used to purchase the plant of the Acme Power Company, and for other extensions and improvements to plants and system.

GEORGETOWN, KY.—At an election to be held in November the proposal to issue $100,000 in bonds for the establishment of electric light and water systems will be submitted to the voters.

SERGENT, KY.—The Commercial Mining Company, Connellsville, Pa., is contemplating the installation of new electrical equipment and other machinery at its coal properties at Sergent, Ky.

VINCENNES, IND.—Plans are under consideration for rebuilding the power house and other buildings at the flour mills of the Atlas Mills Company, recently destroyed by fire. The loss including machinery, is estimated at about $200,000.

BROWNSTOWN, ILL.—The proposal to issue $8,000 in bonds for the erection of a transmission line from Vandalia to Brownstown is under consideration.

PEORIA, ILL.—Arrangements have been made by the Central Illinois Light Company for an issue of $[illegible]953,000 in bonds, the proceeds to be used for extensions and improvements to its plant and system, etc.

SPRINGFIELD, ILL.—Seven subsidiary companies of the Illinois Traction System have filed applications with the Illinois Public Utilities Commission for the right to issue additional stock and bonds as follows: The Bloomington & Normal Railway & Light Company, $69,000 in bonds and $73,000 in stock; Danville Street Railway & Light Company, $84,000 in bonds; Urbana & Champaign Railway, Gas & Electric Company, $[illegible] in bonds; Madison County Light & Power Company of Edwardsville, $69,000 in bonds; Galesburg Railway, Lighting & Power Company, $700,000 in bonds.

ADRIAN, MINN.—Plans have been prepared for the construction of a municipal electric light and power plant, to cost about $40,000. M. J. Farrager is clerk.

MINNEAPOLIS, MINN.—The installation of a new system of lighting in the city parks and parkways, providing for the elimination of arc lamps, is under consideration by the park officials. The plan as tentatively proposed is that the Park Board should provide the lighting fixtures and purchase electricity from the Minneapolis General Electric Company. A. C. Godward is park engineer.

OSHKOSH, WIS.—The Council has passed an ordinance providing for establishing an ornamental lighting system in Oshkosh.

MILWAUKEE, WIS.—Bids will be received by the Sewerage Commission of the City of Milwaukee, City Hall, until Nov. 11, for furnishing coal and ash handling machinery including track hopper equipment, crusher, elevator, skip hoist, motors and controllers, storage bins, spouts, automatic scales, ash cars and track, and appurtenances complete, for building on Jones Island, Milwaukee. Specifications and blank forms of proposal can be obtained and detailed plans examined at the office of the Sewerage Commission, City Hall.

KANSAS CITY, MO.—The City Ice Company, Twenty-first and Campbell Streets, is considering the construction of a new ice-manufacturing plant, [illegible], at Twentieth and Washington Streets, to cost about $75,000.

PLATTE CITY, MO.—Authority has been granted to the Platte City Light & Power Company to purchase electric plants from Henry Gordon and A. C. Morton at Smithville, and from George C. Paris at Weston. The company is planning the erection of an electric transmission line from the plant of the Kansas City Power & Light Company at Fairview to Smithville, Nashua and Platte City including Linkville.

ST. LOUIS, MO.—The St. Louis Lead & Oil Works, International Life Building, contemplates the immediate construction of a power house at its plant at Manchester and Sublette Streets.

Southern States

CHARLOTTE, N. C.—The Southern Power Company is asking for bids on a 66,000-volt transmission line to be erected near Charlotte.

PITTSBORO, N. C.—Negotiations are under way between the Town Commissioners and the Moncure Manufacturing Company whereby the latter would furnish electricity for lighting the town from its plant at Lockville on Deep River now under construction.

ALBANY, GA.—The Georgia-Alabama Power Company has been granted a franchise by the City Council for the erection of a transmission line from its hydro-electric plant in Albany to Cordele.

LOUISVILLE, GA.—The municipal electric light plant was recently damaged by fire.

MOUNT AIRY, GA.—W. G. Martin, Leesburg, and associates, are considering the construction of a hydro-electric generating plant on the Broad River near Mount Airy.

LAKELAND, FLA.—The City Council is contemplating the extension of transmission line to [illegible]

MEMPHIS, TENN.—[illegible] by the Stryker Kot-N-Wood Products Company for the construction of the first unit of a [illegible] adjoining for the manufacture of wallboard products. [illegible]

GANTT, ALA.—The [illegible] Power Company is contemplating the erection of a 2,500-hp. hydro-electric generating plant on the Conecuh River at Gantt. Construction [illegible] company's own forces. The Southern Engineering Corporation is engineer.

LAMBERT, MISS.—[illegible] and street bonds to the amount of $30,000 have been voted.

BATESVILLE, ARK.—The City Council is considering improvements to the municipal water and light plant, including the installation of two boilers and other machinery, to cost about $10,000.

LITTLE ROCK, ARK.—Preparations are under way preliminary to survey for the development of a [illegible] project on the Buffalo River, to cost about $6,250,000. Col. Henry A. Allen, 154 West Randolph Street, Chicago, Ill., is engineer.

MARLOW, OKLA.—Plans are being prepared by V. V. Long & Company, engineers, Concord Building, Oklahoma City, for an addition to the municipal power plant, to cost about $[illegible].

CAMERON, TEX.—Bids will be opened in about 90 days, it is reported, for the construction of a [illegible] municipal plant, to cost about $40,000. James D. Fowler, 606 Sumpter Building, Dallas is engineer.

FORT WORTH, TEX.—Extensions to the lighting system to cost about $50,000, are contemplated. R. A. Hunter is City Commissioner.

PALESTINE, TEX.—The Anderson County Coal Company, Box 68, recently incorporated with a capital of $100,000, is asking for prices, it is understood, on an electrical power plant, hoisting machinery, electric cutters for 1-ton to 1,000-ton daily capacity lignite mine, etc. J. J. Barry is manager.

Pacific and Mountain States

ARLINGTON, WASH.—The Washington Coal Utilities Company is considering extending its transmission lines to Birmingham.

EPHRATA, WASH.—The Soap Lake (Wash.) Utilities Company has applied to the Town Council for a franchise to erect a transmission line from Soap Lake to Ephrata.

OLYMPIA, WASH.—The Gray's Harbor Railway & Light Company, Aberdeen, Wash., has applied to the State Highway Committee, Olympia, for authority to erect a transmission line along the [illegible] Highway. James Allen is secretary of the company.

SEATTLE, WASH.—The Puget Sound Power & Light Company is considering an issue of $[illegible], the proceeds to be used for extensions and improvements to its power plants and system.

CANBY, ORE.—[illegible] has been granted a franchise by the City Council to furnish electricity for light and power in Canby and [illegible] district by means of a transmission line to be erected. Electrical energy, it is understood, will be purchased from the Portland Railway, Light & Power Company at Oregon City.

MERCED, CAL.—Bids, it is reported, will be received until Nov. 7 for the installation of [illegible] system in Merced, to cost about $[illegible]. Plans are filed in the office of W. W. Cornell, city clerk.

RICHFIELD, IDAHO.—Application has been made by the Idaho Power Company, Boise, to the [illegible] Commission for permission to erect an 11,000-volt transmission line from Richfield to Shoshone, a distance of about 18 miles. The line will be constructed [illegible]

GREAT FALLS, MONT.—The City Council has adopted plans for the installation of a lighting system on First Avenue north from Park Drive West under the Great Northern viaduct to west end of the subway.

GUERNSEY, WYO.—Water users of North Platte Valley have approved the construction of a reservoir dam and power plant near Guernsey, to cost more than $[illegible]

Electrical World

New York, Saturday, November 5, 1921

The World's Greatest Exponent of Co-operation

MARSHAL FOCH, hero to the world, has come to America, the welcome and much-loved guest of all our people. While he is here and we are reading daily of his travels and his entertainment, it will be well to think a bit of what this great man stands for. And a word will say it.

Foch is the greatest example in history of what a man can do by co-operation. Four great nations and many smaller ones fought against the German Empire and could not prevail so long as the great armies of France and England, Italy and America made their own plans and carried on the war in their own way. But when the mind of Foch was given power over all, his brilliant military genius organized the many millions into one great weapon and he battled with it and he won. Absolute order and singleness of purpose did it. Foch conquered when he compelled the forces of the world to work in complete co-operation. And it is interesting to know that our own General Pershing was the first to suggest Ferdinand Foch for the supreme command, soon after he arrived in France.

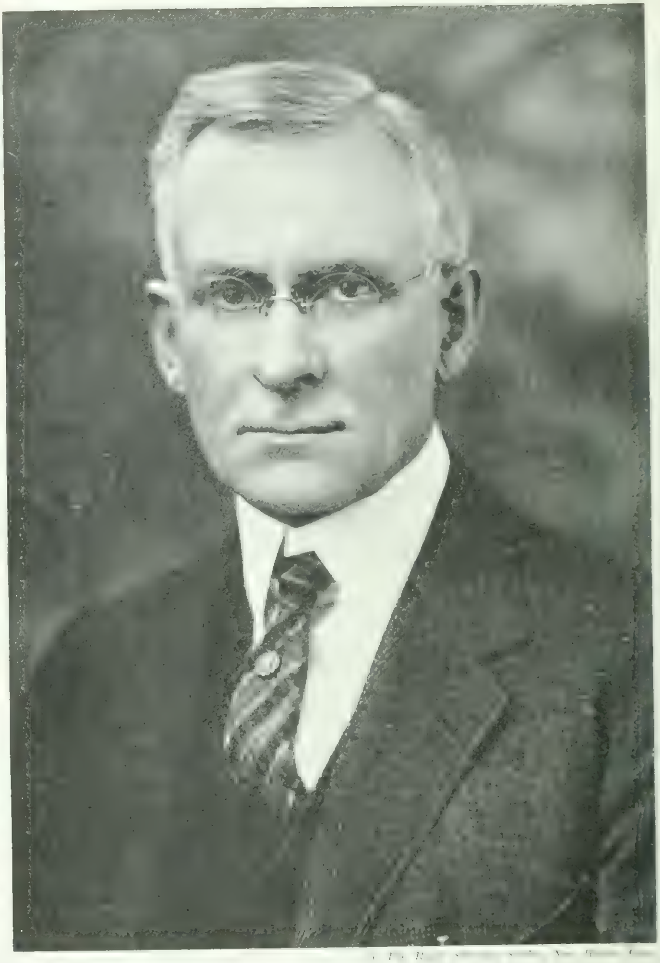
It is a lesson that should dominate us all our days, in all our doings, we who did hang upon the hours and watch while Foch was fighting for our lives. For this idea of supreme command is not a matter just for armies. It is a great principle of living that governs every undertaking where men work together for a common end. It is the underlying law of practical co-operation in which all must obey a single purpose, be it represented in a human leader or in an ideal, if they would measure any great achievement.

We of the electrical industry can well afford, while Foch is here, to think about these things. We, too, have an immense objective—to electrify all industries and to teach all people to provide complete electric service in their homes. But different classes of electrical men continue to make class plans and follow out class purposes. There is no man-figure of a Foch to lead us, and we let our eyes too often wander from that guiding principle which Foch embodies to supreme degree. And so, for all our power and all our progress, the campaign lags and we suffer for the want of a united front and broad co-ordinated purpose.

Too many kinds of electrical men with too many policies and too many associations trying to do the same thing in too many ways are not complete co-operation. We electrical men must think a bit more of the way of Marshal Foch and tie our work together closer so that it may flow on further and faster in one great impelling wave.

Charles Felton Scott

Electrical engineer, inventor and teacher, who, through his versatility and his exceptional ability always to find at least one other method of approach to any problem, has contributed very substantially to the advancement of the science of electrical engineering and to the upbuilding of the engineering profession.



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SOME men are masters of a specialty; others show mediocrity in many things, but to be able to contribute intelligently to a variety of subjects in electrical engineering and allied sciences so that one's opinion is always respected is an exceptional accomplishment. This is, however, the record of Charles Felton Scott, now professor of electrical engineering at Yale University. There is scarcely any field, no matter how small, which forms a part of the general science or the profession of electrical engineering in which Professor Scott has not made some worth-while contribution. From an engineering standpoint, probably his most important contribution has come from his several years of work in inductive interference, although his international reputation began with his invention of the "Scott connection" of transformers.

Born in 1864 at Athens, Ohio, son of the president of Ohio University, he attended that university and later Ohio State University, of which his father had meanwhile become president. He was graduated in 1885 from the latter institution and subsequently took a postgraduate course at Johns Hopkins University. It was while at the Ohio State University, before alternating currents had been more than mentioned commercially, that Professor Scott, in his father's attic tower room, played for hours with a Lissajou pendulum and studied the resulting designs or figures which were traced by the pen. Professor Scott attributes much of his fundamental knowledge of alternating currents to his analysis of these figures, using their physics to interpret alternating-current phenomena.

In 1888 he was employed by the Westinghouse Electric & Manufacturing Company in the testing department, later being transferred to the laboratory, where he assisted Nikola Tesla in his world-renowned work on alternating currents. He was later promoted to be assistant electrical engineer, in 1897 chief electrician and in 1904 consulting engineer. He founded the Westinghouse Club and the *Electric Journal* while with the company. He is one of that group of Westinghouse engineers who have done so much to develop the alternating-current system of electric power generation and distribution and its application to the requirements of present-day industries. In 1911 he accepted the professorship of electrical engineering at Yale.

Professor Scott was connected with the development work on the early Niagara Falls power stations; he had a great deal to do with the electrification of the New York, New Haven & Hartford Railroad; he made inductive-interference studies when the trouble first arose in Indiana years ago and he has been a consultant on many similar problems since that time. His latest work, as a representative of the Western Electric Company, was in the matter of the location of [illegible] in Italy. Beginning with his first activities in the Westinghouse company he has produced numerous valuable inventions.

Professor Scott was elected president of the American Institute of Electrical Engineers in [illegible], being the youngest president that association has ever had. It was during his administration that branches of the Institute were formed at the universities, a plan that is now followed by all of the leading engineering societies. He was one of the small group who had the vision which culminated in the erection of the Engineering Societies Building and the Engineers' Club in New York, being one of those who carried on the negotiations with Andrew Carnegie, and was chairman of the building committee. He was instrumental in forming the Federated American Engineering Societies and is a member of its governing body, the American Engineering Council. He is president of the Society for the Promotion of Engineering Education, a member of the technical advisory committee of the N. E. L. A. and is active in the I. E. S., the A. S. M. E. and in various sectional engineering associations.

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A Thought for Those Still Unemployed

EACH week that passes sees winter nearer, and it must not be forgotten that the situation of those still unemployed becomes more critical. The President's conference has pointed the way toward relief. What are we doing as individuals and as an industry to help provide the work? New interests and other problems are apt to blind us to the fact that this obligation still confronts the country. But if the manufacturer, the merchant and the householder do not make it their business to put more men to work, the number of the idle will not diminish and there is the probability that the suffering will increase.

There is no other way. Each man must ask himself what repair work, what construction can be done right now by him; what added benches and machines can be manned in his own plant, if added selling effort is applied to move the product; how many men and women can be set to selling on commission to provide at least a livelihood. There is sustenance for many families to be found in the house-to-house selling of many electric household devices. Who knows how much help could be given in this way?

Loss of Outstanding Canadian Pioneer

CANADA lost one of her pioneers and industrial captains when Frederic Nicholls died. His career was one of the romances of the electrical industry of the Dominion. Starting first as a promoter and operator of electric light and power companies in the Province of Ontario, his genius and enterprise led him into wider fields of electrical endeavor and made him at the time of his death the outstanding figure of the industry in Canada. Besides being for many years the president and general manager of the Canadian General Electric Company, which he helped to found, Senator Nicholls was either president or director or manager of thirty of the largest concerns in Canada, including among them the Canadian Allis-Chalmers, Ltd., the Marconi Wireless Telegraphy Company of Canada, Ltd., the Canadian Sunbeam Lamp Company and the Mackenzie-Mann group of public utilities. His faith in electricity and his vision of the growth and expansion of Canada were marvelous. While others hesitated he never faltered, so that, despite temperamental peculiarities which at times baffled even his best friends, Mr. Nicholls added achievement to achievement. In both public and private life he retained to the last his tremendous capacity for work and his distinguished genius for organization and financing. He was the only Canadian ever to receive the honor of being president of the National Electric Light Association, and operators and manufacturers on this side of the border lament with their Canadian confrères that death has removed him from the scenes where he accomplished so much.

Protection and Prosperity or Cheap Goods and No Money—Which?

WE—the people—must think about the tariff. Because the subject is difficult to understand, the average American has long refused to bother his head over it. It has been left almost entirely to Congress. But times have changed. The depreciation of foreign currencies and the distortion of former foreign trade relationships have brought new conditions that are rapidly becoming a grave menace to the industries of this country. And it is time that every man knew his mind on the subject of the protective tariff and the American valuation plan.

The purpose of the tariff is clear-cut—to protect existing American industries and the American workingman from unmeetable foreign competition. The passing of the Underwood tariff bill late in 1913 would have gradually flooded this country with imported goods on sale at prices less than they could be made for here. But the war interposed. Now that European peoples are getting back upon their feet they are beginning to invade our markets with competing goods made of materials and by labor so cheap in comparison with ours that we cannot possibly sell against them in our own land. Already some of our industries have been partially paralyzed. Others are in danger.

To cite a few: The glove manufacturers in New York State have gradually laid off 60 per cent of their labor because they cannot meet the competition of French gloves. Our lace industry, which is scattered through the Eastern cities, is now making only grades of lace not made abroad and is working about half time because Irish and Belgian lace have completely absorbed the market here. The toy manufacturers in Connecticut, Philadelphia and Chicago reported in August only half as many hands at work as the year before because German toys have undersold them. Several glass works in New Jersey have recently closed down because foreign glass is now much cheaper than their own. Electrical manufacturers of many classes are beginning to feel the knife-cut of German and Japanese goods which are now beginning to come in, made for this market and sold here at prices below our factory costs.

What are we going to do about it? There is only one thing *to* do. We must protect our own industries with a tariff that will allow competing foreign goods to come in freely, but at a price balanced to our own. For it does us no good to have cheap imported goods to buy if our factories are closed down, our labor has no work, our business is flat with depression, and nobody has free money to buy these cheap things with. Far better pay according to our own standards, with factories busy, and the country prosperous, so that we all have money to spend. There is the simple sense of it.

American industries paying the American wage cannot prosper if they must meet foreign competition without a protective tariff. We—the people—must make up our minds which we prefer—protection and prosperity or cheap foreign goods and no money to buy them with. We must decide for ourselves and make our wishes known. The facts are clearly and convincingly presented in this issue by a recognized authority on tariff subjects.

Electrical Development and Politics Impossible Team Mates

AN ORGANIZATION or business subject to abrupt changes in policy is from the very nature of things doomed to failure. There is perhaps no single thing that stands out more prominently in American business life today than the fact that those great business institutions which have made outstanding successes have been those institutions that have well-defined policies of long standing. Of all the industries in which America is today engaged the one which is most delicately susceptible to policy control is the electrical industry, particularly in its public service branch. Picture, then, a business of this sort subject to the whims and caprices of each incoming and outgoing political administration, and a conception will be obtained of what is proposed in the so-called five-hundred-million-dollar water-power enactment to be placed upon the initiative ballot of November, 1922, in California. This proposed enactment, in the nature of a constitutional amendment, is designed to put the state's resources to the extent of $500,000,000 back of a bond issue for the development of California's water-power resources. It proposes that a board of five men appointed by the Governor every four years shall have full control of this expenditure. Should the principal or interest be insufficient from the sale of power, the board has the right to draw upon the state's treasury to meet such emergencies, and even to add to the tax burden of the state in sufficient degree to meet the situation should funds in the treasury be insufficient. Such a board would supersede in autocratic authority the Governor and the Legislature

There are many other sections in this proposed enactment that are of more than doubtful economic advantage. Allusion will be made to only one. If there is one thing that has proved true in the electrical industry above all else, it is that duplication of physical installation is unscientific and ruinous. The proposed enactment would, with no regard whatsoever to this great economic law, allow the board to go through the state and set up municipally owned or district-owned hydro-electric generation and transmission systems. Electrical development as a whole has created one unfortunate viewpoint. In the public mind the dazzle, inspiration and accomplishment of its past have established the belief that, since electric service is a basic element in modern industrial development, electrical construction projects can be undertaken on a vast scale with little if any regard for the basic economic laws involved. The public mind and particularly those charged with political responsibilities have yet to learn that if there is any one industry that must proceed along sound economic laws of development and service, it is the central-station industry, for here is found a service institution where business is just business with no political appendages.

Superpower Report Reveals Electrical Opportunities

THE tremendous activity of war industries along the Atlantic seaboard between Boston and Washington resulted in such an exhaustion of power in that section that the necessity of a thorough investigation of the situation was apparent. Obviously no broad or well-founded engineering judgment on future requirements could be based on anything less, and after some persuasion Congress was moved to appropriate the necessary funds to the United States Geological Survey, which was authorized to undertake the work. The report of the survey made by W. S. Murray and others has just been made public, and a very creditable report it is. It indicates the enormous savings in labor, material and money that might be effected by the installation of a power system adequate to serve all industry in the district surveyed, and suggests that the existing public utilities act in complete co-operation and adopt a plan of co-ordinated interconnection and expansion to bring the savings about. This they should do, if for no other reason than self-interest, as unquestionably they are the only instrumentalities through which maximum economy in the production of electrical energy can be attained.

The report as a whole is an unqualified indorsement of the modern central-station system of electric generation, transmission and distribution, and the pity of it all is that the study was restricted to so small a section of the country. Certainly the subject of power production is big enough and important enough to warrant a complete survey of the entire United States by the government. Future construction will undoubtedly be along the lines of recent evolution; for the best economy, and therefore the highest national benefit, will result from the erection of large central stations of the super-power-plant type, supplemented by hydro-electric resources where these are found to be efficient and economical, all interconnected by a vast transmission network. Such indeed is the plan proposed by Mr. Murray and his fellow engineers.

It would be hard to pass judgment on the predictions made in the report, particularly as no attention was given to legal and financial questions. The engineers, however, sought out and set in order many vital facts for which the industry should be thankful. There are, for example, no less than 96,000 individual plants in the district which might be supplied with electric service at an annual saving of $190,000,000. By 1930 the estimated energy requirements of the zone will be 31,000,000,000 kw.-hr., and this tremendous output will be generated at a saving of $230,000,000 annually over what it would cost with an unco-ordinated system. The opportunities for business in the districts surrounding Providence, New York, Newark, Wilkes-Barre, Pottsville and Philadelphia will doubtless be of immense interest to the public utility operators in those localities, and they are only a few of the constructive conclusions with which the report abounds.

On the showing there is every reason for optimism. The potential public utility business is immense, greater perhaps in the district surveyed than anywhere else in the country, and should give encouragement and cheer to the existing utilities. It is unthinkable that they should let the opportunity for wider and more intensive service slip or tolerate hindrance from legal or financial handicaps. The survey reveals the opportunity and points the way to its realization.

Golf at Present-Day Conventions

ALL MODERN conventions are divided into three parts—meetings, sitting around and golf, or golf, meetings and sitting around, according to the temperament and inclination of the man. Each has its place, and it is hard to say which is the most important, for the purpose of a convention is to provide an opportunity for men to meet and exchange experience and ideas. Some kinds of ideas and experience come out in meetings, some in corner conversations, some in golf. And all are so valuable that it is a pity that golf and meetings should so often be scheduled in competition with each other, so that men who go for both should be compelled to sacrifice one or the other.

It has come to be a condition that convention meetings are poorly attended. Valuable papers are read before a handful, and half the possible discussion is lost because so many men are on the links. They are there because they want to talk and play with other men whom they have come to the convention to meet. The responsibility lies with the makers of the program. Golf should be scheduled with as much consideration as a meeting. Meetings should not be put into direct competition with golf. Morning and evening meetings, with the afternoons open for golf and conversation, have proved a very practical arrangement.

Measuring Kilovolt-Ampere Demand

MUCH of the power-factor trouble which electric service companies have experienced has been due to the fact that adequate apparatus for measuring power factor has not been available until very recently. In fact, it has taken a great deal of hammering on this particular theme to bring manufacturers to the point of supplying something else than the "standard" metering equipment known for some years back. In the current issue of the ELECTRICAL WORLD S. A. Fletcher of the Alabama Power Company gives an account of a scheme for dealing with power-factor difficulties in which a duplex meter is employed. One of the meters records kilowatts in the ordinary way and the other records reactive kilovolt-amperes, each integrating over a fifteen-minute period. The relative readings of the two enable the consumer to get a pretty clear idea of what is happening on his circuit and permit the station to determine with a considerable degree of precision the whole situation as regards kilovolt-amperes and demand.

The apparatus developed for the Alabama case is certainly interesting and ought to do a very good job, but we cannot refrain here from reiterating the opinion we have often expressed that the complication of central-station operation by subsidiary apparatus, with its attendant care and expense, is gradually becoming intolerable. We are particularly pleased to note the appearance of straight kilovolt-ampere meters in both integrating and demand forms, which, if they turn out as well as they can readily be made to turn out, will furnish by far the simplest means of taking the necessary account of power factor. Measuring of demand is obviously not a thing that can be absolutely neglected, but, after all, it is only one of the variables which go to make up the cost of service. If one attempted to measure all these variables, he would not have a central station but an instrument plant on his hands.

Let electric light and power companies get down to the use of the simplest practicable methods of measuring the smallest number of factors with which they can reasonably get along in actual service.

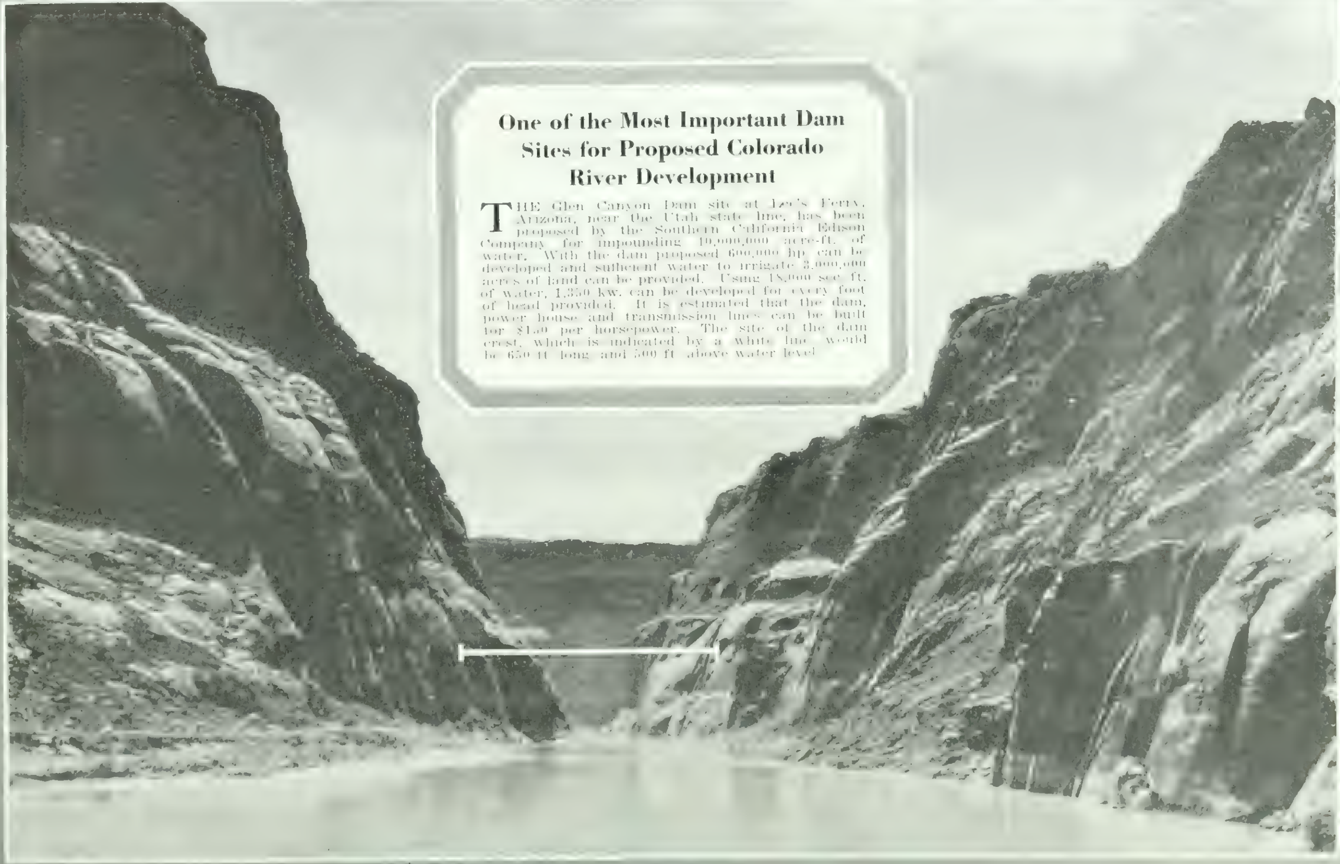
Ownership and Operation of Utilities

ONE of the most noteworthy opinions yet set forth in favor of private ownership and operation of public utilities was presented by a special committee at the recent meeting of the National Association of Railway and Utilities Commissioners. Since 1917 this committee has been studying the subject, and two previous reports have been rendered dealing with its various aspects. The committee stated its conclusions in words of no uncertain meaning when it said: "The foregoing considerations force your committee to the conclusion that the present system of private ownership and operation under public regulation is the logical, just, equitable and best system of conducting the business of public utilities that has been or can be devised to meet the needs and requirements of both the utilities in question and the public by them served."

Moreover, the references to government operation and ownership lay emphasis on sound principles of economy and business efficiency and are a deserving tribute to the operation and service of systems under private management. In pointing out that the business is essentially management and involves, not alone a plant and operating principles, but the functioning of a highly skilled managing personnel, a buying and selling organization, trade connections and the intangible but valuable good will of the public served, the committee has given expression and indorsement to the identical principles which have been laid down by the utilities themselves as the foundation on which they expect their success to be based. M. H. Aylesworth, executive manager of the National Electric Light Association and its spokesman on numerous occasions, has stated this in another way by contending that "public ownership" of utilities as against ownership by cities and states is now an accomplished fact inasmuch as there are more than 1,500,000 people who own securities of electric utilities under private management and indorse the correlation of the business of furnishing electric service with all other lines of business activities which the diversified groups of public utility security holders represent.

On the ever-vital rate problem the following comment of the committee is particularly pertinent: "For the last five years their revenue rates did not proportionately increase with their rapidly increased costs of operations. It therefore follows that, in order to maintain a just, equitable balance and even to keep such utilities out of bankruptcy, it is necessary to maintain their higher rates longer than would to the layman seem necessary judging by the surrounding decline in commodity prices. To follow any other policy would be to put such utilities out of business and to discontinue that service to which the public is so justly entitled and which is now more necessary to the return of the vast bulk of private business to the desired goal of normalcy."

Such an expression brings new hope to electric utilities and can only strengthen the support of commission regulation which they have heretofore universally extended.



One of the Most Important Dam Sites for Proposed Colorado River Development

THE Glen Canyon Dam site at Lee's Ferry, Arizona, near the Utah state line, has been proposed by the Southern California Edison Company for impounding 10,000,000 acre-ft. of water. With the dam proposed 600,000 hp. can be developed and sufficient water to irrigate 3,000,000 acres of land can be provided. Using 18,000 sec.-ft. of water, 1,350 kw. can be developed for every foot of head provided. It is estimated that the dam, power house and transmission lines can be built for $150 per horsepower. The site of the dam crest, which is indicated by a white line, would be 650 ft. long and 500 ft. above water level.

The Protective Tariff and the American Valuation Plan

A Clear, Detailed Statement of the Reasons Why a Protective Tariff Is Needed in This Country and the Advantages of Assessing Duties Under an American Valuation

By JOSEPH McELROY, 3d
Export Sales Manager Pass & Seymour, Inc.

“THE BEST of all possible governments is that in which the last and least citizen feels he is to blame or to be praised for all the government does. The worst is that in which the largest number of citizens do not think it is any concern of theirs.” This was written by Dr. Frank Crane, and it seems to have a particular bearing on the present situation of the tariff. Unfortunately, the subject is little understood. However, the revision of the tariff law is at the moment one of the most pressing problems before the American people. When one reads the daily papers, regardless of their party affiliation, it is difficult to obtain a fair and clear view of this subject. One side of the press leans too far one way and the other side too far in the reverse direction. As to the study and reading of the Fordney tariff bill itself, no one that I have spoken to has read it and all seemed to have formed their opinion from a casual paragraph or column in the daily papers. Yet every man and woman of us is both interested and concerned and should not only understand the present tariff situation but be working steadily to influence the proper solution of the problem. For it is vital to every business and every home.

I have had the pleasure of being a member of a tariff committee representing one of the key industries of the United States (the electrical industry), and I have served for about four years. During this time we have diligently studied the subject of tariff from all angles, not only as it exists in this country but as it exists in foreign countries, and it is distinctly my belief that we must have a protective tariff if we are going to maintain the industries of the United States.

The exports of this country have run from 10 to 20 per cent of the output of the average individual factory. If a tariff is enacted which will protect the 80 or 90 per cent of domestic trade, we shall then also have goods for export and can fight for our share of the trade of the world. But if we look at this tariff situation solely from the export view to protect the 10 to 20 per cent of output now involved—and the factories are compelled to close down because of the influx of foreign-made articles, then eventually we shall have nothing to sell, either for domestic use or for export.

The tariff, however, is not enacted for the protection of manufacturers or capitalists but solely from the viewpoint of the protection of American labor, and the effect of the tariff on labor is best described by concrete examples citing definite products concerned.

In this country, for instance, we have the manufacturer of electric storage batteries, which are used principally on automobiles. This is a young and growing industry, which employs at present approximately 10,000 men in the various plants and about 20,000 additional men in service stations in the country. What are the conditions of this particular industry?

Lead is the chief article employed in the manufacture of electric storage batteries, and in looking at the statistics of the London lead market for a period of fourteen years it is found that the average price is from ½ cent to 1½ cents a pound cheaper than the price of lead in the New York market, which means that under ordinary freight conditions lead could be shipped from Europe to this country and sold in New York at a cheaper price than the lead which is found in our Central Western States. Japanese, German and English labor is cheaper than American labor. Therefore, if one starts with the fact that the pure metal is cheaper than the same article in America and then adds to the cost of the metal the cost of the cheaper foreign labor, there results a cheaper general cost in these foreign countries, and their manufacturers will undersell the American manufacturers.

Impossible to Compete

California is one of the best automobile states in the Union, with more cars per capita, I believe, than any other state. All of the electric storage-battery manufacturers are in the eastern part of the country and figure that it costs approximately 20 per cent to ship and sell their batteries in California. That is, it adds 20 per cent to their cost. Now they mine lead in Japan at a cheaper price than that of the London market. Their labor is the cheapest in any manufacturing country. Their freight rates are cheaper because of the subsidized Japanese steamers. It is a simple and inexpensive run from Japan to any of the Pacific Coast cities.

If there is not tariff protection for the manufacturer of electric storage batteries, therefore, what is going to become of his business against competition of this kind? It is going to mean that he will have to close down his factory and that 10,000 American workingmen will be thrown out of work, to say nothing of the 20,000 men who are now employed in the service stations. Possibly the latter should not be counted, for they might still continue at work in view of the fact that storage batteries of every make need repairs; but there are at least the 10,000 factory workers to be considered.

Take another case. By the terms of the Underwood tariff bill, which was in effect up to the present year, iron castings not made up into complete articles could be imported into this country at the very low duty of 10 per cent. There is an article made of iron employed in the electrical industry which is never used without a face plate of some other metal, usually porcelain or glass. The article is not complete without a face plate and yet, according to trade duties and customs, is sold without this plate.

These castings could be made abroad cheaper than they can be made in this country, owing principally to the low price of labor, and the country I have in mind in connection with this particular article is Germany. There was nothing to prevent Germany from sending these castings to this country as parts and having agents in this country purchase the face plates in order to complete these parts and make them into complete articles.

If this had been done, it would have meant the closing down of several large plants throughout the country and the throwing out of employment of at least 500 men in connection with this single small article. Here is proof enough that the tariff is a live, vital matter to every American workingman, regardless of his standing, whether skilled or unskilled, and to every American business man.

THE UNDERWOOD TARIFF AND THE WAR

Those that are opposed to the tariff may raise the argument, "Why is it, if these dreadful conditions exist, that the country was not flooded with merchandise from abroad when the Underwood bill was enacted toward the close of 1913, thereby repealing the Payne-Aldrich law, the protective measure that existed up to then?"

Statistics of imports in some lines had shown an increase in consequence of the lowering of the tariff, and had it not been for the war which started in the early part of 1914 this condition would have been general. As soon as the various manufacturers in the foreign manufacturing countries realized the change in the tariff conditions in this country their salesmen in many industries visited the United States to find out the possibilities of trade. The magnitude of the demand for certain lines of goods had not previously been fully appreciated by them, but it was not long before they began copying articles made here and offering them for sale. It was only the beginning of the war that prevented this business from increasing by leaps and bounds, and the American market would eventually have been flooded with cheap foreign products in many lines but for this one obstacle.

Those who are old enough to remember President Cleveland's administration will recall the fact that many articles were offered at that time for sale at cheap prices, and this particularly applied to clothing. It was possible to purchase woolen clothing made abroad at cheap prices, but people were unable to buy because they were out of employment, and when a man is out of employment he is not very much interested in the price of anything, because if it is offered to him for almost nothing he is still unable to purchase it. On the other hand, if he can keep his job and receive a fair return for his work, he is able to purchase articles even at a higher price as long as the price is reasonable and not what might be called prohibitive. The fact that prices of articles are low does not necessarily mean that we have good times or that people can purchase the articles.

The argument raised by exporters and importers that foreign countries would retaliate in the event of our adopting a protective tariff is answered by the fact that the leading European countries are now leaning toward higher tariff, according to reports received recently. In great Britain the safeguarding of the British industries bill is believed to herald a modification of the free trade policy. In France an important increase in customs duties has been announced, and new protective tariffs there are also in Italy and Spain.

When shipping goods to any of the Central or South American countries, Australia, South Africa, Canada and many other countries, it is necessary to furnish consular invoices for the purpose of establishing the duty to be paid on the merchandise shown on these invoices. If these countries have their tariffs and have their own good reasons for them, this is their own business. It is also the business of the people of the United States of America to protect their interests.

The fact that duty proposed by the Fordney tariff bill is levied on American articles going into the countries I have mentioned does not prohibit their sale, and the fact that duty is levied on imports to this country does not prohibit their sale, but it does tend to equalize the price of the foreign article with the price of the article as made by the American manufacturer. The duty is not high enough to be absolutely prohibitive except in a few instances in certain industries which are vital in case of war or other public necessity and therefore need to be protected very strongly. In most cases the duty is simply an equalizing one to prevent the dumping of foreign goods into this country.

ESTABLISHING THE VALUE

But there is more to tariff making than the mere establishing of the protective principle and the scheduling of the rates. Tariff duties differ in their application. "Specific" duties are based upon quantity, so much per pound, yard, cubic content, or other measure, and there is no great difficulty in determining the amount of any specific duty. It is not practicable, however, to attempt to impose all duties without regard to value because a certain specific duty might be too low on a given quantity of merchandise having a high value, whereas it might be too high on the same quantity of similar merchandise having a low value. It is therefore necessary in addition to specific duties to impose duties with reference to value. These duties are known as "ad valorem."

To the present time ad valorem duties in the United States have been imposed generally upon the value of the imported merchandise in the country from which it came at the date of exportation to this country, such foreign value being determined by converting the foreign money representing such value into United States money at the prevailing rate of exchange. It follows therefore that the amount of ad valorem duty imposed under the present and past laws depends upon (1) the rate of duty, (2) the foreign value in foreign money, and (3) the value of the foreign money in United States currency. But at present the moneys of the principal countries of the world have depreciated when compared with United States value, and this change in value of foreign moneys has a direct effect upon the amount of duty collected under any ad valorem duty where it is based upon foreign value. This actual depreciation in the value of the principal foreign moneys is shown below:

Country	Money Unit	Value in U. S. Money July 1, 1914	Value in U. S. Money July 1, 1921
Great Britain	Pound sterling	$4.86	$3.73
France	Franc	.193	.08
Germany	Mark	.238	.013
Japan	Yen	.501	.481

Take any article produced in all of the foreign countries and imported into this country to be sold in competition with a similar article manufactured here. Let it be assumed that the rate of ad valorem duty on the article is 33⅓ per cent. The comparative value of this article in foreign money and in United States money in 1914 and 1921 would be as follows:

Country	Assumed Value in Foreign Money	Value in U. S. 1914	Value in U. S. 1921
Great Britain, say	10 pounds	$48.80	$37.30
France, say	250 francs	48.50	20.00
Germany, say	150 marks	35.70	1.95
Japan, say	49 yen	24.55	23.57

Since the ad valorem duty is based upon the foreign money representing the foreign value converted into United States money, therefore the amount of duty paid upon any article having these foreign values upon its importation from each of these countries before the war and at present would be as follows:

Country	July 1, 1914, 33⅓ per Cent Duty Amounts to	July 1, 1921, 33⅓ per Cent Duty Amounts to
Great Britain	$16.25	$12.43
France	16.16	6.66
Germany	11.90	.65
Japan	8.18	7.85

Where ad valorem duties are imposed upon foreign values, as at present, the amount of duty consequently decreases in direct proportion to the value of the foreign currency as compared with the value of the currency of the United States. This means that the manufacturer gets the least protection against that country whose currency is the most depreciated. The greater the depreciation in currency the less the duty and consequently the less protection afforded the manufacturer in this country. There is no way to provide against this automatic reduction in duty due to depreciation of foreign currency if ad valorem duties are based upon foreign values measured in terms of foreign moneys converted into United States currency as under our present law.

How American Valuation Helps

It is therefore proposed by the American valuation plan that the domestic value of imported articles shall be the price at the time of exportation of the imported merchandise at which similar domestic merchandise packed ready for delivery in the principal markets of the United States is sold or freely offered for sale to all purchasers in such markets in the ordinary course of trade and in the usual wholesale quantities. Translated into ordinary workable English, this means that the foreign merchandise would pay duty at the value of similar articles as made in this country, and the merchandise would pay the same amount of duty regardless of the country from which it was imported and regardless of the foreign cost. It does not mean that there would be any change in the amount of the duty charged because the amount of any ad valorem duty depends upon the rate of duty and the assessed value of the merchandise upon which the rate is applied.

The American value of goods here being greater than the foreign value of similar goods abroad, owing to the difference in cost of production, it follows that if a certain duty is to be realized the rate would be less if based upon American value than it would be if based on foreign value. This matter has been carefully considered and worked out in the Fordney tariff bill now pending. The rates are based upon American value. If the duty imposed is too high or too low in any particular instance, it is not because of the substitution of American value, but because the proper rate has not been applied. If the proper rates have not been applied, there can be no intelligent criticism of the bill, so far as concerns the amount of ad valorem duty.

Under the American valuation plan merchandise imported from countries whose production costs are low is subjected to the same ad valorem duties as similar merchandise from other countries having higher production costs. This is as it should be. There is no sound reason for imposing less duty on goods from China, for example, than upon similar goods from France. The labor costs in China are much less than they are in France, and Chinese goods selling in this country in competition with French goods can be sold at a greater profit. The greater the profit, the greater the ability to pay the tariff or duty.

The Reaction on Retail Prices

The American valuation plan also tends to lower retail prices. At this time we feel that retail prices are high compared with wholesale prices, the prices of goods manufactured and of raw materials. By imposing our ad valorem duties upon the American wholesale value we educate the American people as to wholesale values. If the people know the wholesale value, they will have some conception of what the retail price ought to be. This should have a tendency to adjust retail prices to the benefit of the American consumer.

Many complaints have been lodged against the present method of imposing ad valorem duties because of the undervaluation abroad of the imported mrchandise. There is no way to determine whether the foreign value claimed by the importer is correct except by foreign inquisition, or, in other words, by taking evidence concerning such foreign value in the foreign country whence the goods are imported. But it has been found extremely difficult to obtain adequate facts concerning foreign value. This country has no jurisdiction to compel foreign witnesses to give testimony concerning such value. It is beneficial to the foreigner to make the value as low as possible in order to have the goods take the lowest duty. The result has been that merchandise imported to this country has been grossly undervalued for the purpose of ad valorem assessment.

The American value, on the other hand, can be determined in this country from the testimony of impartial witnesses and our own officials will have jurisdiction to get at all the facts. It follows that this country would be in a much better position to ascertain actual value for the purpose of assessment of ad valorem duties under the American valuation plan.

I know of no other adequate means of insuring fair and equitable ad valorem duties under the present existing exchange condition. Unless the American valuation plan is adopted there is little hope of the American manufacturer and American labor getting adequate protection against foreign-made goods, and there is little hope of this country being put in a position to maintain the present standard of living of the American workingman and workingwoman. For all of these reasons I believe it is necessary that citizens everywhere should investigate this subject and realize that it is something which vitally affects their future and their present method of living.

Advantages of Superpower System

W. S. Murray in a Report to the Government Enumerates the Immense Savings Possible by Supplementing and Co-ordinating Existing Utilities and Increasing Their Economies

THE United States Geological Survey, Department of the Interior, has just issued the report of W. S. Murray and others on "A Superpower System for the Region Between Boston and Washington." This special short-period study of the source of energy along the North Atlantic seaboard was begun on July 1, 1920, and completed within a year. An appropriation of $125,000 was made by Congress for the purpose of the survey, and $26,000 additional was contributed by utilities and industries in the Superpower Zone.

The superpower scheme comprehends a plan of power production that includes the generation of electricity in steam stations at tidewater and on inland rivers where a sufficient quantity of water for condensing purposes is available, and also the utilization of all hydro-electric power that can be economically obtainable within the zone or within transmission distance of it, the whole to be tied together through an interconnected system of transmission lines.

Fig. 1 shows the Superpower Zone. It lies between the thirty-ninth and forty-fourth parallels of latitude and extends from the coast approximately 150 miles inland, embracing parts of the States of Maine, New Hampshire, Vermont, New York, Pennsylvania, Delaware and Maryland and all of the States of Massachusetts, Rhode Island, Connecticut and New Jersey. Within this zone is concentrated one-fourth of the population of the United States, and within it are operated, most of them independently, 315 electric public utilities, eighteen steam railroads and 96,000 industrial plants.

The purpose of the study was to show the saving in labor, material and money that might be effected by the installation of a power system adequate to serve the railroads, municipalities, utilities and the industries in the Superpower Zone. There is no thought that this system should seek to supplant or even to compete with the existing electric public utilities. In fact, the idea of the Superpower System is to co-ordinate and supplement these utilities so as to carry to a higher degree the economies incident to their present operation.

The legal and financial aspects of the superpower project are not touched on in the report for the reason that it was deemed inopportune without further consideration to formulate any conclusions on these important matters. The problem set for the engineering staff was that of determining the total amount and the location of the power load that would be required for private, municipal, industrial and railroad purposes at a date sufficiently in advance to permit the construction of a system of the highest economy to supply it. The date chosen was 1930, and the allocation of the load and the power-generating facilities for the six geographical divisions of the Superpower Zone forms a most interesting part of the report. In determining the amount and location of the load, the electric public utilities, the railroads and the industries within the zone lent their co-operation.

The conclusions reached by Mr. Murray are necessarily largely based on the special studies made by the members of his engineering staff. These studies appear as appendices to the report and are as follows:

Appendix B—"Electric Utilities in Independent Operation in the Superpower Zone in 1919," by L. E. Imlay, T. B. Rutherford and others.

Appendix C—"Proposed Electrification of Heavy-traction Railroads in the Superpower Zone," by C. T. Hutchinson, N. C. McPherson and others.

Appendix D—"Industry in the Superpower Zone," by H. W. Butler, H. Goodwin, Jr., and others.

Appendix E—"Performance and Cost of the Superpower System," by Henry Flood, Jr., A. R. Wellwood and others.

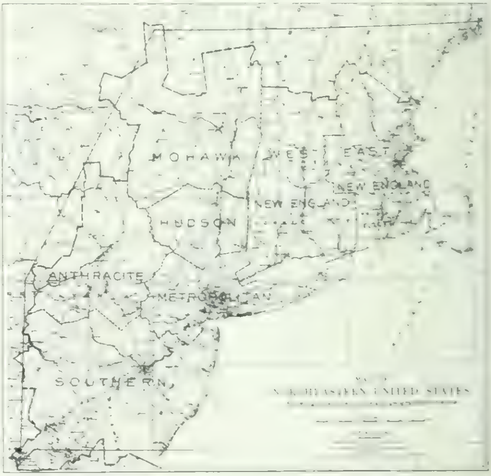


FIG. 1—SUPERPOWER ZONE WHICH EMBRACES 558 ELECTRIC UTILITY PLANTS

Appendix F—"Steam-electric Plants for the Superpower System," by Henry Flood, Jr., and others.

Appendix G—"Hydro-electric Plants for the Superpower System," by L. E. Imlay, L. A. Whitsit, B. J. Peterson and others.

Appendix H—"The Superpower Transmission System," by L. E. Imlay.

Appendix I—"Reliability of Service," by L. E. Imlay and others.

Appendix J—"The Relation of Coal and Coal-Delivery Routes to the Superpower System," by C. E. Lesher, F. G. Tryon and others.

Appendix K—"Use of Process Fuels and Pulverized Coal for Base-load Steam-Electric Plants," by O. P. Hood and others.

Appendix L—"Basic Costs," by the engineering staff.

Appendix M—"Stations and Transmission Lines of Electric Power Companies Engaged in Public Service," by A. H. Horton.

SUMMARY OF CONCLUSIONS

The market for superpower energy will be furnished by the electric utilities, the industries and the railroads. The estimated requirements for energy supplied through the electric utilities for municipal, private, industrial and railroad purposes in 1930 is 31,000,000,000 kw.-hr. This energy could be supplied by a co-ordinated power system at an annual cost of $239,000,000 less than by an unco-ordinated system such as is now in use. The total investment in generating and transmission facilities for the Superpower System will be $1,109,564,000, of which $416,346,000 will represent the value of existing facilities to be incorporated into the system.

A study of the 96,000 manufacturing establishments operating within the Superpower Zone shows that by 1930, through the maximum economical use of purchased electric energy, they can save $190,000,000 annually above the fixed annual charges against a capital investment of $185,000,000 to provide the motor equipment necessary to receive and use this power.

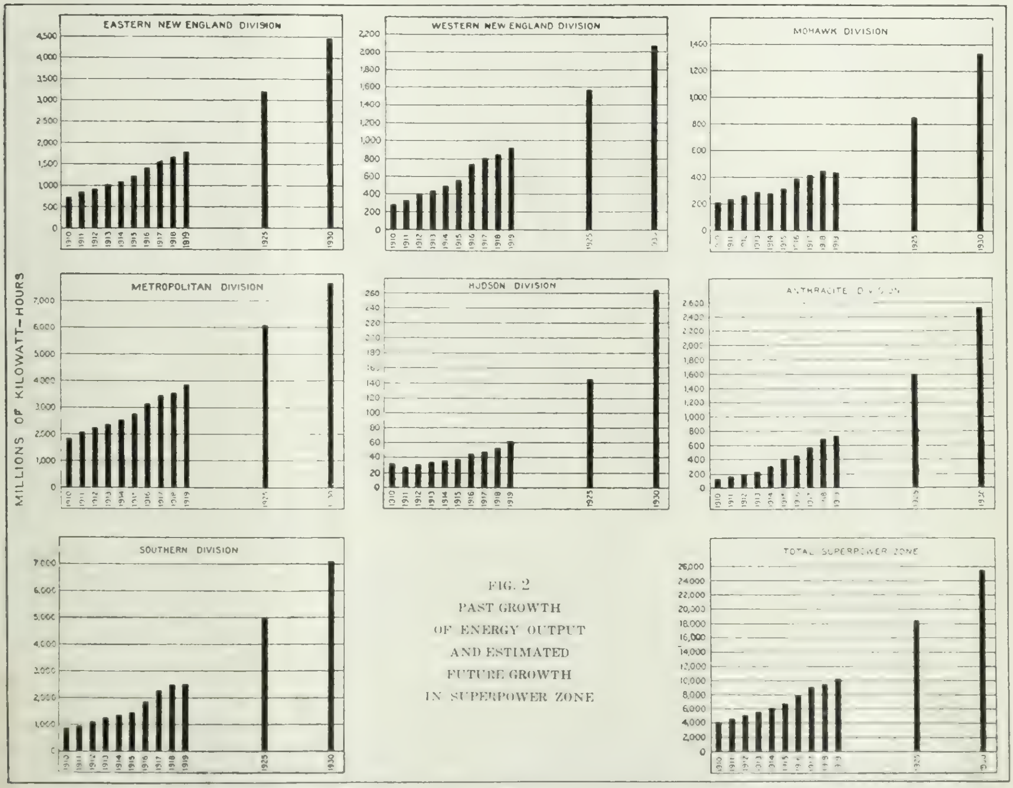


FIG. 2
PAST GROWTH
OF ENERGY OUTPUT
AND ESTIMATED
FUTURE GROWTH
IN SUPERPOWER ZONE

The combined capital investment necessary for the electric utilities and the industries as of 1930 therefore amounts to $1,294,564,000, and this total investment will yield annually above the fixed charges the sum of $429,000,000, or 33 per cent on the investment.

Within the Superpower Zone there are 36,000 miles of railroad measured as single-track—that is, including each track of main lines, yards and sidings. Of this total about 19,000 miles can be profitably electrified, so as to yield by 1930 an annual saving of $81,000,000 as compared with the cost of operation by steam. The capital expenditure necessary to electrify the 19,000 miles would be $570,000,000, and the average return upon the investment would therefore be 14.2 per cent.

The order in which the superpower steam-electric and hydro-electric power plants and transmission systems should be constructed must depend (1) on the present industrial demand for energy that cannot be satisfied because of the difficulties of the local utilities in financing extensions, and (2) on the future demand for energy that will result from the more economical generation of power under the Superpower System. It is believed that the quickest return will be obtained by following in chronologic sequence the order of procedure as follows:

1. The construction of a steam-electric plant near Pittston, Pa., to supply a part of its energy to the anthracite division of the Superpower Zone and the remainder to the metropolitan division, particularly New Jersey.

2. The construction of a steam-electric plant near Sunbury, Pa., to supply a part of its energy to the anthracite division, a part to the Reading load center, and the remainder to Philadelphia.

3. The construction of hydro-electric plants on the Delaware and Susquehanna Rivers to supplement the steam plants indicated above.

4. The progressive development of the Hudson River projects to meet the growth of energy requirements at the Schenectady, Utica, Poughkeepsie and Pittsfield load centers.

5. The construction of a steam-electric plant near Boston to supply the Boston, Lowell and Newburyport load centers.

6. The construction of a steam-electric plant near New Haven to supply the New Haven, Bridgeport, Waterbury and Norwich load centers.
7. The partial construction of the first hydro-electric plant in the development of the Potomac River as soon as the power demands of the Baltimore and Washington load centers require additional plant capacity.

Unlike the Pacific Coast region, where water power abounds and industry is relatively small, the Superpower Zone has relatively small hydro-electric resources and maximum industrial-power requirements. When the increases during the last ten years are projected to 1930, even at a lower rate, the total energy requirement of the zone in that year is found to be 31,000,000,000 kw.-hr., of which about 21 per cent can be supplied from water power.

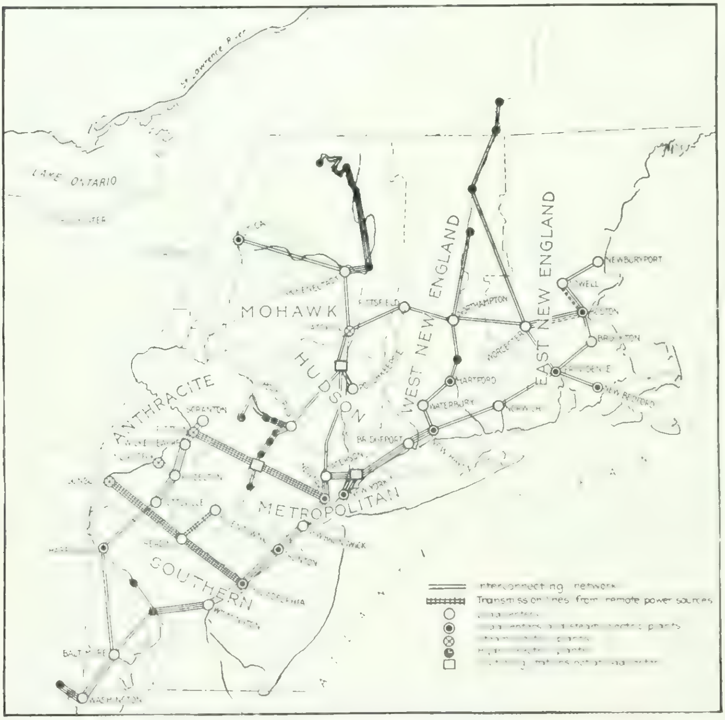


FIG. 3—PRINCIPAL TRANSMISSION LINES AND POWER PLANTS AS THEY MAY BE IN 1925

Fortunately some of the best coal deposits in the country lie near this great industrial territory, and a prime economic purpose should be so to conjoin the hydro-electric supply of power to the steam-electric supply as to produce a maximum of energy for a minimum investment of capital and a minimum operating expense, and at the same time to conserve the rapidly disappearing cheap fuels of the Appalachian coal fields.

Figs. 3 and 4 show how the Superpower System should appear in 1925 and 1930. They give the locations of the new steam-electric plants, the hydro-electric plants and the load centers for each year and show the interconnecting network of transmission systems required. Had superpower been obtainable in 1919, the number of load centers to which its power could have been supplied economically would have been twenty, and this number, as the maps show, will increase to thirty-four in 1930.

Under the present independent operation of the electric utilities and the manufacturing industries in the Superpower Zone the existing power plants are numerous and small. The average capacity of the 558 electric utility plants now in operation in the zone is 7,900 kw. and that of the steam-electric plants 10,000 kw., while the hydro-electric plants average only 2,800 kw. Out of 96,000 industrial establishments in the Superpower Zone 76,000 use power, and each of these isolated plants averages about 350 hp. Under the Superpower System, by contrast, the number of power stations required to supply the entire zone in 1930 will be only 273, of which 218 will belong to the existing electric utilities. The capacity of the base-load steam plants will range from 60,000 to 300,000 kw. In none of these plants will there be installed a turbogenerator having a capacity of less than 30,000 kw.

The new power stations and load centers will be so located with reference to the existing electric utility plants that are to be incorporated in the system as to insure the maximum aggregate economy in power generation and transmission. A prime object to be attained in the superpower plan is the maximum economic utilization of existing generation and transmission equipment.

In the New York, Baltimore and Washington load centers the predominating frequency is 25 cycles; in the remainder of the zone it is 60 cycles.

The electric utility load will grow from approximately 10,000,000,000 kw.-hr. in 1919 to 26,000,000,000 kw.-hr. in 1930. The high-voltage circuits of the Superpower System in general will form ring buses around the larger cities of the zone, in the outskirts of which will be located substations with transformers having their primaries connected to the superpower circuits and their secondaries connected to the existing distribution lines of the electric utilities.

Out of 558 electric utility plants in the Superpower Zone there are but thirty-six whose capacity equals or exceeds the average capacity of the plants for the Superpower System in 1930. Out of the 1,074 generating units of 500 kw. or more operating within the zone in 1919, only about twenty had a capacity greater than 30,000 kw.

A comparison of the production cost for plants greater than 100,000 kw. with that of those less than 1,000 kw. shows a ratio of three to one for cost of fuel and four to one for cost of maintenance and supplies in favor of the larger plants. With these marked economies in mind, it is clear that base load should be supplied from superpower plants employing units of not less than 30,000 kw. each.

Under independent operation in 1919 the generating capacity required was 46 per cent greater than the annual peak load, and the resulting annual capacity factor was 26 per cent. Under the Superpower System in 1930, through joint reserve, the generating capacity required will be only 9 per cent greater than the annual peak, and the annual capacity factor will be 45 per cent.

The reproduction costs for steam and hydro-electric plants under independent operation as of 1919 is $156 per kilowatt of capacity. The corresponding cost under superpower operation is $125 per kilowatt.

The average unit production cost for the electric utilities in 1919 was 1.93 cents per kilowatt-hour; the cost of the electric power produced by steam was 2.12 cents, and that of the hydro-electric power was 0.94 cent. In the steam-electric base-load plants for the Superpower System the production cost, based upon the same capacity factor that is applied to electric independent operation, will be 0.99 cent per kilowatt-hour, as compared with 2.12 cents.

Within the Superpower Zone there is a large railroad mileage upon which the traffic is sufficiently dense to require careful consideration of the savings to be effected by electrification. The zone contains some 36,000 miles of main line, yards and sidings, of which 19,000 miles could be profitably electrified. The total capital expenditure necessary to electrify this mileage is $570,000,000, and the result of the analysis promises an annual saving of $81,000,000, or 14.2 per cent on the investment.

It is the belief of Mr. Murray that the production of electrical energy should be confined to those in the power business and that the railroads should purchase electrical energy and confine themselves to the transportation business. A further step of fundamental importance would be to standardize as far as possible the motive-power equipment required for the three classes of railroad service—passenger, freight and switching. Such standardization would simplify electrification and therefore reduce the cost of maintaining equipment, as well as lessen the investment cost.

No recommendation is made with regard to direct-current or alternating-current traction other than that the great electric manufacturing companies of this country draw together rather than apart and that they unite in a common specification for electric motive power to replace steam.

The normal amount demanded annually for extensions and betterments for the railroads within the Superpower Zone is approximately $150,000,000, an amount which even in the face of present construction prices would suffice in three or four years to cover the cost of electrifying all the mileage mentioned.

Out of 96,000 individual establishments in the zone, 76,000 used power. The industries analyzed included manufacturing establishments, laundries, mines and quarries and government manufacturing institutions. The analysis showed that in 1919 the equivalent of 9,311,440,000 kw.-hr. was developed by prime movers operated by the industries themselves and that 3,338,800,000 kw.-hr. was purchased. It further shows that it would have been economical to shut down 4,008,200 hp. of prime movers and purchase energy to the amount of 5,623,800,000 kw.-hr., which would have made a total of 8,962,600,000 kw.-hr. purchased in 1919. The saving in coal thus effected would have been 13,502,100 tons—71 per cent of the coal used by the industries for producing power, or 25 per cent of all the coal used by the industries. In making the industrial power analysis care has been taken not to invade the field of what might be termed by-product power—that is, power produced by the industries from coal that would have been burned anyway for heat and in industrial processes. In general it was found that plants which require 500 hp. or less can economically purchase energy.

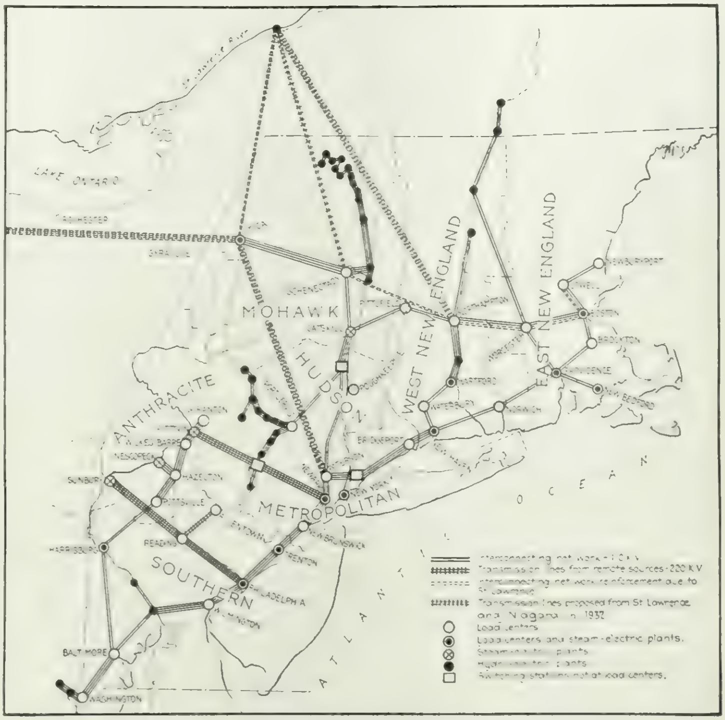


FIG. 4—POSSIBLE POSITIONS OF PRINCIPAL PLANTS AND TRANSMISSION LINES IN 1930

A careful study of the power requirement for industrial establishments in the Superpower Zone has been made and has shown that by 1930 an annual saving of $190,000,000 can be made to the industries themselves above the fixed charges, against an investment of $185,000,000 for the motor equipment necessary to utilize the power.

Performance and Cost of Superpower System

Capacity to provide for load growth has been determined largely from the trend of the load factor. The load factor for the electric utilities within the zone increased from 34 per cent in 1910 to 39 per cent in 1919.

In 1919 only 15 per cent of the total output of the electric utilities was hydro-electric power. By 1930 this proportion will have been increased to 21 per cent. In 1925 50 per cent of the total generating capacity for superpower operation will be contained in plants owned by the present electric utilities, and they will produce about 26 per cent of the energy. By 1930 the corresponding percentage of generating capacity will have dropped to 39 per cent, and these plants will furnish only 18 per cent of the total output. They will be used principally to carry peak load.

Of far-reaching importance will be the maximum use of diversity economy made possible by the interconnecting circuits of the Superpower System.

The unit investment cost in new power plants for the Superpower System is $118.25 per kilowatt of effective capacity; that for all plants is $125 per kilowatt. The unit reproduction cost of the electric utilities in 1919 was $156 per kilowatt of effective capacity.

In 1930 the transmission system of the Superpower System will represent 9.3 per cent of the total investment cost. The new money required for the Superpower System up to 1925 is $453,143,000 and up to 1930 $693,218,000, thus making it necessary to raise $90,600,000 annually for the first five years and $48,000,000 annually for the following five years.

If the demand of 1930 were provided for by the independent systems as constructed today, the total sum required would be $856,000,000, or $85,600,000 a year. Accordingly the construction of the Superpower System will involve a saving in investment cost of $163,000,000 during the next ten years; in other words, the increase of capacity to meet growing demands can be financed by the superpower plan for $16,300,000 annually less than by the normal expansion of the existing electric utilities.

Of great interest is the economic relation established between the joint use of steam and water power. It is shown that steam and water power can be so combined as to yield annually $69,550,000 on an increased investment of only $44,838,000. Here is exemplified one of the prime advantages of superpower production, costs being reduced by means of the interconnecting system, which permits the highest economy in steam-produced power together with the maximum use of water power.

The load growth in the eastern New England, western New England and Mohawk-Hudson divisions should be sufficient to absorb the total available output of the St. Lawrence project by 1932; and the growth in the metropolitan division should be sufficient to absorb 300,000 kw. at a load factor of 80 per cent from Niagara in the same year. Power, Mr. Murray believes, could be purchased from these hydro-electric plants at not over $20 per horsepower-year delivered at their busbars.

The total annual cost for power delivered in 1932 to the load centers of the eastern New England, western New England and Mohawk-Hudson divisions, if St. Lawrence power is used, will be $130,273,000; if the excess energy required in 1932 over that of 1930 were furnished by new steam-electric plants, the cost would be about $141,601,000. The development of the St. Lawrence River would therefore save $11,328,000 a year to these geographic divisions. Moreover, the total investment required to utilize purchased St. Lawrence power would be $24,826,000 less than that required to construct new steam-electric plants to supply this excess energy. In the three divisions mentioned, which lie farthest from the coal fields, the cost of power generated by steam plants is inherently high, and therefore the St. Lawrence development will be of very great benefit to them.

The total cost to the metropolitan division for the power it will require in 1932, if Niagara power is used, will be $107,651,000. If the growth in energy required between 1930 and 1932 were supplied from new steam-electric plants in the metropolitan division, the total cost in 1932 would be $110,899,000, showing an annual saving of $3,248,000 in favor of Niagara power. Were the power purchased from the Niagara power interests, the total investment for 1932 would be $5,080,000 less than that required to generate an equal amount by steam.

The use of the St. Lawrence power as suggested above would save 2,234,000 tons of coal annually, and the use of Niagara power in the metropolitan division as suggested would save 1,204,000 tons of coal annually.

The new power-plant capacity required in the Superpower Zone would be 3,098,000 kw. in 1925 and 4,980,000 kw. in 1930.

The appendix shows that in 1930 the cost of the power produced by the Superpower System, inclusive of fixed charges, as delivered on the buses of the electric utilities, would be 10.6 mills per kilowatt-hour, whereas the cost under independent operation as of 1919, exclusive of fixed charges, would be virtually the same. This, in Mr. Murray's opinion, is the fundamental reason why the expansion of electric utilities should follow the superpower plan.

Steam-Electric Plants for the Superpower System

The capacity of the existing plants of the electric utilities to be retained in the Superpower System is 2,677,000 kw., which represents 79 per cent of the effective capacity of the steam-electric public utilities in the Superpower Zone in 1919. The reproduction cost of these plants is $329,219,000.

The performance of the retained steam plants shows that these should average about 2.15 lb. of coal per kilowatt-hour, as against 2.73 lb. per kilowatt-hour for all electric-utility steam plants operating in the zone in 1919, when both groups are operating at the same annual capacity factor.

The average size of the steam plants retained is 44,600 kw., and the reproduction cost as of 1919 is $124 per kilowatt, as against $109.50 for new steam plants as of 1930. After consultation with many representatives of manufacturers in all parts of the country and with designing and operating engineers, the following operating characteristics for base-load steam plants were determined:

Steam pressure at turbine throttle, 300 lb. per square inch.

Superheat at turbine throttle, 230 deg. Fahr.
Final temperature at turbine throttle, 652 deg. Fahr.
Vacuum at turbine exhaust, 1 in. of mercury, absolute.

The proposed new steam-electric plants have been so located as to obtain the fullest advantage of low freight rates, easy coal-delivery routes and ample condensing water. Fourteen new steam-electric plants, aggregating 2,520,000 kw., will be required by 1925, and four additional plants, or eighteen in all, aggregating 3,930,000 kw., by 1930. The total for 1925 is equivalent to 63 per cent of all the present steam-electric generating capacity, and that for 1930 to 98 per cent.

In the anthracite division base-load steam-electric plants, using buckwheat No. 3 coal, can be operated most advantageously because of the combined use of their power for the metropolitan and Southern divisions. The diversity between these divisions and the anthracite division will permit operation at a capacity factor of 75 per cent, and under these conditions electric energy can be produced in 1930, inclusive of fixed charges, at 5.7 mills per kilowatt-hour. This figure is sufficiently low to permit the additional fixed charges on transmission for the power sent to the tidewater region.

There are three steam-electric power-station sites in the anthracite region—one near Pittston, one near the mouth of Nescopeck Creek and one near Sunbury, all in Pennsylvania and all on the Susquehanna River—at which sufficient condensing water is available to permit the development of 300,000 kw. each.

The principal rivers which can contribute water power to the Superpower Zone are the Potomac, Susquehanna, Delaware, Hudson and Connecticut. It is proposed to utilize power from them in 1930 to the following extent:

	Capacity Kw.	Output (Millions of Kw.-hr.)	Investment	Production Cost (Mills per Kw.-hr.)
Potomac	200,000	950	$22,000,000	3.36
Susquehanna	185,000	1,230	28,000,000	3.22
Delaware	350,000	1,250	51,500,000	5.95
Hudson	150,000	900	38,350,000	5.84
Connecticut	165,000	760	29,000,000	5.45

It is proposed to develop these rivers above their primary power capacity for peak-load operation.

The water powers of the Niagara and St. Lawrence Rivers are within transmission distance of the Superpower Zone, but on account of the time required for construction on the St. Lawrence and of the treaty restrictions concerning the use of the water at Niagara Falls the power from these sources has not been considered available in the zone prior to 1930.

Under present construction and operating costs power purchased at Niagara or on St. Lawrence River at $20 a horsepower, ready for transmission at those points at potentials of not less than 220,000 volts, can be placed at Utica and Schenectady, N. Y., and at Northampton, Mass., for 4.6 mills per kilowatt-hour, and at Paterson, N. J., for 5.7 mills. These figures assume purchases of not less than 300,000 kw. delivered at a load factor of not less than 80 per cent.

The reproduction cost of the 451,500 kw. of existing hydro-electric capacity within the zone is $87,127,000. The new hydro-electric capacity which should be installed by 1930 will bring the total capacity up to 1,501,500 kw., of which the old plants will represent 30 per cent. In 1930 the total hydro-electric investment will be $245,977,000, old plants representing 35 per cent.

So far as the existing electric utilities are concerned the Superpower System begins and ends at their power-station buses, and so far as the new superpower plants are concerned it begins at these plants and ends on the buses of the existing electric utilities.

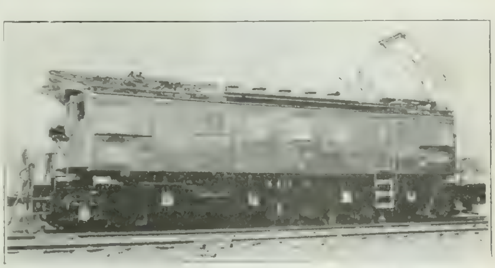
The existing transmission systems of the electric utility companies, which comprise about 1,200 miles operated at 33,000 volts or higher, will become distribution rather than transmission systems, and they will of necessity require expansion to distribute the additional power delivered to them from the Superpower System. The transmission features of the Superpower System will therefore have to do only with the transmission of power from the new plants to load centers and to the buses of the existing electric utility plants.

In 1930 the Superpower Transmission System should consist of 970 circuit miles of 220,000-volt lines and 4,696 circuit miles of 110,000-volt interconnecting lines. To these lines will be connected 5,600,000 kva. of transformer capacity, not including the transformer capacity in the base-load steam-electric plants. The construction of the transmission systems for the St. Lawrence and Niagara developments will add 3,140 circuit miles of 220,000-volt lines and 1,824,000 kva. of transformers. Thus potentials of not less than 220,000 volts will be selected to transmit power from plants that are at considerable distances from the general interconnected superpower plants, and within the zone a potential of not less than 110,000 volts will be employed for interconnection between power and load centers.

Railway Electrification in Brazil

THE Companhia Paulista de Estradas de Ferro is about to begin electric operation over a 44 km. section of double track on its main line between Jundiahy and Campinas, Brazil. This marks the initial step in what is expected to become a broad program of electrification in Brazil, with the ultimate aim of substituting hydro-electrically developed power for expensive coal. It is probable that eventually the entire broad-gage main line will be electrically operated.

The Westinghouse Electric International Company is furnishing two freight and two passenger locomotives for this initial electrification. The freight locomotives are of the six-axle type, with two six-wheel articulated trucks. There are six axle-mounted motors rated at 280 hp. at the one-hour rating. Each motor is wound for 1,500 volts for operation two in series on 3,000 volts and is arranged for field control. Each motor drives its axle by a single flexible gear. The passenger locomotives have each driving axle equipped with a 560-hp., 3,000-volt twin motor and quill drive.

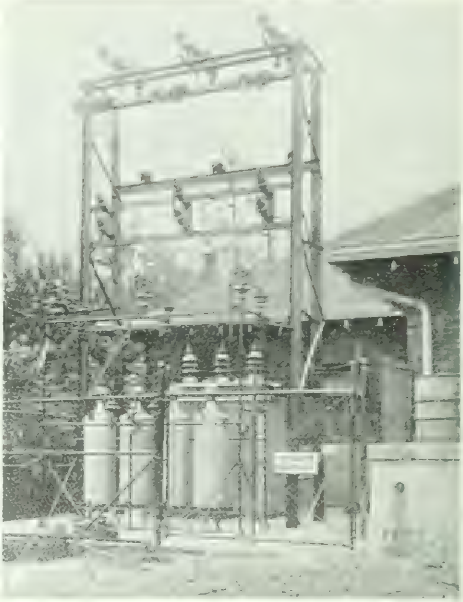


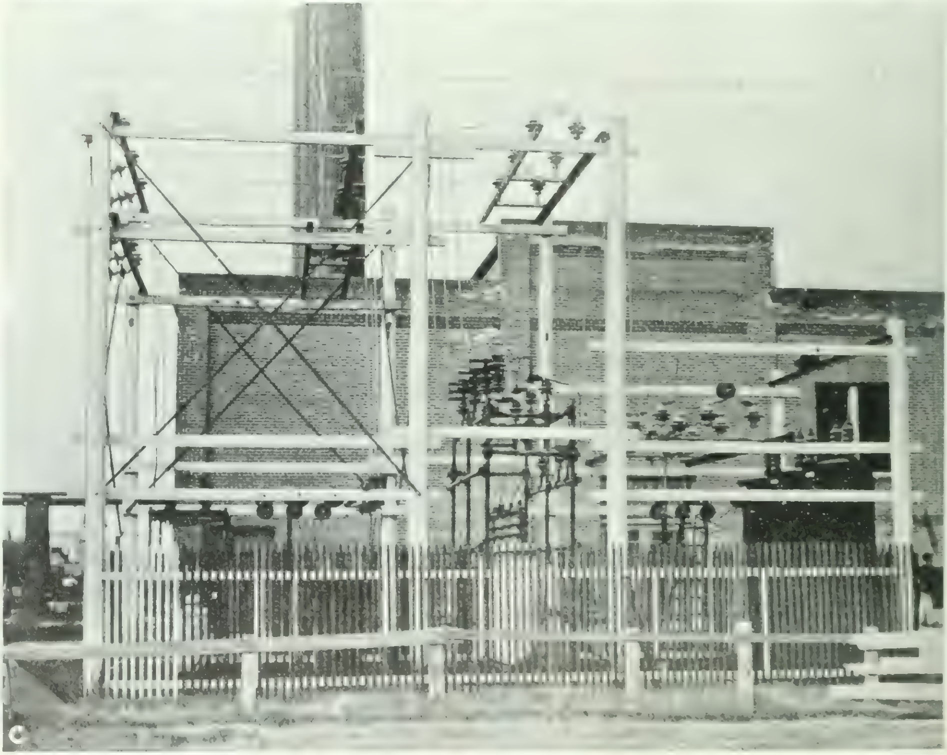
LOCOMOTIVE OF RECENTLY ELECTRIFIED PAULISTA RAILROAD

This information was furnished by S. B. Cooper, general engineering department, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

Outdoor Substations Solve Problem of Service to Small Communities

KEEPING down the investment in substation equipment is a problem that is always a puzzling one for the company that must furnish service to the small community Except by care in selection of capacity the cost of transformers, switches, lightning arresters and other electrical equipment varies within very narrow limits and the prob'em becomes one of eliminating unnecessary items of equipment and utmost simplification of arrangement. These illustrations show how the Middle West Utilities Company has met the problem. A is a 900-kw., 33-kv. outdoor substation at Hoosick Falls, N. Y., reduced to the simplest form. B is an inexpensive steel structure on the property of the Interstate Public Service Company at Edenburg, Ind. C is a splendid example of simple wood structure construction used on the 900-kw., 33-kv. transmission line connecting the Henryetta and Okmulgee plants at Oklahoma.

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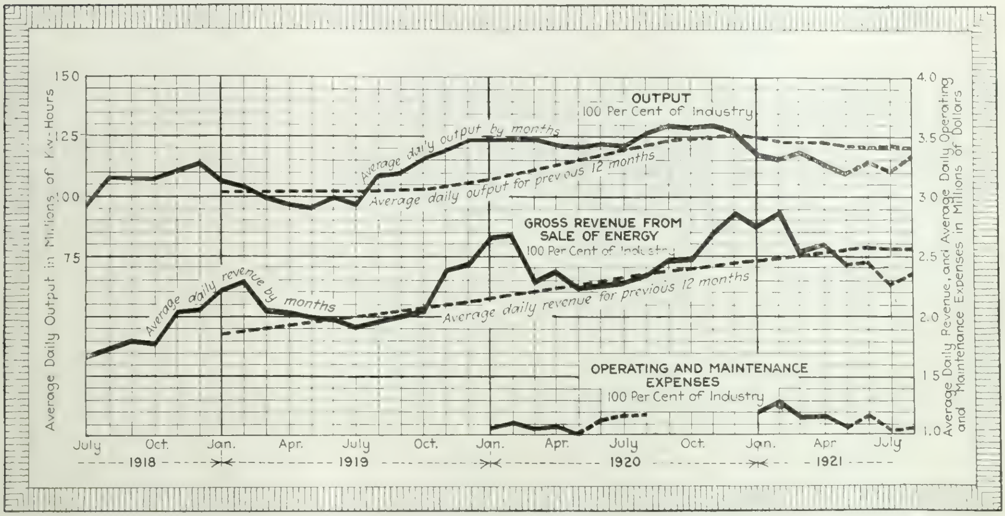
August Output Reflects Slight Increase in Industrial Activity



CENTRAL STATION OUTPUT AND GROSS REVENUE INCREASE DURING AUGUST

REPORTS received by the ELECTRICAL WORLD for the month of August from central generating and distributing companies representing 78 per cent of the total installed generator rating reflect a slight revival of activity in the industrial centers of the country. A comparison with the output reported in July indicates that for the country as a whole the electrical output increased by 4.1 per cent during August. A certain increase in output for August over July was to be expected by reason of the seasonal increase in the lighting load. A careful study of the figures from the ten largest industrial cities of the nation, however, indicates that the increase in output over that reported for July was several per cent greater than the 4.1 per cent increase reported by the country as a whole. Two of the intensely industrial cities reported an increase of over 10 per cent in output, and the consumption in several other cities of this class ranged between 6 and 7 per cent above July. American industry is now relying on electrical energy to such an extent that the least depression or increase in activity in any primary industry in any section of the country is at once reflected in the operations of the central generating plant furnishing electrical energy to that section.

From an economic viewpoint the August returns are most encouraging to the electric light and power industry, especially when the industry is compared with other primary industries of the country. The electric light and power industry, while selling 6.4 per cent less electrical energy in August this year than in August of 1920, reported gross revenue from sale of energy 3.7 per cent in excess of that received in August of last year. In addition, the operating and maintenance expenses during August were 8.5 per cent below those of August of 1920.

Expressing these figures in terms of the operating ration, or ratio between operating expenses and gross revenue from sale of energy, gives further evidence of the tendency toward financial prosperity in the electric

TABLE I—CENTRAL-STATION RETURNS FOR TWELVE MONTHS

	Percentage of Installed Ratings Represented	Kw.-Hr. Output (Companies Reporting)			Percentage of Installed Ratings Represented	Revenue from the Sale of Energy (Companies Reporting)		
		1920 Thousands	1919 Thousands	Per Cent Increase		1920 Thousands	1919 Thousands	Per Cent Increase
Sept.	71	2,734,179	2,327,460	17.4	66	49,224	38,209	28.5
Oct.	71	2,797,625	2,499,488	11.9	66	51,370	41,055	25.1
Nov.	71	2,741,705	2,503,402	9.6	66	54,620	44,711	22.0
Dec.	71	2,792,554	2,648,746	5.4	66	57,697	48,580	18.6
		1921	1920			1921	1920	
Jan.	76	2,765,632	2,943,349	-6.0	70	58,855	50,861	15.8
Feb.	76	2,453,671	2,711,800	-9.4	70	55,540	48,633	14.3
Mar.	77	2,806,609	2,989,581	-6.1	72	55,513	49,071	13.3
April	78	2,675,949	2,895,067	-7.0	72	55,326	49,064	12.8
May	78	2,668,457	2,889,174	-7.6	72	53,901	47,932	12.6
June	78*	2,686,479	2,872,900	-6.4	72	52,385	47,977	9.3
July	78†	2,703,411	2,936,362	-7.9	72	51,118	49,111	4.1
Aug	78‡	2,812,646	3,003,451	-6.4	72	52,383	50,519	3.7

	Percentage of Installed Ratings Represented	Operating and Maintenance Expenses (Companies reporting)			OPERATING RATIO					
					Steam Plants		Hydro Plants		Combined Systems of Steam and Hydro	
		1921 Thousands of Dollars	1920 Thousands of Dollars	Per Cent Increase	1921	1920	1921	1920	1921	1920
Jan.	40	14,562	13,085	11.3	56.1	55.3	26.8	27.0	38.1	45.6
Feb.	43	15,085	13,640	10.5	55.6	54.5	22.9	26.0	44.1	47.3
Mar.	53	18,757	17,249	8.7	56.1	57.7	23.4	19.6	40.2	44.8
April	53	17,815	16,641	7.1	53.0	56.5	23.9	19.8	41.4	43.3
May	53	17,274	16,727	3.1	55.4	56.8	24.2	22.9	40.6	44.8
June	54	18,836	19,089	-1.3	56.2	62.5	20.4	21.6	45.0	50.9
July	54	18,111	20,396	-11.2	56.8	65.9	20.6	20.2	43.0	52.6
Aug.	55	18,607	20,344	-8.5	56.2	63.8	22.3	22.2	44.5	52.3

*Includes estimates for 50 companies, representing 11.9 per cent of the total installed rating of all central stations.

†Includes estimates for 47 companies, representing 10.4 per cent of the total installed rating of all central stations.

‡Includes estimates for 71 companies, representing 18.8 per cent of the total installed rating of all central stations.

TABLE II—CENTRAL-STATION RETURNS BY SECTIONS OVER A TWELVE-MONTH PERIOD

Month	Percentage of Installed Ratings Represented	New England States 1920 Thousands	New England States 1919 Thousands	Per Cent Increase	Percentage of Installed Ratings Represented	Atlantic States 1920 Thousands	Atlantic States 1919 Thousands	Per Cent Increase	Percentage of Installed Ratings Represented	North Central States 1920 Thousands	North Central States 1919 Thousands	Per Cent Increase	Percentage of Installed Ratings Represented	South Central States 1920 Thousands	South Central States 1919 Thousands	Per Cent Increase	Percentage of Installed Ratings Represented	Pacific and Mountain States 1920 Thousands	Pacific and Mountain States 1919 Thousands	Per Cent Increase
KW. HR. OUTPUT																				
Sept.	82	194,730	170,593	14.1	66	903,872	758,737	19.5	74	878,237	758,017	15.9	56	147,524	113,649	30.0	79	607,816	526,464	15.[illegible]
Oct.	82	196,310	191,132	2.7	66	964,739	841,694	14.5	74	896,241	817,757	9.5	56	157,267	126,769	24.1	79	583,068	522,136	11.7
Nov.	82	193,231	183,624	5.4	66	933,436	825,011	13.5	74	895,229	861,552	10.5	56	144,889	125,438	15.0	79	554,920	507,977	9.2
Dec.	82	210,494	227,403	7.4	66	969,909	917,945	5.7	74	903,628	852,264	5.9	56	140,485	133,419	5.3	79	[illegible]	517,715	[illegible]
		1921	1920			1921	1920			1921	1920			1921	1920			1921	1920	
Jan.	81	200,269	247,800	-19.2	77	1,003,223	1,043,650	-3.9	73	860,643	956,078	-10.0	62	144,936	145,336	0.3	81	556,561	550,685	[illegible]
Feb.	81	178,694	216,890	-17.6	77	902,030	970,539	-7.0	73	789,339	882,873	-10.6	63	131,654	132,537	-0.7	81	451,754	508,961	-11.2
Mar.	81	205,348	230,309	-10.8	79	1,029,120	1,119,428	8.1	73	894,500	941,893	-5.0	63	139,381	136,017	2.4	81	[illegible]	[illegible]	4.[illegible]
April	81	196,680	227,008	13.3	79	963,659	1,052,716	-8.4	73	828,457	894,028	-7.3	63	132,075	135,421	2.5	88	555,048	586,894	-5.4
May	82	191,141	219,298	-12.8	79	934,973	989,408	5.5	73	819,506	899,657	-8.9	63	136,573	138,416	-1.3	89	586,264	642,495	-8.7
June	82	192,007	219,476	12.5	79	940,443	1,003,727	-6.3	73	806,270	880,934	-8.5	63	136,011	129,120	5.3	89	611,128	634,637	-4.[illegible]
July	81	187,567	219,144	-14.4	79	934,435	1,014,081	7.9	73	802,438	883,903	-9.3	64	140,203	141,509	9.2	89	639,768	678,725	-5.9
Aug.	81	205,351	224,324	8.5	79	981,745	1,036,035	-5.2	73	837,692	910,306	7.9	64	146,475	156,784	-6.6	89	641,383	676,002	-5.1
REVENUE		1920	1919			1920	1919			1920	1919			1920	1919			1920	1919	
Sept.	82	$5,409	$4,296	25.9	65	$18,081	$14,456	24.5	57	$13,834	$10,522	31.5	54	$3,262	$2,386	36.5	79	$8,638	$6,549	32.[illegible]
Oct.	82	5,675	4,623	22.7	65	19,201	15,722	22.0	57	14,458	11,667	23.9	54	3,504	2,551	37.3	79	8,532	6,442	[illegible]
Nov.	82	5,898	5,017	17.5	65	20,938	17,119	22.2	57	15,158	12,561	20.8	54	3,853	2,910	32.4	79	8,775	7,104	23.5
Dec.	82	6,548	5,744	14.0	65	22,332	19,149	16.7	57	16,004	13,142	21.8	54	3,722	3,113	19.8	79	9,091	7,432	22.[illegible]
		1921	1920			1921	1920			1921	1920			1921	1920			1921	1920	
Jan.	81	6,379	6,170	3.5	74	22,180	19,225	15.3	59	16,818	14,436	17.3	62	4,155	3,484	19.3	81	9,323	7,546	23.[illegible]
Feb.	81	5,925	5,728	3.4	74	21,492	18,327	17.4	59	15,971	14,070	13.6	62	3,915	3,329	17.6	81	8,237	7,179	14.7
Mar.	81	5,784	5,566	3.8	76	21,822	18,934	15.3	59	15,853	14,103	12.4	63	3,747	3,246	15.5	81	8,307	7,222	[illegible]
April	81	5,665	5,554	2.0	76	21,504	18,609	15.8	60	15,506	13,822	12.2	63	3,744	3,312	13.2	88	8,817	7,767	[illegible]
May	82	5,362	5,342	0.4	76	20,795	17,613	18.0	60	14,866	13,558	9.8	63	3,516	3,179	10.7	89	9,362	8,240	13.7
June	82	5,285	5,397	2.4	76	20,058	17,438	15.0	60	14,485	13,519	7.1	63	3,536	3,152	12.2	89	9,621	8,433	[illegible]
July	81	5,186	5,114	1.4	76	19,088	17,082	11.7	60	14,226	14,679	3.1	63	3,516	3,151	11.6	89	9,101	8,733	4.2
Aug.	81	5,297	5,483	-3.4	76	19,550	17,765	10.0	60	14,479	14,500	0.1	63	3,594	3,523	2.1	89	9,463	9,248	2.3
OPERATING EXPENSES		1921	1920			1921	1920			1921	1920			1921	1920			1921	1920	
Jan.	34	$1,098	$1,288	-14.7	48	$6,373	$5,411	17.8	28	$3,941	$3,451	14.2	37	$1,015	$905	12.2	54	$2,135	$2,030	5.2
Feb.	35	1,069	1,242	-13.9	53	6,799	5,937	14.5	29	3,958	3,445	14.8	44	1,217	1,053	15.5	55	2,042	[illegible]	[illegible]
Mar.	45	1,576	1,651	4.5	59	7,969	7,241	10.0	35	4,570	4,228	8.2	51	1,776	1,514	17.2	79	2,866	[illegible]	[illegible]
April	45	1,418	1,479	4.1	59	7,590	7,168	5.9	36	4,347	4,112	5.7	51	1,567	1,403	11.6	79	2,893	2,479	16.8
May	48	1,548	1,577	1.8	56	6,921	6,660	4.0	37	4,274	4,292	0.4	52	1,563	1,486	5.2	81	2,969	2,713	9.5
June	46	1,737	1,862	6.7	56	6,916	6,878	-0.5	39	4,843	5,152	-5.9	60	1,835	1,678	9.4	83	3,565	3,519	1.3
July	47	1,715	2,072	-17.2	53	6,259	6,600	5.2	39	4,913	5,759	-14.7	62	1,885	2,028	7.1	83	3,334	3,937	-15.2
Aug.	48	1,861	2,088	-10.9	53	6,334	6,573	3.6	39	4,949	5,621	-12.0	62	1,862	1,998	-6.8	88	3,600	4,063	-11.4

light and power industry. During August of the present year the operating ratio of companies having steam electric generating plants only, taken in the aggregate, was 56.2 per cent, as against 63.8 per cent reported for August, 1920. Companies having combined systems of both steam and hydro plants reported an operating ratio of 44.5 per cent for August of this year and 52.3 per cent for August of 1920.

Reports of industrial conditions during August indicate that eight of the fourteen industrial groups of the country showed increased activity during August. These eight industrial groups include the principal consumers of industrial electrical energy, and the fact that these were the first to show a revival in operations argues well for the industrial load of the central generating and distributing companies during the fall and winter.

Slightly increased activity by the metal and metal

TABLE III—AGGREGATE OPERATING RATIO OF COMPANIES REPORTING DATA MONTHLY TO THE "ELECTRICAL WORLD"

Type of Generating Plant and Month	New England States 1921	New England States 1920	New England Average for Year 1921	New England Average for Year 1920	Atlantic States 1921	Atlantic States 1920	Atlantic Average for Year 1921	Atlantic Average for Year 1920	North Central States 1921	North Central States 1920	North Central Average for Year 1921	North Central Average for Year 1920	South Central States 1921	South Central States 1920	South Central Average for Year 1921	South Central Average for Year 1920	Mountain and Pacific States 1921	Mountain and Pacific States 1920	Mountain and Pacific Average for Year 1921	Mountain and Pacific Average for Year 1920
Steam Plants.																				
January	54.0	60.8	54.0	60.8	53.5	50.9	53.5	50.9	61.2	61.8	61.2	61.8	53.1	53.7	53.1	53.7	69.0	60.5	69.0	60.5
February	54.3	59.5	54.2	60.3	52.3	53.0	52.7	52.1	63.0	57.9	62.1	59.8	59.1	51.2	56.2	52.3	60.2	60.3	64.3	60.3
March	64.0	70.0	56.7	62.5	54.5	56.7	53.3	53.7	58.4	59.7	60.8	59.8	53.3	50.9	55.0	51.9	68.4	62.5	65.9	61.2
April	59.4	63.5	57.3	62.7	50.9	54.3	52.8	53.8	54.8	61.2	59.3	60.2	54.1	52.8	54.7	52.1	53.7	53.7	61.8	58.6
May	63.2	69.1	58.3	63.8	56.2	58.6	53.4	54.5	54.7	63.3	58.5	60.8	53.3	56.0	54.4	53.0	55.0	57.0	59.9	58.3
June	60.1	71.2	58.7	64.9	55.8	59.5	53.8	55.3	56.6	68.3	58.3	61.8	55.3	60.0	54.6	53.8	53.4	56.2	58.6	57.[illegible]
July	60.7	77.3	59.0	66.7	57.2	62.7	54.1	56.1	56.9	70.6	58.1	63.0	55.1	62.4	54.7	55.3	53.3	59.3	57.8	58.0
August	67.3	72.3	60.1	67.3	55.8	61.3	54.2	56.6	56.0	70.0	57.8	63.9	53.3	57.3	54.3	55.7	51.8	59.8	57.0	58.[illegible]
Hydro Plants.																				
January	26.5	35.2	26.5	35.2	21.2	21.2	21.2	21.2	25.0	20.8	25.0	20.8	26.4	20.1	26.4	20.1	27.5	27.3	27.5	27.3
February	30.1	46.5	26.8	35.6	20.1	20.6	20.7	20.9	24.1	20.6	24.6	20.6	28.6	21.4	27.4	20.5	23.9	27.9	26.0	27.6
March	29.9	30.0	26.9	35.3	21.0	20.6	20.8	20.8	23.0	20.6	23.5	20.6	30.4	23.2	28.4	21.3	24.9	19.0	25.8	25.6
April	24.6	34.7	26.5	35.2	18.2	18.8	20.2	20.3	24.8	20.8	24.2	20.7	22.4	25.0	26.8	21.2	27.3	19.2	26.0	24.2
May	26.5	25.6	26.5	34.3	15.5	17.4	19.2	19.7	21.5	20.1	22.5	20.5	27.9	21.2	27.1	21.2	29.8	22.9	26.6	24.0
June	29.2	21.5	26.6	33.8	17.6	18.8	19.0	19.6	21.1	19.5	22.8	20.2	27.3	18.3	27.1	20.7	30.3	27.4	27.6	24.2
July	29.2	29.6	26.6	33.9	15.9	21.1	18.6	19.8	19.4	19.7	22.3	20.2	27.3	18.3	27.7	20.7	24.2	19.9	26.3	23.7
August	31.4	36.5	26.8	33.9	16.7	20.9	18.3	19.8	20.7	21.6	22.0	20.4	33.7	23.1	28.5	21.0	25.1	24.3	26.2	23.6
Combined Systems of Steam and Hydro Plants																				
January	45.3	53.5	45.3	53.5	43.5	45.8	43.5	45.8	39.5	38.6	39.5	38.6	38.6	46.6	38.6	46.6	35.2	45.6	35.2	45.5
February	44.3	60.0	44.7	58.8	41.8	41.9	42.6	43.8	42.4	49.8	41.9	48.2	41.7	39.6	40.5	42.0	39.6	43.8	37.4	44.7
March	49.7	53.8	47.3	56.0	39.7	47.3	42.0	45.3	41.5	46.0	41.8	47.3	38.6	39.2	40.2	41.2	36.4	39.7	36.9	43.0
April	46.6	48.5	47.1	53.5	42.9	43.9	41.9	44.8	45.0	48.3	42.7	47.5	43.6	48.6	40.7	42.8	37.0	36.8	37.0	41.0
May	49.2	48.5	47.6	52.3	39.8	44.2	41.4	44.7	47.0	52.8	43.7	48.8	40.7	39.6	40.6	42.2	35.0	38.3	36.4	40.3
June	58.5	56.5	49.6	53.2	42.3	45.8	41.6	44.9	50.1	62.2	45.0	51.6	45.1	44.8	41.3	42.7	38.8	44.3	37.0	41.1
July	56.1	63.2	50.5	54.7	42.6	51.3	41.7	45.8	51.6	64.4	46.0	53.9	53.6	45.3	41.4	42.8	35.4	43.1	36.8	41.5
August	60.6	62.7	51.9	55.8	46.5	49.0	42.3	46.2	51.2	64.5	46.6	55.5	45.3	50.0	41.9	43.8	36.8	43.5	36.7	41.8

products industry and also in the leather industry of New England, in addition to an increased lighting load, probably accounts for the increase of 9.5 per cent in the output of the electric light and power companies of this section above the July operations. A further indication of the increased industrial load in New England is the fact that while the energy consumption during July of this year was 14.4 per cent below that of July, 1920, in August the output had decreased to 8.5 per cent under that of August of last year.

The iron and steel mills continue to operate at greatly reduced activity, though increased activity in some centers was reported. Other industries in the Middle Atlantic States increasing their consumption of electrical energy during August were the textile and leather industries. In the South Atlantic States the textile mills continue to call for more energy. The unprecedented water shortage in this section resulted in considerable decrease in the operation of hydro-electric plants during August, and several companies found it necessary to start up steam reserve plants. In one instance curtailment of electric power supply resulted. As a result of these conditions in the South Atlantic States, the operating ratio in the Atlantic Section as a whole of the companies having combined steam and hydro systems increased from the 42.6 per cent reported in July to 46.5 per cent in August. The total output of the electric light and power companies of the Atlantic States during August was about 5 per cent above that reported for July.

A slight improvement in iron and steel mill operations and near-capacity operation of flour mills and packing plants, aided by an increased lighting load, is reflected to a degree in the 4.5 per cent increase in the kilowatt-hour output of the North Central States.

In the South Central States the only increased industrial activity of any extent during August was reported by the lumber industry, other industries operating about on a level with July. The net results of these slightly increased industrial energy requirements, plus an increased lighting load, were an electrical output of about 4.5 per cent above that of July.

Manufacturing and mining operations in the Mountain States showed but slight improvement during August. Industrial activity in the Pacific States was on a par with that during July. The irrigation load was, however, considerably decreased during August, which probably offset any increased lighting load in that section. Taking the Mountain and Pacific States as a whole, the operations of the electric light and power companies of the section were virtually the same as during July.

Hydro-Electric Commission of Ontario Reports Steady Growth of Demand

THE thirteenth annual report of the Hydro-Electric Power Commission of Ontario, which covers the year ended Oct. 31, 1920, says that that year was the most successful in the history of the commission. A curve showing the gradual though persistent increase in electricity used by the districts supplied by the commission from October, 1910, to October, 1920, takes a form which indicates remarkably small divergencies above or below a straight line, even the falling off after the armistice being moderate and temporary. In September, 1920, the demand reached 200,000 hp.

Maintenance of Trolley-Type Mine Locomotive

Daily, Weekly and Semi-Annual Schedule of Inspections for Locating Trouble on Motor, Controller, Trolley, Brakes, Etc.

BY FREDERICK KRUG
Electrical Engineer New York & Honduras Rosario Mining Co., San Juancita, Honduras, C. A.

THE severe service to which electric mine locomotives are constantly subjected makes them liable to a great many more ills than arise with machinery that remains stationary. Considerable time and expense can be saved if the methods of locating troubles are standardized and followed in a systematic manner. If, in addition, the locomotives and the trolley wiring and bonding as well receive thorough and regular inspection, the interruptions to service and the maintenance cost will be reduced to a minimum. A locomotive that is handled properly and on which repairs are made before serious troubles develop will cost considerably less for maintenance than if inspections are not made at regular intervals. A schedule which is followed in one mine is given herewith.

The three principal troubles which locomotives are apt to develop in service are open circuits, grounds and short circuits. These manifest themselves in distinct ways, and a little experience will soon enable one to ascertain the trouble very quickly. As a general guide in locating trouble the accompanying table will prove of value.

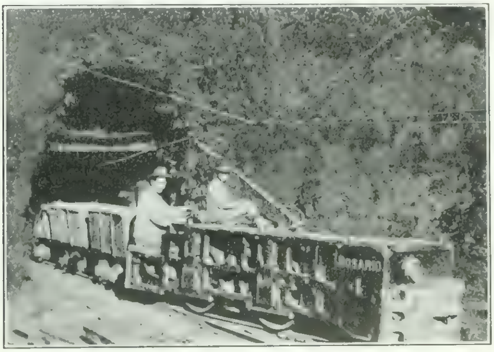
If the trouble is not immediately apparent, it is well to make the following tests in regular order, making use of a magneto or lamps in series with two test leads. If the trouble is surmised to be an open circuit, first make certain that the motor brushes make good contact on the commutator; also remove the trolley from the wire and globes from the head lamps. Test between the trolley wheel and the terminal marked "T," or "trolley," in the controller. If a circuit is found, test between the first and last fingers of the resistance leads. If no circuit is obtained here, disconnect the resistance leads from the terminals one by one and thus isolate the trouble, which will be found to be either in the wiring or in the resistance. If a circuit is obtained, the open circuit is probably in one of the motors and can be located by testing the motor leads.

If it is apparent that the trouble is a ground, proceed in a similar manner, testing from the trolley wheel to the motors, first, however, disconnecting all permanent grounds and notching up the motor brushes. Isolate the ground by disconnecting the circuit, section by section. Attach one lead of the magneto or lamps to ground and test each part in turn with the other.

In connection with the scheduled inspections it is well to remember the following: To insure the proper connection of motors when reinstalled after overhauling, wire a fiber tag to each motor lead and the corresponding tag to the lead connected with it. Mark these according to the wiring blueprint for the locomotive. Adjust parts as follows with the spring scales: Pressure of controller fingers, 2½ lb.; pressure of trolley pole or wire at the average height, about 12 lb. to 15 lb.; pressure of motor brushes, between 3 lb. and 4 lb.

In the average mine sufficient attention is rarely given to the trolley circuit, connections and bonding.

The effect of insufficient feeder capacity, poor connections and poor bonding is to cause an excessive loss in voltage, the stalling of locomotives with load and the burning out of armatures because of this low voltage and the excessive current drawn from the line. So, in a sense, attention to these matters is really a part of proper locomotive maintenance. The feeder connections to the trolley wire should be inspected occasionally as the repeated passage of the locomotive will in time often cause the connections to work loose. In a similar manner connections at sectionalizing switches will need attention now and then. The practice of hooking the feeder wire around the trolley clamps should never be permitted, as it invariably works loose and causes trouble because of the high resistance introduced. Putting wire jumpers around section insulators instead of using switches with insulated handles is also a very poor practice.



SYSTEMATIC MAINTENANCE KEEPS THIS EQUIPMENT IN CONDITION

If the bonding of the rails for the return circuit was properly done at the time of installation, very little trouble should be experienced from this source. Wherever possible, however, it is advisable to give the rail joints periodic tests in order to maintain them at their highest efficiency. The fishplate bolts should be kept tight so as to eliminate as much vibration of the rails as possible. Cross bonding every 250 ft. or so will help maintain the continuity of the circuit in event of the breakage of the bonds on one section of rail. It is also good practice to bond to water pipes or air lines where they parallel the track and then run a lead from these pipes to the power house. If the voltage at the locomotive at maximum load is much less than 80 per cent of the voltage at the power house, it is generally advisable to install additional feeders, first making sure that the loss is not due to excessive resistance in the return circuit. The best practice calls for an equal loss of voltage in the feeder wire and in the track circuit.

Some attention should also be given to the mine cars hauled by the locomotive. They should be kept in proper operating condition and well lubricated.

TROUBLES TO LOOK FOR ON MINE LOCOMOTIVES

	Trouble	Cause
1.	Failure to operate on any position of controller.	Open circuit, usually in wiring. Ground connection disconnected or burnt off.
2.	Locomotive operates on some notch after first.	Open circuit in resistance grids between notch it starts on and last previous notch.
3.	Locomotive operates with motors in parallel, but not in series.	Open circuit in one motor, either in connection or the field.
4.	Circuit breaker opens on some notch of the controller, usually the first.	Ground on resistance or on one of the motors.
5.	Locomotive operates in series, but circuit breaker opens with controller in parallel.	Ground on one of the motors.
6.	Jerky rotation of armature and bad sparking.	Open circuit in armature.
7.	Local heating of armature and sparking and pitting of one spot of commutator.	Short circuit in armature.
8.	Heating and higher speed of armature and perhaps flashing.	Short citcuit in field.

LOCOMOTIVE INSPECTION AND MAINTENANCE SCHEDULE

DAILY

Trolley Pole

See that the trolley-pole runs freely and that harp, wheel axle, springs, brushings and trolley pole cable are in good condition for the day's run. If any part is found defective, change for spare trolley pole and leave in shop for repairs. Put a few drops of oil on the swivel base and trolley-wheel axle.

Controller

Examine carefully for any loose parts. Smooth down any slightly burned fingers or contact segments and change any that are badly burned, making sure that they make good contact by turning controller off and on several times. Clean controller thoroughly and then put a very light coat of vaseline on the segments and fingers and a few drops of oil on the shaft bearings and pawls.

Motors

Note condition of commutator and see that brushes work freely and make good contact.

Brakes and Driving Boxes

See that the entire braking equipment is in satisfactory condition for the day's run, making sure to note whether brake shoes are wearing evenly. If not, adjust. See that the wool waste in the driving boxes is touching the axle and is well saturated with oil. Make sure that covers fit tightly to prevent the entrance of foreign matter.

WEEKLY

General

Clean locomotives thoroughly and blow out with compressed air. Repeat the regular daily inspection and make any changes for which time could not be found during the week. In addition, examine the following:

Circuit Breaker

Clean contacts and put a few drops of oil on all working parts.

Wiring

See that all connections are tight and that the cable is in good condition. Replace marker tags before they become unrecognizable, so as to keep the machine in readiness for disconnection and reconnection of the wiring at short notice. See that all joints are well taped and give the cable an occasional coat of black insulating varnish.

Resistance Grids

After thoroughly cleaning and blowing out, examine for any tendency to buckle and replace any that are likely to cause short circuits. Make sure all parts are tight.

Brasses

Examine journal brasses in the driving boxes and replace those worn too thin. Repack any boxes in which the waste has become dirty.

Bearings

Note the condition of the armature and axle bearings and see that the housing contains sufficient oil to keep the wool waste well saturated. Every two weeks put a small amount of grease on the ball bearings of the motors that are thus equipped.

Gears and Pinions

Examine carefully to see that pinions are tight and not badly worn. See that the gear case fits snugly and prevents the entrance of foreign matter. Grease the gear wheel.

Brake Shoe

Replace brake shoes when worn too thin.

Motors

Remove tap from bottom of motor frame to draw off any oil that may have collected. Remove top cover and clean brush holders and windings with a cloth. Blow out thoroughly and replace. If commutator is rough and blackened, clean with No. 00 sandpaper on the end of a block of wood. To do this remove the brushes of the motor to be cleaned and run locomotive with the controller in "parallel" by the other motor.

SEMI-ANNUAL

Remove motors from locomotive and disassemble. Clean thoroughly and give the field coils and armature a coat of black air-drying varnish if necessary. See that all connections and wiring are in good condition. Replace any worn parts of brake rigging. Change armature and axle bearings if found worn. Change wheels and axles if necessary and put washers on axles if there is play between wheels and frames. Thoroughly overhaul controllers and put locomotives in first-class operating condition.

Letters from Our Readers

This is a readers' forum. Comments on questions before the electrical industry presenting economic, financial, engineering or commercial aspects and new or supplementary viewpoints on published articles are cordially invited

Kva. Demand Found by Two Synchronized Demand Meters

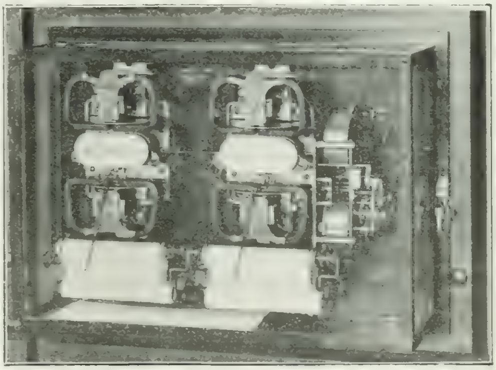
To the Editors of the ELECTRICAL WORLD:

The fact that the cost of virtually all alternating-current equipment is based upon its kilovolt-ampere capacity, while the energy produced or used by the same equipment is sold on the basis of the kilowatt, was brought out in an article by H. W. Meyer in the Sept. 17 issue of the ELECTRICAL WORLD, page 576. This situation has been long understood and studied, and many attempts have been made to correct the unfair condition by basing charges upon the kilowatts of demand corrected for power factor. This method, too, has been recognized as only a partial solution, since there has been no way that the actual kilovolt-ampere demand could be satisfactorily measured.

To meet the required conditions the Alabama Power Company has developed a meter which is used successfully for determining kilovolt-amperes of demand. This meter is really a combination of two watt-hour-demand meters in one case, controlled by one clock, which insures synchronous operation of both charts. These meters are standard meters which are used extensively to measure integrated kilowatt demands. One meter is so connected to the instrument transformers as to record kilowatts and the other so connected as to record the reactive kilovolt-amperes. Thus the two components which together compose the kilovolt-amperes are measured and recorded. The period over which the integration is made is the same as has been used for the kilowatt demand—fifteen minutes.

With this duplex meter there are, then, recorded the fifteen-minute demands in kilowatts and in reactive kilovolt-amperes. It is, therefore, possible to determine, by a formula readily understood, the fifteen-minute kilovolt-ampere demands without the aid of other instruments and with a high degree of accuracy. It is also possible for a customer to see at all times just how his demand is varying and whether it is possible for him to improve his power factor and hence decrease his demand. These two curves are drawn on different charts, but are constantly in view side by side on the meter and must keep in synchronism, so that they give what now appears to be the best means available for measuring a customer's kilovolt-ampere demand for billing purposes. They have the further advantage that the cost of the duplex meter is less than one-half the cost of a graphic kilovolt-ampere meter and a graphic wattmeter. Each unit of this duplex meter is equipped with a dial which records kilowatt-hours and reactive kilovolt-ampere-hours respectively, so that all the information required for billing the customer and for helping him to improve his power factor and reduce his demand is obtained from this metering set. The illustration shows the meter as installed on the switchboard of a large power customer operating from the Alabama Power Company's circuits.

It is thought that this meter overcomes many objections which can be raised to other means of measuring demand. Mr. Meyer's suggestion that it is possible to measure this demand by the use of a graphic recording voltmeter and ammeter is unusual. It is unfortunately open to the objection that the currents and the voltages of a three-phase system are seldom, if ever, balanced in commercial circuits, and hence this method is almost certain to be in error. In addition, it is difficult to use the charts from these meters, as virtually all demand charges are today based upon definite time intervals, that is, are demands integrated over some period—as thirty minutes, fifteen, five or even one minute. Hence, to measure such a demand from these curves with any reasonable accuracy, various sections of both ammeter and voltmeter curves must be measured with a planimeter, which is, to say the least, a cumbersome method.



KVA. DEMAND DETERMINED BY THESE TWO DEMAND METERS, WHICH ARE BOTH OPERATED BY ONE CLOCK

Fortunately, a new meter has recently been placed upon the market which measures the kilovolt-amperes directly, although Mr. Meyer says no such instrument is available This is a graphic recording meter which gives a curve similar to other graphic instruments made by various manufacturers.

To use this meter for billing purposes for an integrated demand over a definite period it is still necessary to planimeter the curve or otherwise average it. This is cumbersome and has the further objection that no indication is given of the actual conditions in the customers' circuits. That is, the measurement of the kilovolt-amperes *per se* in no way indicates to the customer whether his power factor is good or bad. Therefore he cannot tell whether he ought to be able to reduce his demand or not. Central-station companies that are selling on a kilowatt-demand basis have already found that argument arises with customers whose demand meters show higher than they think is correct. The chances for discussion over a kilovolt-ampere demand are much greater unless some means is provided to prove conclusively to a customer that his power factor has also varied. To do this it really is necessary to have a second graphic meter which registers kilowatts.

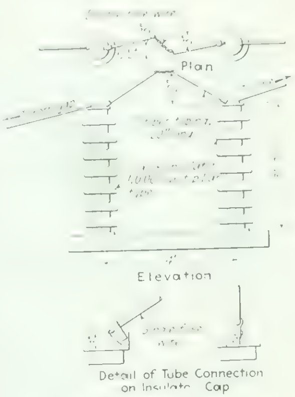
Alabama Power Company, S. A. FLETCHER,
Birmingham, Ala. Superintendent of Service.

Industrial and Station Practice

Installation, Operation and Maintenance of
Generating and Distribution Equipment and Economical Utilization of Electrical Energy
in Mills and Factories, Including Testing and Repair Methods

Expulsion Fuse for 110,000-Volt Tests

A SATISFACTORY fuse was desired in making some recent tests on lightning arresters connected to a three-phase, 110,000-volt transmission line of the Georgia Railway & Power Company. The expulsion-type fuse shown in the accompanying drawing was developed for the purpose and was found to be very satisfactory. The fuse was made of two pieces of 1-in. fiber tubing 20-in. long and shellacked inside and outside to prevent weathering. The tubes were supported on pillar-type insulators 48 in. apart. The free ends of the tubes were placed 3 in. on each side of the center line of the insulators and 12 in. above the top of the insulator caps, as shown in the diagram, so that the fuse could not blow straight across or to ground. The fuse wire was doubled across the open space between the tubes to force the arc formation to some point inside the tubes, which would allow the doubled section to drop clear of the arc path, thereby avoiding a heavy arc between the tubes.



FUSE USED IN TESTING LIGHTNING ARRESTERS ON 110-KV. LINE

The test was made by clearing the line of all load and connecting it to a separate 12,000-kw. unit at Tallulah Falls, the test being made in Atlanta, 89 miles away. This placed about 74,000 volts across the fuse from line to ground with very little resistance in series.

During the test two fuses were blown. When the first one blew no ground was indicated on the instruments at Tallulah, but when the second fuse blew a ground showed up, caused by a dead short circuit to the ground. In both cases the fuse blew inside of each tube and the double portion fell to the ground without a heavy arc and showed no signs of fusing. The current was stopped so quickly that the circuit breaker at Tallulah Falls did not trip out.

Georgia Railway & Power Co., Atlanta, Ga. — C. H. ARMSTRONG, Engineer.

Production Costs of Detroit Company at Connors Creek Station

PRODUCTION costs per kilowatt-hour of output for the Connors Creek station of the Detroit Edison Company are shown in the accompanying table. These costs are compiled on the basis of the twelve-month periods ended June and December of the years 1916 to 1921 inclusive. It must be remembered that the station has been greatly increased in size since 1916 and that new equipment has been installed. About the most significant feature of the table is the fact that better efficiencies are being obtained during the last twelve months as a result of getting the plant back into condition, particularly the completion of repairs to the two turbines which had to be taken out of service in July, 1920, and the systematic overhauling of all equipment, which was impossible during the war years and the boom years which followed. While the efficiency for the year 1920 was 1.92 lb. of coal (or 23,300 B.t.u.) per kilowatt-hour, the efficiency of the first seven months of 1921 was 1.65 lb. of coal (or 20,600 B.t.u.) per kilowatt-hour.

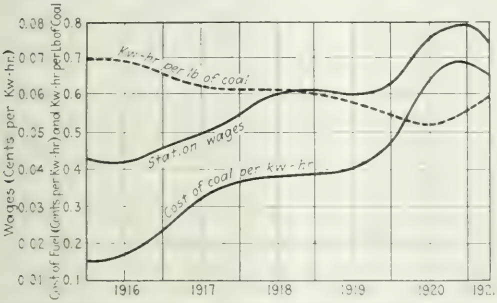
Regarding the operating results for the twelve-month period ended June 30, 1921, Alex Dow, president and

PRODUCTION EXPENSES AT CONNORS CREEK POWER HOUSE (CENTS PER KILOWATT-HOUR OUTPUT)

	For Twelve-Month Periods Ended										
	June 30, 1916	Dec. 31, 1916	June 30, 1917	Dec. 31, 1917	June 30, 1918	Dec. 31, 1918	June 30, 1919	Dec. 31, 1919	June 30, 1920	Dec. 31, 1920	June 30, 1921
Operation											
Superintendence	0.013	0.013	0.010	0.010	0.009	0.009	0.010	0.010	0.010	0.012	[illegible]
Wages	0.043	0.042	0.047	0.050	0.055	0.061	0.062	0.060	0.062	0.076	0.079
Fuel	0.158	0.174	0.240	0.325	0.368	0.382	0.394	0.407	0.471	0.652	0.682
Water	......	......	......	......	......	......	......	......	......	......	......
Lubricants	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.002	0.001	0.002	0.002
Station supplies and expense	0.005	0.006	0.005	0.005	0.006	0.009	0.010	0.007	0.011	0.012	0.010
Maintenance											
Station buildings	0.006	0.007	0.011	0.010	0.008	0.007	0.008	0.011	0.010	0.011	0.012
Steam equipment	0.019	0.016	0.019	0.024	0.025	0.023	0.024	0.029	0.036	0.038	0.043
Electrical equipment	0.003	0.003	0.001	0.001	0.002	0.001	0.001	0.001	0.001	0.003	0.003
Total	0.248	0.262	0.334	0.426	0.474	0.493	0.511	0.527	0.602	0.806	0.846
Kw.-hr. output	125,158,800	162,117,600	210,039,700	249,192,200	280,814,700	327,020,500	383,252,000	445,535,500	488,060,600	479,425,900	485,189,500
Maximum demand (thirty minutes), kw.	35,000	36,000	50,000	58,000	59,000	80,000	82,000	104,000	104,000	100,000	107,500
Average load, kw.	14,300	18,500	23,900	28,400	32,100	37,300	43,700	50,800	55,600	54,600	55,300
Load factor	0.409	0.514	0.478	0.489	0.544	0.466	0.533	0.488	0.534	0.546	0.515
Coal per kw.-hr., lb.	1.44	1.45	1.52	1.61	1.63	1.63	1.67	1.73	1.83	1.92	1.78
B.t.u. per kw.-hr.	19,700	19,800	20,040	20,470	20,930	20,900	21,200	21,800	22,800	23,300	21,800

general manager of the company, says: "I am glad to say that the improvement indicated continues, and that unless there is some unforeseen mischance, the B.t.u. figures for the calendar year will be somewhere near those of the earlier years of the plant before overloads, war-time fuel and crippled turbine came into the equation. The plant is still without economizers. The temporary 10,000-kw. turbine is still in place of one of the 20,000-kw. machines; one 20,000-kw. machine has been rebuilt, and the second one is in the shop, while the third is awaiting its turn."

It will be noted that for almost every item the costs in the year ended June, 1921, were considerably greater than for the preceding year. Coal was the chief item which was responsible for the 40 per cent increase in production costs comparing figures for the twelve-month periods ended June, 1920 and 1921. The unit cost for coal was 45 per cent higher in the year ended June, 1921, than in the previous year and 300 per cent higher than in 1916. In the year ended June, 1921, coal alone cost nearly two and three-quarters times the entire cost of generation in 1916. As may be noticed from the curves, the coal cost per kilowatt-hour and also the labor cost have reached their peaks and are now on the downward slope. In the former case this is, of course, partly due to increased efficiency.



OPERATING CONDITIONS AT DETROIT COMPANY ARE IMPROVING

Feeder Voltage Regulators to Reduce Cost of Line Construction

THE choice between voltage regulators to compensate for the voltage drop in a feeder and an increase in the section of the line copper to decrease the drop depends on the relation between the cost of the regulator plus the cost of the losses in the regulator and in the line, on the one hand, and the cost of additional line copper (sufficient to decrease the line drop to an allowable amount) plus the line loss, on the other.

Assuming, as an arbitrary illustration, a 100-amp., 2,300-volt, single-phase lighting feeder one mile long, and comparing the use of a line of one No. 3/0 wire and one of No. 4 wire, and further assuming the difference in the cost of the line construction to correspond to the difference in the cost of the copper at $0.30 per pound (this cost including the increase in the line cost as a whole), then, on the basis of power cost of 1 cent per kilowatt-hour and with the load factor assumed, the comparison shown in table above applies.

The saving of $327 in investment does not justify the annual loss of $259.70, and therefore, a regulator is not desirable.

FEEDER COST WITH AND WITHOUT REGULATOR

Size of wire	One No. 3/0	One No. 4
IR drop, in per cent	2.84	11.4
Loss in line in kilowatt-hours per year:		
Two hours per day at full load	4,760	19,150
Two hours per day at three-quarters load	2,670	10,200
Two hours per day at half load	1,190	4,780
Two hours per day at quarter load	300	1,190
Total	8,920	35,320
Feeder regulator recommended, per cent		7.5
Kilowatt rating		17.25
Kilowatt-hours per year loss in regulator:		
Two hours per day at full load		570
Two hours per day at three-quarters load		325
Two hours per day at half load		280
Two hours per day at quarter load		205
Sixteen hours per day at no load loss		1,460
Total		2,840
Cost of line at $0.30 per pound	$1,630 00	$403 00
Cost of regulator	....	900 00
Total cost	$1,630 00	1,303 00
Saving in investment	....	327.00
Total losses, in kw.-hr	8,920	38,160
Cost, at 1 cent per.kw.-hr	$89 20	$381 60
10 per cent on investment	163 00	130 30
Total cost per year	$252.20	$511 90
Excess operating cost of No. 4 line per year		$259.70

Now, assuming for the same load a line two miles long and having the same voltage drop, this will require doubling the section of the line without making any change in the regulator. The costs then will be:

	Two No. 3/0	Two No. 4
Cost of line, at $0.30	$6,520 00	$1,612 00
Cost of regulator		900 00
Total cost	$6,520 00	$2,512 00
Saving in investment	....	4,008.00
Total losses, in kw.-hr	8,920	38,160
Cost at 1 cent per kw.-hr	$89 20	$381 60
10 per cent on investment	652.0	251 20
Total cost per year	$741 20	$632 80
Excess operating cost of two No. 3/0 wires		108 40

By using a regulator the saving in the investment is very appreciable, being $4,008, and the total saving per year in favor of the "two No. 4" regulated line is $108.40. From this analysis it would seem that in this case the cost of line construction can be very appreciably decreased by using a regulator.

The use of regulators to reduce line construction cost is not, however, the only consideration, for by their use any variations in bus voltage can be compensated for and a uniform voltage maintained at the center of distribution of each feeder, thereby increasing the sale of power and giving more satisfactory service to customers. The use of various sizes of line copper so that each feeder will most economically satisfy the conditions of service may be objectionable from a standardization viewpoint, especially in congested districts where the feeders are short or where underground feeders are used. It would, however, seem that for overhead lines, and especially for suburban lines of some length, economy could be obtained by the use of smaller line copper, or copper-sheathed wire, and feeder regulators.

General Electric Company, E. F. GEHRKENS.
Pittsfield, Mass.

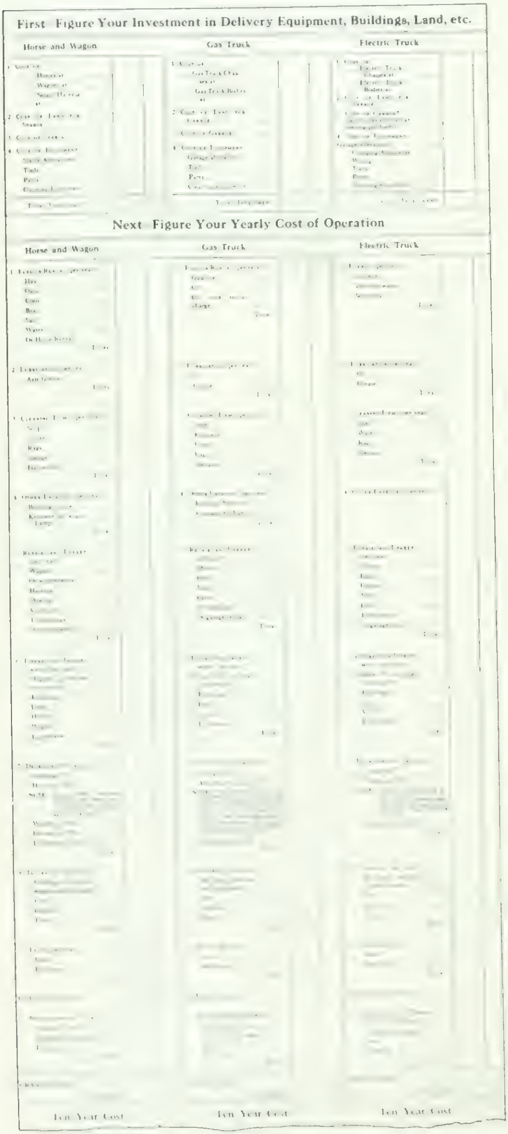
Glass Windows in Cell Doors

THE use of glass windows about 8 in. high and 14 in. wide placed at the level of the eye in oil-switch cell doors has been found advisable by the Pacific Gas & Electric Company, as they permit easy inspection of the interiors of the cells without removing the doors.

FIELD EDITOR ELECTRICAL WORLD.
San Francisco, Cal.

Accurate Cost Records Prove Superiority of Electric Vehicles

ALTHOUGH electric trucks are fast growing in popularity, the main reason that they have not been adopted more widely for delivery purposes is that accurate economic comparisons have not been made between them and other kinds of delivery equipment. If a form like the one shown in the accompanying illustration were used, it would be found in a great number of cases that the electric truck far excels either gasoline motor or horse-drawn vehicles in economy. This form contains parallel columns for all three types of vehicles. In each column may be itemized both investment cost and operating cost. The investment cost includes that for the truck or wagon, the cost of buildings, land and equipment. The cost of operation includes respectively the feed or rental and the fuel or rental for the horse-drawn and gasoline trucks, as well as the energy cost for the electric truck. In the same class are the costs for lubrication, cleaning, etc. Repairs and upkeep expenses come next, and then come interest on investment, depreciation, insurance, taxes, license and miscellaneous charges, including salaries. The total is then reduced to a ten-year basis for comparison.



First Figure Your Investment in Delivery Equipment, Buildings, Land, etc.

Horse and Wagon | Gas Truck | Electric Truck

Next Figure Your Yearly Cost of Operation

Horse and Wagon | Gas Truck | Electric Truck

Ten Year Cost | Ten Year Cost | Ten Year Cost

ACCURATE ECONOMIC COMPARISONS OF ELECTRIC TRUCKS WITH OTHER VEHICLES MAY BE MADE ON THIS FORM

One item which shows a large difference is that of depreciation. For horses, this is figured at 20 per cent, allowing an average life of five years, although in New York City the average life is only four years. Depreciation of gasoline trucks is figured as 20 per cent to 33⅓ per cent. This is on the basis that the average life of gasoline trucks in city delivery is less than five years. In fact the average life of light-delivery cars is still less, as in some instances cars are "traded in" every two years. The depreciation on the electric trucks is given as 10 per cent, although it is probably safe to say this is not more than 7½ per cent.

It may be surprising to some users of delivery vehicles to know that when costs have been checked in such a manner as this electric trucks have shown a saving of some 20 or 35 per cent and more compared with horses and wagons and with gasoline trucks on short-haul and frequent-stop routes. In this field the electric vehicle is pre-eminent.

It is a fallacy to place too great a consideration on the comparison of the first cost of electric trucks with the first cost of other vehicles. The saving in operating expenses during a period of ten years or some such period will more than offset the higher price of the "electric." Moreover, the first cost of one electric truck cannot be compared with the first cost of one horse and wagon or one gasoline truck, because the electric truck will last so much longer that even the investment cost when prorated per year will be less for the electric truck. To convince the users of trucks of the economy of electric vehicles, many of the manufacturers are willing to make analyses of delivery cost at no expense to the user.

The form which is shown here as a good example has been prepared by the Ward Motor Vehicle Company.

Individual Induction-Motor Power Factor Correction Urged

THERE is little difficulty in correcting for power factor by the use of the static condenser at the individual motor, but the use of such equipment has been retarded commercially, said William C. L. Eglin, chief engineer Philadelphia Electric Company, in a recent address delivered before the New England Division of the N. E. L. A. No real manufacturing difficulty exists in making a condenser for induction-motor service which can be applied at each machine and in sizes suitable for this purpose.

Mr. Eglin's company had imported condensers from France for test purposes at a cost of about 45 cents per microfarad of capacity, or $50 to $55 for correcting a 5-hp. motor. Through the co-operative work of the N. E. L. A. and the manufacturers of electrical machinery in this country it is hoped that the building of static condensers may be standardized, and that they may be produced in compact sections which will permit adjustment to meet local conditions and quick replacement of units in case of trouble. With the load upon modern central stations doubling every five years, the time is at hand when it will not be possible to take on any more business at poor power factors unless corrective devices are added. The speaker favored the use of individual condensers and pointed out that through the improved power factor and reduction or elimination of penalties the consumer will save the price of the condenser in a year or two. In many cases the rate offers the customer 50 to 100 per cent return on the investment in corrective apparatus.

Boston, Mass. FIELD EDITOR ELECTRICAL WORLD.

Brush Setting on Interpole Machines

ALTHOUGH setting brushes on interpole machines is well understood and taken care of in plants making electrical machines, this work is often done improperly outside such plants, owing to lack of experience or failure to realize the importance of the matter to good operation. Proper brush setting on all interpole machines is far more important than on machines without interpoles for the reason that such machines are more sensitive to any brush shift. After the brushes are once properly set they should require no shifting for any variation in load or direction of rotation.

For proper setting the brush-holder studs must all be parallel with the shaft of the machine or commutator bars and equally spaced around the commutator. This is generally checked by the use of a strip of strong ribbon paper, about 1 in. wide, which is first passed around the commutator and marked to get the circumference, after which it is divided into the same number of parts as there are brush studs on the machine. It is then placed around the commutator again, starting with one set of brushes on one mark of the paper and seeing that all the other sets of brushes are in the same relative position to the markings on the paper as the first set are. The brushes should then be carefully seated with fairly fine sandpaper so as to bring the entire wearing surface of every brush in contact with the commutator. For machines without interpoles the brushes are simply shifted over the bars that are connected to the conductors, which are midway between the poles of the machine before starting up and later adjusted for the best position under running operation. The rocker arm or brush holder is generally marked approximately by a pointer or by a red-paint mark. On interpole machines the rocker arm is marked generally with a cold chisel, giving a definite position, which is carefully determined by tests. There are several methods of finding the neutral, the best no doubt for a motor being that of reversing the machine. In this method the motor is reversed back and forth and the brushes are shifted until virtually the same current, voltage and r.p.m. readings are obtained in either direction at no load and at full load.

On generators that are to run in one direction only the "fiber-brush" method is very good. In this case one of the brushes is replaced by one made of fiber or wood like that shown in the accompanying drawing, having two small holes drilled parallel with the brush through which two small carbon pencils can be inserted. The holes must be so drilled that one pencil slightly leads the other as they are pressed against the commutator. Voltage readings are then taken between the pencils while the machine is running. The brushes are shifted until the meter shows the least deflection under no load and at full load. The voltmeter reading simply shows the difference of voltage between the heel and the toe of the brush, and this should be lowest in a certain brush position for both no load and full load. If not found so, it would indicate that the interpoles were not of the proper strength and require adjusting, which, however, should seldom be necessary except at the time the machine is built.

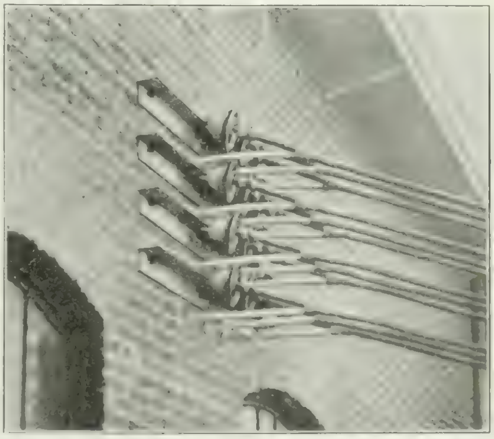
FIBER BRUSH FOR USE IN SETTING BRUSHES ON NEUTRAL POSITION

A simpler and easier method commonly used for locating the neutral is to connect a millivoltmeter across brushes of opposite polarity while the machine is standing still and note the kick of the voltmeter needle while throwing line voltage on and off the shunt field. When the kick is least brushes are set in neutral position.

East Orange, N. J. PHILIP G. BERNHOLZ.

Secure Dead-Ending for Heavy Cables at Building Entrance

AN EXAMPLE of a very strong method of dead-ending heavy cables at their entrance to a building is given in the accompanying illustrations. The cables are spliced to small suspension insulators which are bolted to ½-in. angle-iron pieces held against the brick wall by means of long bolts which pass through the walls and through corresponding angle-iron pieces on the other side of the wall. The cables are run through the wall in porcelain tubes.



STRONG DEAD-END SUPPORT FOR HEAVY CABLES

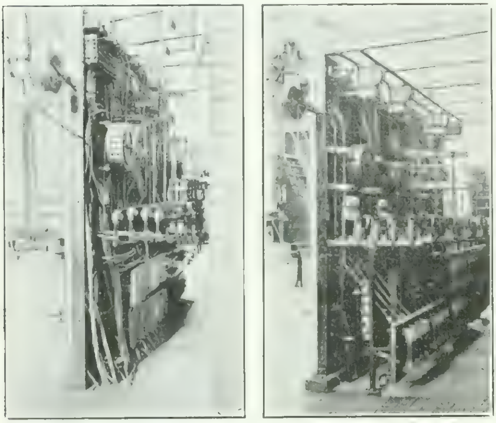
This substantial method of supporting the cables keeps them in place without any swinging and allows a very compact arrangement.

FIELD EDITOR ELECTRICAL WORLD.

New York, N. Y.

Troublesome Switchboard Gives Perfect Service After Remodeling

AN EXAMPLE of the bad and the good in switchboard wiring is shown in the accompanying illustrations of the 440-volt board which was remodeled in a Southern plant. Although this board had been installed less than four years, it had become the seat of repeated and expensive troubles by reason of short circuits and burn-outs due to confused wiring, small clearances and open fuses. It cost the owner about $1,000 to rebuild this board, as shown at the right, about four years ago. The expense has proved well worth while as there has been no trouble on the board since that time.


POORLY DESIGNED SWITCHBOARD AND HOW IT WAS REMODELED

In making the change the switchboard itself was first moved further from the wall, clearances between conductors were increased, every superfluous wire was eliminated, and inclosed fuses were substituted for the open fuses. Small control wiring was run neatly along the surface of the board, to which it was fastened by cleats. The potential transformers were removed from their position against the top of the board and were hung from iron straps supported by the new pipes which were run from the wall to the board. Instead of a mass of open wires along the top of the board, the circuits from these potential transformers were run in conduit at one side of the transformers. The buses were originally supported on long studs which passed through the board, and they were placed too close together. For the new bus supports iron-pipe upright pieces and cross-pieces were fastened securely to the floor and the switchboard. On these pieces were clamped busbar insulators with a sufficient space between.

For the leads from the buses to the posts of the switches copper straps were employed in place of the more flexible insulated wire which was originally installed.

The fuses were mounted on slate panels, which were attached to the upright pipes back of the boards. The leads from below were brought up through the floor in conduit which extended as high as possible. Where it was necessary to run them open behind the board, they were run in straight lines and supported at intervals with porcelain cleats. Wherever it was possible, wires running parallel and close to each other were wrapped with cord and taped on the outside, thus making a neat and safe job.

This change-over was accomplished without interrupting the daily service of the plant by Huntington & Guerry, Inc., Greenville, S. C.

Field Editor Electrical World.

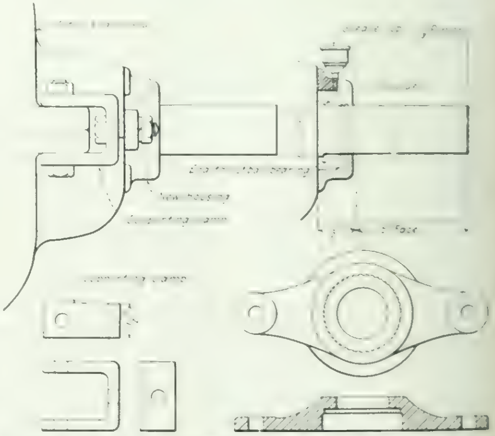
New York, N. Y.

Adapting Standard Motors for Operation When Tipped 20 Deg.

IN A RECENT installation of motors it was found that it would be very desirable to operate them when tipped at an angle of about 20 deg. from the horizontal. As the motors had the standard ring-oiling bearings, it was impracticable to operate them as they were, because the rings would not rotate, the oil would leak out and there was no provision for taking the end thrust now to be put on the bearings. Exchanging the motors for such as were designed for this sort of service was found to be extremely costly in time as well as money, so that some other expedient had to be found.

As shown in the accompanying sketch, the motor shafts had a light shoulder where they entered the bearings. For this reason a ball thrust bearing could be held up against this shoulder by means of a cast-steel housing. This simple housing, its bearing and the clamp for attaching to the motor frame were so designed as to require no machine work on the motors but just bolting on through bolt holes already in place. Spring compression grease cups were provided to keep the housing full, thus preventing the entrance of dust. When made up this appliance was so small that it was entirely hidden behind the motor pinion.

The ring oilers with their sleeves were removed from the bearings and new liners put in their stead. These had larger, wider openings for allowing the waste with which the bearings were now packed to come into contact with the shafts. These motors now operate with entire satisfaction under the new conditions.



HOUSING FOR BALL BEARING BOLTED TO MOTOR FOR OPERATION WHEN TIPPED FROM LEVEL POSITION

Chicago, Ill. Thomas Naf.

Management and Policy

Embracing Central Station Commercial Organization and Management,
Customer and Trade Relationships, Public and Financial Policies, Advertising,
Selling and Service Methods

Some Utility Duties and Opportunities

A Suggestion from a Recent Address
by William C. Lounsbury, President of
the Great Lakes Section, N. E. L. A.

IN THE great advertising campaign for popular good will toward central-station companies which the leading manufacturers have been carrying on we find an excellent example of co-operation. "Co-operate with Your Public Utility—Help It to Help You," is a typical heading to much valuable advertising our industry has received from the manufacturers. It is a straightforward attempt on their part to help us. Have we as local central stations done as much for the small contractor as the manufacturer and large contractor have done for us? The man who is selling washing machines, vacuum cleaners, motors and the like is just as surely working for our business as he is for his own, for every appliance sold adds potentially just so much to the central-station output.

W. C. LOUNSBURY

A very determined effort is now being made to present public utility problems fairly, frankly and honestly before the people. We are very actively engaged in this work. In the program of information for the public, however, it has become very clear to its leaders that the utility managers themselves need quite as much education as does the public. That the manager is learning his lesson is shown in many ways and places by the changed attitude of the utility official toward the public. He is becoming convinced that his is indeed a public business and that it is the public which he must serve.

But when we talk about the education of the public do we really have a true conception of those who compose the public? Are we not too prone to think that the very few men and women with whom we personally come in contact and whose views we hear constitute the public? This is quite as foolish as thinking that the few hundred or thousand words which constitute our vocabulary and which we have at our command make up the dictionary. None of us gets close enough to the mass. We are too much influenced by the few individuals with whom we are in personal contact.

I conceive of the public as a great complex organism always changing, swaying, yet strangely enough acting as a highly intelligent unit according to the knowledge which it has or believes it has at the moment. Are we too frequently misled by those who profess to speak for the public? The public utility is comparatively new. The public senses a potential danger in such an organization. We have allowed the irresponsible politician to play upon this intangible fear of the utility. Let us inform and educate the public, but let us make sure that we are honest about it and attempt to reach all of the people and not only those who may be interested in our securities or just those who are reading our leading magazines.

After all, the place to reach ultimately the great mass of people is through the public school. Here we find together children from families representing every shade of political opinion and religious belief. Could not the central-station company arrange to have the children in the schools become more familiar with our business through their courses of study? I feel very certain that it would be a good thing for the children if simple electrical problems were taught them and they learned the nature of our business and those truths which we are now trying to get to the readers of the national magazines.

Interesting the Employees as the Front Rank of the People

ONE of the secrets of the success which has been attained in the selling of securities to customers of the Central Maine Power Company has been the fact that the company has kept continually "selling" itself to its own employees. An interesting illustration is seen in recent issues of the company's weekly house organ, the *Exciter*, in which the course of the construction of a new dam and hydro-electric plant at Skowhegan has been pictured, and described. The building of this new capacity has supplied a running human-interest story that has steadily engaged the attention of the entire personnel of the company, although many are not directly affected in any way and may never see the dam itself.

The body of employees, however, is after all the first rank of the people and the contact point with the community. Their interest is translated into public interest by telling them this story of the progress of the work and the engineering problems involved.

Employees have thus been able to talk intelligently about what the company is doing to improve and extend its service, and their enthusiasm is passed along. The Central Maine Power Company financed the Skowhegan dam chiefly through the sale by employees of its preferred stock. By showing the progress of the work employees have had concrete evidence of what their stock sales have meant to the company in making possible a new power plant, and their activity in pushing more sales for further construction has been greatly stimulated.

Arkansas Newspaper Cites Utility's Preparedness in Strike Warning

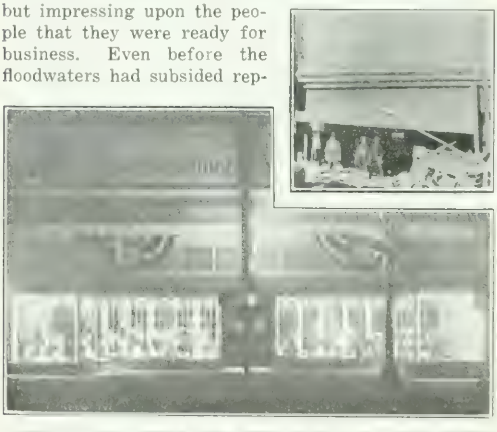
THIS editorial expression from the Helena (Ark.) *World* is an unusually interesting example of the value of newspaper appreciation. In the course of an editorial on the railway strike under the title "How Many Are Prepared?" the paper says:

> There is one important institution in Helena which can operate for sixty days whether there is or isn't a general railroad strike, and the very existence of this institution depends upon its ability to get coal and plenty of it. This is the Helena Gas & Electric Company, whose manager told us yesterday that ample provision had been made for contingencies. Weeks ago orders had been placed for large shipments of coal. There were already about two average trainloads of coal in the company bins. Now the railroad strike can go right ahead without interfering in the least with the city's gas and electric service.
>
> We wonder how many other business and industrial institutions have read between the lines and prepared for eventualities as Mr. Wharton has done for the gas and electric company.

The benefits which come of good relations with the press and people bring help at times most unexpected. In this case J. S. M. Wharton, general manager of the Helena Gas & Electric Company, by his good administration of his company's affairs has won the sympathy and understanding of the newspapers, and when the threatened railway strike became the general topic of discussion the editor gladly used the preparedness of the utility as a text for a sermon to other local industries.

Pueblo Disaster Has Resulted in Much Electrical Activity

ELECTRIC light has played a most conspicuous part in the resurrection of the city of Pueblo after the severe flood disaster in Colorado a few months ago. Large numbers of stores and business buildings were almost wrecked in so far as stock and equipment were concerned, and the merchants faced the necessity of not only setting things to rights but impressing upon the people that they were ready for business. Even before the floodwaters had subsided representatives of the Arkansas Valley Railway, Light & Power Company of Pueblo visited the merchants whose stores and electrical equipment had been damaged, ready to help in every possible way. This offer was gladly accepted, and as a result of the company's endeavors, Pueblo has been reborn electrically. The two pictures here show a men's furnishing store immediately after the flood and its complete recovery a few months later equipped with the latest type of window lighting.



VIEWS OF PUEBLO STORE JUST AFTER FLOOD AND A FEW MONTHS LATER WITH IMPROVED ILLUMINATION

"The merchants generally," says W. F. Raber, general manager of the company, "responded to our suggestions for better illumination and electric advertising. The interior, exterior, window and sign lighting is now much better than it was previous to the flood. Decorative lighting has been greatly improved and by the end of this month (October) we shall have reconnected, with an increase in connected load, virtually all customers that we had prior to the flood."

In other words, the central-station company in times of disaster is in a position to render a vital service in helping its afflicted customers to get back on their feet, and in the process it inevitably sets up a new standard of electric lighting and equipment that makes old installations look poorly in comparison. The result is new and unexpected opportunity both for the business men and for the utilty.

What Other Companies Are Doing—

Youngstown, Ohio.—The Pennsylvania-Ohio Power & Light Company is offering its 8 per cent preferred stock to customers and reports that employees have already subscribed for $196,000 of the issue. G. T. Seeley, vice-president and general manager, states that the proceeds will be used to make extensions and improvements, and he is of the opinion that there is a sufficient supply of local money to assure the placing of the entire issue at home.

Missouri.—Central station companies are very much interested in a potential market for rural electric service in this state. According to the preliminary statement of the Missouri Co-operative Crop Reporting Service at Jefferson City 20,523 farms have a general lighting system of some sort. There is a total of 8,006 isolated electric lighting plants installed on different farms, only 3,133 farms obtain service from central station companies and 9,384 farms are equipped with acetylene lighting plants.

Montreal, Que.—The Electric Service Corporation, distributer of power in and around Montreal, is actively engaged in popularizing the use of electric appliances. The company has inaugurated a plan of holding exhibitions in different towns, one of which was recently staged at St. Tite, Que., which lasted a week. A number of irons, electric stoves, washing machines and other appliances were sold. It is the intention of the company to have special motor trucks for the transportation of this material from town to town and village to village, where exhibitions will be given.

Elmira, N. Y.—For the first six months of 1921 the electrical merchandising sales of the Elmira Water, Light & Railroad Company totaled $30,085 and for the first six months of 1920 they were $12,644, showing an increase this year of $17,441. This increased business is attributed by M. F. Houston, sales engineer of the company, to an intensive sales effort on the part of the commercial department backed up by an increased amount of advertising. During January of this year the company, in co-operation with local contractors, jobbers and dealers, conducted an electrical show, from which good results were obtained at the time and the beneficial effect is still felt in the territory.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
of the World

Generators, Motors and Transformers

Determination of the Coil-End Reactance of Turbo-Generators.—R. Pohl.—The reactance of the stator winding of a turbo-generator is almost the only factor which determines the magnitude of the impulse amplitude of the short-circuit current. The largest part of this reactance is found to be in the coil ends, and it is difficult, if at all possible, to calculate it or even to measure it by actual test. The author shows a novel method of attacking this problem. It is easily possible to measure accurately the reactance voltage of the generator when its armature is removed and to determine the amount of increased teeth leakage over that of the complete machine. Dr. Pohl derives simple relations between the teeth leakage and the corresponding emfs. of two pole generators without armatures and proves the exactness of these relations by a number of actual measurements. He deducts further the core reactance and isolates thereby the desired coil-end reactance. If this method is carried out first with all three phases, then with two and finally with one phase, it is possible to find the mutual inductance between the coil ends.—*Elektrotechnische Zeitschrift*, Sept. 22, 1921.

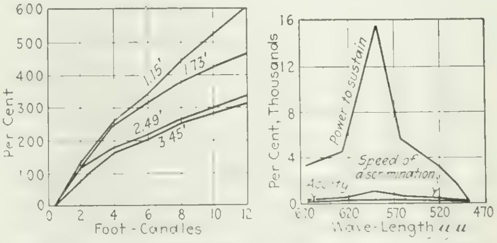
Generation, Transmission and Distribution

Swiss 135-Kv. Outdoor Switching Station.—At Gösgen, Switzerland, there is an important point for several intersecting trunk lines of the 135-kv. and 50-kv. lines of the network of the Schweizer Kraftübertragungs company. After long deliberation between the advantages and disadvantages of an open-air as against a housed-in switching station the Swiss authorities decided upon the former and erected what is believed to be the first Swiss high-voltage outdoor switching station, built after American models. It is said that the cost of this station amounts to only about 4 francs per cubic meter as against 25 francs to 30 francs for an indoor station. At the same time an indoor station would have required 20 per cent more floor space. Of the total cost of the station 25 per cent was building cost, whereas for an inclosed station the cost of building would have been from 50 to 60 per cent of the total cost. To test the merits of different makes of switches three types have been installed, General Electric, Brown-Boveri and Sprecher & Schuch. With the exception of open air-core choke coils, no protective apparatus has been installed, but great stress is laid upon the inherent safety of the design of the apparatus itself. Eight-unit chain insulators are used throughout, and 1-in. (2.5-cm.) steel piping forms the busbars.—*Bulletin de l'Association Suisse des Electriciens*, September, 1921.

Tidal Power and Long-Distance Transmission.—P. F. Wall.—This paper describes the use of alternating-current generators driven directly from turbines operated under a varying head such as results in a tidal-water power system. The frequency of the alternating current and the length of the transmission line are so related that as the speed of the turbines increases the frequency will increase correspondingly, and at the same time, if the excitation is constant, the generated voltage will increase correspondingly. The system is such that with constant current at the receiving end of the line, notwithstanding the rise of generator voltage as the speed rises, the voltage at the receiving end will remain constant.—London *Electrician*, Sept. 30, 1921.

Lamps and Lighting

Effect of Intensity and Composition of Light on Ocular Relations.—C. E. Ferree and Gertrude Rand.—This paper describes the effect of angle of vision, intensity and composition of light upon visual acuity, speed of discrimination and the power to sustain acuity. Results of observers for various visual angles are plotted. As might be expected, the speed of discrimination increased with increasing candlepower. The functions most affected by the change of wave lengths as shown from the accompanying curve are, first, the power to sustain acuity; next in order, speed of discrimination, and, last, acuity. So far as has been determined, this order of ranking holds for whatever affects the powers of the eye. From the standpoint of testing, therefore, the power to sustain acuity affords the most sensitive basis for detecting small disturbances in the eye. The speed of discrimination, however, is a very sensitive test and more feasible for general laboratory purposes than tests on power to sustain.—Paper presented before Illuminating Engineering Society, Sept. 26, 1921.



CHANGE OF OCULAR PERFORMANCE WITH CHANGING INTENSITY AND WAVE LENGTH OF LIGHT

Left—Percentage gain in speed of discrimination plotted against foot-candles for various visual angles. Right—Percentage change of functions with varying wave length. The value for blue is the base on which changes are calculated.

Traction

Operating Results on the Electrified Riksgränsen Road.—E. Wist.—The author reviews the results obtained during the six years of operation of the 250-km. Riksgränsen road in Sweden (15,000 volts, single-phase, 15 cycles). There are twenty locomotives of the "1C + C1," "2B2" and "B + B" types in use, and twenty-five new engines are on order. During the year 1920 the average distance traveled by each locomotive was 33,000 km. Under favorable climatic conditions each locomotive covers 520 km. daily for six consecutive days. The commutators must be trued up (turned) every 50,000 km. After every 25,000 km. the bearings of the coupling rods must be relined and motor and jack-shaft bearings be refitted. After 50,000 km. all bearings are relined and compressors, blowers and contactors are repaired. After 100,000 km. the tires are turned off. Each locomotive is inspected every week, the task taking one day. The great overhaul after each 100,000 km. takes usually four weeks. The engines use 39 kg. of lubricant for every 1,000 km. The output of the electric locomotives proved to be considerably higher than expected, and to increase the output of the road it was not necessary to build a second track, as would have been the case if steam traction had been maintained.—*Elektrotechnik und Maschinenbau,* Sept. 25, 1921.

Installations, Systems and Appliances

Portable Vacuum Thermopile.—W. W. COBLENTZ.—A description is given of a vacuum thermopile container rendered portable by attaching the calcium evacuator permanently to the receptacle. Directions are given for operating the device. The paper also gives some observations extending over a period of about seven years on the behavior of vacuum thermopiles in which the vacuum is maintained by means of calcium.—*Bureau of Standards Bulletin No. 413.*

Reversible Electric Valve Tube.—H. GREINACHER.—For some purposes where one-way electric valve tubes are used it would be desirable to reverse their valve action without any change in the electric connections. This has been made possible by a new valve tube designed by the author and manufactured by E. Gundelach. The tube consists of a spherical glass bulb with two cylindrical ends, containing each a short leading-in wire. Between the two cylindrical ends an aluminum tube, insulated from the two electrodes, is stretched. Within this metal tube is a small aluminum ball. If this apparatus is tilted to the left side, the ball rolls down to the left and makes contact between the left leading-in wire and the tube, so that in this position the left electrode is large and cylindrical and the right electrode just a short piece of wire, resulting in a certain valve action. A slight tilt in the opposite direction makes the ball roll over to the other side, when the characteristic and valve action of the tube will be reversed. A clever little device.—*Elektrotechnische Zeitschrift,* Sept. 15, 1921.

Electrochemistry and Batteries

Recent Developments in Electric Furnaces of the Muffled Arc Type.—H. A. WINNE.—A description of muffled-arc melting furnaces. Smaller units of 1,500 lb. and less per hour capacity are described in comparison with the larger rectangular shell-type furnace. The advantages of muffle-arc furnaces are that little space for heating elements is required, metal losses by volatilization are reduced, a neutral or reducing atmosphere is maintained and load fluctuations are small. They are adaptable to intermittent operation. Other features are accessibility of hearth, low electrode consumption and small expense of refractories.—Paper presented before the American Electrochemical Society, Sept. 30, 1921.

The Electric Furnace Melting of Nickel Silver.—F. C. THOMPSON.—The author presents the advantages of the externally heated electric furnace for nickel-silver melting, in so far as (a) loss of zinc is reduced to less than 1 per cent, (b) occlusion of gases is minimized, and (c) a tougher alloy results owing to less carburization.—Paper presented before the American Electrochemical Society, Sept. 30, 1921.

Units, Measurements and Instruments

Measuring of High-Frequency Losses of Glass and Other Dielectrics.—E. SCHOTT.—Germany lacked mica during the war and was forced to find a suitable substitute, for which glass was recommended in first place. A method had to be devised to measure reliably the dielectric constants of glass under high frequency. If the dielectric of a condenser is a perfect insulator, its capacity causes a current leading the charging voltage at 90 deg. Any imperfectly insulating dielectric will cause a phase displacement of less than 90 deg. (90 minus δ, δ being called the loss angle). It was necessary to find a very delicate measuring method, as the angle δ is very small for good dielectrics, sometimes only fractions of one minute. The method used consisted of a sending circuit (1) generating the desired frequency, a measuring circuit (2) loosely coupled with the sender, and an indicating circuit (3). Circuit 2 contained a fine variometer, a variable resistor and the tested condenser. When these three circuits were brought into resonance, the instrument in circuit 3 gave a certain deflection, and by substituting a standard air condenser for the tested condenser in circuit 2 and varying the resistance until the same deflection was obtained in circuit 3 sufficient data were obtained to determine the characteristics of the tested condenser. The detailed article gives an account of the many difficulties which had to be overcome to carry out this apparently simple method, and tabulations of results obtained on different kinds of glass, quartz and artificial amber are given.—*Jahrbuch der Drahtlosen Telegraphie und Telephonie,* August, 1921.

Telegraphy, Telephony and Signals

Transatlantic Radio Station at Eilvese.—F. LINKE.—Before describing the actual equipment of the Eilvese station, which operates with Goldschmidt generators, the author gives an excellent account of the development, the theory and the constructive details of the Goldschmidt medium-frequency generators, manufactured by the C. Lorenz Company in Berlin. The power supply for this radio station is taken from the Weser power station as three-phase, 15,000-volt current, and is transformed to 5,000 volts before it is rectified in a 600-hp. motor-generator set consisting of one alternating-current motor and two direct-current dynamos, one for 220 volts, the other for 440 volts. The 440-volt generator feeds the high-frequency machines. To be assured of continuity of service there are also installed five Diesel oil engines of 200 hp. each. For the regular telegraph service 400 hp. to 600 hp. is needed. There are two antennas, one of the so-called umbrella type for waves of 7,000 m. to 12,000 m. length and a ring type for longer waves. These two antennas are well insulated from each other electrically. The main tower is 250 m. high and the six smaller towers are 112 m. high. Six weights of 1,500 kg. each keep the wire network under proper tension mechanically. The receiving station is at Hager, 5 km. from Eilvese, and is connected to two 5-km. straight-line antennas, laid out and built like a double high-tension line on poles with disk-type insulators, with two wires 10 m. above ground and two wires 20 m. above ground, both lines on the same poles, one above the other. The corresponding Goldschmidt station in America is at Tuckerton, N. J.—*Zeitschrift des Vereines Deutscher Ingenieure,* Aug. 20, 1921.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

Florida Storm Does Slight Damage to Lighting Companies

ALTHOUGH exact estimates are not available from scores of small plants throughout the state, damage aggregating probably $300,000 was done to electric systems within the storm area of Florida last week. From Dunnellon and Ocala on the north to Fort Myers on the south, and from west coast to east coast, there were lighting and telephone and telegraph poles down—on every hand along the west coast, with fewer comparatively as the state was crossed. Damage was also lighter north of Dade City and south of Arcadia.

The loss to the Tampa Electric Company will run close to $200,000, incurred principally through the washing out of nearly 5 miles of track with brick pavement along the bay shore drive to Ballast Point. Scores of poles were snapped off throughout the city and hundreds shoved over. Remarkably rapid work by linemen permitted resumption of service down town the night after the storm, and within ninety-six hours the entire system, stretching 15 miles north and south and 11 east and west, was getting service. Street cars were running within fifty hours on all except the wrecked Ballast Point line.

Damage to the St. Petersburg municipal lighting plant will not be more than $25,000, according to C. E. Ludwig, director of utilities. This includes the loss of close to a half mile of track and trolley when the bayfront pier was washed away. Other damage throughout the section was confined almost solely to snapped poles and twisted wires.

Attempt in Illinois to Justify Ground-Return Telephone Circuits

ANOTHER case of national importance involving the use of ground-return telephone lines as a permissible standard for rural telephone service came before the Illinois Commerce Commission in Chicago Wednesday and Thursday of last week. The Lena Electric Light & Power Company and some other companies connected with it through transmission lines, together with a number of small rural telephone companies, were cited to appear before the commission in an investigation of inductive interference. At previous hearings the telephone companies through witnesses set up the contention that the ground-return line was modern and standard practice for the serving of rural consumers and that the paralleling power companies must assume the burden of metallizing the telephone circuits to correct interference troubles.

At the hearing which took place last week expert testimony was introduced to show that the ground-return circuits were not proper practice and also to show that the physical condition of the existing ground-return circuits is very poor. The voltage of the transmission circuits of the Lena company is 33 kv. The properties which are involved are all in the northwestern part of Illinois.

Muscle Shoals Development in Statu Quo

IF THE Secretary of War saw anything during his personal visit to Muscle Shoals which will influence him in the consideration of Henry Ford's offer, he is not talking about it. His comment on his impressions was avowedly meager so that he might be left freer to negotiate with Mr. Ford. Secretary Weeks said on Oct. 31 that he was inviting Mr. Ford to come to Washington, but no date was suggested in the Secretary's letter to the Detroit capitalist. Some are of the opinion that before Secretary Weeks and Mr. Ford can get down to actual bargaining another conference between the latter's engineers and the engineers of the army will be necessary.

In connection with the proposal that the government's steam plant at Muscle Shoals be leased to help the Southeastern power companies tide over their shortage of power, Secretary Weeks said that it would be difficult to make such an arrangement in view of the negotiations that are pending. He expressed the opinion that the Wilson Dam could be completed for $22,000,000.

Statement of Controversy Between Coast and National Contractor-Dealers

THE National Association of Electrical Contractors and Dealers has issued a statement covering the details of its controversy with the electrical contractors and dealers represented by the California State Association of Electrical Contractors and Dealers, the Oregon Association of Electrical Contractors and Dealers and the Washington Association of Contractors and Dealers. These three state organizations have recently announced their secession from the national body.

The national association states that the basis of the difference rests on three clauses of the national constitution and bylaws which stipulate that "the state associations affiliated with the national shall adopt the form of constitution and bylaws prescribed by the national association; that all members of such affiliated state associations must affiliate with the national association, and that the dues of the members shall be payable semi-annually in advance." These rules were automatically accepted in behalf of the state memberships by the California, Oregon and Washington groups when they joined the national body. California had ninety-two members, Oregon thirty-nine and Washington thirty. These members paid an average of $9.12 per member for the year, as compared with $12, the average for the country.

Differences of opinion having arisen on the subject of the payment of dues quarterly through the California state secretary instead of semi-annually direct from members as the bylaws proscribe, a representative of the national association visited the state headquarters and there learned, according to the statement, that the actual membership of the California association numbered three hundred paying $60 a year dues, of whom but ninety-two had been enrolled as members of the national association. A conference between representatives of the three coast bodies and the national association followed, in which the coast group applied for reduced membership dues and for an allowance from the national treasury to cover the expenses of representatives of the three Pacific groups in attending a Pacific Coast conference twice a year and the expenses of a Pacific Coast national committeeman in attending a national executive committee meeting once a year, the appropriation not to exceed $1,600. The national association agreed to pay this amount if the other matters in dispute were adjusted in accordance with the national constitution. These stipulations were not accepted, and the Coast groups then suggested that they should receive a flat appropriation of $800 out of their dues, then aggregating $1,300 a year, and not look to the national association for any traveling expense. The national association held to its former proposition, offering $1,600, but refused to reduce its dues in favor of any one section of the country and required that the terms of the constitution be adhered to. The formal secession of the three state groups followed.

Local Security Ownership Indorsed by West Virginia Utilities

ASSERTING that the chief trouble with public utilities in West Virginia is that most of them are owned by outside companies, George R. C. Wiles, chairman of the State Public Service Commission, made a plea before the annual convention of the Public Utilities Association of West Virginia, held on Oct. 20-21 in Charleston, for the ownership of bonds within the community served. A. H. Grimsley, general manager of the Virginia-Western Power Company, Clifton Forge, Va., explained the methods used to achieve this end in his territory, and C. P. Billings of the Wheeling Traction Company expressed his faith in the movement.

J. S. Jenks, vice-president of the West Penn Power Company, Pittsburgh, outlined the progress of the electric industry in the last twenty years and predicted that it would become the greatest of all industries. He thought that with the wider use of electricity there would come a slight recession in its price, after which the price would tend to become stable.

Governor Morgan, who was formerly chairman of the Public Service Commission, in speaking at the annual banquet, expressed the commission's point of view and Fred M. Staunton spoke for the utilities. In an address on "The Pressing Problems of Public Utilities," James P. Barnes, president of the Louisville Railway Company, declared that clean publicity is for the corporation what clean living is for the individual.

The men already in office were re-elected as follows: President, Herbert Markle, general manager Appalachian Power Company, Bluefield; first vice-president, C. P. Billings, general manager Wheeling Traction Company; second vice-president, Mentor Hetzer, Moundsville Water Company; third vice-president, E. T. Alexander, general manager Dunbar Traction Company, Charleston; secretary, A. Bliss McCram, Charleston.

Future Electrification Discussed Before Mining Congress

THE future electrifications of the mining industry can be classified into three groups, according to a paper presented by Graham Bright of Pittsburgh recently before the American Mining Congress at Chicago. These groups are, first, the displacement of manual labor; second, the supplanting of present steam drive by electric power; third, the development of new metallurgical processes. Electric power will replace manual labor more and more as the supply of cheap labor continues to decrease and as the laboring man develops an objection to monotonous occupation—an objection always incident to an improvement in the standard of living.

Mr. Bright pointed out that a great opportunity for the lowering of metallurgical costs lies in the commercial development of processes using electric power directly for the production of thermal effects and for electrolytic action. Great strides are being made in direct precipitation of pure metal from liquors produced by the direct leaching of mine ores, as in the production of copper at the plant of the New Cornelia Copper Company at Ajo, Ariz.

Ways to Reduce Power Costs

Mr. Bright also instanced three ways in which a mine operator could reduce his cost per ton mined by the proper utilization of electric power. The first is the proper selection of apparatus to do the work, thereby reducing the power consumption per unit of work accomplished, eliminating interruptions in operations and decreasing the item of labor required for carrying on the process and for the maintenance of the equipment.

Synchronous motors about mines offer a fruitful field for reduction of costs because of better power-factor correction, thereby increasing the capacity of transformer stations, and also because power companies are willing to make concessions in this matter.

The second way of reducing cost lies in the proper scheduling of operations in order to use the power purchased or generated to best advantage. Frequently, Mr. Bright said, a great saving can be accomplished by the elimination of peak demands that might arise from the concentrated or simultaneous performance of operations which by proper scheduling could be arranged to succeed one another so that their power demands would not be coincident. An example of this scheduling would be the charging of storage batteries during the "off" shift.

The last way concerns the possibility of reducing the unit cost of power by a superpower system which would further stimulate the use of electricity because the power supply would be virtually free from interruption and continuity of service would be effectively perfect. The production of power could be cared for in efficient large units, and the wasteful small plant operating at poor load factor could be discarded. The very large diversity factor in the loading of such a system would permit operating all generating equipment and all trunk-line transmission buses at very high load factor with consequent economy.

Mr. Bright said that about 20 per cent of the energy generated in the Western States by public service corporations for the year 1920 was used by the mining industry.

Further Hearings to Be Held on Water-Power Accounting Regulations

A REQUEST for a further hearing on the accounting regulations has been made of the Federal Power Commission by the National Electric Light Association. The request will be granted. The date has not been set, but it will be arranged so that the hearing can be had before the end of November.

General Electric Lamp Patents Again Upheld

THE Just and Hanaman tungsten filament patent and the Langmuir gas-filled lamp patent have again been found valid and infringed, in a decision handed down last week by Circuit Court Judge Julius M. Mayer in the United States District Court for the Southern District of New York. This decision was rendered in a suit for infringement brought by the General Electric Company against Nicholas Fabian, F. Alexander and the Alpha Electric Laboratories, Inc., New York.

Both of these patents in previous litigation had been upheld by the same court and by the United States Circuit Court of Appeals.

Judge Mayer in his decision has tried to make this case final so far as tungsten lamp patent litigation is concerned and delivered his opinion in no uncertain terms, saying:

"The bulk of the record is quite disproportionate to the simplicity of all but one of the questions involved. This extensive record is due in part to the fact that the court felt that the widest opportunity should be given to put forward almost any conceivable fact, experiment or theory directed against validity or infringement, as the case might be, in order that litigation in any event, as to the validity of these patents, should some day come to an end, one way or the other. If, in view of prior litigations, it be ultimately held in this case that the claim of these patents are valid, it is difficult to imagine what new matter can later be brought forth.

"As to the Langmuir patent, there is not a shred of merit to the present attack on validity. The previous case was ably tried for the defense by experienced counsel who did not neglect anything of consequence.

"In no case has fuller opportunity been accorded to a defendant and has more time been allowed to make experiments and prepare defenses, and yet, notwithstanding the ingenuity and ability with which the Just and Hanaman American patent has been attacked, it remains where it was and where it should be—the embodiment of an impregnable invention of the highest order. The court having on other grounds dismissed the bill as to Fabian, plaintiff may have the usual decree with costs against the remaining defendants."

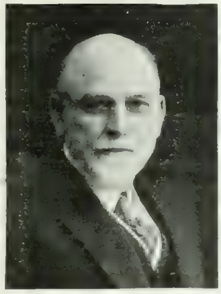
The defense was in validity and non-infringement of the Just and Hanaman patent and non-infringement of the Langmuir patent.

Numerous previous grants of patents were cited to show prior invention, but in no case was the court of the opinion that lamps made under these patents were either practical or by nature of their material worthy of consideration.

The main defense was on the use of a substance called thoria to prevent offsetting of the tungsten filament. This is used to the extent of one-half of 1 per cent by weight and the question arose, therefore, as to "substantially pure tungsten" in a "coherent" and "homogeneous" state. The court held that action of thoria was purely mechanical in strengthening the filaments and did make a composite metal chemically.

Intelligent Work the Cure for Depression, Says James H. McGraw

THAT only by intelligent, untiring work can this country lift itself out of the valley of depression was the message of James H. McGraw, president of the McGraw-Hill Company, last week at the annual convention, in Chicago, of the Associated Business Papers. Mr. McGraw took as his topic "What Business Papers Can Do to Speed the Revival of Business," and after reviewing the general economic situation abroad as well as in the United States he launched into his gospel of work.


JAMES H. McGRAW

"War," he said, "breeds extravagance. In spite of the noble ideals which inspired this nation to take up the great conflict across the seas, the inevitable result was the accumulation of innumerable wastes and habits of extravagance. We became wasteful of our time, our money, materials and even life itself. We could not help it, but we can and we must overcome the habits and tendencies which were developed throughout our entire social and industrial fabric by that terrible conflict. As a tangible example of what can be done, Herbert Hoover has focused the attention of industry upon the unnecessary wastes which are sapping the vitality and reducing the productivity of our nation.

"We are appalled when our attention is called to criminal wastes of life through accidents and negligence, the prodigal waste of our natural resources through underdevelopment or political chicanery, the prodigious waste of materials through mismanagement and inefficiency. But of all the wastes which affect our happiness and prosperity, the waste of time and human effort is the greatest and has the most damaging influence.

"If the business papers collectively and individually can instill into the minds of the thinking men of industry the gospel of intelligent work, we shall have performed a tremendous service.

"In brief, I bring to you as leaders of thought among thinking men that what this country needs more than anything else is to learn anew the gospel of work—intelligent work, untiring work, work in its most homely sense.

"We cannot talk ourselves into prosperity. We cannot argue ourselves into stability, but we can work ourselves out of the valley of depression and up to the heights of plenty. We can do these three things:

"First, everybody can get busy at his present task and make the most of it.

"Second, everybody can consider winning the peace in the same spirit as characterized the winning of the war.

"Third, the business papers, by article, editorial and personal service, can show that selfishness has now no more place than in war time, that interest in the welfare of all men, individually and as society, lies at the basis of prosperity.

"In conclusion, let me say that we must consecrate ourselves to giving a full measure of the best service we have within us. As a nation and as publishers we must quit our petty quarrels and arguments and devote ourselves to the tasks that lie before us. We had to fight and destroy to win the war. We shall have to work and build to win the peace. The first nation that gets hold of the idea that the only salvation comes from work will come out on top and really win the peace."

At the annual election Mr. McGraw was elected president of the association.

Tax Bill in Muddle Before Senate

THE United States Senate is still grappling with the tax bill and endeavoring to make some headway against the parliamentary tangle into which the measure has fallen. Added to the original House bill is the report of the Senate finance committee, and on top of that are numerous amendments which seem to grow with the passing days. Then there are the various agreements entered into by the "blocs," the most noteworthy of which is the agricultural bloc. Thus far the Senate has not passed on the corporation tax, which is one of the most important parts of the bill. The Senate finance committee would raise this tax 50 per cent above what it is at present.

An agreement was reached early this week on the capital-stock provision, Senator Lenroot's amendment providing a tax of $1 on every $1,000 up to $3,000,000 and $2 on every $1,000 in excess of $3,000,000 having been voted on favorably. The Lodge amendment to the capital-stock provision of the bill was also passed. This amendment exempts holding corporations from paying taxes on property on which taxes had been paid previously by subsidiary corporations of the holding companies.

Senator Smoot has introduced two amendments, one proposing a 1 per cent levy on all manufactured goods where sales exceed $6,000 a year, and another proposing a general turnover tax of one-half of 1 per cent where the sales exceed $6,000. The Senator from Utah had previously offered an amendment providing for a general manufacturer's sales tax of 3 per cent with certain exemptions, among them public utilities, this to be in lieu of all the miscellaneous taxes. His plan also provides for a 10 per cent tax on corporations in place of the 15 per cent tax suggested by the Senate finance committee.

Although the sentiment for a sales tax is growing in the Senate, it is strongly opposed by the agricultural bloc, and its passage by the House for that reason is problematical.

The Lodge amendment, if concurred in by the House, would give some relief to public utility holding companies. All public utilities as well as electric manufacturing companies also gain by the changes in the transportation tax. In the New York district alone this approximates 10 cents a ton on coal, not to mention other supplies and equipment. The utilities, of course, have only an academic interest in surtaxes, because few if any enjoy excess profits. They are, however, vitally interested in the application of these taxes to investors, because with their enforcement capital which should flow to public utilities from large holders of investment funds will be forced more and more into tax-exempt securities. The bill as it now stands in the Senate offers no relief in that respect.

Carolina Company Goes the Limit to Give Service

THE Carolina Power & Light Company at Raleigh, N. C., has begun operation of its steam plant and is now able to furnish power to all of its customers full time. For several weeks about seventy cotton mills and a number of other industrial plants which obtain their power from this company have been able to run only three days a week, the company being unable because of the drought to furnish power for full-time operation. The company had its auxiliary steam plant at Raleigh, but was unable to operate this because the city of Raleigh was also suffering a water shortage and sufficient water could not be obtained for boilers and condensers.

The company, however, decided to put the steam plant in operation and give service at almost any cost. Some wells were sunk, arrangements were made to ship water in tank cars from a creek a few miles away, and consent was obtained from the city to use the reservoir to some extent at night. These methods of keeping the steam plant in operation will be kept up so long as is necessary. Within the past week there have been some general rains over the watershed affected which have helped somewhat. By far the most important step, however, in remedying the situation is the linking up of the transmission lines of the Alabama Power Company with those of the Georgia Railway & Power Company and the exchange of energy through the latter company and the Southern Power Company, as reported in the ELECTRICAL WORLD for Oct. 25, page 890.

Boston Edison Rate Hearings to Be Resumed Dec. 5.

FURTHER developments in the Boston Edison rate case are anticipated Dec. 5, when the Massachusetts Department of Public Utilities will resume sittings at Boston upon the issues brought before it by the city and the company in various petitions previously referred to in the ELECTRICAL WORLD. During the last few weeks representatives of the city have been going over numerous books of the company in the preparation of their petition for reduced rates, but these studies have not yet been sufficiently completed to warrant the presentation of testimony before the board. All the principal classes of service are under consideration, including street and commercial lighting, power and many contracts with large industrial users.

At a hearing on Oct. 31 the company emphasized its desire to have the commission include in the consideration of the case the equity of rates in contracts made before the coal clause was adopted. The tendency of the commission in this inquiry has been to conduct it on very broad lines, but no decision has yet been announced as to its procedure in regard to considering these contracts at the same time with the other issues before the board.

Bankers Sound Note of Caution on Local Stock Selling

STOCK sold locally should represent actual investment and be in line with the market, H. M. Addinsell, chairman of the public service securities committee of the Investment Bankers' Association of America, told the association at its annual convention this week in New Orleans.

"It should be borne in mind," Mr. Addinsell stated in his report, "that in undertaking the sale of its own securities a company assumes certain duties and obligations toward the purchasers of those securities. The purchasers, it must be remembered, are mostly people of comparatively small means who are not accustomed to scrutinizing carefully or judging the merits of investment opportunities. To them the utility company has always seemed a financial pillar of strength. In many cases they have considered it, in spite of published figures to the contrary, a veritable gold mine to its owners. To them, the opportunity to buy this stock is an opportunity to share in profits that they have always considered absolutely certain. A careless or unscrupulous company might, in some cases, sell stock that had no real value behind it. This would be a most dangerous practice. Not only would such a company be running risk of losing the confidence and respect of its local public, but it would be getting back to the same old condition of inflated capitalization which proved so disastrous in the past. It is thus plain that stock which a company expects to market direct should be issued under the same conservative restrictions which would be demanded if the issue were to be made through investment bankers. It should represent actual investment in the property, and the price should be in line with the current quotations for securities of a similar class."

The report stated that the past year of general business depression has accentuated the inherent stability of public utility businesses as a class. It has witnessed a more and more universal adoption of the series-mortgage idea, introducing without disadvantage from the point of view of the investor a flexibility advantageous to the company in availing itself of its principal means of major or mortgage finance. The series mortgage makes available to the company its prime security with a face rate and a maturity to meet existing market conditions. The past year has also been marked, the report continued, by a more general adoption of the "no-par-value" stock plan, which introduces a similar flexibility with respect to the sale of junior securities.

Commission regulation, it was pointed out, is steadily becoming more firmly established as a permanent institution. The matter of the basis for valuation of public utilities was said to be unsatisfactory and is one that is being studied by a sub-committee and will be the subject of an interim report later on.

WATER POWER REGULATIONS

With respect to the development of water-power resources under the national water-power act the report states that the regulations now in effect have been under discussion by the leading men of the water-power industry and in many particulars are not yet satisfactory and workable, especially with reference to the accounting rules and the basis for determining when amortization of investment begins. The present regulations require that amortization of capital shall commence when the rate of return on the property has reached one and one-half times the weighted average true interest rate upon the company's indebtedness. A more logical basis, it is stated, would seem to be to have amortization start after earnings equal a certain reasonable and proper percentage of the value of the entire property.

"Many other problems," the report stated, "are constantly coming up for solution. With the readjustment of commodity prices has come a temporary lowering of costs of labor and essential materials, but it is as yet by no means certain that this is not a mere temporary condition so far as the utility business is concerned. It is, therefore, necessary to these utilities that they be allowed to maintain their present rates to cover previous losses in operation and to re-establish a credit for the carrying on of the large construction program which has been deferred for the past four years."

Digest of Proposed California Bill for State Power Control

STATE control and operation of electric power and water plants is, as has been reported before, proposed for California, and the plan will in all probability be placed before the voters of that state at the election in November, 1922. The bill as proposed creates a board of five, members of which are subject to recall. The term of office is four years.

The powers of the board, which are very broad, are:

(a) To acquire by purchase, lease, condemnation, gift or other legal means land, water, water rights, easements, electric energy and any other property necessary or convenient for the purposes of this article, and likewise to acquire and also to construct, complete and operate, works, dams, reservoirs, canals, pipe lines, conduits, power houses, transmission lines, structures, roads, railroads, machinery and equipment, and to do any and all things necessary or convenient for the conservation, development, storage and distribution of water and the generation, transmission and distribution of electric energy. No electric energy shall be purchased by the board at a price to exceed one-half of 1 cent per kilowatt-hour at the power plant, based upon a 50 per cent load factor, except for standby service as provided in Section 12 hereof;

(b) To purchase, acquire, produce, manufacture or otherwise provide facilities, materials and supplies, raw or finished, and any property or thing necessary or convenient to the accomplishment of the purposes of this article;

(c) To supply water or electric energy or both to the state, political subdivisions and other users, and, subject to the provisoins of this article, to prescribe the terms of contracts, and fix the price thereon and collect the same;

(d) To use the waters and the lands of the state, or any material therein or thereon, and to require the reservation from sale or other disposition of such lands and material as, in the opinion of the board, will be required for the purposes of this article;

(e) To require the reservation of water from appropriation for such periods as it may provide;

(f) In the name of the state to apply for and accept, under the provisions of the laws of the United States or of any state, grants, permits, licenses and privileges in the opinion of the board necessary for the accomplishment of the purposes of this article;

(g) To co-operate and contract with political subdivisions of this state, and, with the approval of the Governor, with the United States and other states, concerning the conservation and use of interstate and other waters and the generation and use of electric energy and the acquisition, construction, completion, maintenance and operation of works necessary or convenient for the accomplishment of the purposes of this article;

(h) To acquire or construct for political subdivisions distributing systems for water or electric energy bought from the state, upon terms that, in the opinion of the board, will repay to the state within twenty-five years the cost thereof with interest. The title to or interest of the state in such systems shall vest in the political subdivision when paid for;

(i) To sue and be sued, and to exercise in the name of the state the power of eminent domain for the purpose of acquiring any property, or the use or joint use of any property, deemed by the board necessary for the purposes of this article;

(j) To provide itself with suitable office and field facilities, and to appoint, define the duties and fix the compensation of such expert and technical officers, legal and clerical assistants and other employees as it may require, subject to such civil service regulations as the board may provide;

(k) To define projects and to adopt rules and regulations to govern its activities;

(l) To exercise all powers needful for the accomplishments of the purposes of this article and such additional powers as may be granted by the Legislature.

State bonds in amount not exceeding $500,000,000 may be issued in order to acquire property and rights and "for the acquisition, construction, development, completion, operation and maintenance of such projects, as the board may deem necessary or convenient. . . ."

The board, it is proposed, shall establish rates for the service furnished by each project sufficient to pay, within fifty years, its cost and operating expenses except for municipal systems where the time shall be twenty-five years.

If revenues are not sufficient to meet requirements, then the board may draw upon the general treasury of the state to meet any deficiencies. It is provided, however, that such loans by the state are to be returned as soon as the money is available. Six per cent interest is to be charged.

The bill gives to state and political subdivisions "a preferred right to water and electric energy controlled by the board as against privately owned public utilities." Furthermore "the board shall not supply water to a privately owned public utility for the production of electric energy and shall not supply directly or indirectly to privately owned public utilities which sell electric energy or water to the public more than 20 per cent of the total amount of electric energy or water under its control, and contracts therefore shall not extend over a longer period than five years, or be renewed before one year prior to their expiration."

The bill also assures political subdivisions that they may co-operate with each other in developing water power.

Governor Allen to Address Engineers on St. Lawrence Development

On Monday, Nov. 14, the New York Section, American Institute of Electrical Engineers, will join the metropolitan sections of the civil, mechanical and mining engineers in a discussion of the St. Lawrence River ship canal and power project at 8 p.m. at the Engineering Societies Building. The speakers will be Gov. Henry J. Allen of Kansas, who will represent the views of Middle West producers; Gov. W. L. Harding of Iowa; Dr. R. S. MacElwee of Georgetown University, who will speak on the economic features of the project, and H. I. Harriman of Boston, on the Eastern point of view.

The three hundred and seventy-second meeting of the Institute will be held at the same place on Thursday, Nov. 17, in joint session with the Society of Naval Architects and Marine Engineers. At 2 p.m. these two papers will be presented: "Electric Auxiliaries on Merchant Ships," by E. D. Dickinson, marine department, General Electric Company, and "Electric Propulsion," by W. E. Thau, commercial engineer for the Westinghouse Electric & Manufacturing Company. There will also be an evening session of the Institute at 8.15 o'clock, which members of the Society of Naval Architects and Marine Engineers and all others interested are invited to attend. This session will be devoted to a lecture on "World Communication," by Alfred N. Goldsmith, professor of electrical engineering, College of the City of New York.

October Financing at Much Lower Rates

Stocks and bonds amounting to $30,254,000 were offered investors by electric light and power public utilities during the month of October, a total representing a decrease of more than $10,000,000 under that of the previous month. The month of October showed a marked decline in the rate of return yielded the investor, 7.33 as compared with 7.6 for the month of August. The month's flotation is characterized by lower rates of interest and again by long-term investments, the periods running from five to fifty years. The largest single issue was $160 000 00 for the Philadelphia Company.

Name of Company	Amount of Issue	Period	Class of Security	Purpose of Issue	Rate of Interest	Per Cent Yield	Price
Ohio Public Service Co.	$5,100,000	25-yr.	First mortgage and refunding gold bonds, series A	Retirement of bonds	7½	7.75	97¼
San Joaquin Light & Power Co.	1,500,000	30-yr	Unifying and refunding mortgage bonds	Refund floating debt	7	7	100
Philadelphia Co.	16,000,000	25-yr	First refunding and collateral trust mortgage gold bonds, series A		6	7.15	87
Los Angeles Gas & Electric Corp.	1,500,000	9-yr	General and refunding mortgage gold bonds, series C	To provide for additions	7	7.12	98
New Jersey Power & Light Co.	361,000	15-yr	First mortgage bonds, series of 1916	Reimbursement for expenditures for additions and betterments	5	7.75	76 30
Seneca Power Co.	325,000	50-yr	General mortgage gold bonds		6		Par
Central Illinois Light Co.	1,053,000	30-yr	First and refunding mortgage gold bonds	Reimbursement for expenditures	7½	7.65	98¼
Savannah Electric & Power Co.	1,750,000	20-yr.	First and refunding mortgage bonds, series A	To retire balance of floating debt	7½	7.75	97½
Counties Gas & Electric Co.	1,080,000		Class A, cumulative preferred stock	To reduce floating debt	8		Par
Louisville Gas & Electric Co.	500,000	5-yr	First and refunding mortgage gold bonds of 1918		7	7.20	99¼
Rockland Light & Power Co. (New York)	500,000	5-yr.	Convertible gold bonds	To provide funds to pay outstanding obligations	7	8.25	94 96
Wisconsin-Minnesota Light & Power Co.	235 000	30-yr.	First and refunding mortgage gold bonds of 1914		5	5	100
Crookston Water Works Power & Light Co., (Minnesota)	200,000	15-yr	First mortgage gold bonds	To retire bonds	7½	7.50	100
New Bedford Gas & Edison Light Co.	150 000		Capital stock				
Total	$30,254,000						

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Mexican Hydro-Electric Plant May Be Extended.—The Canadian Power Company, which has spent $11,000,000 in constructing its dam and hydro-electric plant on the Conchas River at Boquillas, Mexico, is reported to be planning the extension of its system to a number of towns and mining plants in addition to those it already serves. The state and national governments are said to be contemplating a system of canals and ditches which would make possible the irrigation from the company's storage reservoir of 200,000 acres of arable land.

Oklahoma's Utilities to Pay Millions in Taxes.—Public service companies of Oklahoma will, it is estimated, pay taxes on a valuation of approximately $308,000,000 for 1921, the total valuation of these corporations having been increased at least $10,000,000 over last year. This is represented largely by improvements which have not only added millions to the taxable wealth of the state, but have brought about a great improvement in service to the public. It is estimated that the utility companies will pay $9,000,000 in ad valorem taxes to the state, county and municipal governments, to say nothing of what they will pay in gross production and federal income taxes.

Record in Restoring Service for Wrecked Substation.—The Barrington substation of the Public Service Company of Northern Illinois, serving nine towns, was destroyed and the station operator on duty lost his life when the substation was struck by lightning a few weeks ago. The lightning stroke was followed by an explosion that utterly wrecked the building. A record was made in restoring the service, the large crew that was quickly assembled having the new outdoor station in operation in thirty-five hours and thirty-five minutes after the accident occurred. The cause of the explosion has not been ascertained, though an investigation is being made to determine it.

Electioneering by Radio.—For the first time in the history of electioneering voters were able to listen to the speeches of candidates without leaving their homes when arrangements were made in Pittsburgh by the Westinghouse Electric & Manufacturing Company to send the speeches broadcast by radio in the recent contest for the mayoralty. Thousands of persons were addressed at one time without the inconvenience of leaving their own radio set. Each candidate for mayor was sent to the broadcasting station, where he was allowed five minutes to tell the reasons why he should be elected to the office. The novel method of electioneering excited a great deal of interest in Pittsburgh and neighboring towns.

Electricity in the Welsh Collieries.—A million pounds will, it is said, be expended by a Welsh company in extending the use of electricity to the mines under its control. A new power house at Bargoad, which represents the latest practice, is to be enlarged to permit the installation of generators rated at 30,000 kw., making it the largest private undertaking in the country. This station will supply energy to the company's pits in various sections and will substitute electrical for steam operation wherever possible.

Kansas City's New Lighting System.—Two thousand gas posts will be displaced when the new all-electric lighting system of Kansas City, Mo., is installed by the Kansas City Power & Light Company. Electric lamps of the pendent and cluster types will go, too, and a new system utilizing "Novalux" units will take their place. About 7,000 of these lamps have already been contracted for, and it is possible that as many more will be used before the system is pronounced complete. Gas, which has hitherto been employed to illuminate the residential districts, will be entirely discontinued for street-lighting purposes, and greatly improved designs of posts and globes will succeed the ones to be discarded. The improvements are expected to put Kansas City in the front rank of the big cities of the country, as regards night-time safety and brilliancy.

"Home Electrical" Opened in Northwest.—The first "home electrical" in the Northwest was opened in Astoria, Ore., Oct. 15, under the auspices of the Northwest Electrical Service League. The demonstration, which lasted for three days, was designed to show the practicability of equipping a home electrically throughout and the necessity of providing adequate convenience outlets. The house used, a bungalow, was completely furnished by Astoria merchants and the electrical equipment was supplied by Portland jobbers. The demonstration was arranged for by W. D. Moriarity, field man for the Northwest Electrical Service League, and conducted under his supervision. The attendance was very large, and the exhibition was thoroughly successful from every standpoint. It is planned to hold other demonstrations throughout the Northwest during the coming year.

Electric Cargo Ship on Maiden Trip Arrives in New York.—The San Benito, the largest foreign built electric drive cargo steamer to enter New York, arrived on her maiden voyage recently from Almeria, Spain. She reported a successful passage through hurricane weather which tested her efficiency and seaworthiness to the utmost. The ship is of 5,500 tons gross burden, 336 ft. long and has a beam of 45 ft. She is equipped with a Curtis turbine generator and a 3,000-hp. synchronous motor connected directly with the propeller. The motor is set far astern, thus eliminating the long shaft and shaft tunnel and giving additional cargo space. The San Benito was designed for a speed of 12 3-5 knots and on her first voyage made a minimum of 10 1-2 knots and a maximum of 15 1-10 knots. Officials said that despite the heavy weather the propellers did not spin when the stern left the water. This was said to be due to the action of a governing device on the electric drive.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

Electrical Manufacturers' Club.—The Electrical Manufacturers' Club will hold its annual meeting at Hot Springs, Va., on Wednesday to Saturday, Nov. 9-12.

Pacific Division, Electrical Supply Jobbers' Association.—The quarterly meeting of the Pacific Division of the Electrical Supply Jobbers' Association will meet at Del Monte, Cal., on Nov. 10, 11 and 12.

Milwaukee Section, A. I. E. E.—Prof. John R. Commons, professor of economics at the University of Wisconsin, addressed the Milwaukee Section of the Institute on Oct. 19 on the labor and employment situation.

A. I. and S. E. E. October Meetings.—Automatic substations were discussed before the Chicago Section of the Association of Iron and Steel Electrical Engineers on Oct. 31 by Charles H. Jones. On Oct. 24 the Pittsburgh Section discussed the papers presented at the annual convention.

American Physical Society.—The one hundred and eleventh regular meeting of the American Physical Society will be held in Chicago at the Ryerson Physical Laboratory on Saturday, Nov. 26. If the length of the session shall require it, there will also be sessions on Friday, Nov. 25.

Boston Section, A. I. E. E.—Dr. H. S. Osborne of the American Telephone & Telegraph Company spoke at the Oct. 28 meeting of this section on "Telephone Transmission Between Cuba and Catalina." The meetings and papers committee of the section has arranged a very interesting program for the winter. The dates are not yet definitely fixed, but the meetings will cover the St. Lawrence project, recent details upon radio communication, some of the recent developments in electrical drive for industrial plants and kindred subjects. Joint meetings with the other engineering societies are being arranged for, as was done last year.

Coming Meetings of Electrical and Other Technical Societies

A. I. and S. E. E., Philadelphia Section—Philadelphia, Nov. 5.
Electrical Manufacturers' Club — Hot Springs, Va., Nov. 9-12.
A. I. E. E., New York Section—Nov. 14.
N. E. L. A., Pacific Coast Section—Del Monte, Cal, Nov. 11.
Electric Power Club—Cleveland, Nov. 14-15.
A. I. E. E. and Society of Naval Architects and Marine Engineers—New York, Nov. 17.
American Physical Society—Chicago, Nov. 25-26.
Electrical Supply Jobbers' Association—Pacific Division—Del Monte, Cal., Nov. 10-12; Atlantic Division—Cleveland Nov. 30, Dec. 1-2.
American Institute of Chemical Engineers—Baltimore, Dec. 6-9.
American Physical Society—Toronto, Canada, Dec. 27-31.
American Association for the Advancement of Science—Toronto, Canada, Dec. 27-31.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies

Service Charge Is Not a Rental Charge for Meters.—That a service charge is not a rental charge for gas meters within the meaning of the statute prohibiting such a charge was the finding of the New York Supreme Court, Special Term, in an action recently brought by the Town of North Hempstead against the Public Service Corporation of Long Island.

Change of Municipal Rules Affecting Signs Not Valid as to Existing Signs Properly Erected.—A new municipal ordinance affecting the size and erection of electric signs has been declared by the Supreme Court of Oregon (City of Portland vs. Yates) to be invalid as regards previously existing signs safely installed in accordance with the former rules of the city, no question of public health, morals or welfare being involved. (199 Pac. 184.)*

Commission May Not Interfere with Alienation of Property of Public Service Corporation Not Essential to Its Duties.—The Supreme Court of Alabama has declared, in Alabama Public Service Commission vs. Louisville & Nashville Railroad Company, that the common-law rule that a quasi public corporation may not, in the absence of statutory warrant, make any contract by which its power to perform its public functions will be impaired never did prevent the alienation of such property as was not essential to the exercise of its duties, and hence the commission was not authorized to determine whether or not an alienation of such property was consistent with the interest of the public. (89 So. 524.)

Increase of Rates Without Full Hearing.—In decreeing that the New York Public Service Commission has power to authorize increased telephone rates where existing rates appear unreasonable, even though a full hearing and investigation have not been had, the New York Supreme Court said (New York vs. New York Telephone Company): "The Legislature has given the Public Service Commission the power not only to make orders fixing the maximum rates, but to abrogate such orders and to 'consent' to an increase of rates. It would be unreasonable to hold, without a clear expression by the Legislature, that when the commission is of the opinion that conditions have changed to an extent which renders the old rate unreasonable and perhaps unconstitutional, it must continue its old order in force and may not 'consent' to an increase of rates pending the time when it can, after a full hearing, make a new 'prophecy' as to what will constitute reasonable rates in the future." (189 N. Y. S. 701.)

Notice of Bonus to Employees Does Not Affect Right to Discharge.—A notice by an employer that salaried employees remaining with the company during the year would receive a bonus dos not, according to the decision of the California District Court of Appeals, in Russell vs. H. W. Johns-Manville Company of California, affect the employer's right to discharge an employee hired from month to month at any time before the expiration of the year, the bonus being a voluntary gratuity and not binding. (200 Pac. 668.)

Where Does "Delivery" of Electricity Take Place?—Where an electric light and power company was bound by its franchise to pay a percentage of its receipts on all electrical energy sold within the city limits, the city cannot, according to a decision of the Supreme Court of California in City of Oakland vs. Great Western Power Company, collect for energy delivered to a corporation outside the city limits, even if the makers are within the limits, since "delivery" takes place at the junction of the wires of the customer and of the wires of the selling company, and not at the meter. Nor does the fact that a customer outside the city limits redelivered electrical energy for use within the city limits authorize the city to collect a percentage on the energy so delivered. (200 Pac. 395.)

Control of Franchise Contract Rates.—In an action begun by the town of North Hempstead, N. Y., to enjoin the Public Service Corporation of Long Island from increasing rates charged for gas to private consumers over those fixed by consent, which had been granted subsequent to the enactment of the Public Service Commissions law, the Supreme Court of New York, Special Term, denied the plaintiff's motion to continue a peremptory injunction. Thereafter, the Appellate Division, Second Department, reversed the order of the Supreme Court, Special Term. The Court of Appeals has now reversed the Appellate Division and affirmed the order of the Special Term vacating the temporary injunction. The court holds that the consent given by the town is subject to the rights reserved to the company by the Public Service Commissions law to put into operation a new schedule on giving the prescribed notice. (132 N. E. 144.)

What Constitutes an Electric Light Company?—In Commonwealth vs. Pennsylvania Water & Power Company, the defendant, a hydro-electric company which had been formed by a consolidation of water-power companies, contended that it was not an electric light company. The state had endeavored to assess against it a gross income state tax on amounts received from the sale of electrical energy. Neither the defendant nor any of its constituent companies was chartered as an electric light company or engaged in electric lighting, but a part of the energy sold by it is ultimately used for that purpose. In 1916 taxes were assessed against the company upon its gross income from the sale of electrical energy on the theory that its business was that of an electric light company. The County Court found against this contention, and the finding has now been sustained by the Supreme Court of the state. (114 At. 489.)

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities

Clerk's Error Binding on Commission.—The North Dakota Board of Railroad Commissioners has held that a schedule of rates which owing to the oversight of a member of its clerical force was not placed before it within the legal period of thirty days from the time of filing became the legal schedule and cannot now be suspended in order to allow a hearing.

Interrelation of Good Service and Adequate Rates.—The principle that, although increased rates should not be granted to a company while its service is below minimum standard, just as soon as its service is improved an advance in rates should be accorded it in order that it may attract capital by assuring safety of investment and continuity of return was sanctioned by the North Carolina Corporation Commission in deciding an application for increased gas rates made by the Asheville Power & Light Company.

Cities Have Right to Appear Against Applications by Utilities.—The right of cities and villages in New York State to appear in opposition to applications made to the Public Service Commission by utility companies affecting municipal contracts has been affirmed by the commission. This right had been disputed on the ground that municipalities had no legal status. The commission held differently and said: "The theory of the whole thing is that a contract is a contract, and we are here to sustain the contract unless certain circumstances are made to appear to us to show that the contract should be for the time being done away with or suspended."

Coal Rider Retained as Precautionary Measure.—In refusing increased rates to the street-railway and electric departments of the Lynchburg Traction & Light Company while granting them to the gas department, the Virginia State Corporation Commission maintained that the water-power facilities of the city should rightly inure to the benefit of electrical customers. Concerning the retention of a coal rider it said: "It is, of course, desirable to minimize the operations of the coal rider as much as possible, so that the customer may more nearly apprehend what the cost of his energy will be. Since, however, we are granting no increase in electric rates and it is given to no one to prophesy as to the future, we judge it best to continue the coal rider for the present, so that the company may be saved from disaster in the event that there is another such extraordinary increase in coal prices as that of the fall of 1920, and on the other hand so that the customers may have the benefit of any saving the company may be able to effect in the price of coal or in the freight charges upon it."

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*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System

Men of the Industry

Changes in Personnel—Responsibilities and Association Appointments of Men Engaged in Professional, Executive, Operating and Commercial Branches of the Industry

D. A. CHENEY

D. A. Cheney, who was elected president of the Southeastern Section of the National Electric Light Association at its meeting in Chattanooga, Tenn., Oct. 17-19, is general manager of the Orlando (Fla.) Water & Light Company. Mr. Cheney was born in Orlando Jan. 23, 1889, and educated in the local schools and Rollins College Academy, Winter Park, Fla. He was graduated with the degree of A.B. from Dartmouth in the class of 1911. Mr. Cheney was first employed by the Orlando Water & Light Company as an engineer in the generating station. After his graduation, however, he was identified with the business office, serving successively as cashier, bookkeeper, assistant manager and general manager. The latter position he has held since 1915. The Orlando Water & Light Company serves the cities of Orlando, Winter Park and Maitland with electric service and also operates rural service lines. The company operates in addition waterworks, gas and ice plants in Orlando. It serves 15,000 people in a fast-growing section. The company was organized as the Orlando Water & Sewage Company in 1887. In 1894, when it went into the hands of a receiver, it was taken over by Judge J. M. Cheney, father of D. A. Cheney, United States district attorney and United States district judge, who has developed the property to the present time. In 1901 the electric plant was installed, in 1903 the ice plant was added, and in 1905 the local gas works were absorbed and the three were consolidated under one organization bearing the present name. Mr. Cheney has been associated with the Southeastern Section of the N. E. L. A. for a number of years and has served as a member of the executive committee and as second and first vice-president.

T. O. KENNEDY

T. O. Kennedy, who was recently elected president of the Rocky Mountain Division of the N. E. L. A., has been general superintendent of the Denver Gas & Electric Light Company since the summer of 1917. Mr. Kennedy has been very active in arousing public appreciation of electrical service. He is chairman of the committee on public utility information in the Rocky Mountain territory and also of the advisory committee of the Denver Co-operative Electric League, and, in fact, credit is given to him as the first to see the possibilities of such co-operative development. He is also head of the league's committee in the building of Denver's first electrical home. In addition, he was at one time chairman of the electrical bureau of the Denver Civic & Commercial Association. Mr. Kennedy was born Nov. 26, 1886, at Poplar Bluff, Mo., and was educated in the public schools of that place, later attending the University of Missouri, where he was graduated as an electrical engineer in 1907. He then started as a junior engineer with the old Denver Gas & Electric Company and in September, 1908, was transferred to the Montgomery (Ala.) Light & Water Company. He returned north in September, 1910, to become superintendent of the Lincoln (Neb.) Gas & Electric Company, and remained there until January, 1912, when he was appointed engineer in charge of the Ozark Power & Water Development on the White River in Missouri. The New York office of Henry L. Doherty & Company was his next place of service, as construction engineer for the company, and in August, 1914, he became general manager of the Massillon (Ohio) Gas & Electric Company. In July, 1917, the Doherty company made some changes in its Denver personnel, with the result that Mr. Kennedy was transferred to that city and made general superintendent. Arriving there during the war, he immediately engaged in Liberty loan and welfare agency drives, heading unusually successful teams in every case.

J. K. SWANSON

John K. Swanson, the recently elected president of the Michigan Section of the National Electric Light Association, is a native of Scotland. He came to America in 1889 and resided in New York City until 1900, when he removed to Michigan. He is a graduate of Albion College and first entered business life as a salesman for the Saginaw Milling Company. He entered the utility field with the Saginaw Gas & Electric Company in 1913 and became the general manager of the Bay City Gas & Electric Company a year later. In 1916 he was transferred to the Jackson office and became secretary of the Michigan Light Company and assistant secretary of the Consumers' Power Company. In 1919 he was made district manager of the Michigan Light & Consumers' Power Company with headquarters in Jackson. This position he now holds. Mr. Swanson has been a strong supporter of the National Electric Light Association work and a consistent "booster" in the state association work of which he now becomes the leader.

D. W. Roper was the subject of a biographical sketch in the Oct. 8 issue of the ELECTRICAL WORLD owing to his appointment as chairman of the underground systems committee of the N. E. L. A. Unfortunately the section originally prepared recording results of Mr. Roper's special engineering investigations was accidentally omitted in making up the page. That section is as follows:

Mr. Roper is a member of the Western Society of Engineers and has taken an active part in developing that organization as well as the local section of the Institute. He has contributed many important papers to the A. I. E. E. on underground cable work and two papers, one in 1915 and the other in 1920, on lightning protection for distribution circuits. His paper on "Experience with Line Transformers," presented before the A. I. E. E. on May 28, 1914, preceded his investigations on lightning protection. He also presented a noteworthy paper on electrolysis before the St. Louis Section of the A. I. E. E. on May 29, 1918. Another paper was presented before the Edison Illuminating Companies on underground work in 1906. He has also served on several committees of that association. For a paper on "A Few Unusual Burn-outs of Underground Cables," presented in 1908 before the Western Society of Engineers, Mr. Roper received the award of the Chanute medal.

William W. Merrill, the new chairman of the Switch Box Section of the Associated Manufacturers of Electrical Supplies, is the vice-president and general manager of the Chicago Fuse Manufacturing Company. He has come up through the ranks in that organization since 1894, having served successively as bookkeeper, cashier, secretary, assistant treasurer, treasurer, and since April, 1910, as vice-president and general manager.

W. W. MERRILL

His education was received in the Boston schools and he went to work for the Boston & Maine Railroad in 1889. He remained with that company until 1892, when he went to Chicago and entered the statistical department of the Illinois Steel Company. He was later transferred to the auditing department, remaining there until he went to the Chicago Fuse Manufacturing Company in 1894. Mr. Merrill has made his way up through hard work and knowledge of the business in building up the company so that at present he is the second largest stockholder.

Edward Flad has resigned as a member of the Missouri Public Service Commission to resume the practice of civil engineering in St. Louis.

C. V. Allen has been appointed Mexican manager of the Westinghouse Electric International Company with headquarters at Mexico City.

C. O. Wilson, formerly merchandising manager for the Adirondack Power & Light Corporation, has become resident manager for the company at Oneida, N. Y.

A. Telford Smith has become associated with the São Paulo (Brazil) Electric Company, Ltd. Mr. Smith was formerly with the Winnipeg (Man.) Electric Railway Company.

Ward B. Kindy has left the Iowa State College, where he was instructor in the electrical engineering department, to take up similar work in the Leland Stanford, Jr., University.

William C. Murrell has become associated with the Public Service Electric Company, Newark, N. J. Mr. Murrell was formerly an instructor in Cornell University.

W. Harry Stone, who was superintendent of electrical construction with the Los Angeles Railway for many years, has resigned and entered into business in Los Angeles.

R. P. Harrison of the Thomas & Betts Company, New York City, has recently been appointed chairman of the Outlet Box and Outlet Box Fittings Sections of the Associated Manufacturers of Electrical Supplies.

Earl Browne, the newly elected president of the California Contractor-Dealers' Association, has been identified with the activities of the contractor-dealers of San Francisco since 1907. In that year he joined the Electric Appliance Company, where he was employed for two years. Subsequently he was with the Dunham, Corrigan & Hayden Company and the John G. Sutton Company. Two years ago he organized the firm of Browne-Langlais, electrical contractors. In 1917 he was president of the San Francisco Association of Contractor-Dealers.

Harry W. Eastwood, who for the last four years has had charge of the steel mill and crane division of the Cutler-Hammer Manufacturing Company, has been appointed manager of the Cleveland branch office, taking the place of Lynn B. Timmerman, former assistant manager of the central district, who leaves to enter the automobile business in Lima, Ohio, after having been associated with the Cutler-Hammer Company at Cleveland since 1914. Mr. Eastwood's experience in the electrical industry, particularly in the controller field, dates back from his graduation from Rose Polytechnic Institute in 1906 with degrees in engineering. He was first associated with the Ohio Works of the Carnegie Steel Works at Youngstown and later with the Electrical Controller & Manufacturing Company of Cleveland, in association with his brother, A. C. Eastwood, who was one of the early organizers of the Cleveland company. Mr. Eastwood's association with the Cutler-Hammer Manufacturing Company began in August, 1917.

Charles L. Shedd has been appointed manager of the Detroit office of the American Bosch Magneto Corporation, taking the place of Roy Davey, who has been made manager of the manufacturing sales department at Springfield, Mass. Mr. Shedd was at one time promotion manager of the truck division of the Packard Motor Car Company at Detroit. Subsequently he served as official distributer at Omaha for that company, and still more recently he acted as sales manager of the Republic Truck Corporation in New York City.

E. Newnham, for the past eleven years connected with the Robbins & Myers Company, Springfield, Ohio, in the capacity of electrical engineer and motor-sales manager, is now financially interested and actively connected with the H. G. Manufacturing Company, St. Louis, manufacturer of fractional-horsepower motors. Mr. Newnham will be active in both production and sales.

E. NEWNHAM

Obituary

Herbert F. Flagg, supervisor of maintenance for the Central Massachusetts Electric Company, Brookfield and Warren districts, was accidentally killed at Brookfield Oct. 15 by the failure of a pole upon which he was working. He was born at Winchendon, Mass., about thirty-one years ago.

James A. Anderson, district manager of the Minneapolis and St. Paul offices of the Wagner Electric Company, with charge of the company's business in Minnesota and North and South Dakota, died recently in Minneapolis after a long illness. He had been connected with the electrical industry in Schenectady, N. Y., and New Orleans.

Trade and Market Conditions

Business Reviews, Together with Market Letters
from Important Trade Centers, on the Supply, Demand and Prevailing Prices of
Electrical Apparatus and Supplies

Some Improvement in Porcelain Insulator Market

A SURVEY of the market for porcelain insulators shows that some improvement has been experienced since last summer, but that something in the nature of a dead level may be expected until around the first of the year. Demand for the small distribution sizes of porcelain insulators is fairly good in the East and South, and indications are that a number of jobbers have let their stocks run low. Rush orders have been received by manufacturers from jobbers in Boston and in various parts of Pennsylvania, though none of these orders has been particularly large. A number of fair orders have been received from the Southeast and the South. Jobbers in other parts of the country seem fairly well stocked.

Reports from the Middle West say that jobbers are well stocked and can make immediate shipments for all ordinary demands. There are numerous inquiries and a fair number of orders, most of them for small lots. Utilities there are not buying as heavily as was the case several months ago. This condition may be accounted for by the fact that the number of small extensions under construction has dropped off.

Prices remain unchanged since the drop which was made around the beginning of September. Manufacturers say that labor costs are still high and that there is not apt to be another decrease for some time.

Unemployment Conference Sees Hope in Building Improvement

IT IS well to note that the National Conference on Unemployment is depending to a great extent on construction work to reduce the number of men out of work at the present time and to help the country over the hard winter season that has been predicted. Basing the program on the tremendous total of contracts let during September, which exceeded the largest previous September by 11½ per cent, Secretary Hoover is keeping in touch with mayors' committees all over the country to speed up the construction of public works and public utilities. The public works committee of the conference is co-ordinating all this information and making it available for any community that wishes it.

This step is important not only to the individual who is out of work but to the contractor-dealer who has been expecting to "lay off" the greater part of his organization this winter and to the manufacturers of wire, fixtures, schedule material and, in general, all wiring supplies. Ordinarily public works construction is allowed to drag along slowly, but if the Unemployment Conference succeeds in its program it will mean that a good percentage of the public works and buildings which had been scheduled to start next spring will get under way at once. At the present time there is planned about $800,000,000 worth of this kind of construction which is not contracted for. If one-half of this could be started now, it would mean at least $20,000,000 worth of electrical work, figured on the basis of 5 per cent of the total building cost.

It is felt by the building industry that the standing committee of the conference will prove of great value to business interests of the country later as well as now. Studies carried on, according to officials, will be designed to prevent sharp variations in the country's employment curve over a period of years by suggesting methods of spreading work opportunity over the lean and the fat years. What this would mean to every branch of the electrical industry may easily be seen.

Malleable Fittings Prices Unsteady in Dull Market

AS IN the other branches of the iron and steel industry the manufacturers of malleable fittings are operating only on part time and quite a wide range in price quotations can be had. One New England foundry which turns out guy clamps, insulator pins, washing machine parts and other miscellaneous small castings is operating from two to three days a week. Very few large orders are being placed and competition is keen. Price cutting is much in evidence and some manufacturers declare that prices have been quoted in a number of instances which cover only the bare cost of material and labor without any allowance for overhead cost or profit.

From the high mark two years ago of 36 cents a pound for small malleable castings the price has dropped to around 13 to 14 cents a pound at the present time. Some quotations as low as 8 to 10 cents have been reported. For the larger castings the price ranges from 8¼ to 11 cents per pound. Malleable prices at Pittsburgh have held steady around $20.50 per ton for the past month. However, slight changes would have little effect on finished castings and there is little to indicate that finished prices will change for some time.

Manufacturers state that many users of malleable castings have large stocks on hand which were purchased a year or so ago and these stocks must be consumed before any considerable activity can be expected.

Metal Market Situation

THE copper market has shown some strength during the week, though some producers are reported to have made sales early in the week at slightly under 13 cents. However, there was little of this, and the large producers have not weakened in their stand for a 13-cent price. There is not a great deal of activity in the market at this price, though domestic consumers seem slightly more interested than before in covering their requirements for the year. Domestic consumption for October was estimated at 60,000,000 lb., which is about 40 per cent under September. Exports for October also apparently will be smaller, though government figures are not yet available.

NEW YORK METAL MARKET PRICES

	Oct. 24, 1921	Oct. 31, 1921
Copper	£ s d	£ s d
London, standard spot	66 2 6	66 5 0
	Cents per Pound	Cents per Pound
Prime Lake	13.00	13.00
Electrolytic	12.75	12.75
Casting	12.37½	12.37½
Wire base	14.50	14.50
Lead, Am. S. & R. Co. price	4.70	4.70
Antimony	4.85	4.80
Nickel, ingot	41.00	41.00
Sheet zinc, f. o. b. smelter	10.00	10.00
Zinc, spot	5.10 5.15	5.05 5.10
Tin, Straits	28.50	28.12½
Aluminum, 98 to 99 per cent	24.50	24.50

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	10.50 —11.00	10.50 — 10.75
Brass, heavy	5.00 — 5.50	5.00 — 5.25
Brass, light	4.75 — 5.00	4.75 — 4.87½
Lead, heavy	3.75 — 4.00	3.75 — 4.00
Zinc, old scrap	2.25 — 2.37½	2.25 — 2.50

THE WEEK

IN TRADE

Prices When Quoted Are Those Prevailing at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

CHANGES in the electrical industry of any consequence are hard to find. The tone of business in all parts of the country still is one of very gradual improvement with very few high spots. There is little or no pessimism and there seems to be confidence that any improvement which occurs from now on is bound to be permanent.

Chicago reports a fair movement of electrical supplies, with virtually no price changes. Contractor-dealers are optimistic there on account of suburban residence building. Manufacturers of arc-welding apparatus report good sales for reclamation purposes. New York jobbing houses are experiencing a good call for wiring supplies. A reduction of 10 per cent on knife switches has been announced. Building operations in Atlanta to Nov. 1 have exceeded the amount for the whole of 1920. Drought is being felt there and power customers are being rationed by the Carolina Light & Power Company. Conditions in the New England textile district have greatly improved, some mills operating on a full-time basis. Boston jobbers have low stocks and are starting to order from manufacturers. The same condition is reported from St. Louis.

The building strike of San Francisco, which lasted four months, has been settled and construction has started there again. The Intermountain section reports better business in lamps and fixtures, and particularly a flurry in ranges. Exports from Portland and Seattle have shown large increases recently.

NEW YORK

With few and slight price changes since last week jobbers report that activity in wiring supplies continues. Individual orders have not increased in size, but sales are becoming more and more frequent, indicating that there has been no let-up in the steady improvement of conditions. A general feeling of satisfaction and relief was expressed now that the railroad strike is definitely out of the way. An atmosphere of optimism pervades the electrical trade, and confidence in the stability of the improvements seems to increase from week to week.

Credits and collections are improving gradually, although new accounts are opened only after careful investigation. Current credit billings are on a thirty-day to sixty-day basis.

Conduit.—Little change has been shown in the demand for this material. Contractors are ordering in quantities sufficient to meet immediate needs, and the additional 5 per cent discount announced last week apparently has not stimulated buying. Prices quoted this week were as follows: ½-in. black pipe in 2,500 ft. lots, $50.83; ¾-in., $65.32, and 1-in., $93.16 per 1,000 ft. Galvanized pipe in the same sizes was quoted at $55.93, $72.22 and $103.36 per 1,000 ft. Jobbers' stocks in the above sizes are good, but for larger sizes are somewhat spotty.

Rubber-Covered Wire.—The market is slightly stronger than last week, and a few jobbers who have been offering special price inducements have advanced their quotations. No. 14 rubber-covered is quoted at $6.50 per 1,000 ft. in 5,000-ft. lots. Demand is fair for moderate-size quantities and stocks are good.

Flexible Armored Conductor.—The activity on this material continues, and some manufacturers are behind with their deliveries. No. 14 two-wire single-strip is quoted this week at $45 to $46 per 1,000 ft. in lots of that quantity. Double-strip is quoted at $48 per 1,000 ft. Jobbers' stocks are limited.

Lamp Cord.—Although wire prices are stronger this week, jobbers have not advanced this material. No. 18, cotton, twisted, was quoted at $12.90 per 1,000 ft. and the parallel cord in the same size at $15.60. Stocks generally are good.

Loom.—Prices on this material, for which there is very small demand in this territory are easier. In 1,000-ft. lots the $\frac{7}{32}$-in. size is quoted at $16.50 to $17 and the ¼-in. size from $18 to $18.50 per 1,000 ft.

Metal Moulding.—Demand is small and stocks are kept low. The three-wire size is quoted at $5.60 per 100 ft.

Schedule Material.—The fairly active demand for wiring supplies keeps this material moving well. No price changes were announced this week. Key sockets in standard package lots were quoted at $18.15 per 100 and pull sockets in standard packages at $33 per 100.

Knife Switches.—Manufacturers have reduced prices from 10 to 15 per cent on open-knife switches and slate and porcelain fuse blocks. The dealers' maximum discount, which formerly was 25 per cent, is now 33 per cent off list.

CHICAGO

A few jobbers report a decrease in sales, but in general the electrical business has been fair with few price changes. The interest in building as shown by the suburbs has lent an atmosphere of optimism to the trade. Business in both fractional and large-size horsepower motors is slow, but several dealers interviewed gave the opinion that the large number of fractional-horsepower motors which were being sold at cut prices by irresponsible jobbers have been cleaned up. With this stock disposed of the dealers feel that a fair demand for motors will be noticeable soon.

Manufacturers report an active interest shown in school lighting fixtures throughout the Western States. Building permits issued during the week ended Oct. 28 numbered 216, showing an increase of 166 over the similar period in 1920.

Wire.—This material continues to hold steady and the bare wire base is quoted at 16 cents. Weatherproof has not changed and is selling fairly well at 16 cents a pound in 1,000-lb. lots. Some better sales have been reported this week on No. 14 rubber-covered, wire, although this material is still selling at $6.50 to $6.75 per 1,000-ft. in 5,000-ft. lots.

Conduit.—Several jobbers report an increased movement on this material because of better activity in the building industry in the suburbs. The prices are as follows: For ½-in black pipe in 2,500-ft. lots, $48 to $50; ¾-in., $62 to $65. and 1-in., $97 to $103 per 1,000 ft. Galvanized pipe in the same sizes sells at $53 to $56, $69 to $73 and $104 to $108 per 1,000 ft. Jobbers report their stocks are on about a thirty-day to forty-day basis.

Flexible Armored Conductor.—This material is also moving fairly well, and No. 14 two-wire, double-strip sells at $50 per 1,000 ft. in 5,000-ft. lots.

Porcelain.—"Nail-it" knobs sell for $19.60 per 1,000 in barrel lots, and jobbers report the demand to be fair. Movement on the 3-in. x ½-in. tube continues to be fair, and it sells for $6.44 per 1,000 in barrel lots.

Lamp Cord.—Jobbers report an increase in sales on No. 18 cotton, twisted, which sells for $13 per 1,000 ft. Stocks on hand are ample enough to maintain a good movement of this material.

Heating Appliances.—Portable stoves are reported as the main leaders for the week, although ironers, grills, toasters and open-air heaters are not far behind in activity. Certain jobbers state that their stocks are on approximately a thirty-day basis; other jobbers report a scarcity in stocks of ironers and hair driers.

Loom.—The demand is small and jobbers' stocks are fair. In 1,000-ft. lots the $\frac{7}{32}$-in. size sells for $18.50 to $19 and the ¼-in. size for $21.

Arc-Welding Apparatus.—An active movement on arc-welding equipment for reclamation purposes is reported by the manufacturers of this material. Stocks are not very heavy.

BOSTON

Better business is apparent throughout New England jobbing circles, and manufacturers of electrical supplies in this section are receiving more orders. The improvement, while slow, is reasonably well maintained week after week. Jobbers' stocks are now low enough to require considerable buying and prices are not deterring purchases as was the case last summer. In the textile field conditions are greatly improved, some of the leading mills being run at about 100 per cent capacity. Woolen and worsted mills are sold up to February, 1922, in some cases.

The unwillingness of labor to take a proposed 25 per cent wage reduction is hampering the shoe business in some quarters, but the demand is excellent. Slow improvement is beginning to be evident in the metal-working industries. The passing of the threatened railroad strike has contributed to better feeling, but New England industries were well prepared for eventualities. Building construction is gradually increasing, and the total contracts of New England for the week ended Oct. 25 were $5,330,900, compared with $4,646,000 for the corresponding week a year ago, and the best for twenty years.

Schedule Material.—Sales are improving, and New England manufacturers of these products are generally reporting improved demand from jobbers. A much healthier fall trade is expected than was apparent Sept. 1. Price readjustments continue, last week registering an advance on a well-known parallel plug of $1.50 per 1,000, f.o.b. factory. Pull sockets are moving well.

Porcelain.—Insulators are moving fairly, with plentiful stocks. A shortage of new code "Nail-it" knobs was reported early in this week among Boston jobbers. These are selling at $18.50 per 1,000 in barrel lots, but deliveries are a little slow. Tubes are plentiful and in fair demand, the 3-in. length, 5/16-in. diameter size selling at $6.20 per 1,000 in barrel lots.

Wire.—Sharp competition features the market, owing largely to accumulated stocks. Rubber-covered, No. 14, sells around $6 per 1,000 ft. in 5,000-ft. lots. The demand is good, owing to improved building construction. Only light sales of weatherproof wire are reported, base price being 16 cents.

Flexible Armored Conductor.—The market is rather quiet, with steady prices. Stocks are ample for current needs. No. 14 single-strip is moving at about $45 per 1,000 ft. at Boston, but in southern Connecticut $40 is being asked.

Washers and Cleaners.—Intensive sales efforts are overcoming the disturbing effect of recent price cuts on washers. Sales are improving slowly, with vigorous concentration on quality characteristics. Cleaners are looking up a little. Stocks are easily maintained.

Transformers.—This equipment is moving fairly well for industrial requirements, and some central-station business is reported on a moderate scale. Smaller and medium sizes are in chief demand in this district.

Meters.—With excellent stocks and only fair demand, distributers are largely marking time. The steady resumption of building work and gradual extension of central-station service are drawing more units into use month by month.

Rigid Conduit.—Trade is a little brisker, although nothing remarkable is evident. Prices are a little easier, about 5 per cent lower being quoted. Representative quotations on ¾-in. black pipe under 5,000 lb. and on galvanized pipe in the same size are $68 and $74.90 per 1,000 ft. respectively.

ATLANTA

Building operations in Atlanta to Nov. 1 have exceeded the entire volume of 1920, the total number of residential permits being 993, with the prospect that the close of the year will see the total number of residences in excess of 1,100. Valuation of permits to date is in excess of $10,000,000. Augusta is also in the midst of a building boom, having approximately $2,000,000 worth of construction under way in that city at the present time. Some of the construction is of the large type, such as hotels and the government hospital. Similar activity is reported from all the other centers in this section.

A storm, the most severe in many years, swept over Florida the first of last week, doing tremendous damage to docks, railways, telegraph and telephone and lighting properties. Prospects for rain have failed to materialize, and the drought throughout the larger portion of this section continues very serious. It has already resulted in the curtailment of power customers by the Carolina Power & Light Company. Request has been made of Secretary Weeks to operate the 60,000-kw. steam plant at the government's nitrate plant in Alabama to assist the situation and forestall the possibility of a more serious condition. No formal reply has yet been received by power companies to their request.

Armored Conductor.—A price advance of 5 per cent is effective this week and has caused some stimulation in sales. Local stocks are ample with quotation on No. 14, two-wire in lots of 5,000 ft., at $57.

Wire.—Rubber-covered, which has advanced 5 per cent in price, is now moving satisfactorily in the smaller sizes and weatherproof in sizes Nos. 6, 8 and 10 is also active. Local stocks are in first-class condition. Prices: Lots of 5,000 ft., rubber-covered, No. 14, $7.08; No. 10, $16.70, and No. 6, $27.40 per 1,000 ft.

Rigid Conduit.—This item continues to move very satisfactorily, particularly in the smaller sizes, and the shortage in ½-in. has been relieved. Prices in small lots are: Black, ½-in., $7.22; ¾-in. $9.42; 1-in. $13.58, and 2-in., $29.56 per 100 ft; galvanized, ½-in. $7.64; ¾-in., $10; 1-in., $14.44, and 2-in. $31.40 per 100 ft.

Knobs and Tubes.—A recent price advance is to be noted on these two items, and the activity is well sustained by small store and residential construction. Prices: Standard packages, 5/16-in. x 3-in. tubes, 80 cents each; "Nail-it" knobs, $22.80 per 1,000. Local stocks are in good condition.

Hollow Ware.—Christmas buying is quite in evidence, very fair orders being received from hardware and department stores, with bona-fide electrical dealers ordering very cautiously. Local stocks are in good condition throughout the line.

Flatirons.—Electrical contractors and dealers seem to be disposing of the majority of flatirons, their orders exceeding those of hardware and department stores for this article. Sales are quite satisfactory and sufficient stocks are on hand.

Cross-Arms.—It is generally rumored that there will be a price advance of 7½ to 10 per cent on all cross-arms, effective Nov. 1. The movement of this item is still quite satisfactory, and jobbers have been fortunate in maintaining sufficient stocks.

ST. LOUIS

With the railroad strike called off, there is manifest more confidence in the immediate future of business. The railroads have been good purchasers of materials used in communication, particularly dry cells, but otherwise the week was about the same as those preceding. The number of orders was possibly slightly less than the week before, but improvement was noted in industrial buying, one concern purchasing a 1,000-kw. generator set. Most of the orders, however, are small and cover only the immediate needs of the purchasers.

Stocks are being maintained by both dealers and jobbers at the lowest possible values; in fact, jobbers are short of a number of items and orders must be filled direct from the manufacturers. Owing to the desire for immediate delivery of goods when ordered, this condition has caused some criticism on the part of the buyers. If the demand should take a sudden increase, local stocks would be quickly exhausted.

The volume of freight handled and earnings by the railroads in this territory continue to show steady improvement. There has been a marked reduction in the number of idle cars during the past thirty days due principally to better movement of coal. Merchandise and farm products are also moving well. Business in general shows a sustained improvement.

Conduit.—Prices declined about 5 per cent last week. In bundle lots ½-in. black sells for $47.25 per 1,000 ft. and 1-in. black for $88.50. In the galvanized the respective prices are $53.15 and $98.20. There is a fair movement in the ½-in. black, but there is little demand for the larger sizes in black or for the galvanized. Stocks are in fair condition.

Pole-Line Hardware.—A price reduction of about 4½ per cent has been announced. Local stocks will take care of small orders, but factory shipments, which can be made promptly are at times necessary for some orders.

Wire.—There continues to be a good amount of buying of rubber-covered, the price of which in the No. 14 size remains at $6.50 per 1,000 ft. for lots of 5,000 ft., and $6.40 for lots of 10,000 ft. and more. The demand for weatherproof also remains good. Wire of large sizes is extremely quiet. Stocks of small rubber-covered are low.

Lamp Cord.—No. 18 twisted, cotton, is priced at $12.50 per 1,000 ft. in lots of 5,000 ft. or more. The demand is materially better and the market is stiffening. Stocks are ample to meet immediate requirements. Silk-covered is moving slowly.

Packing-House Cord.—No. 14 is selling for $35 per 1,000 ft. in lots of 5,000 ft. or more. The demand shows some improvement but is still comparatively quiet. Stocks are good.

Connector Cords.—Good demand is reported for automobile spark-plug cords, a representative price being 13 cents a set of four in lots of 100 sets. Regular battery connectors are quiet and are priced at $11.50 for a lot of 1,000.

Dry Cells.—Railroads continued to buy in liberal quantities last week, and good sales were made to other purchasers. The regular is quoted at 31 cents and the igniter at 32 cents, both in barrel lots.

Tape.—Jobbers' stocks are getting low, and the demand is good. A local manufacturer of rubber tape reports improving business, though materially under normal. Rubber tape sells from 36 to 40 cents per pound, and friction tape around 38 cents per pound.

SAN FRANCISCO

Pacific coast business men were very relieved by the news that the railroad strike was called off, for although it was generally believed that it would not materialize, such a strike would have paralyzed the business of the Pacific Coast, which is so far away from the manufacturing centers. The recent close of the sixteen weeks' building strike, by act of the unions, involved returning to work on the basis of the new day wage of $9.25 for electrical workers and their waiving of the question of open shop. This has been responsible for a good increase in building in San Francisco, but it is felt that this condition will be disturbed. The present wage agreement will expire early in November, and a decided cut in wages is generally expected at that time.

Insulating Material.—Well assorted stocks are maintained by several jobbers, who report a fair but not exceptional movement, the demand for repairing being considerably less than it was at this time last year. A few price adjustments have occurred, mostly in the nature of general revision and not of correction.

Telephones.—Deliveries both of interphones and farmers' sets are steadily growing better. Four or five fairly large apartment-house installations are made each month and are the cause of keen competition. The financial pessimism of the farmers has greatly cut down the number of farmer lines installed, though business, which was held up by the war for several years, was expected to be far larger than it has proved. The Western Pacific Company has completed the installation of a ten-thousand-dollar train-dispatching equipment from Gerlach, Nev., in its Salt Lake City eastern terminal and is now figuring on a corresponding equipment from Gerlach westward into Oakland.

Ranges.—Pacific Coast stocks of new-type ranges have been received, but there are still a number of ranges of older models to be sold.

Poles.—Local stocks are very heavy as there is almost no buying. Next spring will see some good extension work by the larger companies, but only small maintenance and repair orders from the smaller companies and municipalities are being received now. A similar situation exists as regards the cross-arm supply and demand.

SALT LAKE CITY—DENVER

The satisfactory shipment of crops from the Intermountain agricultural districts to various market centers of the country is an encouraging aspect of the business situation in this territory. The shipment of potatoes, for example, shows a 200 per cent increase up to date over shipments for the corresponding period of last year. The money realized on agricultural produce is in fair circulation, imparting a better tone to business generally. Everything possible is being done to rehabilitate the live-stock industry. Growers are being urged to take full advantage of the loans available through the Federal Loan Corporation.

Electrical dealers are stocking well in such seasonable merchandise as air heaters. Electrical fixtures are moving slightly better, an expected and incidental feature of the home-building campaign. Lamps are feeling the usual impetus that comes with the approach of winter and the lengthening of the evenings. A flurry in the electric range business has come as a result of radically cut prices by one of the largest Intermountain jobbers. The reductions on various models vary from $26 to $85. An overload of stocks in old models is assigned as the occasion for the new but temporary schedule. No changes affecting factory prices have been noted.

SEATTLE—PORTLAND—SPOKANE

The improvement in business throughout the Northwest which began with the first weeks of September continues. This conclusion is verified by reports from various quarters by interests which represent the major business activities of this section. Most of these activities have not only shown an increase to date, but they have shown a more or less uniform increase from week to week and are still moving upward. Exports from both Seattle and Portland continue in large volume. Tonnage in the terminals operated by the Port Commission of Seattle was 71 per cent greater in the last week of October than that of the week ended Aug. 22.

Stormy weather in Portland during the past week caused a falling off in business from the previous week, although business is still fair to good. Portland jobbers report considerable activity in the sales of washing machines and ranges, this being due primarily to active sales campaigns on these two lines. No price changes of importance have been noted during the past week with the exception of a slight increase in fuses. Dealers report business fair. Kilowatt-hour generation of central stations is improving, showing a trend for the better in industrial lines. Generation of one power company was 10 per cent below that of 1920 a month ago, but is now only 5 per cent below that of last year, and present reports indicate that it will equal the 1920 output within the next thirty to sixty days, this in spite of the closing down of a 5,000-kw. shipyard load during the last six months.

Electrical jobbers of Seattle report continued improvement. The dark days of approaching winter are putting the usual bulge in the demand for lamps and lighting equipment in general. One manufacturer with a branch office in Seattle has designated the week of October 24-29 as "light and power week" and has conducted an active selling campaign, concentrating on small light and power plants, including pumping equipment. The results of this sales effort were most gratifying, an indication that the rural communities are not without purchasing power. Demand is active on sewing machines, washers and ranges. No pronounced price changes were reported for the week. The general trend of prices is in the way of continued small reductions on most items with the exception of copper, which is holding firm. Quotations on fuses in Portland are as follows: 30-amp. cartridge, $13; 60-amp. cartridge, $19.50, and Edison plug fuses, $4 per 100 in carton lots.

Manufacturers' Activities

Devoted to the Business Side of Manufacturing, Distribution and Sales, News from Jobbers and Foreign Fields and a Record of New Devices and Trade Literature

Jeffrey Company Receives U. S. Approval of Mine-Battery Locomotive

Official approval of a storage-battery locomotive for use in gaseous mines has just been issued by the United States Bureau of Mines to the Jeffrey Manufacturing Company, Columbus, Ohio. This is the second approval issued by the bureau and covers a 6-ton storage-battery locomotive, which may be equipped with a battery consisting of either eighty type A-8 Edison cells or forty-eight type MV twenty-one-plate "Iron Clad Exide" cells. Caustic potash is specified as the electrolyte for use with the Edison battery. The first official approval of a storage-battery locomotive was granted to the George D. Whitcomb Company a few months ago.

Two other locomotives, representing the product of two additional manufacturers, are now under test. Conferences have also been held with two more manufacturers regarding the investigations of their product under Schedule 15. This indicates a decided interest in the efforts of the Bureau of Mines to safeguard this type of mining equipment. Each approved equipment will have an approval plate attached to the controller bearing the seal of the Department of the Interior, Bureau of Mines, and including a cautionary statement which should aid both company and state inspectors in keeping these locomotives in a permissible condition.

The testing of storage-battery locomotives for permissibility is in charge of L. C. Ilsley, electrical engineer of the Pittsburgh experiment station of the bureau.

Stoker Manufacturers Hold Fall Meeting

The fall meeting of the Stoker Manufacturers' Association was held Oct. 18-20 at Shawnee-on-Delaware, the representatives of member companies and guests numbering about seventy in all.

President Maxwell Alpern delivered his address on Tuesday morning and was followed by C. W. DeForest of the Union Gas & Electric Company, Cincinnati, who read a paper on "The Necessity for and Savings Possible with Better Boiler-Room Operation." The research committee presented its report in the evening.

On the following day a paper outlining the "Uses and Character of Equipment Desired for Blast and Induced-Draft Stokers" was read by H. F. Fagan, representing the National Association of Fan Manufacturers. On Thursday the committees of conference with other associations presented their reports. With various committees of the A. S. M. E. had been discussed the proper standard front for water-tube boilers and the matter of a revision of the boiler test code, while arrangements had been made to present a series of stoker papers at the spring meeting of the Fuel Division of the A. S. M. E. The stoker manufacturers' engineering committee had made a study of stoker auxiliaries. At the same session S. L. Nicholson gave the results of a conference with Secretary Hoover on how the association and similar ones could best help the activities of the Department of Commerce.

Rockbestos Finds Demand for Heater Cord Improving

A healthy increase is apparent in the demand for asbestos wire, according to a statement made by Guy Hutchinson, vice-president of the Rockbestos Products Corporation, New Haven, Conn., to a representative of the ELECTRICAL WORLD a few days ago. Inquiries are more active than for some time, and, while the demand for wire for appliance service is not so active as it is expected to be later, orders for stove wire and motion-picture cable are more vigorous. The September business of the company in these lines was more than 50 per cent of that of September, 1920, which was the peak month in the organization's history. The September business was the best in 1921.

Electrical Credit Association to Hold Annual Meeting in Chicago

The annual meeting of the Electrical Credit Association, Central Division, will be held at the Drake Hotel, Chicago, Nov. 17 and 18. Among the subjects to be discussed are: "Credits and Reconstruction," by E. W. Shepard, credit manager Western Electric Company, New York City; "Business and the Industrial Press," by Stanley A. Dennis, associate editor *Electrical Merchandising*, New York City; "Supplemental E. C. A. Service and Interchange Bureau Data," by Henry Schwab, Monarch Electric & Wire Company, Chicago; "How I Believe Difficult Credit and Collection Problems Should Be Handled During These Critical Times," by W. E. Sargent, Cutler-Hammer Manufacturing Company, Milwaukee; "Problems Surrounding Municipal Accounts," by C. E. Vandel, Western Electric Company, Kansas City, and "Sample Credit and Collection Forms," by H. H. Pribbanow, Julius Andrae & Sons Company, Milwaukee.

Formica Insulation Company Wins Decisions in Patent Suits

Actions Brought by the Westinghouse Electric & Manufacturing Company and Continental Fibre Company Dismissed—Insulation Patents Declared Not Infringed

Decision has been rendered in the federal court at Cincinnati in favor of the Formica Insulation Company, Cincinnati, in three suits alleging patent infringement, two of them filed by the Westinghouse Electric & Manufacturing Company and the other by the Continental Fibre Company. Another one brought by the Westinghouse company was decided in favor of the defendant last year. The claim of the plaintiffs in all four suits was that the Formica company was infringing rights alleged to belong to them exclusively by the use of certain processes in building up laminated insulating materials.

One suit filed by the Westinghouse company was an action for an injunction against infringement of the Haefely patent for a machine for the manufacturing of insulating tubes. The primary inquiry concerned infringement, and the essential question in the case was whether two pressure rolls, with their allied mechanism, of the defendant's machine constitute an equivalent for "a longitudinally recessed mandrel holder," which is the vital element of the claims of which infringement is alleged.

The invention has to do with machines for the manufacture of insulating tubes composed of layers of paper or other fiber and some binding material by the process of winding upon a mandrel and at the same time applying the necessary heat and pressure to produce a tube having a hard composite wall suitable for insulating purposes.

The decision found that the machine of the defendant did parallel in function the plaintiff's mandrel holder, but that it did not actually function in the same way and that the difference was real and substantial. Therefore, it was decided, infringement did not exist.

The second suit of the Westinghouse company was also an action for an injunction against infringement of patent on a process of building up laminations of paper or cloth and hardening them with a phenolic condensation product under pressure and heat. It was claimed in answer that the plaintiff had delayed taking legal steps for a number of years and therefore was estopped by laches. In this suit it was shown that the incorporators of the Formica company had been in the employ of the plaintiff and that one of them, D. J. O'Conor, while with the Westinghouse company in 1913, endeavored to secure a patent on the process and at the same time assigned his rights in the invention to the plaintiff.

This patent claim was rejected as were several later amended claims until in March, 1918, certain parts were allowed. During a great part of this time the defendant was using the process, O'Conor and H. A. Faber having resigned from the Westinghouse company, but the plaintiff raised no objection. Therefore, the court ruled, the plaintiff by reason of delay had forfeited its right to protest at the present time.

The suit of the Continental Fibre Company concerned infringement of a patent on a composite material composed of laminations of fibrous materials, saturated throughout with approximate uniformity with a phenolic condensation product. It was decided that there was no advance in invention over the prior art of performing this work, but only in a more skillful selection of material and greater thoroughness of workmanship. The court then declared the patent invalid.

G. E. Lighting Exhibits to Tour Again

The lighting conferences and demonstrations, or industrial and commercial lighting exhibits, which were held last winter and spring by the Edison Lamp Works of the General Electric Company in the leading distributing centers of the country are again to be conducted. A total of nearly 11,000 attended these demonstrations last year, and the result was not only the selling of the better-illumination idea, but orders direct and prospective for the jobbers.

During October of this year the conference and demonstration was held in the following cities of New York State: Albany, Glens Falls, Amsterdam, Utica, Ilion, Rochester and Buffalo. The present plan is to have this exhibit continue into Ohio, Indiana, Michigan and Illinois, down along the Mississippi, across Tennessee and back to Harrison, N. J. It is expected that another booth and demonstrators will tour the New England States and New Jersey, starting about Nov. 1.

The methods followed are essentially the same as before. Demonstrations of various types of lighting units, ranging all the way from unshaded glaring lamps to the latest, best and most efficient units, are given in a portable canvas booth. Thus those who attend have an opportunity to judge for themselves the relative effiicency and desirability of the different types, being aided by foot-candle meters which are distributed among them. A miniature show window forms part of the exhibit, and during the demonstration it is lighted with colored lights, showing the effects that may be obtained in show-window illumination not only by the use of the primary colors but by combinations of them.

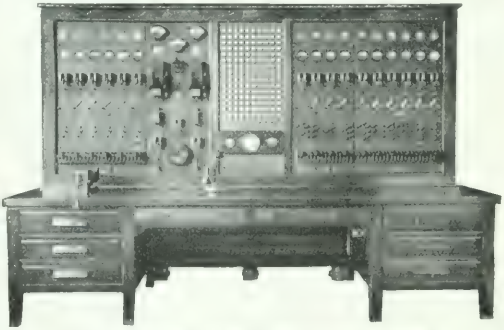
Last winter and spring three booths, accompanied by demonstrators, were on tour. Seventy-two cities in twenty-three states were visited, and the total attendance was approximately 10,800. Seventy-five per cent of those attending were industrial executives, such as presidents, secretaries, purchasing agents and superintendents of industrial concerns. Ten per cent were industrial men, such as foremen and electricians, while another 10 per cent consisted of representatives of civic concerns, such as chambers of commerce, boards of trade and Rotary and Kiwanis clubs. The remaining 5 per cent was made up of engineers, architects, teachers, students, and the general public.

The demonstrations are given with the co-operation of the jobbers in the territory where they are held.

Holtzer-Cabot Produces Record-Size Alarm Control

The largest fire-alarm and watchman control that the Holtzer-Cabot Electric Company, Roxbury, Boston, has ever turned out is now installed in the new plant of the Kelly-Springfield Tire Company, Cumberland, Md. The new buildings cover 12 acres and there are 22 acres of floor space.

An interesting feature of the whole system is the amount of material entering into its manufacture. The control board itself is 9 ft. 8 in. long and 6 ft. 2 in. high and controls six box circuits, ten gong circuits, ten to fifteen station watch routes, ten telephone circuits, twenty-seven combination fire watch and telephone boxes, twenty-six combination fire and watch boxes, thirty-eight plain watch stations, two plain fire alarm stations and two watch and telephone stations. There are 45 miles of wire, including underground cable, used in the system and 2 miles of conduit.



BOARD USED TO CONTROL LARGE ALARM SYSTEM AT KELLY-SPRINGFIELD COMPANY PLANT

New Company to Install Coal Pulverizers

The Powdered Coal Development Corporation, which controls the Pruden patents for the burning of pulverized coal in the western half of the United States, has been organized, with headquarters at Omaha, Neb. The company is actively engaged in financing and erecting central pulverizing plants and the installation of equipment for burning pulverized coal. Byron B. Oberst, formerly with the Interstate Oil & Refining Company, is president of the company. The board of directors includes R. M. Robertson, construction engineer of the American Smelting & Refining Company; A. E. Hall, manager Omaha plant of the American Smelting & Refining Company; Joseph C. Weeth, president of the Harmon Weeth Coal Company; J. J. Dodds, president of the Dodds Lumber Company; Bert Phillips, formerly chief engineer Omaha plant of the Collis Products Company, and Irving H. Arey, with the Republic Metal Ware Company.

The Belden Manufacturing Company of Chicago has appointed C. P. Cushway as manager of its cable and specialties department, effective Nov. 1. Mr. Cushway will supervise the production of telephone, automobile and appliance-cord assemblies, flexible cable, cordage and insulating materials.

The DeFerrorized Asbestos Corporation, Railway Exchange Building, Chicago, has been formed to manufacture and market a form of asbestos paper from which all iron has been eliminated for use as an insulating material. R. C. Hallowell is president and J. F. Green vice-president of the concern.

Nelson S. Moore & Company, district agents for the Jeffery-Dewitt Insulator Company, have opened an office at 19 South Wells Street, Chicago. They will also handle a line of air-break switches and other high-tension equipment as well as other electrical equipment.

The Blaw-Knox Company, 613 Farmers' Bank Building, Pittsburgh, announces the addition of H. O. Davidson to its staff. He is to have entire charge of the Prudential sectional building department of the company and will also be manager of the C. D. Pruden plant of the company at Baltimore, where he will be stationed. Mr. Davidson was for eight years connected with the Hydraulic Steel Craft Company, of which he was general manager, when he severed his connection with that company to join the Blaw-Know Company.

The Rubber Insulated Metal Corporation, 91 William Street, New York City, now has as its president C. P. L. Huston, who was the organizer of the company and who has taken back the control and management from the Century-Plainfield Tire Company. It is intended to pursue exclusively the manufacture of mechanical rubber goods, the "Elchemco" process being used in the manufacture of "Rimco" insulation for such articles as pliers, screwdrivers, flexible couplings, etc. William F. Hart, who was the sales manager of the company, has resumed his former office. The executive office will be at the above address and all business transactions will be handled there.

The Cincinnati Hy-Speed Machine Company, Cincinnati, announces that it has made an exclusive selling arrangement with the Niles-Bement-Pond Company, New York City, covering its full line of "Hy-Speed" products.

The Lamson Company, 100 Boylston Street, Boston, manufacturer of pneumatic tubes, conveyors, elevators, etc., has awarded a contract for the construction of four buildings at its proposed new works at Syracuse, N. Y. Work has already been started on the project, and it is expected that it will be completed early in the spring of 1922.

Shapiro & Aronson, 20 Warren Street, New York City, manufacturers of electric and gas fixtures, have filed notice of increase in capital stock from $250,000 to $350,000.

Foreign Trade Notes

PROPOSED ELECTRIC LIGHT PLANT AND TELEPHONE SERVICE IN CHINA.—Surveys are being undertaken at Ch'ihfeng (Hata) in the Jehol administrative area, according to a recent issue of the *Bulletin* of the Chinese Government Bureau of Economic Information, for the installation of a telephone service and an electric light plant under semi-official auspices. The Sun Fan Electric Light Company formed by Hsu Tsin has petitioned the Ministry of Communications and the Ministry of Agriculture and Commerce for registration. The Kuang Hua Electric Light Company, organized by Wang Yu-wan at Louhokou, has been registered by the Ministry of Agriculture and Commerce.

HYDRO-ELECTRIC PROJECTS PROPOSED AND UNDER WAY IN NEW SOUTH WALES.—The report of William Corin, chief engineer of the New South Wales (Australia) Department of Public Works, electrical engineering branch, for the year ended June 30, according to the *Electrician* states that the volume of work dealt with has greatly increased, owing to the passing of the hydro-electric development act and the local government act. The former resulted in the preparations of plans for the Barren Jack and Nymboida power stations and the latter caused a large number of municipal proposals to be referred to Mr. Corbin. The investigation of the water power of the state was continued and further surveys are to be made. The final scheme for the Snowy River power project shows that 24,000 kw. can be developed at a cost of about £2,000,000. The Clarence River project, it is estimated, will provide about 80,000 hp. If the Kiewa power in Victoria were developed and connected with the Hume power in New South Wales less conservation would be required, and the matter should be decided upon after conference with the Victorian Electricity Commissioners. In connection with the Barren Jack scheme which the government has definitely decided to carry out there is within a radius of less than 100 miles an immediate demand of about 9,000,000 units per annum, with a maximum demand of 2,000 kw., while within easy transmission distance there is a demand for 15,000,000 kw.-hr. and a maximum demand of 4,250 kw. Tenders have been invited for the plant for the Nymboida project, designed to meet a load of 500 kw. at the outset, as well as the much larger undertaking on the Clarence River, of which it will form the first unit.

UNITED STATES TO HAVE EXHIBIT AT BRAZIL CENTENNIAL. — The bill carrying an appropriation of $1,000,000 to provide for an American building and exhibit at the exposition to be held at Rio de Janeiro next year to celebrate the centennial of Brazilian independence has been passed by the United States Senate.

SECOND ANNUAL MEETING OF THE INTERNATIONAL CHAMBER OF COMMERCE.—The second annual meeting of the International Chamber of Commerce will be held at Rome, Italy, in September, 1922.

AUTOMATIC TELEPHONE SYSTEM FOR BOMBAY, INDIA.—The installation of an automatic telephone system in Bombay within three years, according to *Electrical Industries*, is under consideration by the Bombay Telephone Company. The plan proposes for 15,000 lines, to cost about £400,000, providing for the introduction of a full automatic plant. The government of India, it is understood, is prepared to extend the license of the company for twenty years in case the company installs an automatic or a modern central-battery system.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

A merchant in Spain (No. [illegible]) desires to purchase and secure an agency for the sale of copper bars and copper wire, both insulated and plain, for commercial electric wiring, and all necessary accessories.

A firm of importers in India (No. 252) desires to purchase and secure an agency from manufacturerers for the sale of electric novelties, etc.

A commercial agency firm with offices and warehouses in France (No. 254) desires to secure an agency from manufacturers for the sale of electrical apparatus and equipment, hardware and tools, etc.

A mercantile firm in France (No. 223) desires to be placed in communication with exporters able to furnish electrolytic copper in ingots or in bars.

WIRELESS APPARATUS FOR SPANISH ARMY.—The Spanish government has advertised for bids on wireless apparatus for its army, according to a cable from Consul Merrill at Madrid. Bids, which should be received by Nov. 30, should be made through responsible Spanish interests or through a local American agent. The Spanish law requires that bids be in certain forms, which are being forwarded and will be available to parties interested on application to the Electrical Equipment Division of the Bureau of Foreign and Domestic Commerce.

EXTENSIONS TO MUNICIPAL ELECTRIC PLANT AT CAPE TOWN, SOUTH AFRICA. — New equipment is being installed in the electric power plant at Cape Town which will greatly increase the output of the plant. The Cape Town Electricity Department, "in accordance with plan" has for some time been gradually substituting three-phase, alternating current in place of direct current in various districts, the intention being to provide the whole of the municipal area with this service, the city proper remaining on direct current.

New Apparatus and Publications

MOTORS.—The Imperial Electric Company, Firestone Park Station, Akron, Ohio, is distributing two circulars, one entitled "A Motor for Every Purpose" and the other "The Motor Built on a Creed," covering its different types of motors and generators.

ELECTRIC HEATER — An electric heater for library use has been developed by the Majestic Electric Development Company, 1705 Allegheny Avenue, Philadelphia.

ELECTRIC GRILL—Landers, Frary & Clark, New Britain, Conn., has recently placed on the market a "Universal" triple-heat electric grill set.

PORTABLE SEWING MACHINE—The Davis Sewing Machine Company, Dayton, Ohio., has placed on the market a "Bluebird" portable sewing machine.

LIGHT AND POWER PLANT — The Lincoln Light Corporation of Milwaukee, 151 Seventh Street, Milwaukee, has placed on the market a 1-kw. direct-driven light and power plant with enclosing casing.

COIL WINDING MACHINE—The Armature Coil Equipment Company, 3202 Scranton Road, Cleveland, has recently developed a pulley-driven coil winding machine.

BUTTON MAKING AND INSERTING MACHINE—A machine for button making and pigtail inserting machine has been placed on the market by the Sturdy Mechanical Laboratories, 532 West Twenty-second Street, New York City.

ELECTRIC WASHER—A device which cooks and steams the laundry in an ordinary wash tub, known as the "Electro Washer," has been placed on the market by the Electro Thermo Company, Inc., 206 Broadway, New York City.

EXCAVATING MACHINERY. — "Excavating Equipment" is the title of bulletin 56X, recently issued by the Pawling & Harnischfeger Company, Thirty-eighth and National Avenues, Milwaukee, in which it describes the use of "P. & H." excavators under various conditions of service and application.

STREET LIGHTING FIXTURES — The Erie Equipment Company, Inc., Johnstown, Pa., is distributing a leaflet covering the new "Erie" mast arm, supporting bracket, dual insulator pin, etc., for street-lighting.

BLOWERS AND FANS.—The Ilg Electric Ventilating Company, 2850 North Crawford Avenue Chicago, has issued a circular describing the various types of its "Ilg" self-cooled motor propeller fans and blowers.

ATTACHMENT PLUG CAP.— The Cutler-Hammer Manufacturing Company, Milwaukee, has recently developed a non-breakable attachment plug cap, "Dreadnaught," for use on electric flatirons, washing machines, vacuum cleaners, etc.

AUTOMATIC FIRE ALARM.—The Aero Alarm Company, 26 Cortlandt Street, New York City, has issued a booklet covering the "Aero" automatic fire alarm.

FLUSH DOOR RECEPTACLES. — Bulletin No. 17-2, issued by Harvey Hubbell, Inc., Bridgeport, Conn., describes the new "Hubbell" single and duplex flush door receptacles recently developed by the company.

STORAGE-BATTERY TRUCKS. — The Lakewood Engineering Company, Cleveland, is distributing a booklet entitled "The Unbelievable 30%" describing its various types of storage-battery trucks for use in industrial and manufacturing plants.

TRACTOR CRANE. — The Industrial Works, Bay City, Mich., manufacturer of wrecking, locomotive and freight cranes, etc., has recently placed on the market its type BC "Industrial" crawling tractor crane.

ELECTRIC HEATER. — The Carmean Electric Company, 2806 East Eighteenth Street, Kansas City, Mo., manufacturer of electric heaters and electric heating systems, has placed on the market a new "Carmean" motor-driven electric heater.

New Incorporations

THE FARMERS' CO-OPERATIVE LIGHT & POWER COMPANY, Olympia, Wash., has been incorporated by A. G. West, W. R. Taylor, R. Gerth, C. E. Conn and Elmer Walker. The company is capitalized at $10,000.

THE GRAVITY ELECTRIC SWITCH COMPANY, Portland, Ore., has been incorporated with a capital stock of $50,000 to manufacture and deal in gravity and electrical switches and automobile accessories. B. J. Hecker 125 Fourth Street, Portland, is interested in the company.

THE ADAMS BASIN (N. Y.) ELECTRIC LIGHT & POWER COMPANY has been formed to operate a local electric light and power plant. J. J. Ginther and G. R. Ward, Adams Basin, are interested in the company.

THE PENCE MANUFACTURING COMPANY, Warsaw, Ind., has been incorporated with a capital stock of $25,000 to manufacture metal products and electrical specialties. The incorporators are H. O. Pence, I. R. Klinger and G. W. Polk, all of Warsaw.

THE PRESTO ELECTRIC DEVICES COMPANY, Phoenix National Bank Building, Hartford, Conn., has been incorporated to manufacture electrical specialties. The directors of the company are E. F. Kaiser, president and treasurer; and T. H. Grace, vice-president.

THE PARKWAY ELECTRIC COMPANY, Brooklyn, N. Y., has been organized with a capital stock of $5,000 to manufacture electrical equipment. The incorporators are B. E. Simmons, L. M. Wilk and D. Moran. The company is represented by Eisenberg & Eisenberg, 1475 Broadway, New York City.

THE TRI-ELECTRIC COMPANY, New York, N. Y., has been incorporated by W. A. Doyen, W. A. Klein and E. S. Klausner, 80 Delancey Street. The company is capitalzed at $10,000 and proposes to manufacture electrical specialties.

THE SUNLIGHT ARC COMPANY, New York, N. Y., has been chartered under the laws of the State of Delaware with a capital stock of $22,000,000 to manufacture electric arc lamps and kindred products. The incorporators are J. Austin Hermer, Herman F. Harris and W. E. Haskin. The company is represented by the Capital Trust Company, Dover, Del.

THE CORNISHVILLE (KY.) LIGHTING COMPANY has been organized with a capital stock of $3,000 by S. H. Gardner, Bishop Wash and W. W. Gibson.

THE ORANGE & ROCKLAND ELECTRICAL SUPPLY COMPANY, Monroe, N. Y., has been chartered with a capital stock of $100,000 to manufacture electrical machinery, devices, etc. The directors of the company are Roscoe W. Smith and Alfred J. Crane, both of Monroe, and Frank Durland of Chester.

THE BAYARD (OHIO) ELECTRIC LIGHT COMPANY has been organized by F. L. [illegible], R. H. [illegible], John Schrader, Albert Whitacre and George Bisson. The company is capitalized at $5,000.

THE MAGIC ELECTRIC WATER HEATER COMPANY, New York, N. Y., has been incorporated with a capital stock of $50,000 by F. [illegible], J. [illegible] and J. Meyers. M. Wolff, 41 Park Row, is attorney.

Record of Electrical Patents

Notes on United States Patents

(Issued Sept. 27, 1921.)

1,392,266. PROCESS FOR THE MANUFACTURE OF CARBON ELECTRODES OR OF PURE RETORT CARBON; Emerich Szarvasy, Budapest, Hungary. App. filed June 3, 1920. Subjecting methane to thermal decomposition.

1,392,267. PROCESS FOR THE MANUFACTURE OF CARBON ELECTRODES; Emerich Szarvasy, Budapest, Hungary. App filed June 3 1920. Kneading carbon with tarry binding agent.

(Issued Oct. 4, 1921)

1,392,293. SIGNALING SYSTEM; Bornett L. Bobroff, Milwaukee, Wis. App. filed Jan. 5, 1918. For use in hospitals and sanitariums.

1,392,302. TELEGRAPHY; Kenwrick C. Cox, Norfolk Island, South Pacific. App. filed July 17, 1917. Submarine telegraphy in which a selenium relay is employed.

1,392,378. CONTROLLING MECHANISM; Louie E. Willard, Chula, Ark. App. filed Nov. 6, 1916 Speed controlling mechanisms for various kinds of machinery.

1,392,420. PORTABLE ELECTRIC LIGHT; Harry M. Koretzky, New York, N. Y. App filed March 10, 1920. Mounting for lamp and reflector readily applied to metallic or non-metallic casing.

1,392,436. METHOD OF AND APPARATUS FOR ARC WELDING; Harry D. Morton, Detroit, Mich. App. filed Dec. 2, 1918. Means for accurately correlating rate of fusion and rate of feed.

1,392,437. ARC-WELDING SYSTEM AND METHOD OF OPERATING THE SAME; Harry D. Morton, Detroit, Mich. App. filed Dec. 2, 1918. Automatic and semi-automatic apparatus.

1,392,524. PROCESS FOR THE PURIFYING AND CLARIFYING OF WATER; Miguel Puiggari and Nestor Venezia, Buenos Aires, Argentina. App. filed Nov. 24, 1917. Submitting to action of an electric current of high tension.

1,392,553. ELECTRICALLY HEATED STAMPING MACHINE; Jean Bill, Legnano, Italy. App. filed April 4, 1918. For machines in which rivets, bolts and the like are manufactured.

1,392,555. STARTING INDUCTION MOTORS; Johannes Brunken, Cologne-Bickendorf, Germany. App. filed Dec. 2, 1920. Double induction motor constructed for starting.

1,392,557. INSULATION FOR ARMATURES; Jasper F. Cullin, Detroit, Mich. App. filed Dec. 29, 1919. No tape or sleeving used.

1,392,558. ELECTRIC COUPLING; William A. Darrah and Rex G. Averill, Mansfield, Ohio. App. filed Aug. 20, 1917. Used in connecting a plurality of separate and distinct circuits.

1,392,560. TROLLEY; Manuel D. Dominguez, New Orleans, La. App. filed Feb. 10, 1921. Trolley wheel cannot leave the wire.

1,392,563. BRUSH CONNECTION; Howard B. Eynon, Wellsville, N. Y. App. filed Nov. 9, 1920. Methods of securing cable ends to brushes.

1,392,609. METHOD AND MEANS OF SELECTION; Charles R. Underhill, New Haven, Conn. App. filed Nov. 19, 1915. For selecting from stock of suitable movable elements a series or combination of elements.

1,392,686. CAR HEATER; Lee P. Hynes, Albany, N. Y. App. filed July 2, 1919. Installed under car seat.

1,392,712. BALANCING RELAY; Willard E. Brantigam, Avery, Idaho. App. filed Jan. 2, 1920. For railway cars wherein the propelling motor is utilized to recharge the storage battery.

1,392,762. SELECTIVE TELEPHONE SYSTEM; Ruben C. M. Hastings, Columbus, Ohio. App. filed Nov. 28, 1913. Substations may be shunted from the line.

1,392,802. ELECTRIC FIRELESS COOKER AND RANGE; Lemuel W. Serrell, New York, N. Y. App. filed Oct. 31, 1919. Of moderate size and simple construction.

1,392,815. METHOD AND MEANS OF DETECTING IRREGULARITIES IN TRANSMISSION LINES; George Crisson, Hoboken, N. J. App. filed Oct. 15, 1919. Long-distance telephone line.

1,392,840. SANITARY TELEPHONE DEVICE; W. W. Lukenbach, Philadelphia, Pa. App. filed Sept. 28, 1920. For holding the receiver when looking up information.

1,392,846. TROLLEY MOUNT; Hugh J. Murphy and Edward F. Murphy, Troy, N. Y. App. filed Feb. 23, 1921. To prevent injury to cross-wires and other overhead structure.

(Issued Oct. 11, 1921)

1,392,944. STERILIZER; Albert H. Jessup, Erie, Pa. App. filed Feb. 3, 1920. For sterilizing surgical instruments and dressings.

1,392,965. ELECTRIC STEEL FURNACE; Herman F. Priwer, Springfield, Ohio. App. filed June 15, 1920. Easily and quickly charged.

1,392,996. ELECTRIC GENERATOR BRUSH HOLDER; Charles F. Willey, Louisville, Ky. App. filed May 27, 1921. Improved spring arrangement.

1,393,018. RELAY; Peter C. Hewitt, Ringwood Manor, N. J. App. filed May 9, 1916. Use in evacuated apparatus with more than one conductor that may act as cathode.

1,393,019. CONSTANT-CURRENT DISTRIBUTION SYSTEM; Peter C. Hewitt, Ringwood Manor, N. J. App. filed Sept. 12, 1916. For obtaining constant current in circuit having variable electrical characteristics.

1,393,038. ELECTRIC GENERATOR AND MOTOR; Robert Rankin, Leamington Spa, England. App. filed Dec. 15, 1920. Self-regulating machine.

1,393,043. PULL SOCKET; Ralph A. Belmont, New York, N. Y. App. filed April 28, 1916. Does away with number of springs heretofore used.

1,393,077. ELECTRICAL CONDENSER; William C. Brinton, Jr., Kennett Square, Pa. App. filed Oct 8, 1918. Elimination of moisture and reduction of tendency to "store."

1,393,089. MULTIPLE-CABLE GLAND FOR BULKHEADS AND THE LIKE AND PLASTIC FILLING COMPOUND THEREFOR; James H. Collie, Birkenhead, England. App. filed Jan. 13, 1919.

1,393,141. METHOD AND MEANS FOR IMPROVING THE COMMUTATION OF DYNAMO-ELECTRIC MACHINES; Jaroslaw K. Kostko, St. Louis, Mo. App. filed Sept. 18, 1916.

1,393,228. PROTECTIVE DEVICE FOR ALTERNATING-CURRENT ELECTRIC SYSTEMS; Albert E. McColl, Dumbarton, Scotland. App. filed Dec. 31, 1919. Prompt disconnection of faulty apparatus or circuits.

1,393,231 DEVICE OR ARRANGEMENT FOR THE CONTINUOUS MOVEMENT OF ROLLING OR SLIDING BODIES Edmund Magerle and Hermann Martinek, Vienna, Austria. App. filed June 10, 1914. For advertising purposes.

1,393,254. TROLLEY HEAD; Ivan van der Streaten, Liège, Belgium. App. filed May 24, 1920. Adapted to oscillate about its axis.

1,393,275. ANNUNCIATOR; Hector A. Franz, Hood River, Ore. App. filed Nov. 1, 1919. Selective alarm type.

1,393,320. ADJUSTABLE ELECTRIC HEATER; Milton H. Shoenberg and George J. Henry, San Francisco, Cal. App. filed Oct. 1, 1919. Adjustment in several directions.

1,393,321. RADIANT HEATER; Milton H. Schoenberg and George J. Henry, San Francisco, Cal. App. filed Oct. 1, 1919. Zone of radiating heat extending at right angles to the axis of reflector.

1,393,323 METHOD OF ELECTRIC THERMAL CONTROL; Milton H. Shoenberg, San Francisco, Cal. App. filed Dec. 27, 1919. Prevents overheating.

1,393,325. ELECTRIC HEATING ELEMENT; Luther D. Smith, Toledo, Ohio. App. filed Feb. 24, 1919. Resistance wire stranded and twisted.

1,393,326. TELEPHONE SYSTEM; Arthur B. Sperry, New York, N. Y. App. filed July 26, 1917. Number-indicating devices.

1,393,344 METHOD OF AND MEANS FOR SWITCHING Nicholas J. Conrad, Chicago, Ill App filed Sept 24, 1917 Current broken by portable switch shunted around stationary knife switch.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

ROCKLAND, ME—The Knox County Electric Company has submitted a proposal to the street-lighting committee whereby thirty-one ornamental standards surmounted with 600 cp. lamps can be erected on Main Street and the present incandescent lamps increased from 60 cp. to 100 cp. The cost to the company is estimated at $1,[illegible]

ANDOVER, N. H.—A movement has been started to organize a company for the purpose of securing electricity in Andover. It is proposed to extend the lines from East Andover. The Franklin Light & Power Company supplies electricity in East Andover.

FREEDOM, N. H.—The Freedom Electric Company was recently incorporated to take over the business of the Freedom Electric Light & Power Association. The company operates in Center Ossipee, Effingham Falls and Freedom Village. Arthur P. Merrow is president.

RUTLAND, VT—The Hortonia Power Company, affiliated with the Port Henry (N. Y.) Light, Heat & Power Company, has plans under consideration for improvements and additions to its systems during the next two years, to cost about $300,000. The installation of a 500 kw. hydro-electric generating unit to operate at present under an 18 ft. head will be made immediately at Weybridge, Conn., where an ultimate 3,500 kw. will be developed under a 30 ft. head. The systems now operating at 25 cycles and 60 cycles will be inter-connected through a 1,000 kw. frequency-changer set and voltage regulation will be provided for by line changes and the installation of automatic regulators. The above additions and improvements together with the development and enlargement of storage reservoirs will increase the output of the plans of the Hortonia and Port Henry companies approximately 50 per cent.

BROCKTON, MASS.—The W. L. Douglas Shoe Company is planning an addition to its power house. J. William Beal Sons, 62 Summer Street, Boston, are architects.

FALL RIVER, MASS—The Fall River Electric Light Company has filed notice of an increase of $700,000 in capital stock.

GREAT BARRINGTON, MASS — The Southern Berkshire Power & Electric Company is considering the erection of a transmission line to its new plant at Rockdale.

NEW HAVEN, CONN—An appropriation of $12,000 has been approved by the board of finance for the installation of an electrically operated traveling crane at the city wharf.

WINSDOR LOCKS, CONN — Permission has been granted to the Connecticut River Company, Pearl Street, Hartford, by the Federal Power Commission for the construction of a hydro-electric generating plant at Windsor Locks. C. H. Tenney, 201 Devonshire Street, Boston, is engineer.

Middle Atlantic States

BALDWIN, N. Y.—The installation of an electric street-lighting system in Baldwin Harbor is under consideration. The Baldwin Harbor Civic Association is interested.

BUFFALO, N. Y.—The Council is considering the installation of 331 arc lamps in Buffalo, of which 270 will be required for Main Street.

BUFFALO, N. Y.—The City Council has passed an ordinance requiring the electrification of the steam railroad lines within the city limits. The ordinance further provides that a plan for the electrification be submitted by Feb. 1, 1922, and that it be put in operation a year later. Frank C. Perkins is commissioner.

ITHACA, N. Y.—Bids will be received by Mr. C. D. Bostwick, comptroller Cornell University, until Nov. 10, for construction, electric, heating and sanitary work, including electric work-packing and cold-storage plant for the department of pomology at the New York State College of Agriculture, Cornell University, Ithaca, N. Y. Drawings, specifications and blank forms of proposal may be obtained at the Department of Architecture, Capitol, Albany. L. F. Pilcher is state architect.

NEW YORK, N. Y.—Plans have been filed by the New York Steam Corporation, 280 Madison Avenue, for extensions and improvements to its power house at 507-19 East Fifty-ninth Street, to cost about $300,000, including equipment.

RICHMOND, N. Y.—Application has been made by Grover A. Whalen, commissioner of plant and structures, Muncipal Building, New York City, to the Board of Estimate for an appropriation of $177,700 for equipment for a trackless trolley system between Richmond and Tottenville, Staten Island. The present plans provide for a new electric generator and auxiliary power equipment at the Sea View power plant, automatic electric substation, cables and wires for transmission lines, feeder lines and overhead trolley system.

JERSEY CITY, N. J.—Plans have been prepared by the Vulcan Iron Works, Hudson and Exeter Streets, for rebuilding the power plant at its works, recently destroyed by fire. The cost is estimated at $40,000.

MONTCLAIR, N. J.—An ordinance providing for improvements to the street-lighting system in Montclair, to cost about $45,000, was recently introduced at a meeting of the Board of Commissioners, and passed its first reading. James T. Hanan is director of public improvements.

HARRISBURG, PA.—The City Commission is considering plans for the installation of a new street-lighting system on a portion of North Second Street, which will require lamps varying from 400 cp. to 600 cp. S. F. Hassler is commissioner in charge.

HAZLETON, PA.—A tentative agreement has been reached by the City Council and the Pennsylvania Power & Light Company in connection with a ten-year street-lighting contract to become effective Jan. 1, 1922. The new contract provides for an increase in the candlepower now in use 120 per cent, giving Hazleton from 533 to 600 arc lamps. The change in the lighting system will necessitate extensions and improvements to the substation at Lincoln Street and Diamond Avenue.

HELVETIA, PA.—Work is under way by the Rochester & Pittsburgh Coal & Iron Company, Punxsutawney, on the construction of an electric generating plant at Helvetia. The proposed plant will have an initial capacity of 3,000 hp.

WILMINGTON, DEL.—Bids will be received by the Board of Education of Wilmington, until Nov. 14, for the installation of a complete lighting system in a public school and for wiring and fixtures for 25 lights in seven other schools.

BALTIMORE, MD.—The Chesapeake Paper Board Company, Key Highway and the Baltimore & Ohio Railroad, contemplates the construction of a power house. J. S. Smith is president.

BEL AIR, MD.—The Bel Air Electric Company, in co-operation with the Consolidated Gas, Electric Light & Power Company, Baltimore, plans to erect a pole line in the vicinity of the municipality to provide for increased service. The Consolidated company also contemplates a number of line improvements in this section.

BRISTOL, VA.—A company to be known as the Washington County Light & Power Company is being formed for the purpose of erecting a high-tension transmission line to connect with the lines of the Bristol Gas & Electric Company and extend along Abington Road.

North Central States

CHARLEVOIX, MICH.—Work has been started on extensions to the municipal electric power plant. John D. Curtis, Charlevoix, is in charge.

MASON, MICH.—The Consumers' Power Company has preparations under way for the installation of new lines in connection with improvements to the city lighting system, to cost about $20,000.

LOWELLVILLE, OHIO.—The Pennsylvania-Ohio Power & Light Company has work under way on the construction of an addition to the Lowellville power station to house an additional 20,000 hp. turbine generator, to provide for increased service. The installation of the new unit will bring the capacity of the local station up to 80,000 hp.

NEW RICHLAND, OHIO.—The County Commissioners have authorized the Belle Center (Ohio) Light & Power Company to erect an electric transmission line to New Richland, Logan County.

EAST CHICAGO, IND.—Bids will be received at the office of the Board of Public Works until Nov. 14 for the installation of a lighting system on parts of Grapevine Street and 142d Street. T. Y. Richards is clerk of the board.

KOKOMO, IND.—The J. M. Leach Manufacturing Company contemplates the construction of a one-story power house. Thomas McGraw, Citizens' Trust Building, is architect.

MITCHELL, IND.—E. E. Dean, Indianapolis, is negotiating for the purchase of the Mitchell Electric Light Plant, subject to the approval of the Indiana Public Service Commission. Arrangements have been made by Mr. Dean to operate the waterworks of the town.

WILLIAMS, IND.—Plans are under way by the Middle West Utilities Company, Williams, a subsidiary of the Southern Indiana Power Company, for a hydro-electric generating plant in Williams, to cost $80,000. Holland, Ackerman & Holland, Inc., 53 West Jackson Boulevard, Chicago, are engineers.

BELLEVILLE, ILL.—The City Council has adopted recommendation of the Lighting Committee providing for the installation of new street lamps. A municipally owned light plant is being agitated.

SHEBOYGAN, WIS.—The Ke No Company, manufacturer of furniture novelties and hardwood specialties, is planning the construction of a new power house, 25 ft. x 35 ft. W. C. Weeks is architect.

ADRIAN, MINN.—Bids, it is reported, will be received for extensions to the municipal electric power plant, consisting of one 150-kva. generator, one electric switchboard, etc.

SHELL ROCK, IOWA.—A company is being organized, it is understood, for the construction of a hydro-electric plant in Shell Rock, to cost about $100,000. W. M. Roe, Waverly, is interested. Holland, Ackerman & Holland, 53 West Jackson Boulevard, Chicago, are engineers.

EDINA, MO.—The Edina Light Company will extend its transmission lines to Gibbs and Labelle, at an early date. The company is also considering the installation of additional machinery at its plant, including a 300 hp. oil engine complete with generator. L. A. Nickell is secretary and treasurer.

MONTGOMERY CITY, MO.—The electric light plant and a portion of the ice plant of the Montgomery Ice & Electric Company were recently destroyed by fire. E. H. Algermissen is owner.

PARKVILLE, MO.—The Kansas City (Mo.) Light & Power Company is contemplating the erection of a transmission line from Parkville to Fairview.

SALISBURY, MO.—Plans are under consideration for the erection of a transmission line to Prairie Hill. The Council recently awarded contract for equipment for the proposed new municipal electric lighting plant to the General Electric Company, St. Louis.

SCOTTSBLUFF, NEB.—The Intermountain Railway, Light & Power Company contemplates the installation of 140 additional street lamps in Scottsbluff.

Southern States

HIGH POINT, N. C.—Work will be started soon by W. A. Davis and associates on the construction of an electrically operated ice-manufacturing plant, to cost $75,000.

RED SPRINGS, N. C.—The town authorities are considering issuing $50,000 in electric light and water bonds.

STANTONSBURG, N. C.—Plans are under consideration by the town authorities for the construction of an electric light system in Stantonsburg, to cost about $20,000. G. L. Hill is clerk.

LEESBURG, FLA.—The Grass Fibre Pulp & Paper Company plans to construct a power plant to be used in connection with its pulp and paper mill now under construction. E. R. Lacy is vice-president and manager.

WINGATE, N. C.—Arrangements are being made by the Town Commission for an appropriation of $10,000 for an electric lighting system in Wingate. A. C. Small is town clerk.

SAN ANTONIO, FLA.—Plans are under consideration for the establishment of an electric light plant in San Antonio, for which $6,000 in bonds have been voted. The project includes the extension of a transmission line from Dade City to San Antonio.

ROGERSVILLE, TENN.—Improvements and extensions to its plant are under consideration by the Rogersville Electric Company.

HAMMOND, LA.—Improvements and extensions to the lighting system in Hammond are under consideration by the City Council.

SHREVEPORT, LA.—The United States Sheet & Window Glass Company, Shreveport, is contemplating the erection of a large electric power plant for use in connection with its plant under construction at Jewella, near Shreveport. H. E. DeVaughn is chief engineer. The headquarters of the company are at Morgantown, W. Va.

BILLINGS, OKLA.—A high-tension transmission line will be erected to extend from a point on the main line of the Oklahoma Gas & Electric Company at Oklahoma City into Billings. This project is included in the plan to furnish several cities and towns in northwest Oklahoma with electricity from high-tension lines.

HOUSTON, TEX.—The Houston Light & Power Company is considering extensions to its electric generating plant, to cost about $500,000. S. R. Berton, Jr., is manager.

Pacific and Mountain States

TACOMA, WASH.—Work is under way by the Buffelin Lumber & Manufacturing Company on the construction of plant additions, to cost about $350,000, including electric power plant, veneer factory and planing mill.

CORVALLIS, ORE.—The Mountain States Power Company contemplates considerable construction work in Corvallis during the remainder of the year, to cost about $14,000. The company has completed the erection of a transmission line into the city at a cost of $20,000.

MEDFORD, ORE.—A new company is being organized by J. T. Gagnon, operator of a local lumber plant, for the construction of an electric power plant for commercial and industrial service, for which preliminary plans are under way.

LOS ANGELES, CAL.—Plans are under consideration by the Ward Baking Company for the construction of a baking plant to cost about $2,000,000. The installation will include power equipment, ovens, conveying apparatus and other electrical and mechanical equipment.

MANTECA, CAL.—The Pacific Gas & Electric Company, San Francisco, it is reported, is considering improvements to its local power house, including the installation of new machinery, to cost about $35,000.

SAN MATEO, CAL.—The installation of an electrolier system in San Mateo is under consideration. Stanley Whitehead is city engineer.

SHAFTER, CAL.—A petition has been presented to the Board of Supervisors for the installation of a lighting system in Shafter.

STOCKTON, CAL.—A petition has been submitted to the County Supervisors for the formation of the Lathrop Highway lighting district. E. Graham is clerk.

COLORADO SPRINGS, COL.—Tentative plans have been agreed upon for the installation of an ornamental lighting system from Nevada Avenue to the Broadmoor Hotel. Joseph I. Caldwell is city engineer.

Canada

BROCKVILLE, ONT.—The Eugene F. Philips Electrical Works, Ltd., Montreal, contemplate the construction of a plant to cost between $2,500,000 and $3,000,000. The company will secure electrical energy of between 1,000 hp. and 3,000 hp. from the Hydro-Electric Power Commission.

WATFORD, ONT.—The establishment of a hydro-electric and power distribution system, to cost about $50,000, is under consideration by the Warwick Township officials. For further information address N. Herbert, Watford.

Directory of Electrical Associations

Printed in the First Issue of Each Month

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Electrical World

New York, Saturday, November 12, 1921

The Power of the Greatest "Ism" in the World

AMERICA has brought two mighty thoughts out of the great world war. The first is that we do not live just in a country, but in a big wide world, where every nation's actions and affairs affect and influence us all. The second is that laws and habits and traditions *can* be changed if power is applied, and that therefore old, wrong conditions need not be suffered longer if a way can be devised to better them. These are great days for thinking men.

No person can say how history will mark the coming post-war period, but there is one condition that is sure to be writ large. We face an era of mass thinking, a new tendency on the part of all men and women to wonder why things should be wrong and talk about the making of them right. The world has evolved through many dragging centuries. Each generation has accepted as traditional the burdens and the evils that it found and passed them on with little change. There have been few periods of rapid renaissance. But the vast convulsions of the world war, social and economic, have shaken free these habits of men's minds, and they are thinking. We see it everywhere. And if we guide this new-born thinking power, great good will come of it.

Demagogues have charged that capitalism is the dominant force in America. But this is false. For in all history America is the outstanding example of an individualistic country. In the European social structure a man is born into a class and there he stays. He is born high or he is born low, and neither brains nor energy will raise the peasant to a peer, nor will the absence of them both displace a noble to make way for a better man of lower class. But in America there is no power that can prevent the smallest atom in the social mass from rising to the top, or hold it there once it has ceased to merit and maintain this high position. There are many "isms" in the world, but the greatest of all is individualism. And individualism rules in the United States.

So men and women in America are beginning to realize that the people—every people—have the power to shape somewhat the loads they bear by guiding and speeding the course of evolution instead of waiting in the old-time way. And they are thinking more deeply—about the cost of war, about labor, about capital, about taxes, government and education, about living. They see—we see—that, after all, things *can* be changed.

The world is as its people make it. *Collectively* we are the masters of our living and our industries. We can right wrongs if we will think and work together — here and throughout the world.

Comfort Avery Adams

Educator and engineer, who was largely responsible for the organization of the American Engineering Standards Committee and who played a leading part in the war stimulus given to electric welding.

ENGINEERING effort uncontrolled by reasonable standards soon reaches a point where progress is arrested because of high production and utilization costs. Each branch of engineering, therefore, has for years been developing its own standards. Because, however, of the complexity of interest and the growing interrelation of engineering effort it became apparent that some agency must be created to correlate these standardization activities. Such was the genesis of the American Engineering Standards Committee, the organization of which was brought about largely through the efforts of Prof. Comfort A. Adams. This organization, now in its third year, representing the national engineering societies and the government departments, has become the authoritative body through which standardizing activities are co-ordinated. It is also recognized as the national body for the handling of all international standardization. Professor Adams was chairman of the organization committee and first chairman of the standards committee itself.

To Professor Adams must be given the credit also for much of the impetus given to electric welding during the war. He was a member of the sub-committee of the Council of National Defense on electric welding, which was later transferred to the Emergency Fleet Corporation, with him as chairman. Under the stimulus of the committee notable advances were made in the art of welding, particularly in its application to shipbuilding. Several new laws bearing on the quality of welds and the structure and constitution of steel were established. Professor Adams, besides, was chairman during the war of the electrical engineering section of the National Research Council, the activities of which were chiefly related to the art of electric welding. He was first president of the American Welding Society and first director of the American Bureau of Welding.

Professor Adams was born in Cleveland, Ohio, Nov. 1, 1868. He received his electrical engineering education at the Case School of Applied Science, from which he was graduated in 1890. After a year with two Cleveland manufacturers he became an instructor in electrical engineering at Harvard and a student of mathematics and physics. He was advanced to assistant professor of electrical engineering in 1896, professor in 1906 and since 1896 he has been Lawrence professor of engineering. During the years 1915-1918, under the co-operative agreement between Harvard and the Massachusetts Institute of Technology, he was also professor at the latter institution. After the dissolution of that agreement by the courts he was the first dean, during 1919, of the reorganized Harvard Engineering School, but resigned to become chairman of the Division of Engineering of the National Research Council. This fall he returned to Harvard as dean of engineering. It was in 1917 that President Wilson appointed him a member of the general engineering committee of the advisory commission of the Council of National Defense. In this connection he outlined a scheme, later adopted in part, for co-ordinating the government purchase of war supplies

Professor Adams is also a consulting electrical engineer and numbers among his clients both manufacturing and public utility companies. In 1904 he was a member of the jury of awards at the St. Louis Exposition. He is the author of "Dynamo Design Schedules" and has made many valuable contributions to the literature on electrical machine design. For years he has taken a leading part in engineering association work. He is a past-president of the A. I. E. E. and a member of the American Engineering Council.

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Why There Are Objections to the American Valuation Plan

CLEARLY the American valuation plan is the most practicable method that has ever been proposed for administering the tariff. It will change our system of appraising goods so that a proper rate of duty will be levied on the basis of the wholesale price of similar competing goods in our own markets, where the government's authority can ascertain the facts. This is far more workable than calculation on foreign values affected by fluctuating currency and impossible of proof by the very limited number of government agents now engaged in checking prices abroad. The plan will also tax like goods alike, no matter where they come from, which under foreign valuation does not happen.

The idea is so sensible and appealing that it is hard to understand why it is being strenuously opposed. Investigation shows, however, that the opposition comes from four directions—(1) importers oppose it because it will raise the price of foreign goods and affect their opportunity for profit; (2) some exporters oppose it because they believe that foreign countries will retaliate with higher duties against our goods; (3) importing retailers, such as department stores, oppose it because it will decrease their margin of profit, and (4) some others oppose it because it will change existing methods and unsettle existing habits. Analyze these objections and they cannot stand against the obvious advantages. The importer must regulate his business to the needs of the country; the exporter cannot sacrifice 80 to 90 per cent of the business of our industries which is domestic to avoid the possibility of danger to some part of the 10 to 20 per cent of our output which is sold abroad, and the objectors to change must not prevail with this world-old argument against all progress.

The American valuation plan is sound. It makes for stability of trade, for healthy competition, for variety in importations. It will substitute knowledge and scientific regulation for guesswork and manipulation. The country needs it now.

A New Subject for the School Arithmetic

THERE is no good reason why the elementary facts on which the calculation of electric service bills is based should not be taught in the public schools along with the other weights and measures taught in simple arithmetic. In school textbooks the pupil is taught to deal with common weights and measures and the methods of computing the cost of the various articles that he must buy or sell in everyday life. Excepting the avoirdupois units of weight and those of linear measure, it is questionable whether any of these units enter into the daily life of the American family so fully as the units of electrical measure do. The engineer who allows his mind to dwell on the intricate foundation on which the system of electrical measurements is built may be inclined to declare that teaching the subject is impossible. But no one will deny that great good would result from a better popular understanding of such units as the watt and kilowatt, the watt-hour and kilowatt-hour and the horsepower. The calculation of the large majority of service bills is based on the use of these units in combination with simple arithmetic. The introduction of tables and examples showing how the kilowatt and kilowatt-hour are developed by the use of appliances and how these quantities enter into the service bill would be a powerful factor in placing the electrical measurements in which the public is most vitally interested in the same familiar light that from long habit has come to surround other units of measure.

Where Shall Utilities Eventually Obtain Funds?

BEFORE the days of large government expenditures, when Congressional appropriations were reckoned in millions, not billions, the question of tax exemptions was an academic one. Now, however, the total of tax-exempt securities has grown so large as to cause concern, as well it might. What with eighteen billions of Liberty and Victory bonds outstanding, one can get some conception of the enormity of the problem, and even then the tale is only partly told. It is conservatively estimated that thirty billions (the national wealth of Japan is only approximately twenty-five billions) is invested in tax-exempt securities, and the printing presses are issuing millions more daily. Obviously, if private industry and initiative are not to be hampered, much less choked, a halt must be made; otherwise we shall soon drift into a condition of state socialism with the government running everything. This, of course, is un-American and would not be tolerated for one moment. Both England and Canada have sensed this danger, and in Canada the policy of exemption has been abolished without detriment to the salability of government bond issues, while in England the income from government securities issued before and during the war is taxable except to non-residents. The situation as it exists in this country at the present time is such that a 5 per cent tax-exempt security will yield to a wealthy man as great a return as a business enterprise paying from 12 to 17 per cent.

While electric public utilities have been able to raise many millions through the sale of securities locally to employees and patrons of the company for the erection of new stations and transmission lines, they must look to wealthy capitalists for a greater part of the funds. Hence the necessity of a change in a system of taxation which forces the investment of large fortunes in tax-exempt securities. Within a reasonable time, when the industries of the country shall move upward, the sum total of the financial needs of electric public utilities will be very great. To the extent that the utilities are hampered in obtaining the necessary capital by the competition of tax-exempt securities will municipalities and states be encouraged and stimulated to embark in quasi-public enterprises, many of which will ultimately end in disaster. The function of government is to regulate and not to operate, and we cannot cure too much government with more government. By placing the incomes from all bonds on a parity the slogan of "Less government in business and more busness in government" will be made effective.

Industrial-Plant Electrical Specifications

SPECIFICATION writing is a science, but specification writing by one not properly trained becomes a burden on both the buyer and seller of electrical and allied equipment. Manufacturers have spent huge sums in experimentation to perfect apparatus which the best of engineers have toiled over in designing and watched over in operation for years to the end that standards shall be evolved which mean low cost and the greatest reliability. If standard apparatus is known to be applicable in any particular case, it is idle to draw detailed specifications to cover its purchase. If it is not known that standard apparatus is available, or it is thought that something different might be better, the writing of specifications in too great detail becomes an abomination to the manufacturer who must twist his ideas and ideals in a direction away from his standard practice. And the specification writer pays the bill. Common sense indicates that every one concerned would benefit if the purchaser were to limit himself to describing accurately operating conditions and duty requirements and let the manufacturer submit his bid on the equipment his experience has shown to be most suitable. Then, if changes should seem advisable, a more intelligent basis would be provided for working them out.

The 5,000-Volt Limit Again

THE 5,000-volt limit still persists as a source of controversy in connection with the joint usage of poles for power and communication purposes. A recent letter written by the plant superintendent of a telephone company and dealing with a question of joint use at a voltage above that figure makes the direct statement that this limit has been agreed to by the National Electric Light Association as the proper one. Perhaps no one subject has been productive of so much controversy as this one of voltage limit. Starting with the old crossing specifications and the older joint-pole agreements, the telephone interests have insisted that this was the limit to which they could safely work their protective equipment and that the general insulation of their plant would stand no more. The power interests have just as strenuously insisted that they cannot tie up their pole lines by such a limit, since all developments point to a more or less general use of higher distribution voltages. The rural-service line developments of the past two or three years unmistakably point to the need for distribution voltages over wide territories that will be far above the limit named.

The statement cited was probably due to ignorance on the part of the plant superintendent, but such ignorance is the type that does a tremendous amount of harm. In the heat of argument over what shall be done in specific cases, a statement of this sort from a responsible official in a position to know better always breeds suspicion of ulterior motives. The telephone people are entitled to their own opinions in the matter and have the right to fight for them to the limit of their ability. The power interests likewise are free to present their own view of the situation. It should not be necessary to say that the N. E. L. A. has never through its committee or its executives recognized a voltage limit for joint construction or for any other purpose. Whether such a limit shall be established, and if established, what it shall be, will be determined by economic factors affecting each industry and by future developments making for safety to the public and protection to the telephone plant. To say that there is no progress possible in these latter directions is to belie past industrial history.

The Interests of Electrical Men Cannot Be Sectionalized

ELECTRICAL men throughout the country are distressed over the situation, outlined in last week's issue, which has arisen between the National Association of Electrical Contractors and Dealers and its members upon the Pacific Coast. For the electrical industry is more than a mere local business. It is a great evolutionary force which is molding new industrial, social and economic conditions throughout the world. It is a fountain from which is flowing an idea that has spread the length and breadth of our country until it has come to be an influence in every home, in every life. The purpose of electrical men in the North, the East, the South or West is ever the same —to carry electricity into all homes and industries for saving labor and improving health, comfort and happiness. There is nothing sectional about this common purpose, nor in the way they go about it in any state.

In recent years, however, there has developed a feeling in more than one locality that conditions there are "different," and that because of intervening distance, the affairs of the Coast, for instance, must be considered as a sectional problem. This sentiment has led to unfortunate misunderstanding between the contractor-dealers of California, Oregon and Washington and their national headquarters in the East, which has culminated in the actual secession of these three groups from the national body. And there it stands—a dangerous precedent.

The principle of national organization, interdependence and solidarity is as deep and as broad and as enduring as the nation itself. The arguments for membership in any such national association are many. The argument against it cannot be weightier than that it does not pay its cost—which in the case of the contractor-dealers averages, across the country, but $12. This would seem to be a small amount to pay for the advantages that could be made to accrue from national contact and national co-operation in any national association work.

But this is more than just a controversy. There is a broad living principle involved, for the West needs the East and the East needs the West. No man can say that the East has no concern with West Coast agricultural products, for instance, or that the West does not depend upon the East for capital and for manufactures. Nor could he say that such a sectional policy can be right unless he thinks the Coast should fight its battles unassisted if a war should come with a Pacific power—which God forbid!

There are tremendous possibilities in local work among electrical men on the Coast. No doubt of it. There is need for local work in every state. But these local activities *can* be co-ordinated with national plans and achievements, and membership in a national association *can* be made worth its cost to electrical men everywhere. It is to be hoped that further thinking will lead to a sensible adjustment and cure this apparent breach between two sections of an industry whose broad interests actually cannot possibly be separated.

Balanced Production the Key to Orderly Prosperity Everywhere

IN BUSINESS circles such terms as "buyers' strike," "deflation" and "price reduction" have side-tracked attention from the fundamental factors that control orderly prosperity the world around in normal times. Evidences have been frequent of rising prices with a shortage of commodities and of falling prices as the market became saturated, but too infrequently has it been realized that in the controlling economic law of supply and demand the extent of the supply and the extent of the demand must equalize in the long run even if not concurrently. In the electrical industtry, for instance, copper comes into the market as a raw material supply, but it also comes into the market as a demand for electric service, in the form of transmission and distribution line conductors and for motors, generators and other products which use it in construction. In the same way every commodity enters into the circle of production and use, and only in so far as every producer is a consumer is the whole process economical and successful. No one essential element in the circle of producer and consumer can either multiply production beyond normal consumption or hoard commodities for long without serious reaction of the economic law of supply and demand, such a reaction as has already been evident and from which we are gradually emerging as more activity is shown in intensified selling and tendencies to balance demand against production and existing stores of goods already hoarded become evident. An interesting instance comes from the Southern States, where a short cotton crop combined with a gradual increase in local and foreign demand for the staple has brought about improved conditions in all lines of business during the past six months which are probably more marked than in any other section.

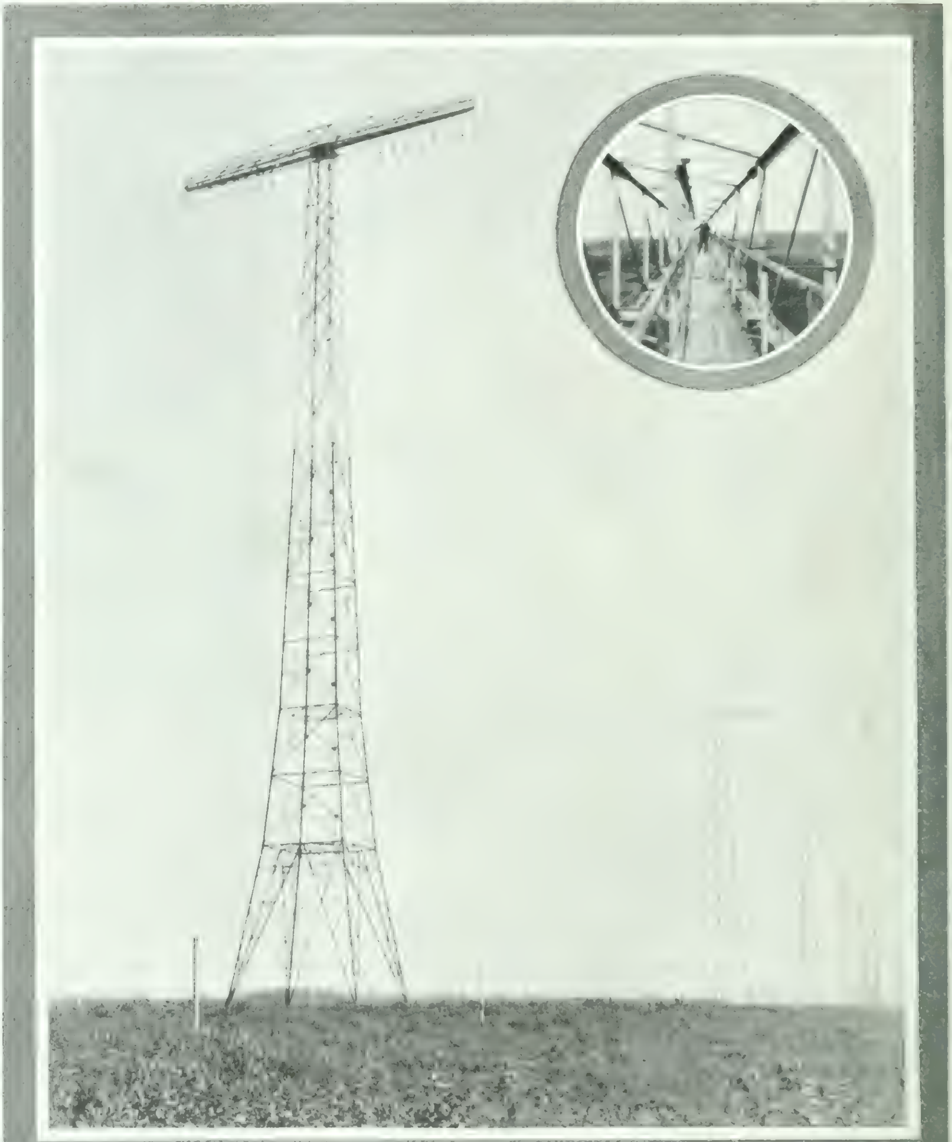
In the same way these fundamentals apply to the world at large, for order and prosperity can return only when all nations fall again into harmonious economic relations with one another. This point was clearly brought out by Dr. B. M. Anderson, Jr., economist of the Chase National Bank of New York, recently, before the American Manufacturers' Export Association, when he stated that there is no indication that there has been overproduction in the United States, but rather a maladjustment of production. He said: "It is impossible for a people to produce more than they can consume so long as they produce things that they want and produce them in right proportions. Production and consumption grow together. It is out of production that the income of the country comes, and the income of the country is spent for goods and services. If we substitute the word 'utilize' for the word 'consume' the proposition is strictly true that if the productive resources of a community are apportioned rightly and devoted to the right things, it is impossible to produce more than we can utilize, even though our current consumption may not take up the whole of our current production. The increase of capital in the form of durable, long-time goods is obviously a means of utilizing productive energies. If things are produced in right proportion, supply can never exceed demand."

The economic problem of American manufacturers therefore has two distinct aspects—first, the acceleration of sales effort among basic industries so as to adjust supply facilities and demand on an equal basis in this country, and second, to assist Europe to get back on her feet and resume her place as a great manufacturing center and an outlet for the raw material supplies concentrated in the United States. Just how to promote the revival of European industry in the face of a debt of sixteen billions of dollars owed to us has not as yet been satisfactorily answered. To ignore the problem for this reason, however, and hope that the world will ultimately shake itself into some normal course, can only prolong the condition holding back our own prosperity. Every manufacturer is in possession of facts concerning his own business and if he will show the same desire to co-operate with the agencies of our government working on this problem and other economists making individual studies, the resulting solution will not be disappointing. Pessimism and indifference at this time have no logical place in the thinking of those who expect to be in business next year.

Traffic Accidents and Street Illumination

THERE has been an enormous increase of traffic accidents in the streets of American towns and cities, an increase altogether out of proportion even to the very large increase of automobile traffic. An important contributory cause of night accidents was considered in a paper presented before the Illuminating Engineering Society recently by Messrs. Anderson and Haas. It discussed the part played by insufficient street illumination in such accidents. A thorough study of the distribution of traffic accidents with respect to the hours of darkness brings out the important, though not unexpected fact that more than one-sixth of all the night accidents are due to driving in inadequate or improper illumination. The study indicates that five or six hundred lives annually are sacrificed to this particular sort of inefficiency, and that the money equivalent of the various forms of accident chargeable to poor lighting is somewhat greater than the total expenditure for street lighting in the United States.

Much has been done in various parts of the country through automobile headlight regulation, but, as was pointed out in another paper at the same convention, there is a great deal to be said for lighting city streets so efficiently that the main reliance need not be placed on headlights. Experiments indicate that dangerous spots where night traffic is a serious menace can be sufficiently well lighted to reduce the accident hazard greatly without particular difficulty or forbidding expense. Certainly there are many places where this should be done. The situation is really grave, and any reasonable method of amelioration should be enforced.



World's Greatest Radio Station on Long Island Formally Opened

THE remotely controlled radio transmitting station at Rocky Point, Long Island, which was formally opened last Saturday, is the largest and most powerful station in the world, its sending range being virtually world-wide. In the ultimate it will far surpass anything else of its kind now considered. Although only two rows of six towers each are installed at present the ultimate development will involve twelve antennas radiating from a single point like the spokes of a wheel. Three spokes will be for transpacific communication or radio-telephone purposes to Europe. Another group of three will be for South America, and each of the remaining spokes for England, France, Germany, Sweden, Denmark and Poland respectively. No conception of the magnitude of the towers and spans can be obtained from the accompanying illustrations, but the insert above indicates the size of one-half of one crossarm. The towers are 410 ft. high and 1,250 ft. apart. The crossarms are 150 ft. long and support sixteen parallel conductors. The construction work was supervised by the J. G. White Engineering Corporation and the station is owned by the Radio Corporation of America. For further details see page 287.

Why Colorado River Should Be Developed

Steady Growth of Load in Southwest Will Force Early Hydro-Electric Development—Protection of Imperial Valley Against Floods and Need of Water for Additional Irrigation Are Other Factors

AT THE HEADWATERS OF THE COLORADO RIVER

THERE are at least three reasons for considering the development of the Colorado River at this time. They are (1) the need of protecting against floods the lands now irrigated with Colorado River water; (2) to obtain a supply of water for additional irrigable lands, and (3) the urgent necessity of supplying additional hydro-electric power in the surrounding country and especially California.

The greatest need for haste in the control of the Colorado River is the flood menace to the rich Imperial Valley in southern California, which lies 250 ft. (76 m.) below sea level in some places and comprises 400,000 acres (161,000 hectares) of land irrigated by the Colorado River. There is a grave danger to the Imperial Valley in the fact that the river is likely to overflow its banks and cut a deep channel directly to the valley. Such an occurrence, in fact, took place in the years 1905 and 1906, and the break was closed only with the greatest difficulty. The increasing danger to the Imperial Valley has caused the residents there to demand that Congress take action looking toward the control of the floodwaters of the Colorado River.

In a report dated Nov. 27, 1920, Director Davis of the Department of the Interior transmitted to the Secretary results of a preliminary investigation under the provisions of the Kincaid act (passed in 1920) which included data regarding the entire river and preliminary studies of the cost and feasibility of various storage reservoir sites on the river. A final report authorized under the same act was presented on July 8, 1921, and the recommendations which form a part of that report are as follows:

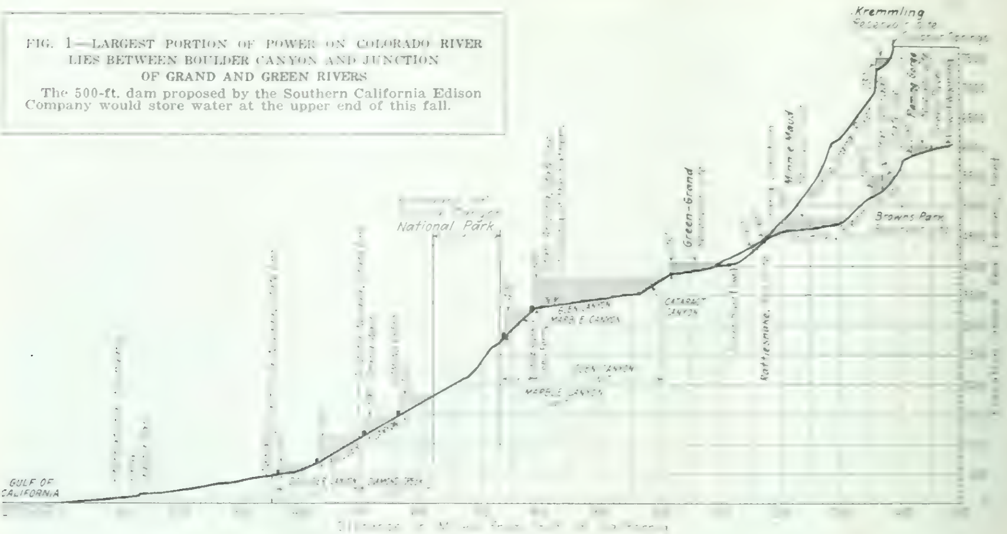
1. That through suitable legislation the United States participate in the construction of the Boulder Canyon

TABLE I—FILINGS WITH FEDERAL POWER COMMISSION ON COLORADO RIVER

Permit No.	Applicant	Location	Operating Rating (Hp.)	Rating to Be Installed (Hp.)
90	F. G. Baum, San Francisco, Cal.	Little Colorado River at Grand Falls, Ariz.	9,400	15,000
91	F. G. Baum, San Francisco, Cal.	Black River, Ariz.	6,300	7,000
30	Beekman & Linden Engineering Corp., San Francisco, Cal.	Colorado River, Ariz.	126,000	200,000
33	C. A. Peterson, Prescott, Ariz.	Cataract Creek, Grand Canyon National Park, Ariz.	(Canceled)	
59	Edward L. Bayard, Seligman, Ariz.	Hualpai Indian Reservation, Colorado River, Ariz.	1,400,000	1,800,000
111	Southern California Edison Co., Edison Bldg., Los Angeles, Cal.	Three power developments in Colorado Canyon, Colorado River	2,500,000	3,300,000
121	James B. Girand, care of Parsons, Klapp, Brinckerhoff & Douglas, 84 Pine St., N. Y. City	Colorado River near Diamond Creek	60,000	120,000
158	Utah Light & Power Co., care of M. O. Leighton, McLachlen Bldg., Washington, D. C.	Green River above Green River, Utah	80,000	100,000
165	Utah Power & Light Co., care of M. O. Leighton, McLachlen Bldg., Washington, D. C.	Green River above Bridgeport, Utah	100,000	125,000
202	Green River Power Co., Pacific Electric Bldg., Los Angeles, Cal.	Green River, from point near Green River, Wyo., to its junction with Grand River, Utah	912,600	1,200,000
230	James B. Girand, Gooding Bldg., Phoenix, Ariz.	Colorado River at the mouth of Andrus Canyon	65,000	130,000
240	[illegible] Consolidated Copper Co., Phoenix, Ariz.	Big Williams River	14,000	28,000
231	James B. Girand, Gooding Bldg., Phoenix, Ariz.	Colorado River just above Pierce's Ferry	65,000	130,000
238	City of Los Angeles, Cal.	Boulder Canyon, Colorado River, Nev. and Ariz.	600,000	800,000
258	Southern California Edison Company	Boulder and Pyramid Canyons		1,200,000

FIG. 1—LARGEST PORTION OF POWER ON COLORADO RIVER LIES BETWEEN BOULDER CANYON AND JUNCTION OF GRAND AND GREEN RIVERS

The 500-ft. dam proposed by the Southern California Edison Company would store water at the upper end of this fall.



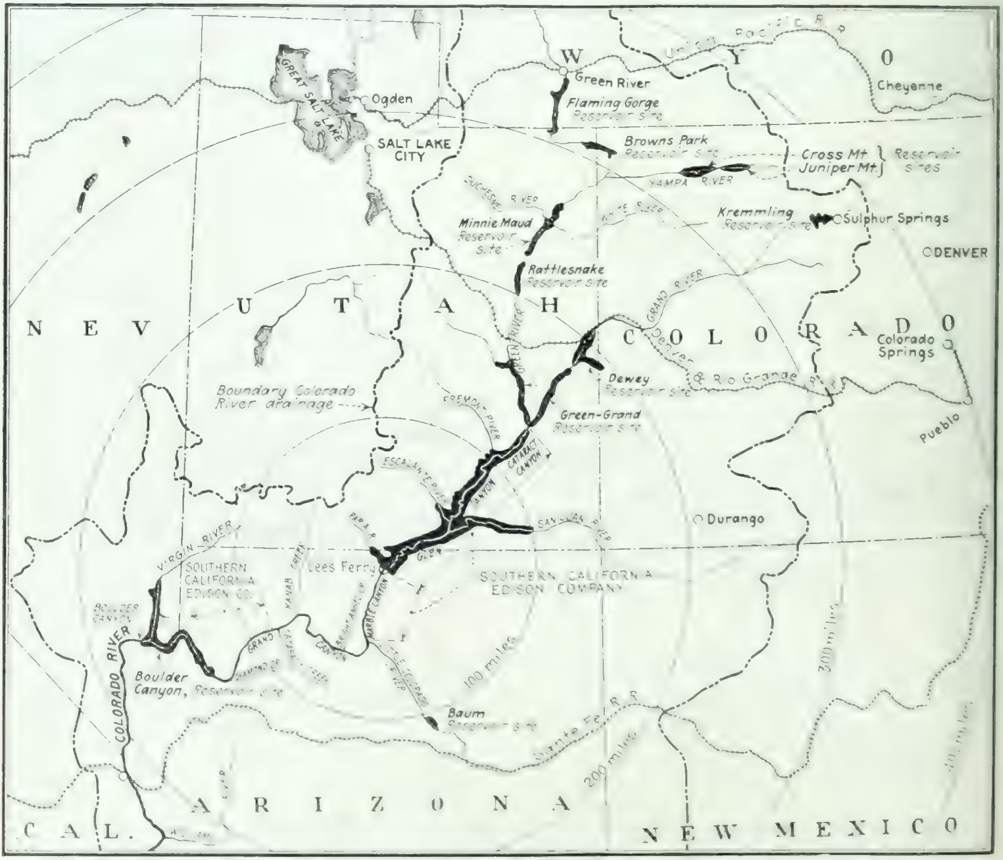


FIG. 2—POWER SITES ON THE COLORADO RIVER ARE WITHIN TRANSMISSION DISTANCE OF MANY LARGE LOAD CENTERS

Reservoir and the High Line Canal from Laguna dam to the Imperial Valley, in proportion to the interests of the public lands and the Indian lands as set forth in the report.

2. That the Secretary of the Interior be authorized to enter immediately into contracts with such states, counties, municipalities and other interests as may desire to participate in the benefits of the construction herein recommended, provided that each participating agency furnish funds with which to defray its proportionate share of the expense, as allocated by a board to be appointed.

3. That there be appointed a board of three competent persons who shall not be resident in any of the states affected by the decisions of the board and who shall have no financial interest in those decisions, one being an irrigation engineer, one a power engineer and one learned in irrigation law, to allocate the cost and benefits of the proposed construction and assess the cost upon those receiving the benefits in proportion to such benefits. The decisions of this board should supersede the preliminary allocation recommended in this report, and contract should be entered into with all participating parties to abide by the decisions of this board and to supply funds for construction in proportion to benefits as determined by the board.

4. That the Secretary of the Interior be authorized to proceed with the work of development as rapidly as the funds are made available from any of the sources provided.

The report embraces the quantity and regularity of water supply for irrigation, data pertaining to flood control, data concerning storage facilities, and information as to the amount of land available for irrigation and the canal systems which will be required.

The opinion is expressed in the report that the investigations at Boulder Canyon have shown the feasibility of a high dam at that point. The amount of storage which would be furnished by this dam has been computed at contour elevations ranging from 750 ft. to 1,300 ft. (228 m. to 396 m.), showing that the capacity would range from 58,750 acre-feet to 31,600,000 acre-feet (7,050 hectare-meters to 3,792,000 hectare-meters). The canyon walls extend to the 2,000-ft. (600-m.) contour, or 700 ft. (210 m.) higher than the contour which would result in a capacity of 31,600,000 acre-feet.

Whatever action Congress may take in the matter will materially influence future power development on the Colorado River. The supply of additional water for the irrigation of other lands lying below and adjacent to the Colorado River is inseparably bound up with the supply of water to the Imperial Valley and has a direct bearing upon the possible power developments along the river and their location, particularly in point of time as regards the order in which the developments may be made.

The mean annual discharge of the river measured at Yuma, Ariz., of 16,400,000 sec.-ft. (4,100,000 cu.m. per sec.) would be amply sufficient to meet all of the requirements for irrigation. Inasmuch as the discharge of the river varies materially from wet to dry years, storage reservoirs having a capacity considerably in excess of this will be required. A large number of possible and ultimate reservoir sites have been found on the Grand and Green Rivers, as well as on the main stream of the Colorado. The estimates of the capacities of these proposed reservoirs made by various authorities are shown in Table II. The feasibility of the sites and their relative desirability have been the subject of considerable conjecture and dispute and will probably necessitate an act of Congress definitely to determine upon the order of their development.

MARBLE CANYON WALLS ARE 3,500 FT. HIGH AT THIS SITE

The Boulder Canyon dam site has been investigated in detail under the authority of the Kincaid act, and a computation of the capacity of this reservoir is shown in Table III. A height of dam approximating 500 ft. (150 m.) has been considered as sufficient to regulate the flow of the river below this site to provide the necessary water for the irrigation of the present and ultimate irrigable areas. The city of Los Angeles, which owns and operates two hydro-electric generating stations on the Los Angeles aqueduct and a distribution system in the city, is making plans to develop the Boulder Canyon dam site in conjunction with the government and other municipalities having irrigation districts with the expectation of having allotted to it a considerable block of power from the generating stations which it is proposed to construct at the base of the dam.

The Southern California Edison Company has proposed a 500-ft. (150-m.) dam near Lee's Ferry, which is just south of the Utah state line, as indicated in the map. This dam would impound over 40,000,000 acre-ft. (49,200,000 hectare-meters) of water. Various arguments have been advanced both for and against each of these proposed reservoirs, which will undoubtedly be among the first to be constructed on the river. The proponents of the Lee's Ferry reservoir claim that the

JUST BELOW ONE OF THE BOULDER CANYON DAM SITES

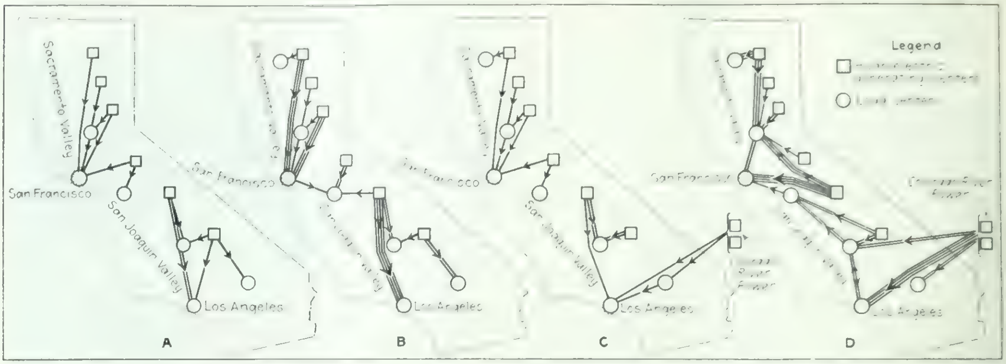


FIG. 3 — EFFECT OF COLORADO RIVER POWER ON CALIFORNIA TRANSMISSION SYSTEMS

A—At present the hydro-electric power generated in California is transmitted in the southerly direction. B—With increasing loads more and more power must be transferred toward the south. C—The introduction of the first block of Colorado River power will affect the southern part of the state only. D—With large developments on the Colorado River the entire transmission system will be turned around to transmit power from the south to the north.

impounding of a large volume of water at an elevation of over 3,000 ft. (900 m.) and above the section of the river wherein the greatest amount of power is available will not only control the floodwaters of the river but also will permit with the greatest advantage later power developments further downstream. Opposed to this is the argument that a reservoir 640 miles (1,029 km.) along the stream from the point of greatest diversion would be too far distant to permit of exact regulation of the water to provide for the fluctuating need for irrigation. It has also been claimed that some 2,000,000 acre-ft. (2,460,000 hectare-meters) of water per annum would be lost should the Lee's Ferry reservoir be constructed rather than the one in Boulder Canyon. The advocates of the Boulder Canyon reservoir site claim that the construction of a dam at this location would regulate the river sufficiently to meet the needs for irrigation and dwell upon the further advantage that the proposed power house would be 150 miles (240 km.) nearer Los Angeles, which is at present the nearest available market.

Although the need for additional hydro-electric power in this section of the country is not so urgent as the problem of controlling the floodwaters of the Colorado River, the time will come within the next decade when this need will be paramount to any other requirement.

The visible market for the power to be developed on the Colorado River is in California. The growth of the load in California from 1910 to 1921 is shown in Fig. 5. During that time the annual output of the fifteen principal power companies of California, which included virtually all of the output in that state, increased from 1,208,000,000 kw.-hr. to 4,386,000,000 kw.-hr. During the last few years the rate of increase has been approximately 10 per cent per annum. If this curve is extended at a rate of increase of 10 per cent per annum, it will be seen that in 1935 the load will have increased to 17,515,000,000 kw.-hr., which is the output of 4,000,000 kw. installed capacity at 50.5 per cent of the maximum possible output. This ratio of 50.5 per cent is that which held for the year 1920.

It is, of course, hazardous to extend a curve of this nature over such a long period in the future. The attending circumstances, however, indicate that such a growth of the load in California is not unreasonable when the rapid increase in the population is considered and proper weight is given to the undeveloped resources of the state. During the decade from 1910 to 1920 the population in California increased approximately 44 per cent while the output of the power companies increased 200 per cent.

In California there are large areas of agricultural

TABLE II—RESERVOIR AND POWER SITES AND CALCULATED POWER AVAILABLE; NOT DEVELOPED AT PRESENT

Reservoir and Power Sites	Stream	Height of Water Above River, Ft.	Reservoir			Power Development	
			Capacity, Acre-Ft.	Estimated Cost	Date of Estimate	Head, Ft.	Kilowatts
Flaming Gorge	Green River	225	3,500,000	$15,991,000	1920	290	53,000
Jumper	Yampa River	200	1,500,000	6,200,000	1920	150 240	27,000 43,000 hp.
Dewey	Grand River	215	2,270,000	11,160,000	1920		
Brown's Park	Green River	150	2,000,000		1916	150	27,000
Cross Mountain Canyon	Yampa River				1916	224	13,000
Blue Mountain Canyon	Yampa River				1916	400	30,000
Split Mountain Canyon	Green River				1916	80	28,000
Ashley Creek	Ashley Creek				1916	2,600	14,000
Duchesne River	Duchesne River				1916	450	3,100
Minnie Maud	Green River	200	4,000,000		1916	120	48,000
Rattlesnake	Green River	175			1916	165	70,000
Coal Creek	Green River	160			1916	160	43,000
Gore Canyon	Grand River				1916	411	45,000
Westwater	Grand River	140			1916	135	9,000
Glen Canyon	Colorado	500	40,000,000		1921	450	600,000 hp.
Upper Grand Canyon	Colorado				1921	450	600,000 hp.
Lower Grand Canyon*	Colorado				1921	850	1,200,000 hp.
Boulder Canyon	Colorado	500	18,700,000		1920	320	600,000 hp.
Pyramid Canyon	Colorado						600,000 hp.
Site Above Parker							200,000 hp.

* If Boulder Canyon is developed Lower Grand Canyon will develop only 600,000 hp.

lands susceptible of development by pumped water which are yet untouched. This feature, combined with the growing importance of the industrial load, which is influenced by the possibilities of Oriental trade, leads to the conclusion that the next decade will see in California an increase in the load approximating 10 per cent per annum. On this basis the estimated commercially feasible hydro-electric possibilities of that state will be exhausted between 1935 and 1940. For these reasons, and because of the present necessity of transmitting large blocks of power from the northern portions of the state to the southern, as noted above, the influx of power from the Colorado River will be an economic necessity. Furthermore, the time element is important as several years will be required in which to make available in California power generated on the Colorado River.

Other markets for Colorado River power lie in southern Nevada, where there are large quantities of minerals which might be exploited provided there were an ample supply of sufficiently cheap power available near by. In Utah and in Arizona there are also available markets for power which will be materially increased by the cultivation of the large areas now awaiting the control of the Colorado River.

With the passage of the federal water-power act a number of filings for power on the Colorado River were made. These are as shown in Table I. Principal among these filings are those of the Southern California Edison Company, which total 3,570,000 hp. and which are grouped in the Diamond Creek, Marble Canyon and Glen Canyon units. The relation of these is shown in the accompanying profile and map of the river.

TABLE III—COMPUTED CAPACITY OF BOULDER CANYON RESERVOIR

Contour Elevation	Area (Acres)	Capacity, (Acre, Ft.)	Contour Elevation, (Ft.)	Area, (Acres)	Capacity, (Acre-Ft.)
700	....		1,050	53,160	7,130,500
750	2,350	58,750	1,100	67,740	10,153,000
800	7,950	316,250	1,150	84,110	13,949,250
850	15,260	846,500	1,200	105,100	18,679,500
900	21,600	1,818,500	1,250	127,660	24,498,500
950	29,160	3,088,000	1,260	131,000	26,000,000
1,000	39,690	4,609,250	1,280	142 000	28,600,000

Various estimates of the developed and potential water power of the State of California have been made by the government and other bodies and place the maximum potential water power of the state at 9,250,000 hp. The latest estimates made by the California power companies place the commercial maximum development at 4,000,000 hp. This figure is based on the expected cost of development within the next fifteen years and may be increased or decreased as conditions change. Water-power filings on California streams aggregating 3,513,930 hp. have been made and give an indication of the accuracy of the estimate of 4,000,000 hp. Up to date 1,107,000 hp. of hydro-electric power has been developed in that state in 130 stations. The growth of the power load in California will be the determining factor as to when and in what quantities power will be required from the Colorado River. It will be seen from the tables and curves of the California load that the commercial maximum development will not be reached before the first power from the Colorado River will be needed. This arises from the economic consideration involved in the transmission of power within California due to the fact that at present the hydro-electric power generated in California is all transmitted in a generally southerly direction. This particular point is brought out in the maps which appear on page 966 and indicate the general direction of transmission under different conditions.

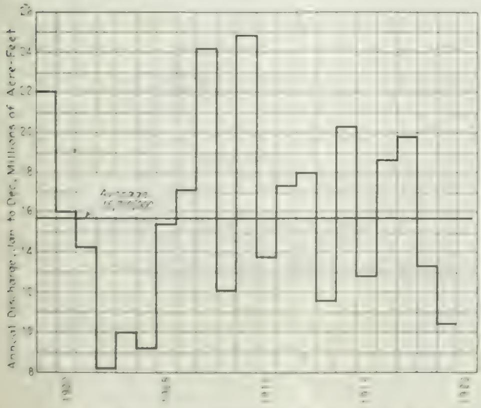


FIG. 4 — ESTIMATED DISCHARGE OF COLORADO RIVER AT LAGUNA DAM

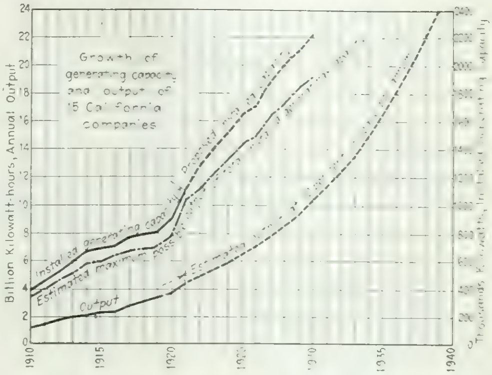


FIG. 5 — RELATION OF GENERATING CAPACITY IN CALIFORNIA TO ANNUAL OUTPUT

Based on past and estimated figures that could be expected in case the commercially feasible projects in that state are developed within the next fifteen years.

Inasmuch as the power available in the northern portion of the state will not in future periods be sufficient to meet the demands of that territory, it will become necessary to transmit power from the south to the north, particularly to the San Francisco Bay district and to Sacramento Valley and still further north.

Therefore it would not be economically sound to construct sufficient transmission lines to transmit all of the required power from the north to the south; rather would it be desirable to bring into the southern part of the state additional power from the Colorado River, thus relieving the necessity of transmitting large blocks of power from the central part of the state to southern California.

The power released in central California by the introduction of Colorado River power into southern California can then be transmitted north to the northern portions of the San Joaquin Valley, the San Francisco Bay district and to the Sacramento Valley. This point also is illustrated.

Classification of "Electric Fires"

A Practical Suggestion Looking Toward Protection from the Present Popular Habit of Blaming Fires on Electricity

By "Kassandra"

PUBLISHED reports of fire departments, underwriting bureaus and so on often contain a classification "electric fires," but on inspection it is found that this classification includes such origins as these: "Lightning struck a hay stack," "A trolley wire broke in the street and set fire to a wagon," "An electric iron was left alive on a suit of clothes," "A spark of static electricity set fire to gasoline in a dry-cleansing establishment," "Street-railway current entered a house over a gas pipe," and, perhaps, even "A cigar lighted at an electric cigar lighter started the fire."

It is true, of course, that electricity is concerned or at least mentioned in all of these. Moreover, a statistician should be left free to classify and analyze his data in any way that he sees fit, since it is only by leaving him free that we shall in the end get the best results. The object of the classification and analysis of fires, however, is to learn the causes so that steps may be taken to improve conditions, and the inclusion of all fires in which electricity is concerned, however remotely, under the general classification of "electric fires" does not help to determine the causes. Furthermore, the object is to reduce the total fire loss rather than the electric loss alone, and it can be shown that if electricity should be entirely done away with, while there would be no electric fires, the total fire loss would be far greater than now.

Present Classification Misleading

The publication of figures showing a large "electric" fire loss from such causes as lightning, static electricity and stray railway current, therefore, does serious harm not only to the electrical industry but to the public. For such figures lead people to believe that electricity is a fire producer, while the reverse is the truth, and the use of electric light and power, even if these do occasionally cause fires, yet on the whole reduces the loss rather than increases it.

It is not fair, however, to criticise the statistician without offering constructive suggestions. One is, of course, that electric fires should include only fires connected with the ordinary supply of electricity for light, power and heat. They should not include fires due to lightning, static electricity, street-railway current or similar remote causes; or at least, if for historical reasons or otherwise it is desired to use a main heading "electric fires" to include all cases when the word "electric" occurs, then the true electric fires due to the electricity used for light, heat and power should be separated from the other so-called electric fires due to lightning, static electricity and so forth.

Among the fires where the wires for electric light and power are concerned there is very important sub-classification in which the question arises whether the electric service itself is the cause or whether the electric wiring is merely incidental. For instance, if street-railway current enters a house over the grounded neutral of the electric wiring or over the conduit in which it is inclosed, this might be called a fire in which the electric wiring was involved. But street-railway current also enters over gas, water or steam pipes. Hence, even if all the cases in which the electric light wiring is concerned are put together, these should still be divided into classes to show whether it was the electric light and power current itself that caused the trouble or whether it was street-railway current or lightning or static electricity which happened to use the electric light wiring but might just as well have used the water pipes or gas pipes or telephone wires.

Another sub-classification which would lead to good results would be one that recognized that incendiary fires are quite a different thing from accidental fires. The application of this is particularly to electric flatiron fires, which should really be classified as incendiary, even though obviously non-criminal. For there is no difference in principle between lighting a match or cigar and leaving it where it will start a fire and turning the current on an electric flatiron and leaving the appliance where the same result will ensue.

How to Reduce "Carelessness" Fires

Electric flatiron fires are not really electric fires, but are fires due to carelessness. This leads to a suggestion whereby these fires can be reduced. If an insured person intentionally burns up a suit of clothes, he should not be allowed to collect insurance. If the insurance companies would refuse to pay the direct loss due to leaving flatirons alive on combustible material, the user would be no less careful than now and in time would become far more careful. By direct loss is meant the loss due to the burning or scorching of the clothes or table on which the iron is left.

If a fire thus started were in time to set a bigger fire and, perhaps, burn the house down, then the insurance company would probably feel obligated to pay for the damage to the house, as it does now. To refuse, however, to pay the small direct loss would be a saving not only to the insurance companies but also, on the whole, to the insured. Then the man or woman who now is able to collect the full replacement value of a dress or suit that has gone out of fashion would be a little worse off than at present, but this would not be serious. Such persons, and in fact every insured person, can stand small occasional losses. Against this would be set the resulting reduction in the annual premiums. This would help a little even the careless people who have occasional small losses, while the careful people would have annually a real net saving in the cost of their insurance.

The insurance premium on an electrically wired house is today so low that it is doubtful if the insurance company would want to complicate the policies by offering a differential, but if some insurance company would boldly take the stand that it would not pay the *direct* losses due to flatiron fires—that is, would not pay for the clothes or table that was burned, but would only pay the loss if a big fire occurred—then that company could reduce its rates and get the business in fair competition.

This is, however, merely a constructive suggestion to insurance companies. The immediate point at issue is that a fire due to the careless leaving of electric irons in circuit is a "carelessness" fire, in an entirely different class from a fire due to electricity itself, and that such fires should be separately classified and not called electric. Eventually such a practice would undoubtedly protect the industry from the present popular habit of blaming on "electric wires" every fire that has the slightest connection with electricity or that cannot be attributed to anything else.

Network in Pennsylvania Would Greatly Benefit Industries

Transmission Lines Connecting Steam Plants and Hydro-Electric Plants that Could Be Developed in or Adjacent to that State Would Be of Utmost Value—Use of Power Growing Three Times as Fast as Population

ALTHOUGH bridges, highways, steel mills, railroad tracks, mining operations and highly developed farms hinder the damming of nearly all the important rivers in Pennsylvania, many sites in that state could be still developed through the exercise of a little ingenuity. This is the substance of some remarks made by H. W. Buck in a recent address,* these observations leading up to a consideration of the importance of power development to Pennsylvania. He went on to say:

"Among the prominent streams of the state where there are large potential power sites are the Delaware, Susquehanna, Juniata, Youghiogheny, Lehigh and Clarion. Notable among these are the proposed sites on the Clarion River. This river valley, although comparatively large, is almost free from railroad and industrial development so that high dams and large storage are possible. Much of the power of the state, however, will be found in numerous small streams and creeks of small drainage area with large storage possibilities and comparatively high head. In the aggregate such sites will represent a large part of the power of the state, and they are less obstructed by industrial construction than the larger rivers.

"Since industry cannot stop during the low-flow season in the rivers, steam auxiliary power must be used as a necessary part of any water-power development in order to make the energy from the water powers available during the entire year. In a combination steam and water-power plant, while the steam capacity must usually be about 80 per cent of the water-power plant in order to carry over the low-water season, the actual energy produced in an average year will not exceed from 10 per cent to 25 per cent of the annual total. The cost of power per year from the combination will be found to be less than steam power alone. Water power alone cannot be considered on account of the shortage in the low-water season. In some parts of the state situations may be found where water storage can take the place of the supplementary steam power, but this requires cheap overflow land, which is not abundant in Pennsylvania.

CONSPICUOUS EXAMPLE OF ADVANTAGE OF COMBINING DEVELOPMENTS

"A conspicuous example of the satisfactory results from the combination of steam and water power can be seen in the great plant at Holtwood, on the Susquehanna River, transmitting power to Lancaster and Baltimore. The great amount of hydraulic energy annually available from the Holtwood plant results from the combination with steam power at Baltimore. Without that combination the water power would not be economically possible.

"Pennsylvania is a great coal-producing state, and developments which might tend to reduce the consumption of coal by substitution of water power might not be regarded with popularity. Such a view, however, is not for the best interests of the state. Every ton of coal consumed for the production of power which might have been produced by water power is wasted. There are many uses for coal other than for power which are highly important to the future industry of the state and which cannot be replaced by water power. Where coal is used for power purposes only about 15 per cent of its heat value is utilized. Where it is used for the numerous heating and smelting processes and in the manufacture of gas and byproducts more than 75 per cent of its value is utilized. It is also of importance to the state that coal be conserved for the production of coke.

NETWORK WOULD RELEASE COAL FOR OTHER PURPOSES

"If all of the feasible water powers of the state were developed, they might amount to 500,000 hp. and possibly more. By applying such hydraulic power in substitution for coal, more than 5,000,000 tons of coal would be released annually for purposes of more value to the state as a whole than for power.

"In addition to the water powers of the state there are, of course, others in adjacent states which, if developed, would undoubtedly have part of their output transmitted into Pennsylvania. Notable among these is the power of Niagara Falls. The northwestern boundary of the state is only about 100 miles south of Niagara, which is within easy transmission distance. If legislation some day extends the use of the waters of Niagara for power purposes, this power will have a far-reaching effect upon the industrial development of that section of the state lying around Pittsburgh, Bradford and Erie.

"The very small hydro-electric power plant as an isolated enterprise is not an economic success as a rule. The cost per kilowatt of the transmission lines usually necessary to reach the market is excessive. If the small water powers of the state are to be utilized, there should be a general transmission network throughout the state into which all of the water powers can deliver their energy. In this way the cost of line per plant is very much reduced. Since the State of Pennsylvania is only 300 miles long and 150 miles in width, such a network would be quite within practicable limits. Such a network of transmission lines should be interconnected with all existing steam plants and with others to be built near the coal mines and at points where good condensing water is available. There is nothing new in such an arrangement, and many sections of the country are already supplied with power from a general system in this way. It enables the steam and water power to work together to the best advantage with the maximum saving in coal.

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*Presented before the Pennsylvania State Chamber of Commerce at Harrisburg

"The question of power in the country or in any state will be of constantly increasing importance as time goes on. The following figures indicate the increase in power used for manufacturing purposes in the United States during the past fifty years:

Year	1870	1880	1890	1900	1905	1915
Population.	38,558,371	50,155,783	63,09,756	76,303,387	82,574,195	102,000,000
Power used, hp.......	2,346,142	3,410,837	5,954,655	10,409,625	14,641,544	22,547,500

"It will be seen from this that the use of power grows more than three times as fast as the increase in population. If the same rate of increase holds for another ten-year period, there must be provided in the United States an increase of power-generating capacity of about 15,000,000 hp. The above figures do not include steam-railroad locomotives. If extensive electrification of steam railroads takes place, the figures will be greatly increased.

"Another table reproduced here indicates the increase in power used per employee in various classes of industry between the years 1870 and 1915. Other available figures would undoubtedly show this tendency still more clearly. A careful interpretation of these figures will show what is coming in the future in the relation of power to human production. If wages are to stay up or to advance still further, then there must be an offset by increasing production per man. This will be brought about in the last analysis by giving each man more power to work with. This increased power should as far as possible come from water-power developments. Additional steam power will not have the same advantage, for that will require more men in the coal mines and the loss of their labor plus the loss of the valuable coal consumed.

HORSEPOWER PER EMPLOYEE IN SELECTED INDUSTRIES

Industry	1870	1880	1890	1900	1905	1915
Boots and shoes	0.01	0.1	0.2	0.4	0.4	0.53
Cotton goods	1.1	1.5	2.1	2.7	3.3	4.10
Flour mills...............	9.9	13.2	15.9	20.9	19.9	21.44
Iron and steel	2.2	2.8	5.0	7.5	11.2	14.10
Paper and pulp...........	3.0	4.8	9.6	15.4	17.0	23.50
Woolen goods	1.1	1.2	1.6	2.0	2.3	2.41

"There has been considerable hostility in some directions in the past toward water-power development. It has resulted largely from the false popular belief that water running down hill represents power which should be free for all. Such an idea is, of course, as absurd as would be the notion that the ownership of a coal mine represents free steam power. A vast amount of capital and operating expense is involved in water-power development as in other forms of industry. Everything possible should be done to encourage the development of water power as it is for the best interest of the state. If there is to be restrictive legislation, federal or state, and intolerant commission control, conditions will become too burdensome and capital will seek other forms of investment.

"The next wave of expansion which takes place in this country, and all hope and believe that it is close at hand, will probably see great activity in hydroelectric construction. It is to be hoped that the great State of Pennsylvania will play an important part in this fundamental branch of industrial development."

National Economy Dependent on Using More Power per Wage Earner

SUPPLEMENTING man power with more machine power was pointed to by Henry Flood, Jr., formerly secretary of the Superpower Survey, in an address made by him at Newburgh, N. Y., recently, as one method for meeting foreign competition. Mr. Flood said:

"To keep our factories operating at full time it is necessary for us to sell their excess production over our own requirements in the markets of the world and to meet the competition of other industrial nations in that field. We are Europe's creditor to the extent of nearly $15,000,000,000. Our manufacturing industries have developed to the point where we must look beyond our domestic markets to keep them busy. Our nation has changed from one in which the majority of the people are engaged in agricultural pursuits to one where they are dependent on our factories for prosperity. Our resources have been fairly well developed, and we cannot now take a large influx of emigrant labor.

"Europe's debt to this country in government loans and commercial paper stands today at about $15,000,000,000. She cannot liquidate this debt, or even pay interest on it, with gold, for today we own the greatest part of the gold available, while her gold reserves are at low tide. She must pay us with goods imported to this country in the same manner that we met our obligations to her by export in the years preceding the World War. In this the low exchange rate resulting from the war becomes an advantage. So, in order to keep our factories running at full production, we must not only be able to meet this competition in the world's market, but must compete with it within our own domestic market. This is the situation that calls for a program of national economy.

"While in the past we have not had to compete with foreign products in the sense we now do, we have been successful in such competition by our ingenuity in supplementing the expensive man power with cheap machine power, and that principle will furnish one answer to our present difficulties. There is a direct relation between the amount of machine power used per wage earner and the value of products which he produces. In 1899 we were using 2.1 hp. per wage earner, with a resulting value of products of $2,400. By 1914 we had increased the amount of machine power supplementing our man power to 3.2 hp. per wage earner, and the value of products had correspondingly increased to $3,400.

"Of all the European countries England leads in the use of power as an adjunct to labor. In 1907, the year of the last industrial census for Great Britain, that country was using 1.5 hp. per wage earner against our 2.7 and the value of her products was only $1,200 per wage earner as against our $2,950. Thus, while using 18 times more power per wage earner than England was doing, we were producing products 2.4 times the value of her products.

"So, if we are to progress and participate in our share of the world's market, we must place ourselves in the position of being able to compete with European labor by increasing the amount of power that we give each wage earner to supplement his own efforts, and we must not stop at any figure of 3 hp. or 4 hp., but must carry it high enough to wipe out the difference in the labor wage paid here and abroad."

Improved Practices in Exterior and Interior Illumination

Broadening Applications of Modern Equipment Yielding Greater Service to Industry and Homes—Continued High Efficiency in Equipment Sought—Lighting for Night Sports, Public Buildings, Factories and Theaters

NO STARTLING developments in exterior or interior illumination have been made in the past year, but progress has been noticed in the more serious consideration of lighting fundamentals and the more general recognition of the relation between lighting and the efficiency of human operations. In the report which the committee on progress presented recently before the Illuminating Engineering Society, attention was directed chiefly to lighting for night sports, floodlighting, illumination of hotels and public building interiors, factory and laundry illumination, street lighting and theater illumination. Features of that report are given below.

GAS-FILLED LAMPS AND LUMINOUS ARCS COMPETE IN STREET LIGHTING

Street-lighting development in America has begun again to forge ahead, although lack of funds has retarded it in some cases. The committee favors the preparation by the society of a standardized model data form for street-lighting information. The trend of opinion is that street-lighting development should form a part of the architectural progress of every community. There is also a tendency now toward single lamps with prismatic reflectors and toward higher mounting heights. Typical present practice uses heights of 12 ft. to 14 ft. (3.7 m. to 4.3 m.), though heights of 25 ft. to 35 ft. (7.6 m. to 10.7 m.) are used somewhat. Electric street-traffic signals are growing in use.

Noteworthy developments in street lighting are under way or planned for early realization in the Middle and Far West. In San Francisco improvements have come to a standstill, largely owing to the increased cost of lighting through surcharges approved by the California Railroad Commission. In Los Angeles small ornamental post installations have been made. At Salt Lake City 112 new "White Way" standards are to be provided, using 6.6-amp. ornamental luminous-arc lamps, installed three per standard, fourteen standards per block, seven on either side of the street and covering 2 miles (3.2 km.) of streets. There will be about 90 cp. per foot of street lighted. On the Williams Highway, near Denver, 150 600 cp. series incandescents will be mounted on 20-ft. (6.1-m.) posts, the lamp centers being 18 ft. (5.5 m.) from the ground and serving a 5-mile (8-km.) stretch.

In Kansas City, Mo., 5,600 gas lamps are to be replaced by 2,600 electric lamps of the 600-cp. size downtown and 400-cp. in outlying parts. Here the "white-way" lighting is to go upon the regular street-lamp schedule of operation. At Fort Worth, Tex., 800 300-watt lamps will be installed, increasing the system 75 per cent, and Oklahoma City, Okla., has installed a "white-way" system. Since June, 1920, in Detroit, 442 inclosed arcs have been replaced by 4-amp. luminous arcs of the pendant type, and 1,107 new lamps have been installed also. Forty-seven 4-amp. boulevard-type lamps have been placed in Roosevelt Park, and in the ensuing year it is expected that 1,260 4-amp. luminous-arc lamps will be installing in this city.

INTERCHANGEABILITY ACHIEVED

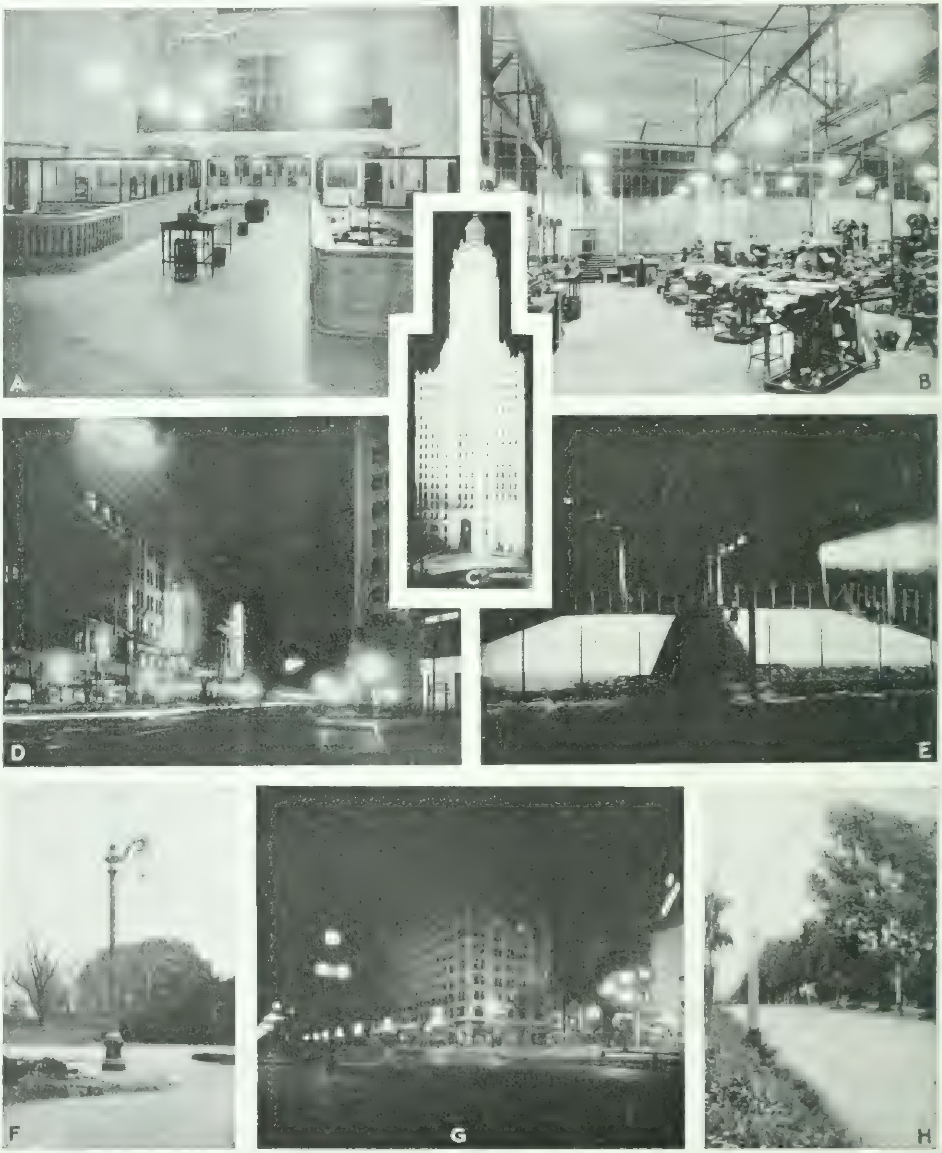
Four hundred more "white-way" lamps are scheduled for Cleveland in the coming year, and recently 600-cp. tungsten lamps spaced 200 ft. (60 m.) apart, with lamps 20.5 ft. (6.2 m.) high, have replaced for park lighting 250 cp. gas-filled lamps 250 ft. (75 m.) apart and 9 ft. (2.7 ft.) high. The globes are of the "white-way" type used in the same city and, with parts of the standards, are interchangeable. At Hamilton, Ohio, 1,400 gas-filled tungsten lamps ranging from 1,000 cp. to 250 cp. will replace series inclosed arcs, now obsolete, and at Lima, Ohio, 1,000 lamps of 1,000 cp. are going into a new system. Two hundred "globeless" standards have been installed at Rochester, N. Y., and Montreal West is to be lighted by 280 tungsten lamps. In the western part of Victoria, B. C., gas-filled tungsten lamps are replacing arcs.

Outside North America, considerable activity is evident. Many places in Cuba are installing electric street lighting. Havana is providing electric lamps on all streets, and 500 arc lamps have been replaced by gas-filled incandescents, utilizing the old hoods as fixtures, with bracket-arm suspension retained. The high cost of fuel has led to the increased adoption of electric street lighting in place of gas, notably in Holland and Italy. In the latter country, high cost of labor and shortage of carbon electrodes have hastened the use of incandescent in place of arc street lighting. Last fall the coal stock at Paris reached a point permitting increased lighting and 1,500 electric lamps were to be installed. In Shanghai, China, the lighting of the main thoroughfare, Nanking Road, has been changed, thirty-five 400-cp. cluster fittings being replaced by seventy-two 600 cp., gas-filled tungsten lamps.

FIXTURES RESPOND TO DEMAND FOR PROGRESS

Several marked advances in fixtures for street lighting have been made. In the so-called globeless standard (see ELECTRICAL WORLD, June 18, 1921, page 1,430) the main feature is the porcelain insulator, which is made flaring and thus serves as a reflector and socket holder. It is designed to redistribute downward the light coming upward from the lamp. Glare is eliminated by using bowl-frosted lamps. A new unit made double and fixed to utilize the light from a single intermediate bulb, to illuminate the road in both directions, is another striking development. Nested reflectors throw a large flux, much of which is ordinarily wasted, upon the road surface. The rays make an angle of 10 deg. below the horizontal, giving the effect of an over-

Extent to Which Illumination Can Be Commercially Applied Depends Largely on How Fully Available Equipment Is Utilized



A—Suitably shielded high-intensity light sources make this banking space cheerful and facilitate accuracy.

B—A high intensity of 21 foot-candles is found desirable in this machine shop, which is lighted by 300-watt gas-filled lamps in R L M domes.

C—Floodlighting makes building architecture as attractive by night as it is by day.

D—Blue-bulb gas-filled sign lamps becoming popular.

E—Side lighting with twenty-four 250-cp. series lamps enables tennis playing on these courts at night.

F—Cleveland parks are lighted by this type of ornamental post holding a 600-cp. lamp.

G—Three-lamp posts illuminate the newly lighted business districts of Salt Lake City.

H—For the residence sections of Rochester, N. Y., no globe is employed in the fixture.

head reflector 15 ft. (4.6 m.) in diameter. The bracket is both vertically and horizontally adjustable. In a test installation 250-cp. lamps were used at a height of 30 ft. (9.1 m.), with 400-ft. to 600-ft. (121.6-m. to 182.4-m.) spacing.

In England fixtures combining mirrors and reflectors are being tried out, using gas-filled lamps. Adjustment is a feature of some of these units, and easy cleaning has been provided for.

Opinions still differ as to the desirability of shadows in tennis-court illumination. Both uniform and non-uniform systems appear satisfactory. At San Francisco installations of four 1,000-watt gas-filled lamps per court in metal reflectors mounted 30 ft. (9 m.) above ground have been made, the lamps being suspended over the center line on steel cables. The shadows caused by the fixed position of the lamps are said to facilitate playing. Interior court lighting has also been adopted to apparent advantage, and a notable Montreal installation equipped with 200-watt and 100-watt gas-filled lamps in rows and with floodlight supplementary illumination gives virtually no shadows, with a range of 10 to 25 foot-candles on a plane 30 in. (0.76 m.) above the floor. In this case the total connected load gives 5.61 watts per square foot of floor area.

Floodlighting of the Executive Capitol at Pretoria, South Africa, marks a pioneer installation in that region. The building, 920 ft. x 200 ft. (187.9 m. x 60.8 m.) is illuminated by thirty-nine projectors equipped with 1,000-watt lamps, and a coloring effect with red glass screens is also provided by a number of 500-watt lamps. At Vancouver, B. C., railway terminal lighting by twelve 1,000-watt lamps in reflectors placed on ornamental standards in front of the building has replaced the former direct-lighting units. An angle reflector with fixed focus and adjustable about 10 deg. is inclosed in a spherical globe of composite nature, the lower half being of copper and the upper half of glass. The standards are 27 ft. (8.2 m.) apart, and the intensity on the building front is 1.5 foot-candles. A novel use of floodlighting is reported in the case of a suburban residence owner who applied it to tree-tops within 100 ft. (30 m.) of his home to keep off blackbirds during certain periods of the year.

ELECTRIC LIGHTING FLEXIBLE AND ATTRACTIVE

Improved lighting of public building interiors received considerable attention in the report. The new Town Hall of New York City has been lighted by 2,500 indirect units, and Independence Hall, Philadelphia, has been equipped with chandeliers duplicating in design those used in 1735, when the building was constructed, frosted bulbs having replaced the original candles. Bracket lamps and pendent bowls are used effectively in the new Sessions House of the London County Council, the glassware of the latter having a transmission factor of about 45 per cent. Tests show 3.8 to 4.2 foot-candles in the court rooms and 4 to 5.1 foot-candles in the hall. In offices and committee rooms the intensity varies from 3.1 to 5.7 foot-candles, and in the prison cells it is 0.89 foot-candle 3 ft. (0.3 m.) above the floor. The famous Church of St. Dunstan's at Canterbury, England, has been equipped with gas-filled lamps in reflectors giving 2 foot-candles to 3 foot-candles at an expenditure of 0.3 watt per square foot of floor area, in place of gas lighting.

Advances in hotel lighting include a considerable use of crystals in the promenade, ball room and dining rooms. Special fixtures have also been designed to meet the requirements of dark finishes in hotel lobbies, a noteworthy installation being made adaptable for either a 200-watt or a 300-watt lamp, with side panels of dense opal glass and a bottom diffusing plate. This installation gave 4.5 foot-candles on a reading plane with an energy consumption of 1 watt per square foot and at the same time does not distract attention from the main attractions of the lobby.

DEPARTMENT-STORE INTENSITIES HIGHER

An increase in the intensity of lighting counters and tables in department stores was recommended after investigation of conditions in twenty-six large establishments. For the first floor it is now recommended that the intensity range from 6 to 10 foot-candles, and from 4 to 8 foot-candles for other floors.

Wide ranges of spacing, heights and make-up of factory lighting units are cited in the report, including both uniform and non-uniform distribution of equipment. In one new machine shop an intensity of 9 foot-candles is attained by the use of 150-watt gas-filled lamps in standard steel reflectors mounted 9 ft. (2.7 m.) above the floor, the units being staggered in rows 7 ft. (2.1 m.) apart and with a spacing of 14 ft. (4.2 m.) between units in each row. From other examples cited illuminations around 3 foot-candles over aisles and 7 foot-candles over lathes and machines were given, and the report quotes special examples of lighting previously described in the ELECTRICAL WORLD (March 19, 1921, page 657; April 16, 1921, page 884; May 7, 1921, page 1054; April 2, 1921, page 768). In a new lighting installation in an English sawmill it was found possible to get an intensity of 6 foot-candles at an expenditure of only 0.7 watt per square foot. The main shop, 66 ft. x 125 ft. (20 m. by 38 m.) is equipped with fifty-eight 100-watt gas-filled lamps with intensive reflectors uniformly spaced and 10 ft. (3 m.) above the floor. In the carpenter shop, with the same type of reflectors and lamps, 6 foot-candles were obtained with only 0.65 watt per square foot.

Additional information on the relation between lighting and factory output is given in a report (Bulletin No. 9) issued last year by the Industrial Fatigue Research Board of Great Britain. This deals with conditions in two mills investigated, with the following conclusions: (1) There is a gradual increase in the output of silk weavers between December and March, due chiefly to the decrease of artificial lighting required; (2) that under artificial illumination production falls off by about 10 per cent of the daylight value of the output. The illumination at the cloth fell in one mill varied from 3 to 3.5 foot-candles and on the porry from 3 to 5 foot-candles. In the other mill each loom was provided with two 30-watt lamps, the control being in the hands of the operators.

EQUIPMENT MEETS SEVERE CONDITIONS

Illumination of laundries is a problem of some difficulty on account of the presence of steam vapor and bleaching chemicals. A recent installation comprised prismatic reflector units of the reflector-refractor type mounted 10 ft. (3 m.) above the floor on 19-ft. (5.8-m.) centers and containing 200-watt gas-filled tungsten lamps in the washing, ironing and pressing departments. In the sorting, marking and packing rooms the same unit with a lamp of small wattage, lower mounting heights and closer spacing was used. After two months' use the intensity in the washing and drying rooms was found to be 3 foot-candles and in the other departments 5 foot-candles. In the offices, larger units were used and gave 8 foot-candles illumination.

A new system has been developed for railroad enginehouse lighting. A special type of reflector is used, and these are mounted in pairs so that the beams of light from each pair are crossed. The units have a cast-iron body with a reflector of glass of which the surface is like that of sheet metal which has been hammered with a ball-peen hammer. This produces many small reflectors and results in a distribution of light rather than glare. It is easily cleaned and is not affected by locomotive smoke. In one installation the units are mounted 10 ft. from the floor, and generally they are 7.5 ft. (2.3 m.) each side of the track center line. The lamps are the 100-watt gas-filled tungsten type. In another house a 13.5 ft. (4.1 m.) height is used.

Advances in the lighting of motion-picture theaters are noted in the more skillful use of cove lighting and in the use of translucent glass ceiling inserts concealing lamps of various colors. Tests show that illumination on the table plane may reach 0.1 to 0.2 foot-candle without interfering with the quality of the projected picture, and that, further, to avoid glare and undue lowering of the adaptation level, the maximum surface brightness that may fall within the field of vision of the observer should not exceed 2.5 to 3 millilamberts. The use of chandelier and dome lighting is also being extended. One of the latest installations has a main auditorium lighted by a sunburst dome 65 ft. (19.5 m.) in diameter, silver-lined and lighted by lavender-colored lamps. All lighting projectors and floodlamps are concealed behind pastel ornaments, the theater having three separate means of illumination.

FLOODLAMPS DISPLACE FOOTLIGHTS

A method of eliminating footlights is reported from Germany, where two large reflectors totally inclosed, with a lens in front of only 15 cm. diameter, are placed high up in the fore part of the stage, one on each side. A dimming arrangement and various colors are provided, and the results are reported to be satisfactory. Reference was also made in the report to the description in the ELECTRICAL WORLD of Oct. 16, 1920, page 777, of the lighting of the auditorium of one of the largest playhouses in the world.

In reflector design for mercantile use the general tendency is to make the units dustproof as far as the interiors are concerned. This simplifies the cleaning problem. Forms of reflectors vary. They include the use of multi-surface housings for lamps and sometimes facilities for concentrating light on a working plane. One sample is made in four sizes and can now be obtained in decorative form for home use. A feature of a new indirect unit which emits only 14 per cent of the lamp output below the horizontal is the use of two inverted bowls, one inside the other, with different optical properties for producing a fading spot on the ceiling. The new unit throws a wide spot shading away with no marked limit even when mounted only 12 in. (0.3 m.) below the ceiling. The outer bowl is translucent and thus avoids a sharp contrast against the ceiling. All glass surfaces exposed to the air are smooth, making cleaning easy, and the space between the two bowls is sealed at the top by a white-enameled diaphragm. Another innovation is the use of silk and other fine-mesh light filters, which may be placed around the inner reflector in the form of an outside cover. Parchment and silk shades may also be used with this unit in lighting the home.

Other units lately designed provide for rearrangement of parts to suit conditions in different locations, and another unit for store and factory lighting is provided with a focusing arrangement for alteration of the light distribution through a considerable range. A semi-indirect commercial unit has a glass globe blown in one piece and enameled on sides and bottom, low intrinsic brilliancy being accompanied by good distribution. The two-piece units, however, still maintain their popularity, and new designs continue to appear, together with units designed for heavy duty amid gases and vapors.

The Ownership and Operation of Utilities

Conclusions of a Committee of National Association of Railway and Utilities Commissioners Resulting from a Study Begun in 1917

AT THE annual convention of the National Association of Railway and Utilities Commissioners in Atlanta, Ga., the committee on public ownership and operation of utilities rendered the following report, resulting from a study of all phases of the subject during the past four years:

In 1917 there was created by the National Association of Railway and Utilities Commissioners a special standing committee known as the committee on public ownership and operation. The report of the first committee made at the thirtieth annual convention of this association, November, 1918, outlined an elaborate program of study of the subject, and the two reports of subsequent committees have dealt with various aspects of the question. The limited space available in this present report precludes the setting out in full of the results of any detailed study of the question and circumscribes this report to a condensed expression on the most salient and important factors involved.

There are, as we see it, only two elemental aspects of the question of public utilities, viz., (1) publicly owned, either with public or private operation, and (2) privately owned and privately operated, either with or without public regulation.

This committee takes the negative view as to the first and the affirmative as to the second, *i.e.*, with public regulation, and sets out its reasons therefor in the following:

Government is instituted among enlightened, civilized peoples in order to insure to the majority of the governed the greatest degree of freedom, liberty and happiness. There is no other sound reason or excuse for the existence of government, if we grant the truth of the principle that all government derives its just powers from the consent of the governed.

This granted, it is then no less true that a sound theory of government would dictate that there should be as little governmental interference with legitimate business activity as is consistent with the protection of the rights and property of the citizens and their enjoyment of life, liberty and the pursuit of happiness.

BUILDING ON ACCEPTED AXIOMS

We take it that these general principles are now but axiomatic. If these be the great basic truths that they are generally and universally conceded to be in this country, then it naturally and logically and inevitably follows, as a necessary conclusion, that the less governmental encroachment there is upon the domain of private business initiative and incentive, consistent with the fair and equitable protection of the rights of the majority of citizens, the more nearly does such government approach the real functions of sound government as laid down by our forefathers in the basic principles of the creation of our republic. It necessarily and logically further follows that government is then not instituted, as one of the ends of its creation, for the purpose of the ownership and operation of what are essentially and basically private businesses. Public utilities are essentially such, provided the public is given fair and adequate service at a reasonable cost. Public, governmental, regulatory bodies are created for this latter purpose only and can have no other reason for their existence at the expense of the public. However, the safeguarding of these essential rights of the people does make the existence of such bodies a real necessity.

POLITICS FATAL TO ECONOMY

Again, a closer examination of the application of these general principles, we submit, but bears out the conclusion reached. In the ownership and operation of such utilities by government it is practically impossible to exclude the influence of politics. As long as human nature and self-interest is as it is, and before the coming of the dreamed-of Utopia or millennium, the subtle influence of politics would almost inevitably creep in, however ingenious the safeguards that might be thrown around it. Again, with every change of political administration would come a change of business administration of such utilities, with its consequent change of business policy. This would be fatal to their operation under sound principles of economy and business efficiency.

As illustrative of this fact we may be pardoned for calling attention to two late outstanding examples in this country, the government operation of railways and the creation, management and operation of the United States Emergency Fleet Corporation. The first of these is now almost past history, except for the readjustments to private ownership and operation and the liquidation of the staggering operation-loss debt of $1,800,000,000 resulting from the twenty-six months of government operation.

The United States Shipping Board and its subsidiary, the Emergency Fleet Corporation, were created in 1917 as a war measure to provide adequate transportation of troops overseas. Since the signing of the armistice, November, 1918, the fleet corporation has been operated as a business corporation. It has over $3,000,000,000 worth of property. For the first two years after the armistice there was an extraordinary boom in shipping. Yet the statement of its business operations from its inception to June 30, 1920, shows the following astonishing financial results from operations: Revenues received, $817,271,542; expenses, $1,002,396,579; operating loss, $185,125.037.

Yet privately managed British merchant fleets reported during the same period net profits on their investment ranging from 20 to 40 per cent. The latter were privately owned and managed, under certain reasonable government regulations; the former was government owned and operated. The difference in the respective systems of management is responsible for the difference in the results. This, we believe, sufficiently speaks for itself.

GOVERNMENT OWNERSHIP OF UTILITIES A FAILURE

However, it may not be amiss to call attention to a few other cases where government ownership and operation has been in recent years tried. The largest example, carried to its ultimate logical conclusion, is found in the communistic régime in Russia. The plans upon which their theory is based apparently are wholly logical and should work out successfully if only they had a new and different kind of human being to deal with; but, human nature being what it is, such plans will not and do not work out in actual practice. The result of the attempt to put these into actual practice is known to the whole world. Another example is the tramways of Glasgow. They are said to be a model of municipal ownership, and they are, yet the tax rate of Glasgow has steadily risen. The English telephones are owned by the government; they are not self-supporting. The people of this country would not for a moment submit to such service as they give. Our telephone service at its worst is better than theirs at its best, and yet our tolls are lower. Instances of public ownership and operation might further be multiplied. The results are practically all the same. Private ownership and operation under municipal or community regulation has also been tried in this country in many instances. Instances are found, among others, in the States of Washington, Arkansas, North Dakota, etc. However, wherever tried, it has proved a practical failure, with either a resultant increase in rates beyond the reasonable value of the service rendered or the breaking down of the utility in question, with a large proportion of its operation costs borne by taxation.

Business is essentially management—not a plant, nor blueprints, nor rules, but men. Business is the functioning of a highly skilled managing personnel, a buying and selling organization, trade connections, and the intangible but valuable good will, in addition to plant and equipment, and even finances. The latter constitute but the instrument, the former the business. The criterion of successful business is the periodical balance sheet. Government is essentially a political concern; it necessarily thinks and acts politics. Politics is not concerned with the profit or loss showings of balance sheets, but is vitally concerned with political campaign showings. "Passing the buck" in critical situations is necessarily one of politics' favorite pastimes. Basic conditions of politics make it so. Making quick decisions and assuming responsibility is an essential part of the lifeblood of business. The two are uncongenial bedfellows. Again, as above mentioned, changes in political administration necessarily bring about changes in administrative policy. Changes in administrative policy are costly and bring about unsettled business conditions. Continuity in adherence to a sound, tried business policy is an essential to continued successful business operation and the maintenance of the concurrently necessary business good will. This is at least difficult, if not impossible, in the publicly owned and operated public utility. The ultimate conclusion in the last analysis is self-evident to all thinking men, and forces us to discard the publicly owned and operated public utility.

There then remains only the privately owned and operated public utility, either with or without public regulation. All experience has shown, as is generally conceded, that such, without a regulation by a representative body of those who are dependent for service upon such utility, is both unwise, unsound and unfair to the public served. By the process of elimination there then remains only the public utility regulated by an authoritative governmental body in close touch with and sensitive to the needs of the public served.

UTILITY RATES SHOULD NOT BE HASTILY REDUCED

Such regulatory governmental bodies, however, at the same time must be sufficiently wise and fair and far-seeing to stand between the utility in question and unthinking, hasty public clamor, not based upon full knowledge and careful thought. Public utilities are subject to the same financial laws of operation as are private enterprises. They must operate successfully in order successfully and adequately to fulfill their duty of service to the public, not only in the present, but in the near future. This is peculiarly true at the present time, and for the reason that for the last five years their revenue rates did not proportionately increase with their rapidly increased costs of operations. It therefore follows that, in order to maintain a just, equitable balance and to even keep such utilities out of bankruptcy, it is necessary to maintain their higher rates longer than would to the layman seem necessary, judging by the surrounding decline in commodity prices. To follow any other policy would be to put such utility out of business and to discontinue that service to which the public is so justly entitled and which is now more necessary to the return of the vast bulk of private business to the desired goal of normalcy.

The foregoing considerations force your committee to the conclusion that the present system of private ownership and operation under public regulation is the logical, just, equitable and best system of conducting the business of public utilities that has been or can be devised to meet the needs and requirements of both the utilities in question and the public by them served.

Letters from Our Readers

This is a readers' forum. Comments on questions before the electrical industry presenting economic, financial, engineering or commercial aspects and new or supplementary viewpoints on published articles are cordially invited

Multigap Arresters Adopted as Home by Woodpeckers

To the Editors of the ELECTRICAL WORLD:

Instances of multigap lightning arresters being partly destroyed by the nest-building proclivities of birds were discovered recently on the lines of the Kansas City Power & Light Company. Birds' nests are not uncommon in boxes of this sort installed on poles. In this case the holes in the boxes were made by woodpeckers. After drilling the holes in four different boxes they in each instance removed the sheet of asbestos which lined the inside and then completely filled the box with grass and feathers. Fortunately, company linemen on an inspection trip found the nests before fire had an opportunity to destroy evidence, and the boxes have been preserved to demonstrate how far birds can go with their nest building in electrical apparatus and still not be killed.

The explanation of the persistence of the woodpeckers in drilling through such thick pieces of wood is that birds of this species "drum" on any hollow wood to call their mates. Lightning arresters have proved particularly attractive to the birds as the accompanying photograph shows. It will be noted that there are only three gaps at the top of the box between the line and ground polarity and that the birds built their homes and deserted them without in any case being electrocuted.

INTERIOR OF ONE OF THE BOXES COMPLETELY FLLED WITH GRASS AND FEATHERS

D. D. CLARKE,
Electrical Engineer.
Kansas City (Mo.) Power & Light Company.

The Accident at the Greendale Substation of New England Power Company

To the Editors of the ELECTRICAL WORLD:

There has been considerable misunderstanding in electrical circles regarding the accident in Worcester, Mass., on Sept. 9 which resulted in the death of P. C. Henry of the New England Power Company and H. B. Bush of this firm and the injury of Mr. Armstrong, also of the New England Power Company. We believe, in justice to all concerned, that these misconceptions should be corrected. With that end in view the following report has been prepared giving as accurately as possible the events which led up to the unfortunate occurrence and the results of subsequent investigation.

The demonstration in Worcester was given for the purpose of testing the value of the Bush phase stick as a means of locating defective insulators on 66,000-volt lines. The instrument had been used with entire success in the Middle West on voltages up to and including 33,000 volts, but not on any of the higher voltages.

The test was conducted at the Greendale substation of the New England Power Company. In order that various officials of the company who were present might see the operation of the tool at close range it was decided that a preliminary demonstration should be given on the ground. About eight insulators which had been in service were collected for test.

The demonstrators had with them a Bush hot-wire working outfit, and with this equipment it was possible to arrange a test platform. A safety staging basket (made of treated wood) was inverted and placed on the ground at the rear of the substation. Across this staging was lashed a treated wood beam about 6 ft. long with a metal plate at each end. To one of the metal ends of this beam was connected a length of insulated No. 10 wire, and the other end of the wire was tapped by means of a grounding clamp and treated wood handle to one phase of the line just above the insulator on the framework over the lightning arresters. To the other end of the beam a similar length of wire was lashed, leaving about 2 ft. projecting toward the center of the staging, its end being attached to a treated wood rod about 4 ft. long provided with a bayonet point. The other end of this wire was also run up and tapped to one of the other phases. Before the hot taps were made an insulator with a piece of bare copper wire wrapped beneath the upper bell was placed in the center of the staging for test as shown in the figure.

For the benefit of those not familiar with the construction of the Bush phase stick, the following brief description is given: A current-limiting device in the form of a condenser is mounted near the end of an 8-ft. treated wood handle. The upper terminal of this condenser is connected to the bayonet point of this handle and the lower terminal to a length of flexible cable carried on a spring reel just below the condenser. On the outer end of this cable is a spring snap by means of which the cable can be hooked into an eyelet on a second treated wood handle known as the placement stick. This eyelet is near the upper end of the placement stick and is also connected to a bayonet point. Thus, when the two sticks are attached, the point of the placement stick is connected to the point of the phase stick *through* the condenser on the latter. The condenser is designed with sufficient resistance to allow the phase and placement sticks to be touched to opposite phases on the voltage for which the tool is built. This is done in phasing-out work, a spark gap which may be opened or closed being provided on the side of the phase stick which gives the indication of similar or dissimilar phases. On insulator-testing work this phase gap is closed. The point of the phase stick is touched to one phase and the point of the placement stick inserted beneath the bell of the insulator to be tested on one of the other phases. A voltage equal to that of the line is thus impressed on the under side of the top unit of the insulator. In the event that there is a defect a stream of sparks will pass through the insulating material to the line above. From the foregoing description it is apparent that the conditions arranged for the test were similar to those actually found on the line except that the insulator under test was energized from below.

Mr. Henry held the phase stick in contact with the left phase. Mr. Bush manipulated the placement stick connected to this phase stick, and the writer held the right phase in contact with the copper wire below the upper unit of the insulator. An apparent flaw was discovered in the first insulator tested. On account of the bright sunlight, however, it was impossible for the observers to see the behavior of the spark, and Mr. Armstrong was stationed to the rear of Mr. Bush and Mr. Henry with a long switch pole on the end of which was a piece of canvas to cast a shadow on the insulator.

After testing the top unit of the first insulator for possibly five minutes Mr. Bush announced that he would move the point of his placement stick over to the edge of the insulator bell and make contact with the copper wire which the writer was energizing from the other side, thus throwing the condenser directly across phases. He proceeded to do this and the condenser on Mr. Henry's stick exploded. Subsequent investigation showed that the flash actually occurred before the point of Mr. Bush's stick touched the wire.

All four men engaged in the test were thrown to the ground. Mr. Armstrong regained consciousness in about ten minutes, having sustained severe burns about the face, arms and side. Mr. Henry attempted to rise to his feet after the explosion but dropped back unconscious. Mr. Bush spoke a few words as he was being carried out of further danger and then became unconscious. The writer was uninjured.

First-aid measures were taken immediately by the New England Power Company's men, who showed a very commendable familiarity with resuscitation methods. Neither Mr. Bush nor Mr. Henry responded to treatment, and they were pronounced dead at the hospital some hours later, after pulmotors had been used.

It is the general opinion among the men who saw the accident that the fatalities were caused by the effect of gases generated by the several arcs formed. This theory would appear to be substantiated by the condition of the bodies. Mr. Bush had what appeared to be a small burn on one of his toes and another even smaller on his right thigh. His hands were slightly blistered as though by the heat of the arc. His shoes were not marked in any way. The writer did not see the other body, but he understands that only minor burns were found. The direction of the disturbance was apparently away from the writer and toward Messrs. Bush, Henry and Armstrong, as is evidenced by the fact that Mr. Armstrong, who was further from the test apparatus than any of us and in no way connected to it, was burned as described above. This was due no doubt to a very slight breeze.

There is no doubt in the minds of any one concerned that the treated wood handles stood up. If the charge had been so received the victims' hands would certainly have been burned electrically, which was not the case, nor were there marks of any kind found on the handles.

In concluding this report we wish to emphasize the fact that the value and safety of the method of working hot lines devised by Mr. Bush and exemplified by the "safety staging" and "safety ladder" are in no way affected by this accident. The demonstration in Worcester was in reality a laboratory test of a tool that in no way involved the Bush principle of putting the protecting insulation between the man and the ground.

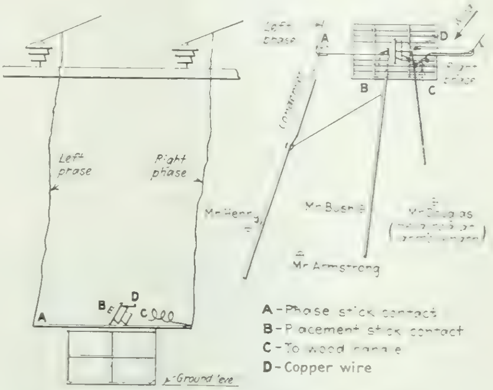


DIAGRAM OF CIRCUITS DURING INSULATOR TESTS

The Bush Electric Company, M. D. Douglas.
Cleveland, Ohio.

I have read the foregoing report and find that the facts as given therein are in accordance with my understanding of the accident. C. R. Oliver,
Assistant General Manager.
New England Power Company,
Worcester, Mass.

Paramount Importance of Good Public Relations

To the Editors of the Electrical World:

I have read with interest Bert H. Peck's article on "The Public Utility from the Customer's Viewpoint" in the Oct. 15 issue of the Electrical World.

The one thing we always preach about to our own people is their relations with our customers. Viewed from a merchandising standpoint, our business is not different from any other business, and we try to conduct it in about the same manner that any good merchant conducts his business. The most successful department store is the one where the salesmen and saleswomen are educated in courtesy and good will toward the customers. People do business with stores in a certain way. Then why should a public utility try to teach them any other way?

Mr. Peck is right—public relations matters deserve the best talent that can be afforded in the industry. Our success has been largely due to our efforts along proper lines of merchandising effort. We always welcome constructive complaints and go as far as good business methods permit in carrying out suggestions from our customers, who are our best salesmen.

We have not gone into customer ownership because our stockholders "grab" new issues as soon as offered.

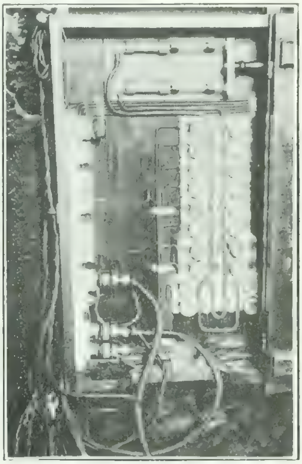
Worcester Electric Light Co., Fred H. Smith,
Worcester, Mass. Assistant General Manager.

Industrial and Station Practice

Installation, Operation and Maintenance of
Generating and Distribution Equipment and Economical Utilization of Electrical Energy
in Mills and Factories, Including Testing and Repair Methods

Good and Safe Lighting Necessary When Working in Wheel Pit

ADEQUATE and safe illumination of wheel pits during inspection and repair work in hydro-electric plants is a vital element in operation, in the opinion of Alexander E. Bauhan, Pennsylvania Water & Power Company, Baltimore, who presented a paper on "Hazards in Hydro-electric Plants" at the recent congress of the National Safety Council at Boston.



PORTABLE DISTRIBUTION BOX HUNG IN WHEEL PIT WHERE WORK IS BEING DONE

In wheel-pit illumination it is advisable to have portable lighting equipment made up and used when needed in accordance with a predetermined plan. General illumination can best be provided by a few high-powered units with suitable reflectors, particular attention being paid to avoid deep shadows. Provision must be made for an adequate number of portable lights. "In our case," said Mr. Bauhan, "the number of circuits needed is large and a pipe connection through the wall of the pit, normally capped at both ends, is used for leading in a pair of main supply wires. A portable distribution box made up for the purpose, equipped with fuses and receptacles to which the various circuits can be plugged, is hung on supports permanently mounted on the wall of the pit. Whenever any extended work is to be done in the wheel pit electricians install this distribution box and all the necessary lighting equipment before the work is started.

"The duty on the drop cords is particularly severe as they are pulled over castings, stepped on and frequently lie in the water. A rugged type of heavily braided waterproof or vulcanized rubber cord is needed. The portable lamps themselves are subject to the same abuse and should be of a type which has no metallic parts which might be made alive by defective insulation. A defective drop cord may short-circuit in a man's hand and burn him. Furthermore, a wet, leaky cord in the hands of a man wet all over and climbing around on wet castings is a hazard of the worst order. Under these circumstances a shock even at 110 volts, and particularly at 220 volts, may be fatal. In any event a shock may cause a man to lose his hold or balance and result in a bad fall into the pit. On account of this hazard this company has abandoned the use of 220 volts in wheel-pit work and changed to a 32-volt system. A 220/32-volt transformer has been permanently installed at a central point in the station and a 32-volt circuit has been run the length of the station with connectors at each unit to which the leads going into the wheel pit can be attached. At each unit there is also installed a 32-volt receptacle in which a single drop light can be plugged to take care of the frequent case of a man going into the pit for a brief inspection with only one lamp. To prevent the danger of 32-volt lamps and drop cords being used in the ordinary 220-volt receptacles in other parts of the station, all of the 32-volt equipment has been made up with bayonet-type receptacles instead of the usual Edison base receptacles. This eliminates the danger of a 32-volt lamp exploding in a man's face when being plugged into a 220-volt circuit. A lighted oil lantern should be hung in the pit to guard against the danger of all the lamps being extinguished, as by electrical trouble in the station, blowing of fuses or accidental pulling of switches. In fact, this practice is desirable throughout the station at night." FIELD EDITOR ELECTRICAL WORLD.

Boston, Mass.

Appliances Form Large Part of Connected Load in Resident Section

IN LAYING out or changing a distribution system at the present time the amount of connected load which consists of appliances must not be overlooked. In making a survey of the secondary distribution system in the residential section of Canton a condition due to the use of small motors and appliances was found which should have attention in designing distribution systems serving the better residence sections. In fact, the connected appliance load on one typical transformer was found to be about 42 per cent of the total connected load. In making this survey a transformer was selected which would be representative of the load carried by the several distribution transformers in these high-class residential sections.

On this transformer were twenty-three customers, seventeen two-wire and six three-wire, with a connected lighting load of about 30 kw., ranging from 800 watts to 2,000 watts for each customer. The appliance load was as follows: One 1-hp. motor, five washing machines (motor of each approximately ¼ hp.), twelve sweepers (motor of each approximately 1/20 hp.), five ironers (motor of each approximately ¼ hp.), one desk fan, two heaters (550 watts each), sixteen flatirons (500 watts each), four grills (maximum 1,000 watts, medium 500 watts each) and seven percolators (420 watts each).

No doubt, in the near future the company will be required to furnish range services in this section of the city, at which time the appliance load will greatly exceed the lighting load.

O. C. KEENAN,
Ohio Power Company, Distribution Department.
Canton, Ohio.

Insulators Meggered on 110-Kv. Line in Fifteen Minutes per String

IN THE first job of changing insulators on a live 110,000-volt line of the Alabama Power Company 303 strings, seven units per string, were tested and defective units were replaced in about fifteen minutes per string average time. Before this time this company had never done any live-line maintenance, so in order to obtain first-hand information two representatives were sent to study the methods of the Georgia Railway & Power Company. They stayed about a week, learning the uses of different tools, necessary precautions to be taken and other tricks of the trade. On their return a dummy line was built and a crew was instructed on this line, so that no mistake would be made when they tackled a hot line.

The first job was to megger insulators on the first 92 "H"-frame structures of the Gadsden-Huntsville 110,000-volt line. Hot-wire tools were used to detach the line wire with suspension clamp from each insulator string, and then all defective units were replaced and the line wire reconnected to string. Three hundred and three strings, or 2,175 10-in. insulators, were tested during seventy-four hours of actual work, or about fifteen minutes per string. About 22 per cent of the strings had defective units. Actual work includes time taken in moving from structure to structure, but does not include time taken to travel to and from work. Work was not performed on wet days.

The success of live-line work depends on keeping the tools thoroughly dry, although moisture does not permanently affect their usefulness as their insulating properties can easily be restored by putting them in a drying box or room. Moisture on the tool handles causes a brush discharge, which can be recognized by a "fuzzy" feeling to the bare hands. The brush discharge is very useful as it warns the lineman when he grasps the handle too close to the live end. He should always grasp the handle far enough away from the live end, so that there will be no fuzz. A moist stick held near the line will cause a fuzzy feeling, thus warning the lineman that the stick should be dried before using.

A special box was made for transporting and drying the tools. The box is 13 ft. long, 18 in. wide and 18 in. deep with a compartment for a heater in one end. The tools are mounted on racks on the sides of the box and the blocks and tackle are hung from one end. When the box is used for drying purposes it is placed upright and the heater is turned on. The heater is made from elements of a headlight heater connected for three different degrees of heat. Each night the tools are placed in the box and the next morning they are in the best of condition. When the tools are taken from the box they are wrapped in oilcloth and carried to the job. Tools cared for in this manner will have very little fuzz, if any at all.

Among the tools employed is the "fuzz stick," a large wood-strain insulator which is used between the tackle and "come-along" when changing strain insulators. It is also used between tackle and conductor to pick up the conductor when changing suspension insulators. A special "fuzz stick" with four feet of insulation was employed. The "forked stick" resembles a pitch fork and it is used for handling suspension insulators. It is very useful for raising and lowering the string while uncoupling and recoupling suspension clamp.

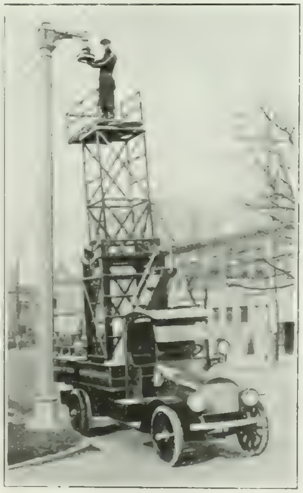
The hawk-bill cotter-key puller is used for pulling cotter keys. A special cotter-key puller is made for working Ohio Brass hardware.

The coupling-pin stick, which is shaped something like a fishhook, is used for replacing coupling pins in clevis-and-eye type insulators. The coupling pin must be drilled in the head to receive the point of the coupling-pin stick on which it is wedged. The clevis and eye are lined up and the coupling pin is then pulled.

Alabama Power Company, L. T. SMITH.
Birmingham, Ala.

High-Tower Truck for Street-Lighting Maintenance

A TOWER truck with an unusual range of height has recently been placed in service on the municipal street-lighting system in Milwaukee. The lamps for the maintenance of which the truck is principally used are mounted 30 ft. above the street surface. As the truck is used largely on the downtown streets where trolley wires and other obstructions must be avoided, it has been necessary to provide a double lift by means of which the height of the platform can be varied from a minimum of 13 ft. to a maximum of 26 ft. The mechanism for raising and lowering the tower is installed behind the driver's seat and consists of two winches operated by a battery-driven electric motor. The mechanism is controlled by a two-position, three-push-button control system. One set of buttons is back of the cab within reach of the driver and the other is on the working platform, permitting complete control of the working tower by the man on the working platform or by the driver. Each set consists of three buttons, one each for "up," "stop" and "down." The working platform can be stopped in any desired position within the working range.



LAMPS 30 FT. ABOVE GROUND ARE REACHED FROM THIS MAINTENANCE TRUCK

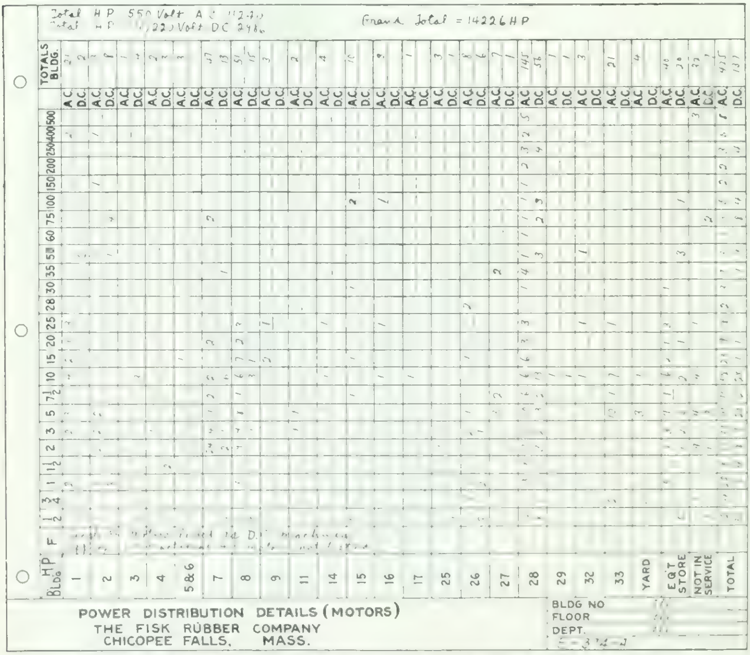
Thirty-six 100-amp.-hr. cells mounted along the sides in the truck body supply the current for operating the tower control mechanism. The covers of the battery boxes serve as seats for the crew when more than two men are carried, and the space between the boxes is available for carrying material. The battery will lift the tower about forty times on one charge.

The working platform is 3 ft. x 6 ft. in size with collapsible railings for two sides and one end. It can be revolved about an axis 18 in. from one end and locked in any desired position. A capstan winch, connected to the truck engine through a special clutch, is provided for cable pulling or other uses. The chassis is a standard 1,500-lb. truck chassis weighing 6,500 lb. with a four-cylinder motor.

Chicago, Ill. Field Editor Electrical World.

Motor Record Saves Time in Inventory and Assignments

TO FACILITATE keeping a record of the number of each size and type of motor in the different buildings and in the storehouse the accompanying chart is employed by the engineering department of the Fisk Rubber Company, Chicopee Falls, Mass. The listing of sizes and buildings in the way shown enables the number of motors of a given rating in any particular building, group of buildings or the entire plant to be determined almost at a glance. Under each motor size the number of such ratings used in each building is given, with totals footed at the bottom of the columns.



Total H P 550 Volt A C 112.20

Total H P 220 Volt DC 2486

Grand Total = 14226 HP

POWER DISTRIBUTION DETAILS (MOTORS)
THE FISK RUBBER COMPANY
CHICOPEE FALLS, MASS.

BLDG NO
FLOOR
DEPT.

DISTRIBUTION OF 562 MOTORS IN 21 BUILDINGS SHOWN ON 8½-IN. X 11-IN. SHEET

In case of relocation of motors following studies of their loading it is convenient to know in which buildings particular sizes are installed, and in making up inventories of plant equipment a tabulation of this kind is convenient in checking motor units. The chart is maintained in tracing form so that blueprints can be supplied to officials concerned at any time and is about 8½ in. x 11 in. in size, with loose-leaf perforations. In this factory 425 alternating-current and 137 direct-current motors are in service.

A. E. Trudo,
Fisk Rubber Company, Mechanical Superintendent.
Chicopee Falls, Mass.

Loop Test Determines Field Polarity of D.C. Machines

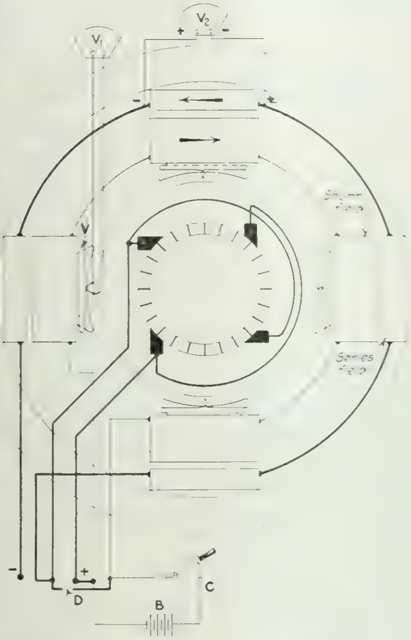
AFTER placing new field coils on a direct-current machine there is sometimes doubt as to whether the leads are connected to give the correct polarity. Even if suitable current is available for exciting the fields, it is not always possible to get satisfactory results with a compass, the polarity of which may be reversed by the strong field. In the case of compound-wound machines, it is especially inconvenient to supply the heavy current required in the series windings for excitation independent of the shunt coils.

The writer has used what he calls the inductive loop test, with excellent results. For a compound-wound machine, the coils should be connected in the manner thought to be correct, and then tested as follows: Loop one turn of wire around each pole to be tested, as shown at *L* in the accompanying sketch. Connect battery *B*, consisting of several dry cells, to the shunt-field terminals, leaving the circuit open at one point *C*. If the armature circuit is connected in parallel with the shunt, open one leg, as at *D*, so that the battery will not be short-circuited through the armature. Connect a millivoltmeter (or a shunt ammeter without the shunt) to the terminals of one of the test loops, as at V_1. Close the battery circuit at *C* and then suddenly open it, at the same time noting the direction of meter deflection, caused by the induced emf. in the test loop, due to the dying flux in the pole.

Transfer the meter to the next loop, keeping the leads in the same relative position. Again make and break the circuit at *C* and note the direction of deflection at the time of break. If the deflection at the preceding pole was positive this one should be negative. In the same way proceed around the machine. If the meter deflection is positive, negative, positive, negative, etc., changing for each succeeding pole, the shunt field coils are properly connected together. If the meter deflection is so great that there is danger of bending the needle with negative deflection, the number of dry cells may be reduced. If the deflection is too small to be observed with certainty, several turns should be used in each test loop.

To test the series coils for alternate polarity proceed as outlined, with the meter connected to the series coil on each pole instead of the test loop. If the deflection is in the *same* direction for *all* the poles, the series coils are properly connected. It is necessary, of course, to be sure that the shunt coils are properly connected before testing the series coils.

After these tests have been completed and connections reversed where necessary, it remains to test the relation between the two groups of field coils, to determine whether the series turns will build up the field or cut it down. Assume either of the machine terminals as positive and trace out the direction of current in the shunt and the series leads of any one pole, conveniently the uppermost pole of the machine, keeping in mind whether the machine is to operate as a motor or a generator. Referring to the sketch, suppose that the current would flow from left to right in the shunt coil, and from right to left in the series coil, if the machine were in operation, which would be the case for a cumulatively compounded motor. For a generator the directions would be the same. This refers to the direction from lead to lead, and not to the direction around the pole. Connect the battery to the shunt-field terminals as shown, with the battery polarity such that its current through the pole under consideration will be from left to right, as traced out for the operating current. Now connect the milli-voltmeter to the series coil, so that the positive meter terminal will be connected to the lead that would provide a current exit from the coil if the machine were in operation. In the case shown in the sketch, this will be the lead at the left of the pole, the connections being shown at V_2. Upon breaking the battery current at *C* the meter deflection should be positive. If so, the groups of field coils are connected in the proper relation to build up the field together. If not, the whole group should be reversed.



CHECKING POLARITY OF FIELD COILS OF COMPOUND-WOUND MACHINE

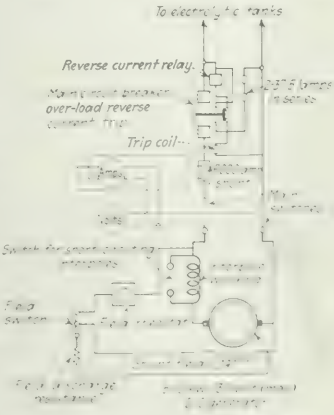
If any confusion arises, it is well to keep in mind that a dying flux tends to maintain the current that produced it. Thus when the flux produced by battery current in the shunt coils begins to disappear, the direction of emf. induced in the test loop or in the series coil is such as to send current around the pole in the same direction as the battery current.

Empire Tire & Rubber Corporation, M. J. RICH,
Trenton, N. J. Experimental Engineer.

Switch Prevents Electrolytic Load Reversing Generator Voltage

TO PREVENT an electrolytic load from reversing current through an interpole generator when running at light load, a switch short-circuiting the interpole was installed recently in a Canadian plant. The machine was a ten-pole shunt-wound interpole direct-current generator rated at 75 volts to 125 volts, 4,000 amp. It was connected to an electrolytic load consisting of a number of cells in series. On a certain occasion a number of tanks were cut out, and it should have required only about 20 volts to circulate the 4,000 amp. The machine was adjusted to 20 volts at no load and thrown across the tanks. Immediately the current and voltage built up to high values, the circuit breaker kicking out, although it was set at 6,000 amp. Many theories were advanced for this, but the final conclusion was that the machine was acting as a series generator, the commutating-pole flux serving as useful flux for generating voltage on this light load. With a load having a much lower resistance than normal the shunt fields were weak and very unstable, due to armature reaction, causing the machine to build up as a series generator, under which condition the armature current cannot be controlled.

As is shown in the figure, the remedy was to short-circuit the commutating poles, allowing the machine to operate as a plain shunt-wound generator. This was found quite satisfactory at the light loads. The short-circuiting switch should be mounted as close to the generator as possible, in the same manner as an equalizer switch, owing to the fact that this machine is supplying an electrolytic load for the refining of zinc. The anodes being lead, the cathodes zinc and the electrolyte zinc sulphate, the result is a primary battery with potential of about 2 volts per cell, which is about 60 volts, there being thirty cells in series. This voltage is made use of as an auxiliary lighting source in emergencies. When the alternating current goes off the motor driving the generator, the reverse-current relay on the direct-current bus operates because of the voltage mentioned, opening the circuit breaker and preventing the generator fields from being reversed. When the breaker opens, a small switch mechanically connected to it connects in the two 37.5-volt lamps.

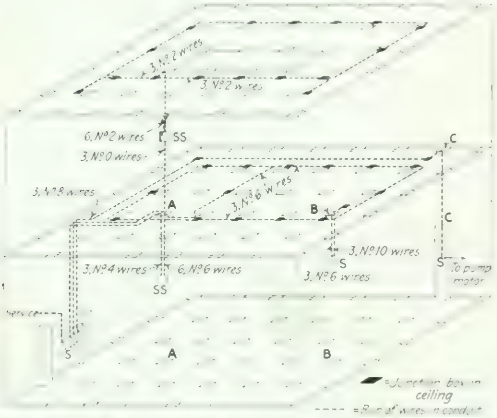


SWITCH TO SHORT-CIRCUIT INTERPOLES WHEN ELECTROLYTIC LOAD REQUIRES LOW VOLTAGE

Bonnington Falls, B. C. R. H. N. LOCKYER.

Perspective Wiring Diagram Helps Designer and Installer

A WIRING diagram drawn in perspective like the one shown in the accompanying sketch has been found in many instances quite valuable for the designing engineer, the construction crew and finally for the operating force after the building is completed inasmuch as it meets the needs of these various departments for ready and accurate reference. This type of diagram furnishes a comprehensive view of the entire layout and shows the distribution or grouping of equipment and the mains feeding it. The diagram also provides the operating crew with a quick reference for use when making changes or when it is necessary to make emergency connections. Moreover, when holes have to be drilled in the floor or walls for other purposes the perspective diagram will show where they must be located to avoid striking the conduit.



PERSPECTIVE DIAGRAM OF WIRING GIVES A CLEARER VIEW OF RESPECTIVE LOCATIONS

This shows mains and sub-mains run in conduit concealed in floors and posts.

The diagram shows the basis of the perspective method of drawing. The angle at which the oblique lines are to be drawn as well as the scale will depend quite largely upon the subject to be covered. They should be determined by preliminary sketches. As it may be desired to make the diagram of a large plant upon a sheet that may be handled without difficulty, a metric scale can be used to advantage. By use of such a scale and starting all measurements from one point, the "creeping errors" due to measuring from point to point may be avoided.

For example, assume a building with rows of posts the length of the structure, and that the preliminary sketches have indicated the advisability of making the drawing to a scale of 10 mm. to the post space; then, measuring along the post line with the metric scale, the posts can be spotted at the 10, 20, 30, 40, etc., marks on the scale, thus avoiding errors that might occur if measurements were made from point to point. If in place of 10 mm. to the post space 12 mm. to the post space had been selected, 12, 24, 36, etc., can be easily read on the metric scale.

It will be found at times that it is advisable to make the measurements along the oblique lines on a basis differing from that used for the horizontal lines; for example, 8 mm. along the oblique lines may represent the same actual distance as 10 mm. along the horizontal lines. This difference, often a great help in the making of the diagram, is not a hindrance to its use, as the diagram indicates relative rather than actual locations. The diagram reproduced in the preceding column is drawn with a 30-deg. triangle which is very suitable in this case. For another case it is possible that a clearer drawing might be obtained by using some other angle.

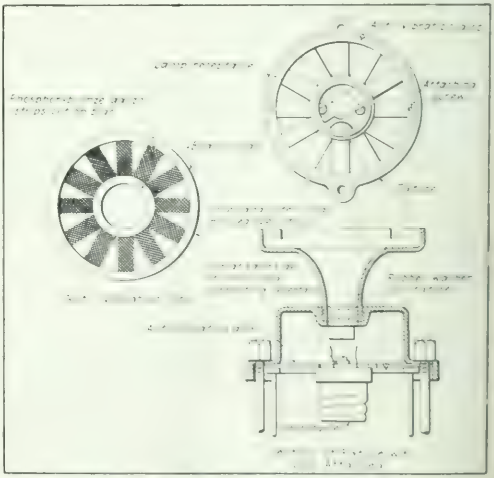
In making a diagram of this kind it should be kept in mind that the drawing is to be a picture and as such should be clear, concise and not crowded. Although the diagram is not a "drawing to scale" as that term is ordinarily used, yet accurate planning and measuring will assist greatly in laying it out. This refers especially to the floor plan that is drawn first.

C. W. KINNEY,
Electrical Engineer.
Worcester, Mass.

Support Protects Lamp Against Destruction by Vibration

A METHOD of lamp suspension which enables metallic-filament lamps to be used where previously their use has been found inexpedient on account of vibration is shown in the accompanying drawing. The device has been tested under the most severe conditions on board ship and under gunfire, also by vibration set up by a pneumatic hammer, and in no instance has a metallic-filament lamp been broken, although carbon lamps in the vicinity which were fitted in ordinary sockets have been destroyed.

In this support the lamp is hung by a number of phosphor-bronze gauze strips cut on the bias and attached to an inner and outer ring. This cutting on the bias effectively damps out any vibration. The support does not allow side sway, is unaffected by heat or atmospheric conditions and will readily dissipate heat set up when gas-filled lamps are used.



BRONZE GAUZE STRIPS SUPPORTING LAMP PROTECT IT AGAINST VIBRATION

C. M. WHITFIELD.
New York, N. Y.

Management and Policy

Embracing Central Station Commercial Organization and Management,
Customer and Trade Relationships, Public and Financial Policies, Advertising,
Selling and Service Methods

Utilities Just Groups of Thrifty Neighbors

A Well-Turned Thought from a Recent Address by S. B. Irelan, President of the Southeastern Section, N. E. L. A.

THE public does not appreciate that the capital employed and necessary in the utilization of our water-power resources and in the building of our steam-electric generating and transmission systems is in actual fact simply the combined small savings of a number of its thrifty neighbors. It has been gathered and collected by an organized group of individuals who serve them with vision and foresight and put the money to work for their benefit and use. Therefore the co-operation that to the man on the street sometimes seems to represent so much in power, booty and corruption is after all, just this—an organization of thrifty neighbors. This thought must be carried to the public so that they will stop and think and realize that our corporations" charters simply set out our objective and define how each thrifty neighbor is to share in the undertaking.

S. B. IRELAN

People already realize and appreciate the necessity of our giving continuous electrical service and its importance to the development of the communities and districts. They are ready and willing to support honest efforts of organized groups of thrifty investors to supply their community with this commodity, but must be truly informed of the various problems of our business and must realize that they also have a responsibility of securing an adequate supply of electrical energy for the community.

Today we have millions of dollars invested in our plants and facilities, and we shall require millions more each succeeding year. This new capital must come from our consuming public in all of our communities served and must represent the small savings of our thrifty neighbors. And we must organize as never before to present the investment advantages of our business to our customers.

In our own organization we must perfect our plans for an honest and prudent application of the funds gathered, then if we take our consuming public into our entire confidence and inform its members of the high principles and the high objectives of our business, we shall mold a favorable sentiment that will insure a sound and healthy business and will give the electrical central-station company a stability and earning power that will insure its securities a high position among investments.

The Local Pride Appeal in Small-City Stock Campaigns

INTEREST and local pride in the development of home industry has been turned to advantage in the sale of stock to customers by the Cape & Vineyard Electric Company, which supplies electric service in the Cape Cod and Martha's Vineyard sections of Massachusetts. The company has been encouraging customer ownership through small advertisements in the local press calling attention to the opportunity for safe and profitable investment right at home. One of the advertisements, which have attracted much interest in the Vineyard sound section because of their local appeal, is reproduced here.

STOP

investing your money away from the Island.

WHY

let people you know nothing about have your money to develop some other state?

INVEST

in your electric light company and get the benefit of Island improvement as well as a 6 per cent dividend every quarter.

Help Us Develop the Island.

Cape & Vineyard Electric Company

Henry C. Taylor, general manager of the company with headquarters at Falmouth, Mass., says that these advertisements have proved particularly successful in stimulating a sense of obligation to support the company's stock sale because it represents strictly a home industry.

"Why should strangers invest their money in our utilities if we have not sufficient confidence in the future of our communities to back them ourselves?" It is a pointed appeal that makes a strong impression.

District Customer Expense as an Index to Branch Office Efficiency

COST per month to serve each customer exclusive of the cost of generating and transmitting electrical energy furnishes the Texas Power & Light Company with a good index to the efficiency of its district offices. The accompanying tabulation of district customer expense includes the cost of distribution, municipal street lighting, local commercial and local general expense only, per customer for each district. Cost of production, taxes, insurance, salaries and expenses not controlled by the manager are not included.

[illegible] OFFICES

No.	District	[illegible]	[illegible]
1	[illegible]	1,743	$0.62
2	[illegible]	2,000	0.72
3	[illegible]	2,997	0.75
4	Bonham	1,889	0.79
5	Cleburne	3,111	0.80
6	Denison	3,718	0.89
7	[illegible]	[illegible]	[illegible]
8	[illegible]	[illegible]	[illegible]
9	[illegible]	3,098	0.94
10	[illegible]	[illegible]	[illegible]
11	[illegible]	[illegible]	0.99
12	Waco	[illegible]	1.01
13	Terrell	[illegible]	1.04
14	Temple	[illegible]	1.05
15	Palestine	1,699	1.07
16	Taylor	2,467	1.07
17	Hillsboro	2,512	1.11
18	McKinney	3,607	1.26
19	[illegible]	17	6.76
	Total	50,941	$0.95
1	Sweetwater	[illegible]	$1.12
2	Eagle Pass	1,140	1.24
3	Wichita Falls	7,717	1.70
4	Big Springs	674	1.72
	Total	11,130	$1.57
	Grand Total	62,071	$1.06

In comparing the standing of the different branches, due allowance, of course, is made for the local conditions in each district. But the net result is a practical comparison of the cost of doing business in so far as serving the customer is concerned, and should carry an impulse of intercompetition through the organization.

Results of Joint Selling Compared with Independent Effort

MUTUAL profit from co-operative selling effort is shown in the results of a recent flatiron campaign conducted jointly in Newark, N. J., by the Public Service Electric Company and the local electrical dealers. It gives a good comparison between a combined campaign and one in which the central-station company and the dealers worked independently and in some respects at cross purposes.

In June, 1919, the Public Service company sold a special iron of its own at $5.75. It was a standard iron of a well-known make but different in design, with a special finish, extra stand and attached cord. Dealers who sold the standard iron of regular design met the price of $5.75 but advertised it as "genuine." As a result there was considerable confusion in the minds of purchasers as to why there should be so much talk about the fine points of difference in the same make of flatiron. In that campaign the Public Service Electric Company sold about 5,000 irons, while the electrical jobber who is the local distributer for the standard iron sold a few more than 200 to the dealers.

This year the Public Service company scheduled its flatiron sale for September and arrangements were made so that the jobber could purchase irons for resale by dealers and department stores at the same price, thus making it a united effort by the entire electrical trade. The central-station company also purchased through the jobber. The outlook for business was not so good as in 1919, and it was expected that the sale would not net over 3,000 flatirons.

However, this sale was made a feature in twenty-five Public Service salesrooms, ninety-four dealers' stores and two large department stores. The largest department store, carrying a number of different makes of irons, in June, 1919, sold about fifty of this particular iron. This September the store sold over 300 during the general campaign. Dealers who before had taken only 210 from the jobber sold nearly 1,700. The Public Service Electric Company purchased during the sale just under 5,000 in spite of slack times and the fact that a September campaign has never before netted more than about 60 per cent of a June campaign.

The success of this campaign was attributed largely to the concerted publicity and the absence of any confusion in the public mind because of opposing advertisements as in the former sale. This is an excellent example of the value of co-ordinated effort in selling and the profit that accrues when the local electrical family really co-operates.

What Other Companies Are Doing—

Oklahoma.—A recent survey shows that with but a few exceptions all the public service corporations in Oklahoma are offering their capital stock to the public served. This proves that customer ownership thrives even where 10 and 12 per cent interest rates are common, as at present in this state. The yields vary from 7 to 9 per cent and the investment departments of these companies are very successful in spite of the high yields of building and loan associations and others. More than $16,000,000 capital stock of Oklahoma's public utility companies is now owned by customers and small stockholders.

Illinois.—A particularly useful seven-page booklet for promoting the sales of household electric appliances has been issued by the Public Service Company of Northern Illinois. On each page there is a photograph and description of one appliance, while the reverse side of the page carries an order blank for the appliance, stating the rate of monthly payments to be made with the regular electric light bill. The pages can be torn out of the booklet, signed and sent to the company as an order for the appliance. The last page is a detachable post card on which the customer may request catalogs on other appliances sold by the company.

Thompsonville, Conn. — The Northern Connecticut Light & Power Company closed its books on Oct. 13 on a 500-share issue which was 10 per cent oversubscribed in just four days. The company serves somewhat under 4,000 customers, and the territory was financially stagnant because of a recent protracted strike and an unsatisfactory market for the local tobacco crop. The sale was conducted under the general direction of Walter P. Schwabe, vice-president and general manager of the company, and under the immediate supervision of Percy H. Whiting, 1921 chairman of the customer-ownership committee of the New England Division of the N. E. L. A.

Massachusetts.—Through contracts placed with the Haverhill (Mass.) Electric Company and the Salem (Mass.) Electric Lighting Company, the Eastern Massachusetts Street Railway Company has been enabled to shut down its steam plants in these places and to simplify the supply of energy to substantial portions of its lines north of Boston. At Haverhill three 500-kw. rotaries have been installed and at Salem one 1,500-kw. and two 500-kw. rotaries have gone in for this service. The estimated output to be supplied at these places is 3,500,000 kw.-hr. and 6,000,000 kw.-hr. respectively per year. The contracts are for ten years and were negotiated by Vernon M. F. Tallman, power engineer with Charles H. Tenney & Company of Boston.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
of the World

Generators, Motors and Transformers

Automatic Synchronizing Apparatus of the Siemens-Schuckert Works.—C. MICHALKE.—This apparatus, suitable for three-phase machines, is operated by a small, special motor the stator of which has a three-phase winding while its rotor represents a short-circuited single-phase field. The characteristics of such a motor are explained in theory and with diagrams. The complete apparatus consists of the motor, a time relay, an auxiliary relay, two contactors, three indicating lamps and the necessary transformers and resistors. A connecting diagram and several photos are shown.—*Elektrotechnische Zeitschrift*, Sept. 29, 1921.

Use and Abuse of Electric Motors.—J. M. HIPPLE.—This article describes the causes of trouble in electrical motors, particularly those used on railway cars, and tells what must be done to prevent such troubles. A table is given showing what characteristics govern the choice of material and what material is used for each part of the motor. Systematic maintenance is declared to be the wisest policy for preventing trouble.—*Electric Journal*, October, 1921.

Electric-Steam Generator for Low Voltage.—F. A. LIDBURY and F. A. STAMPS.—A description is given of an inexpensive form of apparatus and its method of employment for generation of steam by means of alternating current at voltages of from 100 to 500. This apparatus is particularly adapted to a plant which operates its own hydro-electric installation or purchases blocks of hydro-electric power and has available at times energy which it can use at little or no additional cost. Under such conditions considerable saving in fuel may be made by use of the electric boiler.—Paper presented before American Electrochemical Society, Oct. 1, 1921.

Lamps and Lighting

Incandescent Lamp Temperatures in Modern Practice.—CHESTER L. DOWS and WILLARD C. BROWN.—This paper is intended to clear up any questions on the operating temperatures of incandescent lamps. The material is divided into four main parts: (1) Temperature of lamps operated without reflecting and diffusing equipments; (2) temperatures of lamps operated with reflecting or diffusing equipments; (3) ventilation versus non-ventilation; (4) suggestions on the use of incandescent lamps in interiors which present special temperature problems.—Paper presented before Illuminating Engineering Society, Sept. 29, 1921.

Regulation of Automobile Headlights.—A report of the committee on motor vehicle lighting of the Illuminating Engineering Society says that state laws controlling approximately 43 per cent of the automobiles in the United States have embodied the system advocated by the society. The bulletin issued by the society gives tests to determine whether the headlights of the motor vehicles conform to the requirements of the law. Methods of using equipment in accordance with the regulations are also described, including a headlight controlling device, lamps, adjustment of tilt, focus adjustment, beam adjustment, etc.—Paper presented before Illuminating Engineering Society, Sept. 29, 1921.

Generation, Transmission and Distribution

Hydro-Electric Development in New Zealand.—Plans have been made and are being carried out for developing the three principal power sources in New Zealand. This article indicates the progress which has been made to date.—*Electrical Times*, Sept. 8, 1921.

Hydro-Electric Developments.—F. ROWLINSON.—This article considers the hydro-electric plants now under construction or soon to be constructed in every part of the world. Probable cost of the construction and probable amount of power which can be developed are given.—*Beama* (British Electrical and Allied Manufacturers' Association), September, 1921.

Water Powers of the World.—A. H. GIBSON.—A discussion of the developed and available water-power sites of the world and particularly those of Great Britain. Of the developed power in the empire, about 80 per cent is in Canada. Throughout the remainder of the territory only about 700,000 hp. is now developed, which is a little over 1 per cent of the power avaiable.—*Electrical Times*, Sept. 15, 1921.

Edinburgh Power Station.—S. B. DONKIN.—A description of a power plant with a present rating of 30,000 normal output from three 10,000-kw. turbogenerators.—London *Electrician*, Sept. 30, 1921.

Water Power in Iceland.—An account of the chief waterfalls in Iceland taken from the report of a traveler on horseback. Considerable power is available and the volume is remarkably constant.—*Electrical Times*, Sept. 15, 1921.

Developments in Power-Station Design.—A description of various equipment which has been developed in recent years for the boiler room. This includes pumps, oil burners, etc.—London *Engineer*, Sept. 2, 1921.

Water-Power Development.—A. H. GIBSON.—A study of the water powers available in Great Britain with suggested plans for developing them.—London *Electrician*, Sept. 16, 1921.

Installations, Systems and Appliances

High-Voltage Outdoor Oil Switches.—V. CANDIE.—The good results achieved in American power plants with outdoor apparatus seem to have been acknowledged by French engineers, and this article describes a new outdoor type of high-voltage oil switch manufactured by the French concern Métallurgique Electrique. The author of the article, who is the designer of the new switches, made an inspection tour through America to study our structures and their performance. As a consequence several of our well-established switch features reappear in the French design. For example, the oil-filled lead has been adopted. A good and apparently original feature is a quadruple contact opening per phase, so arranged as to have a current transformer between the two main leads. Two movable rods with two contacts each complete or break the circuit. The primary and secondary of the current transformer have no insulation between them except oil, being interlinked in planes meeting each other at 90 deg. The entire contact-making apparatus is surrounded by a double-wall fireproof container, the two rods being separated from each other and from the main steel tank by oil spaces. Careful study has been given to the rupturing capacity of switches, and a formula for determining this capacity from certain dimensions of the switch is printed. The necessity that the contacts shall have a high mechanical rupturing speed—from 8 m. to 10 m. per second—and that the arcing contacts shall be carefully designed is emphasized. The author rejects the automatic opening device if the opening is actuated by an external current source, maintaining that in case of serious trouble this source is liable to fail. He advocates the use of the controlled current itself to open the circuit. A sectional drawing and several photographs of the switches accompany this noteworthy article.—*Revue Générale de l'Electricité*, Sept. 3, 1921.

Electrical Equipment for a Mine Hoist.—GRAHAM BRIGHT.—A discussion of the many factors which have to be taken into account when choosing a hoist for a mine. Numerous examples are given and sample load curves are shown. Various types of control are discussed.—*Transactions American Institute of Mining and Metallurgical Engineers*, September, 1921.

Units, Measurements and Instruments

Electrolysis Measurement and Mitigation.—An account of the first successful attempt to make, under practical conditions of field testing, a definite quantitative measurement of the current density discharged from a pipe at any point, this being the factor directly responsible for corrosion. The method described will probably prove the basis of future research work of the American Committee on Electrolysis, and the results of approaching surveys in certain cities will depend on its use and accuracy. It is an attempt to place the art of electrolysis testing on a definite engineering basis.—*Report of American Committee on Electrolysis*, 1921.

Electrochemistry and Batteries

Electric Silver Melting.—H. A. DEFRIES.—A description of the advantages of electric furnace melting of silver, relating how a more ductile and tougher silver results upon introducing an iron block into the bath.—Paper presented before American Electrochemical Society, Sept. 30, 1921.

A New Theory of the Corrosion of Iron.—J. NEWTON FRIEND.—An auto-colloidal catalytic theory, which postulates the corrosion as starting by the formation of colloidal ferrous hydroxide. This by-contact with the air forms hydrated ferris hydroxide, which in turn is alternately reduced by contact with iron and oxidized by contact with air, thus continuing the corrosion.—Paper presented before American Electrochemical Society, Sept. 29, 1921.

Rust Prevention by Slushing.—HAAKON STYRI.—An extended research which shows that for protection against rust by greases a thorough cleaning of the steel parts by an aqueous solution is essential. An oil emulsion which leaves an oil film for short-time protection is preferable. Such emulsions protect against rust.—Paper presented before American Electrochemical Society, Sept. 29, 1921.

Aluminum-Copper Alloys.—R. J. ANDERSON.—A discussion of the manufacture, properties and uses of the commercial aluminum-copper alloys employed in the United States.—Paper presented before American Electrochemical Society, Sept. 30, 1921.

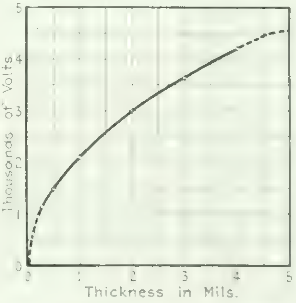
Telegraphy, Telephony and Signals

Rectifying Properties of Three-Electrode Valves.—L. F. PALMER.—An investigation undertaken for determining constants by which the rectifying properties of valves may be calculated. Curves were plotted from experimental data.—*Radio Review*, September, 1921.

New Experiments with the Telegraphone.—A. NASARISCHWILY.—In the "telegraphone," devised many years ago by Poulsen, a telephonic conversation was "fixed" by magnetic action upon a steel ribbon or a steel wire and could be reproduced later by passing this ribbon again over a small electromagnet in the winding of which a fluctuating voltage was set up which in turn energized a telephone receiver. The results obtained with this apparatus did not warrant its more general use, on account of the faintness of the reproduction. Since, however, the modern vacuum tube came into vogue, it has been possible to amplify the sound to any degree, and the author has built an electromagnetic phonograph on the combined principles of the telegraphone and the amplifying tube. He shows further that with this method a message may be "spoken into" a rail and may be picked up by the engineer of the train following. Here is a suggestion that might be of great value for railway signaling purposes.—*Elektrotechnische Zeitschrift*, Sept. 22, 1921.

Miscellaneous

Electrically Welded Steel Boats.—A. LAGANE.—The author advocates the use of electric welding instead of riveting for the steel hulls of boats. He uses metallic electrodes with a non-metallic coating, or the so-called "quasi-arc." As examples of accomplished jobs a 20-m. x 4-m. x 2½-m. boat and a 500-ton cargo boat are given. The former had to be transported on land for a distance of 3 miles (4.8 km.) before it was launched, subjecting all welds to a very abnormal stress, but no damage to the welded joints resulted.—*Revue Générale de l'Electricité*, Sept. 24, 1921.



BREAKDOWN VOLTAGES OF VARNISH APPLIED IN LAYERS

Insulation Experiments.—F. FERNIE.—A test made on the insulation resistance of various materials. Accompanying curves show the breakdown voltage of an air-drying varnish painted on in coats, each coat being allowed to dry before the next one is applied. The tests were made at 15 deg. C. between a sphere and plate.—*Beama* (British Electrical and Allied Manufacturers' Association), September, 1921.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

Hearing on Colorado River Projects

THE Secretary of the Interior and the Director of the Reclamation Service expect to hold a hearing in San Diego Dec. 1. At this hearing the report of the Reclamation Service in which have been assembled all available data bearing on the problems of the Colorado River will be considered. Owing to the demands made on Secretary Fall's time, it has been impossible for him to conduct this hearing on the dates which have been fixed previously.

Bankers Opposed to Interest-Rate Basis for Water-Power Amortization

MEMBERS of the Investment Bankers' Association of America unanimously adopted at the annual convention in New Orleans last week a resolution urging the Federal Power Commission to modify the regulation on amortization of investment. The association went on record as being opposed to interest rate on bonds as a basis for determination of amortization.

The resolution, a copy of which has been sent to the Federal Power Commission, follows:

> Whereas the federal water-power act of June 11, 1920, requires among other things that provision shall be made in licenses granted under such act whereby a large portion of the profits on the investment of the licensee in excess of a specified rate of return to be named in the license shall be used to amortize the investment; and
>
> Whereas the Federal Power Commission's rules and regulations, effective June 6, 1921, provide among other things, in Regulation 17, as follows:
>
> "Sec. 3. Specified Rate of Return.—Method of Determining.—A. The 'specified rate of return' upon the actual, legitimate investment of a licensee in any project or projects shall, for the purposes of this regulation, be one and one-half times the weighted average annual interest rate payable on the par value of the bona-fide interest-bearing debt of the licensee actually outstanding, in whole or in part, on account of the project property at the beginning of the period of amortization and of each calendar year thereafter; provided, that, if at the beginning of the period of amortization or of any calendar year thereafter the outstanding interest-bearing debt of the licensee on account of the project or projects under license, together with any other works or property operated in connection therewith, is less than 25 per cent of the actual, legitimate investment of the licensee in said project or projects, then and in such event for the calendar year next following the specified rate of return shall be two times the legal rate of interest in the state in which the project, or the greater part thereof, is located"; and
>
> Whereas sound financing of water powers and other public enterprises necessitates the providing of a large part of the capital from the proceeds of stock to the end that the companies may maintain a high degree of credit and thus be able to sell their bonds on a low interest basis and always be able to finance the necessary facilities to enable such companies adequately to serve the public; and
>
> Whereas the financing of public enterprises wholly through debt obligations is under modern conditions usually impracticable and in any event is always unsound and dangerous because it necessitates the selling of bonds on a high-yield basis and places the companies in bad credit, thus hampering them in serving the public and increasing the cost of any service that can be given to the public; and
>
> Whereas the above-quoted regulation penalizes the development of water powers upon a basis that is safe for the investor and economical from the standpoint of the consumer and places a premium upon uneconomical development and unsound finance; and
>
> Whereas the cost of money acquired through the sale of stocks depends upon many factors besides the amount of bonds outstanding or the effective rate of interest thereon;
>
> Therefore, be it resolved, that the American Investment Bankers' Association respectfully call the attention of the Federal Power Commission to these facts and earnestly request a reconsideration and modification of the regulation above referred to as being in effect a serious deterrent to the development of the water powers of the nation and injurious to the public interests; and
>
> Be it further resolved, that in the opinion of this association a requirement that when earnings equal one and one-half times the average effective bond interest amortization of investment shall begin is unfair to the investors in the case of properly financed companies and will seriously retard the development of water powers, and that this association earnestly urge the adoption of some standard as a basis for determining earnings applicable to amortization of investment other than the effective interest rate on bonded debt; and
>
> Be it further resolved, that the secretary of this association be instructed to send certified copies of this resolution immediately to the members of the Federal Power Commission.

Most Powerful Radio Station Opened

THE Radio Central station of the Radio Corporation of America, on Long Island, declared by the corporation's engineers to be the most powerful yet built, was formally opened Nov. 5 by President Harding. Seated at his desk in Washington, the President pressed a key and an automatic sending device began to send out his message to receiving stations in twenty-nine countries. The message read as follows:

> To be able to transmit a message by radio in expectation that it may reach every radio station in the world is so marvelous a scientific and technical achievement as to justify special recognition. It affords peculiar gratification that such a message, from the Chief Executive of the United States of America, may be received in every land, from every sky, by peoples with whom our nation is at peace and amity. That this happy situation may ever continue, and that the peace which blesses our own land may presently become the fortune of all lands and peoples is the earnest hope of the American nation.
>
> WARREN G. HARDING.

Within a few minutes after the message had been flashed out replies were being received from England, France, Norway and Italy. All congratulated the Radio Corporation on the construction of a station that meant such a great advance in the science of wireless communication.

The station is situated near Port Jefferson, L. I., about 70 miles from New York. The site covers ten square miles, and when completed the station will resemble a huge wheel with twelve spokes. The power house and sending station will form the hub, while each set of antennas, mounted upon six towers, will form a spoke. At the present time only two sets of towers have been erected, but it is planned to build ten more as it becomes necessary. Each tower is 410 ft. high, while the cross-arms are 150 ft. long. The distance between towers is 1,250 ft., each antenna system being almost 1½ miles long. Each antenna consists of sixteen silicon bronze cables, ⅜ in. in diameter, stretched horizontally from tower to tower. In all, 50 miles of this cable has been used for the first two sections. The ground system for each antenna consists of 450 miles of copper wire buried in the ground of the entire antenna system in starfish and gridiron fashion. Ten high-frequency Alexanderson alternators will eventually be used, giving an output of 20,000 kw.

A sending speed of 100 words a minute is possible with each unit, so that when the entire installation is completed twelve different messages may be sent simultaneously, each at the rate of 100 words a minute. The transmitting range of the station is virtually worldwide, preliminary tests having been heard in all parts of Europe and in Australia, South America and Japan. The station is to be operated by remote control from the New York office of the corporation, over wire lines built by the forces of the New York Telephone Company.

The receiving station is at Riverhead, L. I., 16 miles away. No operators are stationed there either, the signals being automatically transferred to wire lines and received at the New York office. The action is simultaneous from the time the signals are transmitted abroad, picked up by the aërial, to the moment of actual transcribing by the receiving operators in New York at the central traffic office, 64 Broad Street.

The formal opening of the station took place before about 400 visitors who had been brought from New York by the Radio Corporation on a special train. There were present a large number of men prominent in electrical and governmental circles.

In the absence in Europe of Edward J. Nally, president of the corporation, the guests were addressed by Owen D. Young, chairman of the board of directors. Mr. Young said that America now stood in the van of the world in radio communication, but that only courage, skill and the use of financial resources would continue to keep her there.

"England has taken advantage, and properly, of her geographical position to control European cable lines, and America should follow the same method," said Mr. Young. "With the construction of this station America becomes the center of radio communication. Poland has contracted with us for a station there, and we have just come from Europe, where an agreement was made with French, British and German representatives that the station to be built in Chile shall be jointly owned and operated. Another station is proposed for Brazil, and still more will be built in South America as the need arises. Of all these, Radio Central will be the center."

Mr. Young gave great credit to the engineers and executives of the General Electric Company, the Westinghouse Electric & Manufacturing Company, the Western Electric Company and the United Fruit Company for their aid in working out commercial, financial and technical problems. He announced that these companies all had agreed to turn over to the Radio Corporation all inventions dealing with radio for a period of twenty years so that the progress of American-controlled radio would not be hindered by any patent litigation whatever.

Approves Million and a Half Expenditure for Alaskan Cable

THE Director of the Budget has approved the expenditure of $1,500,000 for replacing the worn-out portions of the Washington-Alaska submarine cable system. The President has forwarded the request for this appropriation to Congress.

The cable composing this system is 2,675 miles in length. It is a single-strand conductor installed nineteen years ago. It is so worn that 95 per cent of the current escapes through grounds, abrasions and mechanical defects. Since it has been established that wireless communication to Alaska is subject to such great interruptions, the War Department urges that this appropriation be made so that a contract may be closed at the earliest possible time for this cable, allowing for its delivery next spring. It is intended that practically the entire amount of this appropriation shall be expended for the cable, as the War Department will use its own personnel for its installation.

Kentucky Association of Public Utilities Issues Convention Program

MORNING and afternoon sessions will be held by the Kentucky Association of Public Utilities when it meets in annual convention at the Seelbach Hotel, Louisville, on Tuesday, Nov. 22. In the morning the outlook for power and light companies, the electric railway industry and the telephone industry will be discussed by representatives of the respective interests. The speaker for power and light companies will be Donald McDonald, vice-president and general manager of the Louisville Gas & Electric Company. James P. Barnes will speak for the railways and M. F. Hosea for the telephone companies. This session will be followed by a luncheon at which Martin Insull, past-president of the N. E. L. A., will be the guest of honor.

In the afternoon "Public Safety" will be discussed by George H. McClain, manager of the Louisville Safety Council; "The Financial Outlook" by Richard M. Bean, president Louisville National Bank, and "The Functions of a Public Utility Association" by A. Bliss McCrum, secretary of the Public Utilities Association of West Virginia.

Puget Sound Power & Light to Supply Energy in Wenatchee Valley

FOLLOWING negotiations extending over a period of months, it is reported steps were recently taken to supply the Wenatchee Valley and parts of Chelan and Douglas Counties in Washington with electric power from the Seattle district under a contract entered into between the Puget Sound Power & Light Company and the Washington Coast Utilities Company, in which the former agrees to supply the latter's power requirements in this district for a period of thirty-five years. A total of 5,060 hp. will be delivered as soon as the necessary construction work is completed, but as expansion proceeds it is estimated that the load in this district may run up to 30,000 hp. or more. The contract is an "open-end" instrument, allowing for unlimited development, the Puget Sound Light & Power Company standing ready at all times to meet the needs of the district as they develop.

It is planned to supply the power over a 110,000-volt transmission line running from Snoqualmie Falls to Wenatchee, a distance of approximately 100 miles. Preliminary surveys of the transmission-line route have been made, and it is expected that construction will begin early in the coming year. The work will probably be completed about the first of July.

The Washington Coast Utilities Company now owns and operates what was formerly the property of the Wenatchee Gas & Electric Company.

Use of 80,000-Volt Cables and Water-Cooled Generators in Europe

THE most impressive example of the electrical progress made by Europeans, according to Philip Torchio, chief electrical engineer of the New York Edison Company, who has just returned from a visit to Italy, France and England, has been the practical application of underground transmission pressures far above any voltages employed for that purpose in this country. One important underground circuit, he stated, has operated at 50,000 volts without failure for four years, while the Union d'Electricité of Paris is installing an extensive system of 60,000-volt cable transmission and in Italy cables have been built for service at 80,000 volts. In steam power-station development, the construction of the Gennevilliers central station of the Union d'Electricité is a remarkable example of the broad basis on which modern France is planning to cope with the problems of reconstruction, Mr. Torchio said. He has obtained from Colonel Mercier's engineers considerable information, but because they will undoubtedly shortly publish full details of the work he did not feel at liberty to say more than that the station will contain five 40,000-kw. turbo-generators, three of which are water-cooled. The generators will be connected to 6,000/60,000-volt transformers without intervening low-tension buses. Another plant specially mentioned by Mr. Torchio was the North Tees power plant in England, which contains two 20,000-kw., 40-cycle, 11,000-volt turbo-generators operating at 450 lb. steam pressure. Mr. Torchio said he was under the impression that the cost per kilowatt installed in both of the stations mentioned is considerably below the cost that can be obtained under American conditions.

PHILIP TORCHIO

"Several million horsepower of hydro-electric plants," Mr. Torchio continued, telling the ELECTRICAL WORLD of his impressions, "are being considered by France in the Pyrenees and Alps to conserve its natural resources. In this undertaking the government is giving its whole-hearted support and financial backing where necessary. Italy, too, has numerous water-power projects under consideration or construction. Several in northern Italy have been completed and are supplying energy to operate electric furnaces for making iron. The transmission system which has been recently installed to connect the water powers of the Alps and the Appenines has been productive of extremely beneficial results.

"Despite the great difference in size between Italy and the United States, Italy has 230 electric locomotives compared with 385 in this country. This high state of electrification is largely due to the topography of Italy and the almost prohibitive price of coal. About 4,000 miles of electrified track is now under consideration. In the north of Italy three-phase energy is being used chiefly to operate trains. Although this system has several disadvantages, it deserves more attention in this country than it has received. Between Rome and Naples a direct-current system is being installed, while near Rome a 45-cycle system is being constructed for experimental purposes.

"From a business point of view, Italy and France appear to be in a much better position than one year ago, their chief activity, namely agriculture, having increased considerably. The combination of the world-wide business depression and the inability of the Soviet government of Russia to fulfill its promises to the laborer has helped stabilize European labor conditions.

"As a result of the exchange situation, most of the European countries are raising barriers higher than the Woolworth tower against the exchange of labor and commodities. Unless each nation will lower import tariffs on some of the products which the other nations have to sell it cannot be expected that international business will improve greatly."

Tax Bill Now in Conference

THE much-revised tax bill is now in conference and the hope is expressed that it will be reported out within ten days. It passed the Senate on Tuesday with some further amendments and with others disallowed. All hope of a sales tax was lost when the Smoot amendments to that effect were rejected.

Reconsidering its former action, the Senate voted to strike out the Lodge amendment allowing holding companies to deduct from their capital stock tax the amount of such tax paid on the stock of subsidiaries. The capital stock tax on all corporations will remain as it is at present—one dollar on each $1,000, in excess of $5,000. Another effort to continue the excess profits tax after this calendar year failed.

In rapid succession the Senate rejected three amendments proposing changes in the corporation income tax rate of 15 per cent previously agreed on. As it now stands the Senate and House are in agreement in repealing the excess profits tax and the transportation tax on Jan. 1, 1922. The corporation tax fixed by the Senate is 15 per cent instead of 10 per cent as in the existing law, while the House has placed the figure at 12½ per cent. Of interest to the electrical industry in particular is the Senate amendment repealing taxes on portable electric fans and portable lighting fixtures.

The Senate also passed the House bill extending the emergency tariff, but amended so as to continue in effect until superseded by the permanent bill instead of expiring on Feb. 1. All provisions of the temporary law passed originally on May 27 were retained.

Merrill Makes Statement on Water-Power Depreciation Regulations

MEMBERS of the water-power development committee of the National Electric Light Association conferred with Secretary Merrill of the Federal Power Commission on Nov. 3 in regard to the depreciation regulation of the commission. After the conference Mr. Merrill said that he is very willing to receive practical suggestions in regard to this regulation but that he does not believe it wise to throw open these regulations for reconsideration at this time. A further conference was to have been had Nov. 10. Mr. Merrill stated that it is probable a plan can be worked out which will permit of some elasticity in the application of this regulation, but, he said, there are some who would have the principle of the regulation thrown overboard, and to this he is unalterably opposed. He believes it is necessary to perfect a system as nearly uniform as can be so that the licensees of the commission, in fulfillment of the requirements of the act, will not have to do more than submit copies of the reports which are made to the state commissions. In this way all questions of accounting can be left exclusively to the states, he pointed out.

Supreme Court Holds Municipal Plant Exempt from Regulation

AN OPINION unfavorable to the contention of the Springfield Gas & Electric Company in its case against the city of Springfield, Ill., was handed down by the Supreme Court of the United States on Nov. 7. The company contended that the exemption of municipal corporations from the provisions of the Illinois public utilities act is void under the Fourteenth Amendment to the Constitution and that the act should be enforced without regard to this exception. In its opinion the Supreme Court upheld the decree of the Illinois Supreme Court. Extracts from the decision just rendered are as follows:

"The plantiff's argument shortly stated is that in selling electricity the city stands like any other party engaged in a commercial enterprise and that to leave it free in the matter of charges while the plaintiff is subject to the Public Utilities Board is to deny to the plaintiff the equal protection of the laws. We agree with the Supreme Court of the state that the difference between the two types of corporation warrants the different treatment that they have received.

"The private corporation, whatever its public duties, is organized for private ends and may be presumed to intend to make whatever profit the business will allow. The municipal corporation is allowed to go into business only on the theory that thereby the public welfare will be subserved. So far as gain is an object, it is a gain to a public body and must be used for public ends. Those who manage the work cannot lawfully make private profit an aim as the plantiff's directors not only may but must.

"The fact that the municipality owned the plant for which its counsel fixed the rate was supposed to disqualify its officers at least when other plants were submitted to the judgment of strangers. But a city council has no such interest in the city's electric plant as to make it incompetent to fix the rates. Whatever the value of the distinction between the private and public functions of the municipality, the duty of its governing board in this respect, as we have said, is public and narrowly fixed by the act. The conduct of which the plaintiff complains is not extortion, but on the contrary charging rates that draw the plaintiff's customers away. The standard of these rates, however, according to the Supreme Court, is fixed by the Legislature. If the rates had been fixed by law at the present amounts, it would be vain to deny their validity. The trouble with the plaintiff's argument is that it attempts to go behind the interpretation that the Supreme Court has given to the acts concerned and to overwork the delicate distinction between the private and public capacities of commercial corporations. It is unnecessary to refer to the numerous cases upon classification by state laws in order to show that the distinction in question here is very far from being so arbitrary that we must pronounce it bad."

Authorizations Granted by and Sought from Federal Power Commission

THE Federal Power Commission has authorized a twenty-five year license for the Gladstone Mining Company of Buena Vista, Col. The application was filed Sept. 28 and was approved Oct. 31. The license covers a small power development on Denny Creek to be used for mining purposes. The commission has authorized the issuance of a preliminary permit covering a small power project at the government lock and dam in the Ocklawaha River in Marion County, Fla., where 600 hp. is to be developed for public utility purposes by the Ocklawaha Reclamation Farms of Ocala Fla. A preliminary permit was granted the Louisiana Gravity Canal Company of Alexandria, La., covering a power project on Bayou Cocodrie in Rapides and Evangeline Parishes. Another preliminary permit was granted for the project of the Elmore Copper Company on the south fork of the Boise River in Elmore County, Idaho.

The commission also has ruled on four declarations of intentions. In the case of a proposed development by Ira Cornelius on the White River near Rogers, Ark., the commission found that the interests of interstate and foreign commerce were not affected. The proposal of the Pigeon River Lumber Company to build four dams in Pigeon River near the international boundary between Minnesota and Canada is of a nature to affect interstate and foreign commerce, the commission held. A similar finding was made in the case of the proposed project of Fred D. Breit in the Fox River near Dayton, Ill. The proposed project of F. M. Waring in the Juanita River near Newport, Pa., was held to come under the purview of the water-power act. The Juanita River is not navigable, but it is believed that the project will affect the navigable capacity of the Susquehanna.

An application for a preliminary permit has been filed by the Fort Klamath Meadows Company of Klamath Falls, Ore. The project involves 550 hp. intended to furnish light and power on the company's own land.

The San Joaquin Light & Power Corporation of Los Angeles has applied for a preliminary permit covering one large reservoir, three conduits, two diversion dams and three power houses on the South Fork of the Merced River and one dam and power house on the main stream of the Merced River. The project is located in Mariposa County, Cal. The power capacity is estimated at 55,000 hp. and the insatlled capacity at 110,000 hp.

American Valuation to Bring Price Statistics

A BENEFIT of the American valuation plan which had not been emphasized before has been pointed out by Secretary of Commerce Hoover. He calls attention to the fact that the adoption of this method of valuing imports will necessitate the building up of a much needed statistical service on prices. He believes the American valuation plan will require a very elaborate return of price data.

American Engineers to Design Brazilian Centennial Lighting

DESIGN of the general illumination of the Brazilian Centennial Exposition has been placed in the hands of American engineers. An appropriation of $500,000 has already been approved by the Brazilian government, which may be increased. The contract for the wiring has been obtained by the General Electric Company of Brazil, the Brazilian subsidiary of the International General Electric Company.

W. D'Arcy Ryan, designer of the Pan-American Exposition illumination and numerous other spectacles, including the National Capitol illumination on Armistice Day, together with his chief engineer and designer, is being sent to Brazil to take charge of the work. His engineer and designer are leaving for Brazil this week, and Mr. Ryan expects to follow about Nov. 25.

The contract was taken on a cost basis, which will permit the General Electric Company to take advantage of Brazilian stocks. The company is now engaged in manufacturing lamps in Brazil and has been able to build up a Brazilian stock of a million or more lamps.

Congress has appropriated $1,000,000 for the erection and equipment of the American building at the exposition, and it is understood that the British government as well as several others will have buildings. An effort is being made to standardize on the lighting of all the buildings.

Holds Pre-War Valuation Unfair for War-Time Rates

THE Court of Appeals of the District of Columbia this week reversed the opinion of the District Supreme Court which had upheld the valuation placed by the Public Utilities Commission on the property of the Potomac Electric Power Company. The higher court held that the commission erred in making the valuation as of July 1, 1914, rather than as of Dec. 31, 1916. The commission has decided to appeal to the United States Supreme Court.

The company is collecting 10 cents per kilowatt-hour, of which it keeps 8.075 cents and places the remainder in a fund pending the price outcome of the case. Already over $2,000,000 has so far been set aside and there is a possibility that the fund may reach $3,000,000 before the case is decided.

In issuing its decision the Appellate Court said:

> The commission found the fair value of the property as of July 1, 1914, to be $10,250,000. The uncontradicted evidence showed that between that date and Dec. 31, 1916, the time of said valuation there had been a sharp rise in values. Appellants contend that the commission as matter of law in reaching a conclusion as to the fair value of their property on Dec. 31, 1916, should have taken into consideration the increased value of that property as shown by the evidence between the earlier and the later dates. This the commission declined to do, but taking for a basis the fair value of the property as of July 1, 1914, the commission added net additional expenditures on the property subsequent to that date and they entirely ignored the evidence as to the increase in the value of the property forming the basis of the valuation of July 1, 1914.
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> The trial court was of the view that the rule adopted by the commission was correct. We are unable to concur in that view.
>
> The principal object of valuation of cost is to provide a rate base and the statute clearly contemplates that the commission shall ascertain the value as of the time of said valuation and not as of some anterior date. It has been ruled many times that there must be a fair return to a public utility "upon the reasonable value of the property at the time it is being used for the public."
>
> In the present case the commission, in effect, declined to find the present value of the property because not satisfied as to how long existing conditions would continue. In assuming this position the commission must have overlooked paragraph nine of the statute, authorizing it at any time, of its own initiative, to make a revaluation of the property of any public utility.
>
> As conditions changed and values were substantially affected, it would have been the further duty of the commission to exercise its discretion and revalue the property. The conditions existing were world-wide, and, while their duration and future effect were problematic, there was no immediate prospect of a return to normal conditions. It may be suggested, although the point was not raised in the opinion of the commission, that practical difficulties would have been encountered in an attempt to ascertain the increase in value of the property between July 1, 1914, and Dec. 31, 1916. But there was substantial evidence before the commission as to the rise in values, and a brief investigation would have enabled the commission to determine with substantial accuracy, how much in fairness should be added to the earlier valuation.

Electric Bond & Share Investigating American Cities Properties

THE American Cities Company, the 5 per cent-6 per cent collateral trust gold bonds of which are in default, is to be reorganized. The Electric Bond & Share Company has been invited to participate in the reorganization and pending its decision is making an investigation of the properties. The bonds in default and outstanding amount to $7,709,000 and are secured by a majority of stock of each of the underlying companies.

The subsidiary properties are the Birmingham (Ala.) Railway, Light & Power Company, Memphis (Tenn.) Street Railway Company, Little Rock (Ark.) Railway & Electric Company, Knoxville (Tenn.) Railway & Light Company, Houston (Tex.) Lighting & Power Company and New Orleans (La.) Railway & Light Company.

The American Cities Company in turn is controlled by the United Gas & Electric Corporation.

Utah Light & Power Issue Sells on 6½ per Cent Basis

AS A FURTHER indication of the strengthening of the public utility security market is the eagerness with which a $2,000,000 issue of first lien general mortgage 6 per cent bonds of the Utah Light & Power Company due on Feb. 1, 1944, was taken up by investors this week on a 6½ per cent basis. This is a particularly low yield for public utility bonds.

A $4,000,000 issue of cumulative 8 per cent preferred stock of the Connecticut Light & Power Company was placed on the market this week at 98, yielding 8.16 per cent.

The Proposed Engineering Center for San Francisco

PLANS are under way for interesting a large number of San Francisco engineers in the movement for constructing and operating an office building of from twenty to twenty-five stories which would be recognized as a center of engineering activity. The movement is fostered by the San Francisco Electrical Development League, which estimates the cost of the project at about $2,000,000. Several schemes for financing have been considered, the preferred means being to accept the offer of a capitalist who has agreed to advance $1,700,000 toward the total amount necessary provided that 1,500 San Francisco engineers will buy stock in the enterprise to the extent of $200 each. An alternative plan is to accept an offer of capitalists to meet the entire cost of construction, provided that engineering societies, the Engineers' Club and a representative number of other engineering interests agree to become tenants.

Rocky Mountain Committee on Public Utility Information Formed

PERMANENT organization of the Rocky Mountain Committee on Public Utility Information has been completed. The committee, whose field will cover the states of Wyoming, Colorado and New Mexico, was organized under the joint auspices of the Rocky Mountain Division of the N. E. L. A., the Wyoming Utilities Association, the Colorado Electric Light, Power and Railway Association and the New Mexico Utilities Association. The presidents of these four organizations are to be ex officio members of the committee.

The full membership of the committee and its officers are as follows: T. O. Kennedy (chairman), Denver (Col.) Gas & Electric Light Company; V. L. Board, (secretary and treasurer), Denver Gas & Electric Light Company; Frank Kivel, Denver Gas & Electric Light Company; Norman Read, Colorado Power Company, Denver; W. C. Sterne, Summit County Power Company, Denver; Walter F. Brown, Mountain States Telephone & Telegraph Company, Denver; John J. Cooper, Mountain Electric Company, Denver; John F. Greenawalt, Mountain States Telephone & Telegraph Company; E. A. West, Denver Tramway Company; E. A. Phinney, Jefferson County Power & Light Company, Golden, Col.; Fred Norcross, Home Gas & Electric Company, Greeley, Col.; Frank J. Dostal, Colorado Springs (Col.) Light, Heat & Power Company; Charles A. Semrad, Western Light & Power Company, Boulder, Col.; W. F. Raber, Arkansas Valley Railway, Light & Power Company, Pueblo, Col.; E. P. Bacon, Natrona Power Company, Casper, Wyo.; Arthur Prager, Albuquerque (N. M.) Gas & Electric Company; H. D. Randall, General Electric Company, Denver; L. M. Cargo, Westinghouse Electric & Manufacturing Company, Denver; A. C. Cornell, Western Electric Company, Denver; D. P. Strickler, Colorado Springs (Col.) & Interurban Railway Company; J. A. Clay, Western Colorado Power Company, Durango, Col.; W. P. Southard, Trinidad (Col.) Electric Transmission Railway & Gas Company; E. J. Condon, Jr., Intermountain Railway Light & Power Company, Colorado Springs; A. E. Bent, Tucumcari (N. M.) Light & Power Company; C. M. Einhart, Roswell (N. M.) Gas & Electric Company; J. H. MacMillan, Santa Fé (N. M.) Water & Light Company; E. A. Bradner, Las Vegas (N. M.) Light & Power Company; F. H. Roberts, Popo Agie Light & Power Company, Riverton, Wyo.; J. J. Withrow, Sheridan (Wyo.) County Electric Company, and R. R. Beddow, Intermountain Railway, Light & Power Company, Laramie, Wyo.

Automatic Substaions Discussed

SPEAKING before the Chicago Section of the Association of Iron and Steel Electrical Engineers on Oct. 31, Charles H. Jones of the Chicago, North Shore & Milwaukee Railroad said that one substation on that road had only 0.485 failure in 1,000 operations. Mr. Jones also asserted that should the alternating-current supply be lost and a number of trains be stalled near the substation, when the lines were again energized the substation would go through its usual operations, but the direct-current output would be curtailed by the load-limiting resistors, which would merely decrease the acceleration of the trains instead of pulling the circuit breakers.

The future of the substation, in Edward Taylor's opinion, depended upon standardization of equipment, and he predicted that present apparatus would not be recognizable within five years. Gordan Fox favored the automatic substation for steel mills because it would require less operators than the semi-automatic station. Because there are many cases where attendants cannot be eliminated completely, some of the engineers discussing the subject favored the semi-automatic type in which the main supply circuit switches must be closed by an attendant, after which the equipment cares for itself automatically.

Maine Utility Works Night and Day in Race Against Record Drought

BY CONSTRUCTING a dam on the north channel of the Kennebec River at Skowhegan, Me., the Central Maine Power Company is raising the head from 25 ft. to 32 ft. upon the waterwheels of the Weston station and increasing the capacity of the three present generating units from 2,500 kva. to 3,750 kva. each. This photograph was taken at 1 a.m. Oct. 14, as the company is maintaining night shifts on this job and in the installation of additional boiler capacity at its Farmingdale steam plant in a race against the worst drought experienced in eighteen years. So far no industry has suffered for power, although the maximum daily output recently reached 408,000 kw.-hr. against 310,000 kw.-hr., largest twenty-four-hour output in 1920.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

New Norwegian Accumulator.—A Reuters message from Christiania, Norway, announces that an important new invention has been made there by Court Gross. The invention is a storage battery said to possess more than eleven times the capacity of those now on the market. By its use, it is said, an electric motor car can run six or seven times longer than with the older types.

Great Northern Power Will Extend Reservoirs to Increase Employment.—To afford the greatest possible amount of employment the Great Northern Power Company of Duluth, Minn., will throughout the winter extend its reservoirs to provide for future needs. A substantial reservoir will be built on the Whiteface River, where work has already been started, and work will also be carried on on several smaller storage basins.

War Claims Against Telephone and Telegraph Companies.—Transfer to federal courts of claims for loss and damage against telegraph, telephone, cable and radio companies during the period of federal control will be precluded if a bill introduced in the Senate by Senator Sheppard of Texas should be approved. The bill provides that the mere fact of federal control is insufficient to bring the suit within the jurisdiction of a federal court.

Palmer Electric Company Establishes Bonus System.—The Palmer Electric Company of Des Moines, Iowa, has established a system of bonuses by which every man making accessory sales will be rewarded. To maintain the force over the winter it was decided also to place the shop on an hour basis, each man to be paid only for the productive hours he works each day and the company's inspector to have the privilege of reducing the time charged a customer if there is evidence of time being wasted. Should work be returned, the workman will lose the time. The hourly rate of pay has been increased.

Ohio Village Fights Discontinuance of Electric Service.—Because the village of Ridgeway, Ohio, is in arrears more than $1,500 for street-lighting service, the Mount Victory Electric Light & Power Company has discontinued the street-lighting service in that village and has applied to the Ohio Public Utilities Commission for permission to cut off all other service to Ridgeway also. The village has hired counsel and expects to fight the application. It is declared that almost every house in Ridgeway has installed electrical fixtures and appliances which would be useless if the service were stopped. An attempt is being made to secure a settlement by allowing a slightly higher rate for domestic service and by arranging for a five-year bond issue to cover the amount in arrears on the street lighting.

Nova Scotian Water-Power Development.—The first undertaking of the Nova Scotia Power Commission, which is only two years old, was a development at St. Margaret's Bay primarily intended to supply the city of Halifax. An initial installation of 10,700 hp., delivering approximately 20,000,000 kw.-hr. a year in the city, has been made and constitutes the largest undertaking of its kind in the province. Ultimately the rating will reach 15,000 hp. and the output 30,000,000 kw.-hr.

Electricity Aids Interpretation of Church Service by Color.—Four large circular lanterns which shed many variations of blue, red, amber and green as the electricity was switched on and off were installed in a New York City church recently, the idea being that by the use of "interpretative" lighting the ritual and music of church services can be made more impressive and their emotional significance enhanced. The idea appears to be a development of the "color harmony" theory that has been demonstrated before the Illuminating Engineering Society and others and which aims to synchronize color and music.

Rochester Company's New Rural Transmission Line.—A new 35,000-volt, 60-cycle transmission line between Rochester and Webster, N. Y., which takes the place of a former 25-cycle line energized from the wires of the Rochester & Sodus Bay Railway, is described in the October house organ of the Rochester Gas & Electric Company. An interesting feature of the new line is that it carries lead-covered cable overhead on poles for 11,000-volt operation, the smaller space occupied and the freedom from danger and trouble being thought to outweigh the difficulty and cost of installation. Unusually rugged construction was necessitated, particularly where crossings with other lines were made, and in one place stone-filled cribs had to be constructed in order to support the poles where a marsh was crossed.

First Canadian Electric Light Plant.—In sketches of the life of the late Senator Frederic Nicholls of Canada appearing in our columns it was stated that "the first system for supplying electric light to the Canadian home was the Toronto Incandescent Light Company, which came into being June 26, 1889." An authority on such matters, John Murphy, electrical engineer of the Department of Railways and Canals of the Dominion of Canada, brings to our attention the fact that the Chaudière Electric Light & Power Company, predecessor of the present Ottawa Electric Company, began to supply electric lighting to Canadian homes on May 21, 1887, more than two years before the date of the Toronto installation, thus making the Ottawa station the pioneer electric light plant of Canada. We are glad to set the record right in the interest of historical accuracy.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

Electrical Supply Jobbers' Association.—The general meeting of this association will be held at the Hotel Cleveland, Cleveland, Ohio, on Nov. 30, Dec. 1 and 2. It will be preceded by a meeting of the Atlantic Division, to be held at the same place on Nov. 29.

New York Section, Illuminating Engineering Society.—This section will consider "Color Psychology and Its Application in Church Lighting" at its next meeting, Nov. 17. A practical demonstration will be given and there will be a discussion of the technical and mechanical phases of the system.

New York Companies' Section, N. E. L. A.—The first meeting of this section for 1921-22 will be held on Nov. 16 at 130 East Fifteenth Street. John W. Lieb, vice-president of the New York Edison Company, will deliver his lecture on Leonardo da Vinci and H. M. Aylesworth, executive manager of the N. E. L. A., will talk of the national body.

Institute Section Meetings.—Section meetings of the A. I. E. E. for next week are scheduled as follows: Nov. 14, New York, "The Great Lakes-St. Lawrence Canal"; Nov. 14, Philadelphia, "The One Best Way to Do Work," by Frank Gilbreth; Nov. 18, Akron, "The Superpower Survey Report," by W. S. Murray; Nov. 18, Schenectady, "Energy," by David B. Rushmore.

Activities of the A. I. and S. E. E.—The 1921-1922 activities of the Association of Iron and Steel Electrical Engineers are now in full swing, and programs for the next meeting of each section have been formulated as follows: Cleveland District Section, Nov. 14 (joint meeting with the Cleveland Safety Council), "Mechanical Breathing Apparatus as Compared with Manual Methods of Resuscitation from Electrical Shock and Other Asphyxiation," by E. H. Lyon, president Cleveland Breathing Machine Company; Pittsburgh Section, Nov. 21, "Large Power Rectifiers," by James H. Milliken, consulting engineer, Chicago; Chicago Section, Dec. 16 (joint meeting with Western Society of Engineers), "Electricity in Steel Mills," by W. S. Hall; Philadelphia Section, Dec. 20 (joint meeting with A. S. M. E. and Engineers' Club), "Yard Electrification of Industrial Plant Railways," by D. M. Petty, electrical superintendent Bethlehem Steel Company, Lehigh plant.

Coming Meetings of Electrical and Other Technical Societies

Electric Power Club—Cleveland, Nov. 14-15.

A. I. E. E. Section Meetings—New York, Nov. 14; Philadelphia, Nov. 14; Worcester, Nov. 17; Akron, Nov. 18; Schenectady, Nov. 18; Kansas City, Nov. 25; Toronto, Nov. 25; Minnesota, Nov. 28; Atlanta, Nov. 30; Baltimore, Dec. 8.

A. I. and S. E. E.—Cleveland Section, Nov. 14; Pittsburgh Section, Nov. 21; Chicago Section, Dec. 16; Philadelphia Section, Dec. 20.

A. I. E. E. and Society of Naval Architects and Marine Engineers — New York, Nov. 17.

Central Division, Electrical Credit Association—Chicago, Nov. 17-18.

Philadelphia Section, American Welding Society—Philadelphia, Nov. 21.

Kentucky Association of Public Utilities—Louisville, Nov. 22.

Electrical Supply Jobbers' Association—Cleveland, Nov. 30, Dec. 1-2; Atlantic Division, Cleveland, Nov. 29.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies

Fact that Automobilist Could Have Seen Pole with Which He Collided Not Sufficient to Nonsuit Him.—In sustaining a nonsuit found by the lower court in Luckhart vs. Director-General of Railroads, the Supreme Court of Washington found the plaintiff, who sought damages because of his collision with an electric light pole while driving an automobile, to have been negligent and therefore not entitled to recover a verdict, but none the less asserted that the mere fact that the driver was able to see the pole was not in itself enough to establish negligence on his part. (200 Pac. 564.)*

Impairment of Contract in Franchise Antedating Commission Law Forbidden.—Where a franchise was accepted by a company with a provision limiting the rates, the Supreme Court of New York has held (Village of Warsaw vs. Pavilion Natural Gas Company), the subsequent passage of the Public Service Commissions law permitting increases of rates by filing a schedule and publishing it, as ordered by the commission, does not apply, as it would impair the obligation of the contract contained in the franchise; nor does an order of the commission not retroactive in its terms authorize an increase in rates for service prior to the order. (190 N. Y. S. 79.)

Powers of Pennsylvania Commission.—When the appeal of the Pennsylvania Power & Light Company from the decision of the Superior Court of Pennsylvania reversing the Public Service Commission and holding that a public service company cannot increase its rates while a prior increase complained against remains undetermined by the commission reached the Pennsylvania Supreme Court (see ELECTRICAL WORLD, Oct. 1, page 687), that body found the decision of the commission that it had no power to forbid the increase was a proper one, declaring that the Superior Court fell into error in not considering the general scope and scheme of the public service act and its applicability to utilities in the performance of their various obligations. The act did not mean abrogation or restriction of the rights of public service companies to manage their own affairs to the fullest extent consistent with the protection of the public's interest. "Public service business," the court continued, "occupies a peculiar position in the community, interwoven as it is with communal life, of a nature monopolistic in character, compelling the public to be its customer, whether it would or not, operating under laws with governmental powers not given to ordinary companies. In determining whether the exercise of a right such as now discussed offends against the regulatory control necessary for such concerns, in the interest of the convenience, accommodation and safety of the public, the authority given the commission should be liberally construed, and that incidentally necessary to a full exposition of the legislative intent be upheld as being germane to the law. Where, therefore, the unrestricted exercise of existing powers tends to nullify the commission's control, a restrictive use is intended, its extent to be determined by the commission, with a right of appeal to the courts as provided by the act. . . . There is no limitation on the number of times a company 'may demand, collect and receive fair, just and reasonable rates.' When a given rate, because of business conditions, becomes unfair, unjust and unreasonable, the company has the power to demand fair, just and reasonable rates. It initiates rates when the necessity here defined compels it; the wavering scale of reasonableness is the standard, and of it the utility is the sole judge in the first instance, subject, of course, to what may later follow when the commission's machinery is started. This authority certainly is not hostile to the public service act, but makes the act a more workable one, secures to the public the service demanded, the public being fully protected by complaint and reparation. . . . Governmental control over these essential elements of corporate existence must be carefully exercised. The commission and the utility are not dealing with a purely legal proposition, subject to inflexible rules of law, but with an ever-changing economic condition, through this administrative body, with powers adapted to fit recurring changes in economic life. To attempt to confine it or the utility to the sometimes unwieldy procedure adopted by the courts would be subversive of all the good intended by the act. The business disposed of by this body, with the speedy and expeditious manner in which it is conducted, is enormous. Certain matters before it must assume a legal aspect, as appears from the act. But subjects like that now before us (frequency of change of rate of utility) are not to be adjudged by technical legal procedure. They are regulated by economic law, which, so far, courts or legislatures have not been able to control. What may be an adequate rate today next month may be quite unreasonable, and this through circumstances beyond the control of the commission, utility or courts. Therefore the right to initiate and change is fundamental to the company." (114 At. 649.)

Relief from Alleged Excessive Charges in New Jersey Must Come from Commission.—The New Jersey Court of Chancery has refused to the city of Millville an injunction against the collection of increased rates by the Millville Electric Light Company, whose application was heard but not passed upon by the old Board of Public Utilities Commissioners. The company claimed that with the expiration of ninety days from the date of the application its amended rates became legal, while the city held that the original application had been withdrawn. The new commission refused to consider the city's request for its adjudication, on the ground that it could not take up holdover cases from its predecessor. The court has refused the city's application, holding that relief can come only through the Board of Public Utility Commissioners.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities

Reasonableness of Rates and Value of Service.—Rates sufficient to produce a full return should not be allowed, the Wisconsin Railroad Commission observed in granting increased rates for gas to the Interstate Light & Power Company, when such rates would exceed the value of service and mean a probable discontinuance by consumers.

Municipal-Plant Rates.—Authorizing increased electric rates for the municipal plant of the village of Argyle, the Wisconsin Railroad Commission declared that separate schedules should be established for light and for power service rendered by a municipal electric plant, that street lighting service should return its share of the cost of operation, that energy used for electric pumping in the municipal waterworks should be metered, and that a charge should be made for energy used to operate a city stone crusher.

Grounding Secondary Circuits Insisted On.—Declaring that a large number of fatalities and less serious accidents have occurred in the last few years through the failure of electric light and power companies to ground their secondary circuits properly, the Public Utilities Commission of Illinois ordered the Springfield Gas & Electric Company to comply with the commission's rule on the matter. Failure to do so, it pointed out, "permits excessive and dangerous voltages to exist on wiring in buildings and sometimes makes it possible for persons to come in contact with dangerous voltages while handling lamps or appliances."

Full Return Cannot Always Follow at Once Upon Plant Extension.—In reducing the amount of surcharge temporarily allowed the Great Western Power Company (see ELECTRICAL WORLD, June 4, page 1329), the California Railroad Commission observed: "The reasonable amount on its investment in the Caribou development which applicant is entitled to earn during the present year is difficult of definite determination. The contention of applicant that it should be allowed a full return upon all of the money invested for the period when the plant is physically in operation, even during the present depression when an actual decrease in business is estimated, does not appear to be reasonable. Applicant has increased its hydro-electric capacity in one installation by 60 per cent and its total plant capacity by approximately 45 per cent. If it sells no more power than originally estimated to the Pacific Gas & Electric Company, it would without question be unfair to the existing consumers to require them to bear the entire additional burden this year. Applicant cannot expect during a period when its business does not increase to receive a full return on all additions immediately upon an increase of approximately 40 per cent in its fixed charges and plant capacity."

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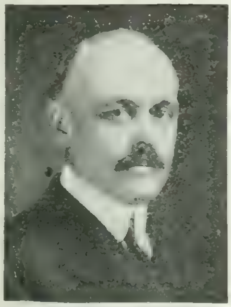
*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel—Responsibilities and Association Appointments of Men Engaged in Professional, Executive, Operating and Commercial Branches of the Industry

Eugene H. Rosenquest, the new president of the Empire State Gas and Electric Association, has been engaged in the business of supplying gas and electric light and power for twenty-five years. He is the president of the Bronx Gas & Electric Company, which supplies gas and electricity to the eastern section of the Borough of the Bronx, New York City. Mr. Rosenquest is a member of the American Institute of Electrical Engineers, the National Electric Light Association and the Illuminating Engineering Society. He has served on the executive committee of the Empire State Gas and Electric Association for the past ten or twelve years and has taken an active interest in all its affairs.


E. H. ROSENQUEST

Dr. Kenneth G. Matheson, president of the Georgia School of Technology, has accepted the presidency of the Drexel Institute of Philadelphia and will assume his duties there in April next.

John S. Hester, superintendent of overhead and transportation of the Laurel (Miss.) Light & Railway Company, has been promoted to succeed A. B. Coryell as general superintendent, and will supervise the operation of the power plant in connection with other duties.

Russell G. Warner has been promoted from instructor in electrical engineering to assistant professor in electrical engineering at Yale University. He will handle the technical courses formerly conducted by Prof. H. V. Bozell, who has resigned to devote his entire time to the McGraw-Hill Company as co-editor of the *Electric Railway Journal* and editor of *Bus Transportation*, which is a new monthly section of the first-named publication. For the past year and a half Professor Bozell has devoted part time to Yale in addition to his duties as co-editor of *Electric Railway Journal*.

G. F. Lackey, consulting engineer, has been elected vice-president of the Colorado Springs (Col.) Light, Heat & Power Company to succeed Rush L. Holland, who has resigned to become Assistant Attorney-General of the United States.

Lieut.-Col. S. W. Fleming, Jr., of the firm of Gannett, Seelye & Fleming, engineers, Harrisburg, Pa., has been appointed by Governor Sproul of Pennsylvania a member of a commission to study the battlefields of France and Belgium with the object of marking where Pennsylvania troops fought in the war.

A. H. Horton is now directing a new census by the United States Geological Survey of developed water powers in the United States. This survey will, it is believed, be completed by Jan. 1. It was under Mr. Horton's direction that the Survey prepared state maps showing the location of power stations and transmission lines used in the public service.

Mr. Horton is a native of Franklin, Pa. His primary education was obtained in the public schools of Silver Creek, N. Y. He received his engineering training at Cornell University, where he was graduated in 1898. His first year out of the university was spent in the service of the United States Deep Waterway Survey. He then spent five years with the United States Lake Survey, after which he was for two years a member of the staff of the United States Reclamation Service.

Since 1906 Mr. Horton has been with the Geological Survey. He began as a junior hydraulic engineer and has risen through various promotions to the important position of chief of the power resources division. In addition he is the district engineer in charge of the Survey's power work in the middle Atlantic and Ohio River districts.

A. H. HORTON

Henry G. Morris has been appointed by Secretary Hoover to head the new fuel division of the Bureau of Foreign and Domestic Commerce. Mr. Morris, who is a graduate of the Massachusetts Institute of Technology, has been connected with government activities since 1917.

D. McFarlan Moore, who has been elected a vice-president of the Illuminating Engineering Society, has been prominent in electrical circles for a number of years. He was one of Edison's sixty-five early assistants. In 1894 he organized his own company and at one time there were over four miles of the unique "Moore Light" long tubes in domestic use. The advent of the tungsten lamp resulted in Mr. Moore's activities being absorbed by the General Electric Company. Mr. Moore is a fellow of the A. I. E. E. and has served on other technical bodies. More than a hundred patents have been granted to him, and at the Rochester convention of the Illuminating Engineering Society, in September, he gave an interesting demonstration of several new forms of electric lamps.

D. McF. MOORE

F. H. Sauter has become connected with Gibbs & Hill, consulting engineers, New York, and will be concerned with the development of railroad electrification. He was in the service of the General Electric Company from 1894 to 1903 and has also held positions with the American Locomotive Company of Schenectady, N. Y., including those of designer of steam and electric locomotives. Recently Mr. Sauter has been associate editor of the "Locomotive Dictionary."

C. O. Mailloux, well-known consulting engineer and chairman of the International Electrotechnical Commission, has been invited by the President of France through M. Berthelot, of the Academie des Sciences and chairman of the Ampière centennial committee, to deliver the address of eulogy on Ampière on Nov. 24. The ceremony will take place at the Sorbonne in Paris and will be presided over by President Millerand of the French Republic. Mr. Mailloux has also been asked to act as honorary president of the Internal Conference on Superpower Systems, which will be held during the same week. The expectations are that Mr. Mailloux will sail from New York on Nov. 12 on the S S. Lafayette.

J. I. Colwell, district manager of the Western Electric Company at Seattle, has been appointed on the industrial bureau of the Seattle Chamber of Commerce, which is making a survey of industrial opportunities in the Puget Sound district.

Bruno H. Ahlers has been appointed sales representative of the Rockbestos Products Corporation of New Haven, Conn., with offices at 366 Madison Avenue, New York City, and Alvah D. Stein, Boston representative, with offices at 156 Purchase Street, Boston.

J. H. Lobban, who has been appointed chairman of the fixed-capital records committee of the N. E. L. A., is assistant general accountant of the Detroit Edison Company. He has served as vice-chairman of the committee on classification of accounts, reports to commissions and relations with other associations. Mr. Lobban was graduated from the University of Michigan in electrical engineering in the year 1911 and entered the statistical department of the Detroit Edison Company as engineer. Later he was promoted to be property engineer in charge of valuation work, property and construction records.

J. H. LOBBAN

L. H. Lund has been elected auditor of the Westinghouse Electric International Company, to succeed F. N. Kollock, resigned.

Charles F. Leonard has taken charge of business promotion for Walter N. Polakov & Company, Inc., New York, managerial counsel, and has severed his connection with the American Institute of Weights and Measures, for which he has been acting as technical adviser. Mr. Leonard has become a vice-president of the above company and makes his headquarters at 33 West Forty-second Street, New York.

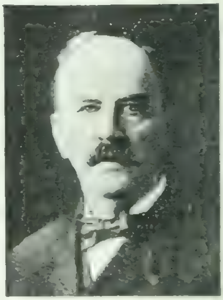
Charles Schneider, formerly superintendent in charge of electrical construction of the Robbins & Myers Company, has been appointed general factory superintendent of the company. Mr. Schneider joined the Robbins & Myers Company in 1898 and wound and assembled with his own hands that year the first power motor ever built by the company. Previous to his employment by the Robbins & Myers Company Mr. Schneider had several years' experience in central-station work.

Obituary

Henry Harvie, who was killed recently in the plant of the Canadian General Electric Company at Peterborough, Ontario, when a large generator burst during an overspeed contest, was well known among hydro-electric engineers in eastern Canada, having been associated with the design and construction of power plants for twenty years. Mr. Harvie was born in England and studied mechanical engineering at London University. In 1900, when about twenty-two years of age, he went to the United States, and in the following year he joined the engineering staff of the Ontario Power Company at Niagara Falls, Ont., where he spent the next seven years. In 1909 Mr. Harvie was engaged by the Algoma Steel Corporation on the construction of a plant on the Michipicoten River to supply power to the company's mines in that district. After the completion of that work, he went to New York, where he spent a few years on the staff of a well-known firm of consulting engineers, returning to Canada in 1915 to join the Ontario Hydro-Electric Power Commission's staff as chief draftsman in the hydraulic department. Early in 1920 Mr. Harvie became hydraulic engineer and designer for the Canadian Ingersoll-Rand Company at Montreal, but this position he relinquished at the end of the year, joining the staff of C. H. & P. H. Mitchell, Toronto.

John B. Crouse, who died at his home in Cleveland on Nov. 6, was one of the pioneers in the manufacture of electric lamps and a persistent advocate of the elimination of competition through co-operation. His broad vision led to the conviction that the bitter warfare between lamp manufacturers in the early days could not continue without sacrificing quality and destroying standards which were essential to progress in the manufacture of lamps. With H. A. Tremaine, F. S. Terry, J. R. Crouse and B. G. Tremaine, Mr. Crouse co-operated in the development of the idea of concentrating the lamp business of the country through the organization of the National Electric Lamp Association. The first step after the organization of this association was the establishing of a mutual engineering department and laboratories in Cleveland, where a personnel was provided for conducting, through co-operative effort, investigations in chemical and physical research, testing, factory inspection and organization, illuminating engineering, technical publicity, business development and sales conferences for the betterment of the lamp business and the benefit of members of the association. One of the great influences of this organization, which has been extended to the present time, was its activity and enterprise in advanced investigations in the field of lighting and illumination. In recent years the publications issued as the result of these researches have been considered the most authoritative available. In all of this work Mr. Crouse took an active interest and lent his support up to the time of his death.

Mr. Crouse was born Nov. 29, 1842, in Hartland, Mich., and at an early age became connected with the milling business. Later he became associated with H. A. Tremaine, an association which continued throughout his career. In the early eighties Messrs. Crouse and Tremaine established the Cleveland Carbon Company, which was later merged with the Bolton & Crystal Carbon Company, forming the Standard Carbon Company. Later the controlling interests in the latter company were sold to the National Carbon Company. Messrs. Crouse and Tremaine then went to Fostoria, Ohio, where they conducted the Crouse & Tremaine Carbon Company. Later they sold their interest to the National Carbon Company and, together with B. G. Tremaine, R. Crocker and Ira Cadwalder, organized the Seneca Baking Company at Fostoria and the Fostoria Incandescent Lamp Company, with Mr. Crouse president of the latter. This group then purchased the Fostoria Bulb & Bottle Company, changing its name to the Fostoria Glass Specialty Company and using the factory largely for the incandescent-lamp business. While engaged in this work the idea of the National Electric Lamp Association was conceived, and Mr. Crouse devoted to it his whole-hearted attention. Of late the work of Mr. Crouse in promoting co-operation in the electrical industry has been taken up by his son, **J. Robert Crouse**, who has been associated with and a partner in his father's business since his graduation from college in 1897.



J. B. CROUSE

Winthrop G. Bushnell, who for thirty years had been active in the development of public utilities, particularly in Connecticut, died suddenly of heart disease on Oct. 23. He was graduated from Yale in 1888 and a little later entered the commercial department of the United Edison Manufacturing Company. This company was afterward merged with the General Electric Company, Mr. Bushnell remaining with the latter until 1906 and acquiring much knowledge along electrical engineering lines. About 1905 he bought the Falls Village Water Power Company, merging it into the Connecticut Power Company, together with the New London Gas & Electric Company. Under the guidance of Stone & Webster the Connecticut Power Company, of which Mr. Bushnell became vice-president, grew until today it supplies twelve Connecticut cities and towns with electricity.

Trade and Market Conditions

Business Reviews, Together with Market Letters from Important Trade Centers, on the Supply, Demand and Prevailing Prices of Electrical Apparatus and Supplies

Spotty Collections Rule in New England

COLLECTIONS in New England electrical circles are still slow, according to leading jobbers. Settlements are being made anywhere between sixty and ninety days, and the improvement noted in merchandise sales since summer has not yet extended perceptibly to credit departments. Underlying financial conditions are unquestionably better, and business is gradually recovering in most lines of manufacture and distribution. Some jobbers report that contractor-dealers of moderate size are paying their bills more promptly than the larger houses. The stronger central stations are discounting their bills, and the large industrial buyers are doing better. Municipal plants are meeting their obligations very slowly, pending tax levies. Heavy business is yet to materialize in the construction field, but on the whole a gradual improvement is expected.

English Electrical Industry Hoping to Increase Exports to Canada

FIGURES recently laid before the parliamentary fuel committee by the Water-Power Branch of the Canadian Department of the Interior are interesting in showing how completely the United States has dominated Canadian electrical imports during the fiscal years 1919-1920 and 1920-1921. According to these statistics, the United States shipped into Canada during the fiscal year of 1919-1920 a total of $7,311,499 worth of electrical equipment and machinery against $88,981 worth from the United Kingdom and $34,759 from all other countries. In 1920-1921 the proportion was almost the same, imports from this country being $7,296,540, from the United Kingdom $313,344, and from all other sources $23,541. How imports from the United States were divided may be seen in Table I.

That this important export market may be in danger is pointed out by no less an authority than *Electrical Industries* of London. According to that paper, English electrical manufacturers are looking hopefully forward to increasing the total of their exports to Canada and are depending on the exchange situation which is likely to develop as a result of the passing of the emergency tariff by congress. English manufacturers feel that this situation is exceedingly favorable to them and strongly prejudicial to American firms seeking trade in Canada.

TABLE I—IMPORTS FROM UNITED STATES DURING FISCAL YEARS 1919–1920 AND 1920–1921

	1919–1920	1920–1921
Batteries	$222,243	$153,924
Cooking and heating appliances	111,148	123,627
Dynamos and generators	1,039,067	1,227,398
Lighting fixtures	698,879	650,548
Meters	243,252	352,348
Lamps, arc	9,719	28,669
Lamps, incandescent	1,153,407	970,163
Motors	1,956,639	2,578,807
Sockets	138,312	300,935
Telegraph, telephone and wireless apparatus	754,179	966,084
Transformers	123,118	167,427
Total	$7,311,499	$7,296,540

In addition to this, the opinion is held that the recent decision of the Canadian Customs Department to add the exchange margin to the face value of American invoices when valuing goods for duty should set a large number of wholesalers in Canada to seeking an alternative source of supply.

That the Canadian market for electrical material will grow largely in importance during the next few years can be seen from the report of the Water-Power Branch. At the beginning of 1920 there were developed 2,417,896 hp. in hydro-electric plants with another 650,000 hp. under construction. Figures are not available on the amount under construction in the beginning of 1921. Numerous rural-distribution lines are being planned, according to the report, as is also the construction of several hundred miles of light radial railways.

TABLE II—PRODUCTION OF ELECTRICAL SUPPLIES AND EQUIPMENT IN CANADA, DURING THE FISCAL YEAR 1920–21

Classes of Products	Selling Value at Factory
Dynamos, generators, etc	1,804,687
Transformers	1,502,261
Switchboards, panelboards and cabinets	1,011,837
Motors, all kinds	1,692,823
Storage batteries	561,974
Primary batteries	1,767,094
Parts and supplies:	
Dynamos and generators, etc	152,877
Motors	368,950
Storage batteries	115,136
Carbons	1,243,631
Incandescent lights	2,424,720
Sockets, receptacles, bases, etc	769,582
Electric lighting fixtures	1,248,640
Telegraph apparatus	15,677
Telephone apparatus	1,835,979
Insulated wires and cables	8,536,126
Electric stoves and heaters	1,009,353
Electric irons and fans	453,085
Fuses	313,550
All other electrical apparatus and supplies	5,009,514
All other products, including repair work	2,350,382
Total	$34,187,658

A glance at the total yearly production of electrical materials in Canada is sufficient to show that much of the supplies for these improvements must be imported, and this applies not only to materials and equipment for generation and transmission but to household appliances also.

Improving Outlook for Schedule Material Production and Sales

WITH but one or two exceptions, manufacturers of schedule material interviewed recently by a representative of the ELECTRICAL WORLD point to a continuing improvement in demand for this class of supplies. Within the past two months substantial progress has been made in converting raw material purchased at former high price levels into finished products covered by actual orders from distributers. Thus one considerable obstacle to the resumption of buying by switch and socket makers has been minimized, and in a striking instance, raw material is now being purchased at the value of $20,000 in a given period compared with about $1,000 but a comparatively few weeks back. Doubtless it will be some months more before the heavy stocks of raw material on hand in this or that manufacturer's plant since war-time orders were a factor in the market are completely liquidated, but the proportion of new material coming in is rapidly increasing, and with this condition is coming about a greater stabilization in production costs and prices.

Wages have been slowly going down in comparison with war-time scales, defining these as the total compensation of employees within a stated period. One leading manufacturer stated that further reductions must be established before good business can be enjoyed and pointed out that better work is being performed by new employees. Additions to the payrolls have been made in other plants also, and one manufacturer now utilizes 700 employees as against about 350 on Sept. 1. It is noted in more than one plant that the efficiency of labor is decidedly better than a year or two ago. The continuance of very high wages in the building industry, one manufacturer holds, is retarding the expansion of switch and socket production in different sections of the country where such products are fabricated.

The volume of business now being handled by representative concerns was declared to have reached from 60 to 75 per cent of the 1920 peak. Notwithstanding the slow revival of building, enough new construction is being done in scattered fields to make a decided impression on the demand for schedule materials. Foreign trade in this line is still dull, but it is believed that the high quality of American products will be more and more recognized in other lands, and that a gradual increase in shipments is to be expected where the necessary credits can be granted. Jobbers are buying more frequently and in larger volume, as regards domestic business. As the electrical appliance trade improves, the demand for plugs and switches is bound to increase perceptibly over the present fairly good totals.

Good Holiday Trade Expected

OPINIONS of jobbers and dealers throughout the country are divided on the subject of the volume of holiday trade to be expected this fall. The amount to be done is given at anywhere from 75 per cent to 125 per cent of last year's business, the majority, however, seeming to feel they would be satisfied with a volume equal to last year's. In several localities dealers and jobbers are said to have considerable carry-overs from last year, and this will tend to cut down orders to manufacturers. Always, however, there remains the chance that there will be a rush of buying at the last moment that will bring up sales to the desired level, though at the present time dealers in only a few sections of the country seem to show any desire to place orders. Most jobbers, however, are going ahead with confidence and stocking up.

New York jobbers say they are placing orders for the holiday trade, and manufacturers are urging dealers to provide for their requirements as early as possible to avoid a last minute shortage. Estimates of the probable volume of Christmas business in the East this year vary considerably because of price reductions which have been made during the year, stocks carried over and the hesitancy on the part of dealers to put in new stocks. Indications are that jobbers and dealers will do from 75 to 80 per cent of the business, in dollars, that they did last year. Manufacturers' business will probably be slightly under this figure.

Chicago Christmas trade in electrical appliances this year will vary anywhere from 60 to 100 per cent of the 1920 business, according to the opinions of dealers and jobbers interviewed by a representative of ELECTRICAL WORLD. Very few dealers have had any Christmas stock left over from 1920 so that they are buying now. One dealer is expecting a better sale of small appliances than of the larger equipment, such as washers and vacuum cleaners. The majority of dealers feel that most of the Christmas retail buying will come in a rush just before Christmas. This occurred last year and brought what had started out as a dull holiday season to an unusually successful end.

A holiday trade equal to last year's and in some cases surpassing it by at least 25 per cent is anticipated by New England jobbers. General buying from manufacturers for this trade has been in progress for some time, carry-over stocks amounting to little or nothing. A shortage of a leading make of hollow ware is already being encountered, and new orders for delivery from the factories before Christmas must be placed promptly if they are to be filled in time by other representative manufacturers. This year's stocks are more diversified than last year's accumulations. Few electrical toys were carried over, and the demand for flatirons, toasters and percolators overtops the call for other appliances.

Jobbers in the Southeast, according to a recent report, are beginning to accumulate their goods for holiday trade on the basis that there will be approximately 75 per cent of last year's business in the portable line and 80 per cent in the toy line. Orders on manufacturers for toys, however, will be only 50 per cent of last year as jobbers there had heavy carry-overs in this specialty.

Holiday purchasing is commanding the interest of jobbers in St. Louis. It is the general expectation there that the business done this year will equal and possibly exceed that of last year. The reduced prices have resulted in more liberal buying by the public, and trade conditions here are better than they were in November and December of last year. Dealers have placed but a small portion of their orders, but jobbers are laying in their stocks. During the year stocks in the hands of both dealers and jobbers were substantially reduced, so that almost all of the demand for this season will pass through their hands and to the manufacturers. It is expected that the principal demand will be for heating appliances, especially flatirons and toasters. Some difficulty is being experienced in getting a satisfactory supply of irons and also of curling irons.

Inquiries are coming in for holiday goods on the Pacific Coast, but not many sales are being made at the present time. Jobbers in general are anticipating that the holiday trade will approximately equal that of last year. Jobbers held over considerable stock, in some cases practically the entire stock that will be needed for this year's demands. What new orders have been placed by jobbers were placed on the basis of last year's sales. Dealers are anticipating that the holiday business will range anywhere from 70 per cent of last year's sales to from 15 to 25 per cent greater than last year. Many dealers carried over a considerable amount of stock from last year and probably will not do much reordering until this has been moved.

Metal Market Situation

SALES of copper in October were considerably in excess of estimates, some of which put October under September. The official figures on sales were 140,000,000 lb., compared with 97,000,000 lb. in September. Output in October was unchanged from the previous month, amounting to 40,000,000 lb. This means a decrease of 100,000,000 lb. in the surplus of copper.

During the first week in November price was an uncertain quantity. Some of the producers were reported to be shading 13 cents, others stuck to 13¼ cents, and some met 13-cent competition. The publication of the sales figures for October bolstered the market, however, and producers are declining to quote under 13¼ cents for the rest of the year. During the week it became known that a large utility had covered its needs for some time, and this has made many feel that the utilities are confident of a steadily rising copper market. Export movement for the year to date is behind 1920.

NEW YORK METAL MARKET PRICES

	Oct. 31, 1921	Nov. 7, 1921
Copper	£ s d	£ s d
London, standard spot	66 5 0	66 0 0
	Cents per Pound	Cents per Pound
Prime Lake	13.00	13.00—13.25
Electrolytic	12.75	12.00
Casting	12.37½	12.37½
Wire base	14.50	14.50
Lead, Am. S. & R. Co. price	4.70	4.70
Antimony	4.80	4.75
Nickel, ingot	41.00	41.00
Sheet zinc, f. o. b. smelter	10.00	10.00
Zinc, spot	5.05—5.10	5.20—5.25
Tin, Straits	28.12½	28.62½
Aluminum, 98 to 99 per cent	24.50	24.50

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	10.50—10.75	10.50—10.87½
Brass, heavy	5.00—5.25	5.00—5.25
Brass, light	4.75—4.87½	4.75—4.87½
Lead, heavy	3.75—4.00	3.75—4.12½
Zinc, old scrap	2.25—2.50	2.00—2.25

THE WEEK
IN TRADE

Prices When Quoted Are Those Prevailing at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

NOVEMBER has started well in electrical lines, with demand good for many items, some shortages, and with the price trend seemingly deflected from the downward path to the level. New York jobbers report numerous orders for more than ordinary quantities, and as they have let their stocks run low on a number of lines, there is a good movement from manufacturer to consumer. Chicago manufacturers and jobbers are expecting a constantly increasing business until the first of the year. There is a considerably improved sign business noted there. St. Louis sales to contractor-dealers are very good, and a shortage in ½-in. black iron conduit is reported there. Atlanta jobbers have had an exceptionally good movement of farm-lighting plants, as a result of higher cotton prices.

Electrical contracts in New England have shown activity, and this, coupled with better motor sales, is a cause for optimism on the part of jobbers. On the Pacific coast and in the Intermountain region there is a great deal of construction, and jobbers are moving their stocks better than in the summer and early fall. A reduction of 10 per cent in pole line hardware took effect Nov. 3 and is expected to stimulate demand for that article.

NEW YORK

November promises to be a still better month for the electrical trade than was October, according to jobbers' comments on the nature of last week's business. This month started off with more activity in all lines, and orders have been for somewhat larger quantities. Close, hand-to-mouth buying of wiring supplies is gradually giving way to purchases which will build up dealers' stocks. Few jobbers are carrying any large stocks, and there is a much better movement of material from manufacturer to jobber and jobber to dealer. There is a shortage of flexible armored conductor, and some jobbers have been unable to fill orders immediately because of delayed shipments from the manufacturer.

Heating appliances and household devices are moving better and orders for holiday stocks are beginning to make a definite showing.

Conduit.—Trade is a little more active, but so far there has been no tendency toward large orders. The following prices were quoted this week: For ½-in. black pipe in 2,500-ft. lots, $48.29 to $50.83; ¾-in., $62.06 to $65.32, and 1-in., $88.51 to $93.16 per 1,000 ft. Galvanized pipe in the same sizes was quoted at $53.19 to $55.93, $68.61 to $72.22 and $98.19 to $103.36. Jobbers' stocks are ample in the above sizes but stock in larger sizes is rather low.

Rubber-Covered Wire.—No change has been noted in the conditions of the wire market during the week. Demand is moderate and prices remain as last quoted. No. 14 rubber-covered sells at $6.50 to $6.60 per 1,000 ft. in 5,000-ft. lots. Stocks generally are good.

Flexible Armored Conductor.—The active demand for this material has completely exhausted some jobbers' stocks, and one leading manufacturer is reported to be from 2,000,000 ft. to 3,000,000 ft. behind with his orders. No. 14, two-wire, single-strip, is quoted this week at $44.50 to $46 per 1,000 ft. in lots of that quantity. Double-strip is quoted at $46.50 to $48 per 1,000 ft.

Lamp Cord.—Jobbers report a fair demand for No. 18 cotton, twisted, which sells for $11.22 to $12.90 per 1,000 ft. Parallel cord in the same size is quoted at $14.96 to $15.60 per 1,000 ft. Stocks are ample to meet the present demand.

Loom.—There is only a very moderate demand for this material and stocks are small. The 7/32-in. size is quoted at $16.50 to $17.33 per 1,000 ft. and the ¼-in. size is quoted at $18 to $18.90 per 1,000 ft. in lots of that quantity.

Metal Molding.—This material is in fair demand, stocks, however, being kept small. The three-wire size remains at $5.60 per 1,000 ft.

Tape.—Friction and rubber tape is in fairly active demand and stocks are good. Both are quoted at 36 cents per pound in 100-lb. lots.

Heating Appliances.—Jobbers who specialize in household devices report that the demand is increasing and dealers are ordering for holiday requirements. On some makes of flatirons and curling irons there is still a shortage, but manufacturers are promising deliveries in ten days to two weeks.

CHICAGO

A strengthened copper market was the principal event of the week, but it has not hampered the suburban building industry, because jobbers report brisk trade on flexible armored conductor. In general, the trade this week has been good on most lines, especially on portable lamps and ironers. Jobbers and dealers are gaining confidence, and they express the opinion that trade for the remaining year will improve each week.

Pole-line hardware has been reduced about 7½ to 10 per cent, but prices on poles and cross-arms still stand the same. Price changes on conduit have been reported by some jobbers while others report no change. Meters for central stations in the Middle West are reported selling well.

Wire.—Movement on rubber-covered No. 14 has been good this week, and it is selling for $6.75 per 1,000 ft. in 5,000-ft. lots. Weatherproof went up to 16½ cents a pound in 1,000-lb. lots, and jobbers report a fair market with ample stocks to fill the orders. The bare wire base also has advanced to 16½ cents.

Flexible Armored Conductor.—This material has increased in price along with the rise in copper, and No. 14 single-strip, two-wire sells for $50 per 1,000 ft. in 5,000-ft. lots. The No. 14 double-strip, two-wire conductor sells for $52.50 per 1,000 ft. in 5,000-ft. lots. The demand is very active, and stocks in some cases are just even with the orders.

Conduit.—The new discount of 5 per cent has been reported by some dealers. The prices for black pipe in 5,000-ft. lots per 1,000 ft. are as follows: ½-in., $46.55 to $48; ¾-in., $59.72 to $62, and 1-in., $85.05 to $90. Galvanized pipe for the same quantity in the same respective sizes sells for $51.39 to $53, $66.26 to $70 and $94.72 to $100. Sales have been fair to good and stocks are ample.

Heating Appliances.—Jobbers report all lines of appliances moving well, but principally ironers and portable stoves. With a few exceptions the stocks of most jobbers are heavy enough to supply the trade.

Tape.—Tape has not changed in price, but the market is still moving fairly well. Rubber tape sells for 40 cents a pound, while cotton tape sells for 38 cents a pound, both in 100-lb. lots. Stocks are ample.

Portable Lamps.—Several jobbers report very active inquiries on portable reading lamps and also report some good sales on this line. Stocks are sufficient for the trade.

High-Tension Equipment.—Numerous inquiries on high-tension equipment for irrigation purposes in the West are reported by one manufacturer. This company also reports a sale of a 3,600-kw. outdoor substation in the eastern Pennsylvania coal mine district. Other manufacturers report business better than last week because of the removal of the railroad strike threat.

Pole-Line Hardware.—A general price reduction of between 7½ and 10 per cent has been reported on this material by several large jobbers. This equipment is moving fairly well, and jobbers have ample stocks for trade.

Meters.—One dealer reports a brisk trade on this material for central stations in the Middle West. Another dealer reports an upward trend on sales of meters for every month since July.

BOSTON

Business activity is well sustained in electrical lines, barring the development of large projects in the construction field. Industrial activities in New England are generally reflecting better sentiment in trade, and building operations are picking up somewhat outside of Boston. Prices were easier at the week end on pole line hardware and rigid conduit.

Considerable buying interest was reported from last week's textile show at Boston along electrical lines, industrial electric truck and motor sales showing more life than of late. Jobbers are still buying on a moderate scale, though less hesitation is apparent than a few weeks ago. Stocks are spotty and certain appliances are in strong demand, making deliveries a little longer than earlier in the season. Non-employment is diminishing slowly. The labor situation is somewhat unsettled here and there, but in electrical circles conditions appear fairly tranquil.

Wire.—Prices remained relatively firm last week, but an early advance is expected in rubber-covered wire, at least in some quarters. In 5,000-ft. lots No. 14 sells around $6.25 per 1,000 ft. Weatherproof base is 16 cents, with a little better movement. Bare base, at 15½ cents, is unaccompanied by much activity.

Lamps.—Trade is better in this line than in many other branches. There is a very healthy seasonal demand this year, and popular interest in artistic illumination is more evident than for some time. Industrial lighting is also receiving widespread attention. No shortages are reported in the usual sizes of lamps, and deliveries are excellent in this territory.

Pole-Line Hardware.—A revived interest in this class of material was apparent at the close of the week, and a price reduction of the order of 10 per cent was announced effective Nov. 3. Central-station buying has picked up somewhat. A few representative prices from jobbers' sheets are as follows: Cross-arm braces, $1\frac{7}{32}$-in. x $\frac{7}{32}$-in. x 28-in., per 100 pieces, order of $50 to $100 net value, $11.22; galvanized carriage bolts, less $50 net value, 4½-in. x ⅜-in., $2.23 per 100; galvanized lag screws, less than $50, ½-in. x 4-in., $2.81 per 100; machine bolts, ⅝-in. x 10 in., under $50, $9.07 per 100; galvanized thimbles, ½-in., under $50, $5.76 per 100.

Flexible Armored Conductor.—No. 14 double-strip stiffened last week to $47.50 per 1,000 ft. in 5,000-ft. lots, single strip remaining at $45. Trade is not very vigorous, but routine requirements are yielding a fair volume of small business.

Loom.—Recent price movements appear to have dulled the edge of demand somewhat. So far the increased cost of cotton has had little effect on quotations for this material, which is readily obtainable in quantity. Some complaint is heard that present prices are unprofitable to the trade. In 1,000-ft. lots the quotation Saturday was $17.50 on ¼-in. loom.

Porcelain.—Shipments of "Nail-it" knobs have reduced the shortage mentioned last week to nominal proportions. These are selling around $18.50 per 1,000 in barrel lots, and the demand is fairly good.

Sockets.—These moved briskly last week. In case lots, pulls sell around 31½ cents net.

ATLANTA

Reports from all over the section indicate considerable improvement, though some of the banks and mercantile establishments report disappointment that the liquidation of cotton and other agricultural paper has not been made with the rapidity that was anticipated. This is causing some little delay in readjustment, especially in central and south Georgia, where the cotton yield this year was most unsatisfactory. In north and northeast Georgia, however, the crop approximated normal, and a trip through the principal cities this week shows business to be well on the road to normal conditions.

The report of the Sixth Federal Reserve District shows improvement in the volume of business done in wholesale grocery, dry goods, hardware, shoe and furniture lines, this increase varying from 6 per cent increase in grocery to 35 per cent in the shoe line. The acute housing shortage is continuing to hold up building activities, with the result that October permits for Atlanta amounted to $1,074,000, while other centers in this district show somewhat similar activity. A number of steel mills in Birmingham have reopened for business, while plants that were already operating are increasing production. Reports are that cement mills are operating to capacity, while iron pipe, clay pipe and brick plants are on a 70 per cent basis with business on the increase. Reports from Florida indicate considerable activity in the building line in anticipation of the winter tourist trade.

Pole-Line Hardware.—A price reduction of 10 per cent is effective this week in the face of a brisk demand for all articles in this line. Stocks are reported in fair to good condition with factory shipments satisfactory.

Safety Switches.—The new low-priced switch recently introduced is beginning to make itself felt in the safety switch line, though jobbers are not making special efforts to push this particular size. Other sizes continue in popularity, the two-pole and three-pole 30-amp. being most in demand. Stocks are in good shape.

Farm-Lighting Outfits.—Business in this specialty is the best for many months, one of the largest dealers reporting that improved conditions in rural districts is most noticeable in this line. The demand is mostly for the small to medium-size outfits.

Air Heaters.—This line has again become dormant after the flurry of three weeks ago, despite efforts of dealers to move their stocks through the medium of reduced prices. Very few of the new-style heaters are being ordered as a large portion of last year's stocks still remain unsold.

Starting and Lighting Batteries.—Approaching winter, together with better conditions in rural districts, is responsible for an increase in the volume of business being done in this line.

Interphones.—Apartment-house construction is taking a fair to good volume of the moderate-priced installations. Jobbers report a slightly increased activity during the past sixty days, with prices steady.

Panelboards.—Sales in this line are quite satisfactory, one jobber reporting his business approximately $20,000 ahead of last year's. Sizes range from four-circuit to fifty-circuit sizes, though the twelve-circuit to fourteen-circuit size is by far the most popular. Shipments are satisfactory.

Poles.—Maintenance and replacement work is responsible for heavy pole purchases throughout the district. Chestnut and cypress varieties lead in the volume of sales, with cypress particularly popular. Pole yard stocks are in first class shape with better quality available.

Lamps.—The usual fall buying is under way, and as far as can be ascertained no unusual stimulus resulted from the recent price reductions. The Type C lamp in 40-watt and 60-watt sizes continues the most popular.

ST. LOUIS

Conditions continue to show gradual improvement, as is shown by the fact that the so-called "bread-and-butter" materials are being sold to contractors and dealers in more liberal amounts. The low prices which have prevailed, especially in wire and porcelain, have resulted in their carrying heavier stocks, and also small residential wiring jobs are more numerous. More confidence is felt in the stability of the present prices.

Business in the South is showing improvement. For a time it did not pay to have men cover the territory, but all of the larger jobbers are now actively soliciting business there. Sales are evenly distributed over various lines, except for industrial goods.

Fuses.—Plug fuses are finding excellent demand and stocks have a tendency to be low. Cartridge fuses are moving slowly. A clear-window plug fuse is priced at $31.50 per 1,000 in lots of 1,000 or more. N. E. C. nonrenewable cartridges, 3 amp. to 30 amp., sell for $9.60 per 100 in standard packages, and 31 amp. to 60 amp. sell for $14.40 per 100.

Sockets.—Fairly good demand obtains, principally for house wiring, and stocks are on a satisfactory basis. In lots of 500, keys are quoted at $18.15 per 100, keyless at $16.50 and pull at $33. Contractor-dealer stocks are low.

Conduit.—There is a shortage of ½-in. black, on which sales have been particularly good the past week, but satisfactory stocks of other sizes are on hand. Representative prices are: ½-in. black, $47.30; ½-in. galvanized, $53.20; ¾-in. black, $62; ¾-in. galvanized, $68.60 per 1,000 ft.

Flexible Armored Conductor.—Slightly higher prices prevail, No. 14, 2-wire, double-strip being priced at $52.50 per 1,000 ft. in 5,000-ft. lots. Stocks are in good condition, but the market is weak.

Outlet Boxes.—The following discounts from list have been established for lots of 100 to 1,000: black, 60 per cent; galvanized, 55 per cent. The 3¼-in. round box sells for $7.20 in the black and for $8 in the galvanized. The demand is not active.

Metal Molding.—Jobbers are finding molding hard to obtain and stocks are getting low. The demand has shown substantial improvement. The three-wire size is quoted around $5.70 per 100 ft.

Pliers.—The demand has been quiet for several weeks, and stocks, while low, are complete. The 6-in. side-cutting Klein plier is priced at $2.80 and the 8-in. at $3.75.

Wire.—A good and steady demand is found for No. 14 rubber-covered, which is selling for $6.50 per 1,000 ft. in 5,000-ft. lots. Stocks are being maintained but are getting low. The larger sizes of rubber-covered are inactive. A falling off in the demand for weatherproof was felt last week. The base on both bare and weatherproof remains around 16 cents per pound.

Lamp Cord.—Increased sales for the week were reported, almost entirely in the cotton-covered, though there was a slight improvement in the call for silk. Stocks are reasonably good. Cotton-covered is selling for $13.25 per 1,000 ft. and silk-covered for $27 per 1,000 ft., both in size No. 18 and in lots of 1,000 ft.

SAN FRANCISCO

The report of building permits for October shows a marked increase over October, 1920. The figures follow: October, 1921, San Francisco, $2,498,523; Los Angeles, $9,781,394; Oakland, $1,245,220. The corresponding figures for October, 1920, were: San Francisco, $1,890,530; Los Angeles, $6,431,661; Oakland, $520,717. San Francisco shows somewhat more than its normal rate of increase, but Los Angeles is particularly noteworthy in running far ahead of even last year's extraordinary record. It is predicted that Los Angeles will achieve a total of close to $80,000,000 for the entire year.

Boxes.—Single boxes in the 2½-in. size are now selling for about 11 cents each in lots of 100. There is a consistent demand, but it is far below last year's sale.

Boxes and Covers.—The present standard-package lots take these discounts: Galvanized, 40 and 10 per cent; in 1,000 lots, in packages, 42½ and 10 per cent. Stocks are rather large and the call rather light just now save in the Southern District.

Ranges.—There has been a very good demand for the new-type ranges, especially in the open-coil units, and reorders were sent to the factory within two weeks of receipt of Coast stock, the most popular type being the four-coil top with side oven and warming compartment.

Batteries.—The dry-cell line, despite new substitutions, such as bell-ringing transformers and new ignition specialties, still holds its own and finds steady sale. The greater publicity given flashlights and the educational campaign to keep them properly renewed has made a good business for 1921.

SEATTLE—PORTLAND—SPOKANE

Business conditions in general are good, and the prevailing state of mind among merchants and business men generally continues to be optimistic. The upward trend which set in two months ago has been well maintained to date, although in the Puget Sound region there are signs of a tendency for the curve to flatten out to a new fixed level. The export business of Portland is the largest in the history of the city.

Building permits so far this year for Portland are nearly 200 per cent greater than for 1920. This heavy building program is manifesting itself in increased sales of wiring materials and greater volume of business for the contractors.

The reduction of freight rates recently ordered by the Transcontinental Freight Bureau on several hundred items of merchandise is a matter of importance to the Northwest, since this will help to bring to the Northwest ports much business which they previously enjoyed but which has sought other routes since the last tariff increases. This is particularly true of steel rails and other steel products. A large electrically driven sawmill will be built at Astoria, Ore., soon and the town of McMinnville, Ore., plans the construction of a 6,000-hp. hydro-electric municipal plant soon.

In the electrical supply business jobbers report greater activity in the industry than at any time during the past year, although in some sections there was a slight slowing down during the past week. Portland jobbers report demand for heaters and ranges active, with seven car loads of ranges placed on order during the past week. In Seattle business consists largely of lighting equipment, lamps and fixtures, farm lighting and pumping plants and domestic appliances. The only price change of note during the past week was a 5 to 6 per cent drop in watt-hour meters.

Electrical dealers and contractors of Portland report wiring in small jobs to be exceptionally good at the present time, store sales good and fixtures somewhat less active than for the past few weeks. While prices received for goods are lower than last year, the volume is reported greater, which indicates considerable activity in actual sales.

Electrical construction for the month of October exceeded anything in the history of Portland. Portland quotes as follows on knobs, cleats and tubes: "Nail-it" knobs, unit packages, $26.40 per 1,000; standard packages, $24 per 1,000; two-wire unglazed cleats, unit packages, $23.30 per 1,000; standard packages, $22.20 per 1,000; tubes, $\frac{5}{16}$-in. x 3-in., unit packages, $9.05 per 1,000; standard packages, $8.60 per 1,000.

SALT LAKE CITY—DENVER

Continued mild and fair weather is a great stimulus to late fall building. Except for a week of storms the Intermountain region has enjoyed an autumn phenomenal for sunshine and moderate temperature. Scores of homes are being fully completed that builders had expected would be held up on account of inclement weather. There are scarcely any large construction jobs now under way and few are projected for spring.

Retail business has not been brisk during the past week. Aggressive advertising is necessary to keep business from lapsing into a state of lethargy. The mild weather is considered one of the prime causes of the tendency to inactivity. The first storm, it is believed, will bring the purchases out in goodly numbers. The live-stock industry is in much better shape than it has been for a long time. Credit is now available to all responsible growers, feed is cheap and forced liquidations of a disastrous nature are now a thing of the past.

The sugar industry is making a hard fight for its life. The outlook, however, is far more encouraging than it has been for some months. Farmers are being paid for their beet crop as per contract schedule and are in a position to make necessary fall purchases. The electrical trade reports steady improvement, with sales picking up at a slow pace. Jobbers are moving their stocks at a better rate than during the summer and early fall months.

Manufacturers' Activities

Devoted to the Business Side of Manufacturing, Distribution and Sales, News from Jobbers and Foreign Fields and a Record of New Devices and Trade Literature

Woodrow Reports Washing Machine Sales Better

October proved to be the largest month in point of production and sales that the Woodrow Manufacturing Company, washing-machine manufacturer, Newton, Iowa, has had since the first of the year, according to Charles M. Brown, sales manager of the company. Mr. Brown stated that on account of the numerous orders which had been received in October the company has become considerably behind in delivery. He continued to the effect that it was apparent that people are not buying entirely on a price basis at this time, as the Woodrow company has made only two reductions this year and does not contemplate another. The washing-machine market is considerably nearer stabilization at the present time than was the case last summer, he said, and the expectation of the Woodrow company is that a gradual improvement will continue.

St. Louis G. E. Lamp Factory Completion Postponed

The Missouri Glass Division of the National Lamp Works of General Electric Company has postponed for about a year the completion of its St. Louis factory. The demand for lamps is low because of the diminished industrial activity throughout the country, there is about three months stock of glass on hand, and the Eastern plants of the National Lamp Works can supply all the bulbs now necessary. The building is completed and a small portion of the equipment has been installed.

Habirshaw Finds Good Code Wire Demand

The output of the Habirshaw Electric Cable Company has been increased to 45,000,000 ft. of wire per month at its Bridgeport plant by the addition of a night force there. The Bridgeport plant is now running to full capacity, and the company hopes to be able to continue the operation of the plant at this rate for some time to come. Officials do not look for any phenomenal increase in business, but find that at the present time there is a heavy demand for small sizes of code and telephone wire.

Chicago Pneumatic Alleges Patent Infringement

Suit has been instituted by the Chicago Pneumatic Tool Company in the United States District Court in the western district of Michigan against the Keller Pneumatic Tool Company for injunction and accounting of profit and damages due to alleged infringement of certain United States patents covering power hammers. The patents alleged to be infringed are Nos. 879,106, 897,958, 1,029,082 and 1,126,096.

Suit also has been brought against the H. Channon Company in the United States District Court in Chicago for alleged infringement by sale and offering for sale of the power hammers manufactured by the Keller Company and for alleged unfair competition by acts calculated to produce confusion in the trade. Two previous suits filed by the Chicago Pneumatic Tool Company against the Keller Pneumatic Tool Company for alleged infringement of patents are now pending. One is for alleged infringement of patents 730,887, 822,146, 866,573 and 917,242. The other action is for alleged infringement by the use of the trade name "Keller" and certain other trade marks of the Chicago Pneumatic Tool Company.

Gainaday Goes Into Production of Cleaners

The Pittsburgh Gage & Supply Company, manufacturer of electrical household appliances, has announced its entrance into the electric suction cleaner field. The new product is being sold under the trade name of "Gainaday" and is being distributed through branches already established, numbering thirteen, and also through fifty-two previously established agencies, which handle products of the company only.

Appleton Company Not Interested in Anderson

An item on page 853 of the Oct. 22 issue of the ELECTRICAL WORLD dealing with a change in the control of the Anderson Electric & Equipment Company gave the impression in its headline that the Appleton Electric Company was interested. Officials deny any company interest in the transactions, and this statement is made to correct any idea that the Appleton company is interested in the changes.

Tacoma Manufacturer Producing Electric Appliances

The Western Foundry & Furnace Company, 3002 South Chandler Street, Tacoma, Wash., has announced that it has started production of electric household appliances. At the present time the company has on the market an electric heater, and production of an electric clothes drier will start in the near future. The company has been manufacturing furnaces in Tacoma for the past ten years, but only recently has the manufacture of electric appliances been attempted. A short time ago the company was reorganized and the capital stock was increased from $29,000 to $50,000, the management being taken over by J. W. Wright, now vice-president. A. Z. Love is president and A. R. Chastain, formerly manager of the Johns-Manville offices in Vancouver, B. C., was named as secretary-treasurer.

Brass Goods Manufacturer Now Publishing Net Prices

The H. B. Sherman Manufacturing Company, Battle Creek, Mich., manufacturer of brass goods, has announced its adoption of the plan of publishing net prices instead of list and discount. The present system has been in use only three months, the latest bulletin—price sheet No. 14—being dated Aug. 1. The new method involved an elaborate change on the part of the company, inasmuch as it had several hundred prices on its sheet. but officials state that it is proving a success and will be continued.

Philadelphia Electrical & Manufacturing Company Enlarges Plant

The Philadelphia Electrical & Manufacturing Company, 1206-1220 North Thirtieth Street, Philadelphia, has acquired the property adjoining the site of its present factory and will use it for expansion purposes. The property is already improved with a one-story building, 62 ft. x 157 ft., and alterations are being made. Not all of the building will be used by the company at the present time, part being reserved for expansion as conditions improve.

Westinghouse Buys Seattle Plant for Assembling

Negotiations leading up to the establishment in Seattle by the Westinghouse Electric & Manufacturing Company of a manufacturing and assembling plant were consummated during the past week when this company purchased the plant of the Kilbourne & Clark Manufacturing Company of Seattle for a reported consideration of $130,000. The plant will be used for the assembling and testing of machinery, manufacturing switch-boards and instrument panels, warehousing of the company's products and the housing of its sales organization. Seattle is the principal distributing center for the Westinghouse products in the Northwest.

Joint Rubber Insulation Committee Disbands

The Joint Rubber Insulation Committee, whose specifications for 30 per cent Hevea rubber insulation are now almost universally used in the purchase of high-grade rubber insulation, has gone out of existence after ten years of service to the electrical industry. On July 15 a sub-committee of the Joint Rubber Insulation Committee passed the following resolution: "Whereas the Joint Rubber Insulation Committee has completed its special work, and whereas its members are no longer in a position to continue its activities and whereas the American Engineering Standards Committee is now the recognized organization for the control of engineering standards, and whereas the constitution of the American Engineering Standards Committee requires that engineering standardization be brought within the influence of that committee through a recognized technical society, such as the American Society for Testing Materials, therefore be it resolved, that the American Society for Testing Materials be requested to assume the responsibility for this work, and be it resolved, that should the American Society for Testing Materials accept this invitation, it be requested to add to the membership of the committee to which this work will be assigned a suitable number of members of the Joint Rubber Insulation Committee to insure continuity of efforts, and be it resolved, that if this consolidation is effected, the Joint Rubber Insulation Committee shall go out of existence and the secretary shall give due notice to the technical press, to the members of this committee and others, duly interested."

The American Society for Testing Materials acted favorably upon the requests contained in these resolutions at a meeting of its executive committee held Oct. 11, 1921. The work of the Joint Rubber Insulation Committee will be taken over by committee D-11, on rubber products, the chairman of which is F. M. Farmer and the secretary C D. Martin, 466 Lexington Avenue, New York City.

The history of the work of the Joint Rubber Insulation Committee will be found in the report printed in the *Proceedings* of the A. I. E. E., April, 1917. Reprints of the report may be secured from John Wiley & Son, New York City. It contains specifications for rubber compound and the details of analytical procedures which will determine the amount and quality of rubber.

Whitall Company Changes Name

The name of the Whitall Engineering Company, Waterbury, Conn., has been changed to the Whitall Electric Company. The company manufactures lighting fixtures, household appliances and engineers' and contractors' supplies. P. S. Whitall is in charge.

Washing-Machine Reversing-Clutch Patent Upheld

In reporting the victory of the Conlon Electric Washer Company in its suit against the Brokaw-Eden Company for infringement of its reversing-clutch patent the ELECTRICAL WORLD, in its Oct. 29 issue, referred to this clutch as having been designed to protect washing machines of the "oscillating type." The Conlon company writes that this is incorrect in the present case as the patent in suit had to do with washing machines of the "reversing-cylinder type."

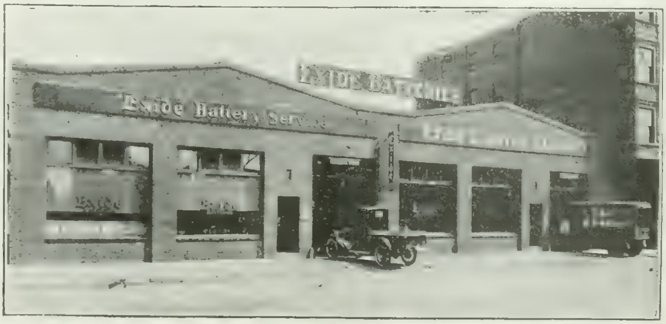
Trumbull Company Declares Present Prices Afford Fine Investment

Another vigorous declaration about the attractiveness of present prices to electrical material buyers appears in the October issue of the *Trumbull Cheer*, the house organ of the Trumbull Electric Manufacturing Company, Plainville, Conn. The company points out that to any careful observer it must be evident that prices on many lines are particularly low and should be very inviting. "When it becomes true," the statement says, "that any given lines are selling for less than they cost to produce, then, indeed, is it time for the buyer to open his eyes to an opportunity. Today's prices on many items are lower than they cost to make, even below a normal factory cost, and it is absolutely certain that sooner or later they must advance. Such a condition is in spots only and caused to some extent by those so in need of a dollar in currency as to disregard the more than dollar in the material they sell. Buyers have a good chance right now, if they have the money to spend, to make a real investment in a good many lines, and it would not be a half bad idea for jobbers and dealers to cast a careful eye on the price situation as it is today on wiring devices."

The company points out that on Oct. 19 prices were reduced 10 to 15 per cent on its open knife switches, slate and porcelain fuseblocks. L. L. Brastow is sales manager.

Large Electric Vehicle Garage Opened in Chicago

An electric garage for the accommodation of electric trucks and vehicles has been opened recently by the Electric Storage Battery Company in Chicago. The garage is on the south side of the city on Twenty-fifth Street and is large enough to accommodate forty trucks. It will be used exclusively for garaging electric vehicles.



NEW CHICAGO ELECTRIC VEHICLE GARAGE WITH FORTY TRUCK CHARGING CAPACITY

It is felt that the new Chicago garage will be of distinct benefit to the owners of one or two trucks rather than the owners who maintain their own battery service. There are forty charging circuits on the switchboard, allowing each car its own individual charging circuit, and thus it will not be necessary to hurry one car in order to make room for another vehicle. In addition, these small fleet owners will have at their disposal the services of an organization of factory battery experts.

Considerable care will be exercised at the new garage, according to the announcement, to have all charging done according to the instructions furnished by the battery manufacturer of the particular battery with which the truck is equipped. In case it is necessary to boost at high rate two charging circuits with a capacity of 300 amp. have also been installed.

Anaconda Receives Large Order From Chilean State Railway

An order for the trolley wire to be used by the Chilean State Railways in the electrification of their system has been received by the Anaconda copper Mining Company, New York City. The copper involved in the order is 1,000,000 lb., but before the work is completed much more will probably be used.

Westinghouse Issues New Series of Publicity Matter

A number of leaflets and publications have just been issued by the Westinghouse Electric & Manufacturing Company discussing and illustrating a number of its products and the uses to which they may be put. The series includes No. 3,665, on motors for elevator service; No. 57, on type No. LC crane safety switches; No. 56, on insurance against loss by stock renewal parts; No. 1,732, describing and illustrating inclosed float switches for use on motor operation pumps to maintain a water level in tanks or reservoirs, and No. 1,950, on electric motor drive for power pumps. Vol. 3, No. 1, of the Westinghouse Electrification Data is also being distributed. This issue treats of the economy of railroad electrification and includes a portion of the progress report made by the Superpower Survey to the ex-Secretary of the Interior. Among the installations mentioned are the Norfolk & Western Railroad, New York, New Haven & Hartford Railroad, Erie Railroad, Grand Trunk Railroad and Chicago, Milwaukee & St. Paul. Another publication discusses electric railway problems of 1921.

The Peerless Drawn Steel Company, Massillon, Ohio, manufacturer of cold-drawn screw stock, shafting and alloy steels, announces the appointment of Clyde E. Dickey, Woolworth Building, 233 Broadway, New York City, as its sales representative for the metropolitan district.

The Universal Crane Company, Elyria, Ohio, announces that George L. Sawyer, formerly sales manager of material handling machinery for the Barber-Greene Company, Aurora, Ill., has been appointed as its representative in the New York field in the sale of Universal cranes. His offices are at Allied Machinery Center, 141 Center Street, New York City.

The National Electric Condenser Company, Pennsylvania Building, Philadelphia, has obtained the exclusive rights in the United States from the Establissement Industriel, L. Segal et Cie., for static condensers. The company is now importing these condensers and announces that it has a fair stock on hand and intends to begin manufacture soon. The contract with Segal et Cie., it is understood, calls for manufacture within one year. These condensers are now undergoing tests by some of the larger Eastern utilities.

Foreign Trade Notes

PRODUCTION OF ELECTRICAL EQUIPMENT IN SWITZERLAND.—The manufacture of electrical machinery and equipment and apparatus for utilizing electrical energy, according to the Commercial and Industrial Handbook on Switzerland issued by the Bureau of Foreign and Domestic Commerce, Department of Commerce, holds a leading place in the Swiss metal industry. More than 20,000 employees are occupied in different establishments in the country in the production of such equipment, ranging from household articles to motors of from one-hundredth of a horsepower to many hundred horsepower and electric locomotives for use on federal railways. The production of practically all of these articles greatly exceeds the demand, with the result that a foreign trade has been built up amounting in 1919 to nearly 40,000,000 francs. Imports of complete electric machines are very small. Prior to the war the bulk of the copper wire for railway electrification and other purposes was imported, but with government assistance the manufacture of wire has been much developed and the copper is imported largely in the form of bars. Certain types of large insulators for use in connection with high-tension voltage, especially on railways, are not manufactured in the country, or are not of satisfactory quality. The continuance of railway electrification will furnish a market for a limited quantity of this equipment. Switch equipment, more especially for out-door use, is needed by the railways and must be imported.

PROPOSED WATER-POWER DEVELOPMENT IN CZECHOSLOVAKIA.—A law has recently been passed by the Czechoslovakian Government, according to *Commerce Reports*, providing for the systematic development of the water-power resources of the country. In accordance with this law the state will take over the utilization of water power and construction of hydro-electric plants, while the construction of the distribution systems and auxiliary steam plants will be left to private companies. In the latter case at least 60 per cent of the capital will be held by the state or local authorities. The National Assembly has assigned 75,000,000 crowns (about $750,000 at present exchange) toward the electrification of the country. This sum is to be distributed over the budgets up to 1928. The unused water power of Czechoslovakia today is estimated at more than 1,600,000 hp. This plan also contemplates ultimately a system of nine steam plants in the coal districts of the country, which will operate in conjunction with the hydro-electric project. Standard transmission pressures of 22,000 volts and 100,000 volts are proposed.

ELECTRIC RAILWAYS FOR NORWAY—The Norwegian Storthing has granted a concession to "A/S Akersbanerne," according to the *Electric Times*, for the construction of an electric railway from the center of Christiania to Ostensjo, a distance of about 8 km. Work on this line will probably commence simultaneously with the construction of the Majorsteun-Sognsvandet railway, a concession for which was granted recently.

PROPOSED WATER-POWER DEVELOPMENT IN JUTLAND, DENMARK.—The commission appointed in November, 1920, to study the question of utilizing the water power of Jutland to generate electricity, according to the *Electrical Industries*, has submitted its report. The commission examined sixteen schemes in connection with water power developments and recommends, subject to further comprehensive investigations, the establishment of seven plants, to be located at Vestbirk, Holstebro, Bur i Ahlersgaard, Skjern, Karlsgaarde and Ansaager. The cost is estimated at about 30,000,000 kronen.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

A mercantile firm in Spain (No. 258) desires to purchase and secure an agency for the sale of flashlights and dry batteries.

A manufacturing firm in Mesopotamia (No. 257) desires to secure the representation of manufacturers of copper and brass sheets.

ELECTRICAL EQUIPMENT FOR RAILWAYS IN AUSTRALIA.—Tenders will be received by the Victorian Government Railway Commissioners, Melbourne, Australia, until Jan. 4, 1922, according to *Electrical Industries*, for furnishing the following equipment: 60 tons of galvanized telegraph wire, 23 steam meters and accessories for Newport power house, and 150 electric train stops for power signaling. Particulars may be obtained at the inquiry room, Department of Overseas Trade, 35 Old Queen Street, London, S.W.1, England.

HYDRO-ELECTRIC PROJECT FOR AUCKLAND, NEW ZEALAND.—The Dominion government, according to *Electrical Industries*, has adopted the Arapuni hydro-electric scheme to supply electricity in Auckland. The proposed plan provides for a water-power development of 50,000 hp. as soon as possible, with an ultimate capacity of 162,000 hp. The cost is estimated at approximately £1,879,000. Work is not to be started until funds are available.

EXTENSIONS TO STOKE-ON-TRENT ELECTRIC SYSTEM.—Plans have been approved by the Corporation of Stoke-on-Trent, according to the *Electrician*, for the proposed extensions at the Hanley power house, to cost about £200,000.

New Apparatus and Publications

CHAIN SCREEN DOORS.—The E. J. Codd Company, 700-708 Carolina Street, Baltimore, has issued a booklet covering the "Wiegand" patent-chain screen doors for furnaces and ovens.

ELECTRIC CONDUIT.—The Dahlstrom Metallic Door Company, Jamestown, N. Y., is distributing a twelve-page booklet describing its "Condue-Base," which is a combination metal base, electric conduit for low-tension and high-tension wires and a continuous electric outlet box.

LUBRICATION.—"Diesel Engines" is the subject of the leading article in the September issue of *Lubrication*, published by the Texas Company, 17 Battery Place, New York City.

BLOWERS.—The Coppus Engineering & Equipment Company, Worcester, Mass., has recently placed on the market a new propeller blower, known as the Coppus "Vano" blower.

LATHE AND MICA UNDERCUTTER.—David W. Onan, 43 Royalston Avenue, Minneapolis, is distributing a leaflet describing the "Onan" lathe and mica undercutter.

ILLUMINATING SHADES.—Tindal & White, Inc., 329 East Twenty-second Street, New York City, is distributing a circular describing the "Perfection" electric illuminating shade.

ELECTRIC HEATERS.—The Hale Electric Manufacturing Company, 1073 Power Avenue, Cleveland, manufacturer of "Halelectric" radiators, is distributing a new folder on its electric air heater.

AIR TIGHT DOORS.—The Conveyors Corporation of America, 326 West Madison Street, Chicago, is distributing a circular describing its "American" air-tight door for ash pits, boiler settings, coke ovens, etc.

AUTOMATIC STARTER.—A new automatic starter for direct-current motors of 10 hp. capacity or less has recently been placed on the market by the Automatic Reclosing Circuit Breaker Company, Sixth and Wesley Avenues, Columbus, Ohio.

SOLDERING PASTE.—A new soldering paste has recently been placed on the market by the Killark Electric Manufacturing Company, 3940-3948 Easton Avenue, St. Louis, Mo.

SOCKET.—The Tremont Products Company, 216 High Street, Boston, has recently developed a new pull socket.

LAMPS.—The Multiple Electric Products Company, Inc., 450 Fourth Avenue, New York City, has placed on the market an "Ediswan" base lamp and adapter and also a concentrated filament lamp.

ARC WELDING RESISTORS. — The American Steel & Wire Company, Chicago, is distributing a bulletin describing two resistors for welding rail bonds recently developed by the company.

DRY VACUUM PUMPS.—Bulletin 710, issued by the Chicago Pneumatic Tool Company, Chicago, describes its steam, belt and motor driven pneumatic dry vacuum pumps.

PNEUMATIC TOOLS. — The Chicago Pneumatic Tool Company, Chicago, has issued a special publication, 674, covering its different types of pneumatic tools.

DRILLING AND AUTOMATIC TAPPING MACHINES.—The [illegible] Machine Company, Cincinnati, has issued circulars covering its "Hy-Speed" drilling and automatic tapping machines.

CRANES.—The Whiting Corporation, Harvey, Ill., has issued a catalog 158, superseding 151, describing its standard crane [illegible]. It also contains several tables of standard clearances.

GARAGE AND MACHINE WELDING TORCH.—The Davis-Bournonville Company, Jersey City, N. J., has issued a circular describing its garage and small machine shop welding torch and carrying outfit.

ELECTRIC IRON. — The Commercial Electrical Supply Company, corner Broadway and Spruce Streets, St. Louis, has recently placed on the market a small electric iron known as the "Tommy iron," designed for the use of milliners, hat manufacturers, dressmakers, etc.

ELECTRIC WATER HEATER. — The Standard Electric Stove Company, Toledo, Ohio, is distributing a leaflet describing the new circulation electric water heater recently developed by the company.

PORTABLE ELECTRIC BLOWERS.—"Fights 'Dustruction'" is the title of a folder issued by the Clements Manufacturing Company, 609 Fulton Street, Chicago, covering its "Cadillac" portable electric blowers.

New Companies

THE SELSO COMPANY, Ogdensburg, N. Y., has been organized by H. J. Parker, M. H. Stevenson and R. C. Sanford, all of Ogdensburg, to manufacture electrically operated water heaters and parts. The company is capitalized at $50,000.

THE ENCO ELECTRIC NOVELTY COMPANY, New York, N. Y., has been incorporated with a capital stock of $24,000 to manufacture electrical specialties. The incorporators are F. David, M. H. Cohen and M. Smiley. The company is represented by Frederick Lese, 277 Broadway.

THE NATIONAL LIGHT & ELECTRIC COMPANY, Newark, N. J., has been incorporated by George Ollendorf, Albert R. Hamerslag and Harry Hirsch, Newark, to manufacture electric lamps, electrical fixtures and kindred equipment. The company is capitalized at $100,000. Harry A. Friedman, 9 Clinton Street, represents the company.

FORD & MANION, INC., Wilmington, Del., has been incorporated with a capital stock of $100,000 by Joseph J. Ford and Francis T. Manion, Wilmington. The company proposes to manufacture electrical heating equipment and appliances. Henry R. Isaacs, Equitable Building, represents the company.

THE O. & R. ELECTRICAL SUPPLY COMPANY, Monroe, N. Y., has been incorporated with a capital stock of $100,000 to manufacture electrical machinery devices and supplies. R. W. Smith, Monroe, and others are incorporators.

THE HANLEY ELECTRICAL COMPANY, Lawrence, Mass., has been incorporated with a capital stock of $15,000 to manufacture electrical appliances. The incorporators are Thomas J. Hanley and Charles V. Hanley of Methuen and William J. Kelleher of Lawrence.

THE MERRILL COMPANY, Ipswich, Mass., has been incorporated by John Merrill and Arthur C. Damon of Ipswich and Louis H. Harriman of Haverhill. The company is capitalized at $25,000 and proposes to manufacture electrical appliances.

THE UNITED LIGHT & POWER COMPANY, Iaeger, W. Va., has been incorporated with a capital stock of $25,000 to operate an electric light, heat and power plant in Iaeger. The incorporators are F. B. Lamp, H. P. Musser, C. E. Elson, M. D. Jennings and William T. Lively, all of Charleston.

JOHN D. OSGOOD, INC., Haverhill, Mass., has been chartered with a capital stock of [illegible] to manufacture electric heating appliances. John D. Osgood, 10 Falmouth Street, is president and treasurer.

THE RADIO DEVELOPMENT COMPANY, Springfield, Mass., has been incorporated with a capital stock of $25,000 to manufacture radio equipment. The officers are Frank W. Sickles, president, and A. Roul Silber, treasurer, both of Springfield.

Record of Electrical Patents

Notes on United States Patents

(Issued Oct. 11, 1921)

1,393,346. INSULATING COMPOSITION OR MATTER; Frank J. Cook, Cleveland, Ohio. App. filed Aug. 19, 1920. For use as composition in which electric resistance wire is embedded.

1,393,352. TELEPHONE SYSTEM; William L. Dodge, Maplewood, N. J. App. filed Sept. 22, 1919. Signals for plurality of trunk lines controlled over a single path.

1,393,368. RADIANT REFLECTOR; George J. Henry, San Francisco, Cal. App. filed March 10, 1920. Heater of the radiant type.

1,393,369. APPARATUS FOR TRANSLATNG ELECTRICAL VARIATIONS; Peter C. Hewitt, Ringwood Manor, N. J. App. filed March 12, 1915. Receiver for wireless telegraphy.

1,393,370. PROCESS OF MAKING ALUMINUM NITRIDE AND OTHER CHEMICAL SUBSTANCES; William Hoopes, Pittsburgh, Pa. App. filed Sept. 19, 1919. Means for heating charge.

1,393,371. APPARATUS FOR MAKING ALUMINUM NITRIDE AND OTHER CHEMICAL SUBSTANCES; William Hoopes; Pittsburgh, Pa. App. filed Sept. 19, 1919. Means for heating charge.

1,393,372. PROCESS OF MAKING ALUMINUM NITRIDE AND OTHER CHEMICAL SUBSTANCES; William Hoopes, Pittsburgh, Pa. App. filed Sept. 19, 1919. Means for heating charge.

1,393,373. ELECTRICAL RESISTOR; William Hoopes, Pittsburgh, Pa. App. filed Oct. 2, 1919. For nitrifying aluminous charges.

1,393,375. THERMOCOUPLE; Matthew A. Hunter, Troy, N. Y. App. filed Feb. 17, 1920. One element of an alloy having a high melting point and resistant to oxidation.

1,393,395. ELECTRIC MACHINE; Otto Pletscher, Albisrieden, Switzerland. App. filed April 14, 1917. For production of light in electric pocket lamps.

1,393,398. INSULATOR; Howard N. Richards, Pittsburgh, Pa. App. filed Feb. 19, 1921. For supporting trolley conductors.

1,393,404. SAFETY DEVICE FOR ELECTRICALLY OPERATED SYSTEMS; William S. Smith, Cambridge, Mass. App. filed Aug. 3, 1918. For elevators, etc.

1,393,427. ELECTRIC TOASTER; Emil A. Christoph, Chicago, Ill. App. filed July 1, 1920. Horizontal domestic type.

1,393,429. TELEPHONE SYSTEM; Henry P. Clausen, Mount Vernon, N. Y. App. filed July 12, 1917. Trunking arrangements between exchanges.

1,393,430. TELEPHONE SYSTEM; Henry P. Clausen, Mount Vernon, N. Y. App. filed Jan. 4, 1918. Systems wherein both automatic and manual lines are used.

1,393,433. MOTOR-GOVERNING DEVICE; William W. Dean, Wilmette, Ill. App. filed May 16, 1919. For use in connection with electric phonograph motors.

1,393,439. SYSTEM OF CONTROL; Arthur J. Hall, Wilkinsburg, Pa. App. filed Jan. 5, 1918. Control of electric motors and generators located upon mechanically coupled cabs of a locomotive.

1,393,442. CONTROL SYSTEM; Rudolf E. Hellmund, Swissvale, Pa. App. filed Sept. 27, 1916. For governing operation of propelling motors of electric vehicles.

1,393,45[illegible]. CATENARY TROLLEY CLAMPING EAR; Paul G. Schwarz, Indianapolis, Ind. App. filed Dec. 22, 1919. Catenary hanger for overhead trolley.

1,393,465. TELEPHONE-EXCHANGE SYSTEM; Dawson M. Targett, East Orange, N. J. App. filed Sept. 4, 191[illegible]. Common and local battery lines may be interconnected.

1,393,467. PROCESS FOR PROTECTING SEPARATORS; Charles J. Thatcher, New York, N. Y. App. filed Dec. 13, 1918. Process for impregnating pores of material.

1,393,471. SUBMARINE SIGNALING; Raymond L. Wegel, New York, N. Y. App. filed Oct. 9, 1919. For receiving vibrations transmitted through water.

1,393,472. TIDE MOTOR; Harry Williams, Return, Va. App. filed Feb. 28, 1920. Power from the tide utilized for commercial purposes.

1,393,483. ELECTRODE; Joseph M. Askin, Chicago, Ill. App. filed Dec. 5, 1919. Bobbin type involving a core.

1,393,491. TROLLEY HANGER; Leland F. Brahmer, Edgewood Park, Pa. App. filed July 30, 1920. Means for holding lock washers in assembled position.

1,393,502. MACHINE-SWITCHING TELEPHONE SYSTEM; Henry P. Clausen, Mount Vernon, N. Y. App. filed Dec. 26, 1917. Established connection may be more closely supervised.

1,393,503. ELECTRICAL SYSTEM; Henry P. Clausen, Mount Vernon, N. Y. App. filed Aug. 19, 1918. For the automatic charging of storage batteries.

1,393,520. INCLOSED ARC DEVICE AND THE METHOD OF STARTING THE SAME; Ernst Friederich, Berlin, Germany. App. filed Oct. 13, 1914. Arc operated in an inclosed envelop between electrodes of refractory material.

1,393,521. MACHINE-SWITCHING TELEPHONE SYSTEM; Charles L. Goodrum, New York, N. Y. App. filed April 27. 1917. Group-selecting switches.

1,393,522. TELEPHONE-EXCHANGE SYSTEM; Charles L. Goodrum, New York, N. Y. App. filed Oct. 25, 1918. Circuit arrangements for selector switches.

1,393,530. TROLLEY - WIRE EXTENSION SPLICE; Mike W. Hermes, Bulger, Pa. App. filed March 18, 1921. Adjusted to accommodate expansion and contraction.

1,393,531. ELECTRIC INCUBATOR; John A. Howard, Sr., West New Brighton, N. Y. App. filed July 3, 1920. Automatic control of current.

1,393,558. TELEPHONE-EXCHANGE SYSTEM; James L. McQuarrie, Montclair, N. J. App. filed Aug. 7, 1919. Circuit arrangements for various switches.

1,393,559. TELEPHONE-EXCHANGE SYSTEM; James L. McQuarrie and Charles L. Goodrum, New York, N. Y. App. filed Aug. 7, 1919. Arrangement for controlling selector switches.

1,393,594. MEANS FOR PRODUCING HIGH-FREQUENCY OSCILLATIONS; William C. White, Schenectady, N. Y. App. filed June 3, 1918. Receiving system of heterodyne type.

1,393,602. ELECTRICAL CONDENSER; Ernest A. Bayles and Harold Higham, Helsby, England. App. filed Dec. 22, 1919. Made of laminae of paper and metal.

1,393,635. ELECTRICAL BRUSH; Helen R. Mondy, Atlantic City, N. J. App. filed Feb. 12, 1921. For drying the hair.

1,393,674. BATTERY CONNECTOR; Walter S. Doe, Kent, Ohio. App. filed Oct. 25, 1919. Non-corrosive and acid-proof.

1,393,675. FLASHLIGHT; Walter S. Doe, Kent, Ohio. App. filed Nov. 2, 1920. New and improved switch.

1,393,685. ANNUNCIATOR DROP; Charles J. Henschel, Brooklyn, N. Y. App. filed April 25, 1919. Suitable for use on shipboard.

1,393,715. SYSTEM OF CONTROL; Normal W. Storer and Rudolf E. Hellmund, Pittsburgh, Pa. App. filed Feb. 10, 1916. Automatic regenerative control of electric-railway motors.

1,393,727. CALL-DISTRIBUTING SYSTEM; Samuel B. Williams, Jr., Brooklyn, N. Y. App. filed Nov. 28, 1919. Automatic switches for distributing calls.

1,393,728. TELEPHONE-EXCHANGE SYSTEM; S. B. Williams, Jr., Brooklyn, N. Y. App. filed Dec 8, 1919. Automatic switches for establishing talking connections.

(Issued Oct. 18, 1921)

1,393,732. ELECTRIC HEATING UNIT; Charles C. Abbott, Pittsfield, Mass. App. filed Dec. 17. 1920. Simple, compact and reliable.

1,393,737. ELECTRIC METER; Edwin C. Ballman, St. Louis, Mo. App. filed Nov. 15, 1917. Constant magnetic field and magnetic field varying with current.

1,393,739. ELECTRIC BATTERY; Raymond C. Benner and Harry F. French, Fremont, Ohio. App. filed Jan. 16, 191[illegible]. Dry cell.

1,393,750. SECTOR CABLE; Hilton P. M. Carter, Montreal, Quebec, Can. App. filed Feb. 28, 1920. Without distortion of form of wires thereof.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

BOSTON, MASS.—The Edison Electric Illuminating Company of Boston has been granted permission by the Massachusetts Department of Public Utilities to issue 45,056 shares of stock, par $100, at $130 a share, to take up outstanding indebtedness and for extensions.

Middle Atlantic States

BROOKLYN, N. Y.—Bids will be received by Thomas J. Drennan, fire commissioner, eleventh floor, Municipal Building, New York City, until Nov. 15, for furnishing, delivering and installing protector board, jack and test board, relay boards, dispatcher's receiving and transmitting board, automatic transmitters, control table, cable and wire, conduit, cable racks and miscellaneous appurtenances in new central office, borough of Brooklyn, N. Y.

BUFFALO, N. Y.—The Bison Ice & Coal Company, Rapin Street near Doat Street, is planning the construction of a one-story addition, 12 ft. x 84 ft., to its ice-manufacturing plant. Fred Teichert is treasurer.

CAROGA LAKE, N. Y.—The Kolenaka Electric Light Company, Johnstown, recently incorporated with a capital of $15,000, contemplates the construction of a generating plant to supply electricity for street-lighting and domestic purposes at Caroga Lake. The plant will be driven by a Diesel engine. T. H. Cepereley, Argusville, is in charge.

ELLISBURG, N. Y.—The Adams Electric Light & Power Company has been granted permission by the Public Service Commission to erect a distribution system in the village of Ellisburg. The commission has also approved franchise granted by the town and village authorities.

NEW YORK, N. Y.—Bids will be received by R. W. Rodman, superintendent of plant operation of the Board of Education of the School District of the city of New York, room 515, Municipal Building, New York City, until Nov. 21, for electric ash hoists in Public Schools 3, 4, 5, 46, and 48, borough of the Bronx, and in Public Schools 84, 85, 109, 148 and 168, and installing ash trolley in Public School 84, borough of Brooklyn. Bids will also be received until the same date by C. B. J. Snyder, superintendent of schools, room 2800, Municipal Building, New York City, for installing electric wiring and fittings in new Public School 54, Sanford Street, between DeKalb and Willoughby Avenues, borough of Brooklyn.

SCOTCH PLAINS, N. J.—Plans are under consideration by the Board of Freeholders of Union County, Court House, Elizabeth, N. J., for extensions and improvements to the power plant at the county institution at Scotch Plains, to cost about $25,000.

HUNTINGTON, PA.—The consolidation of the Cove Electric Company, the Roaring Spring Light, Heat & Power Company and the North Woodberry Electric Company, to operate under the first-named company has been authorized by the Public Service Commission. Extensive improvements and extensions are under consideration.

LANCASTER, PA.—The Lancaster Milk Products Company, Inc., Hollinger, Pa., is planning the construction of a power plant to be used in connection with its proposed plant to be built at 623 Thirty-second Street, Lancaster, to cost about $100,000. John Harmon, 48 North Queen Street, Lancaster, is architect.

NEW BRITAIN, PA.—The New Britain Improvement Association has obtained sufficient funds to provide for the installation of an electric lighting system in this village.

PHILADELPHIA, PA.—New bids, it is reported, will be asked by the Department of City Transit, City Hall, for a power house at Cumberland and Kensington Street.

PHILADELPHIA, PA.—The Department of Public Works, Bureau of City Property, City Hall, is considering the construction of a power house for the buildings comprising Independence Hall, Sixth and Chestnut Streets. John P. B. Sinkler, Otis Building, is architect.

POTTSVILLE, PA.—Application has been made by the Eastern Pennsylvania Light, Heat & Power Company to the Public Service Commission for permission to install and operate a system in certain sections of Schuylkill County.

TEMPLETON, PA.—Plans are under consideration by the Templeton Limestone Company, Kittanning, for the construction of a crushing plant, 30 ft. x 60 ft., and a power house, 25 ft. x 25 ft., at its property at Templeton near Kittanning, to replace its works recently destroyed by fire. W. L. Snyder is superintendent.

TOWANDA, PA.—The Towanda Electric Illuminating Company is considering the construction of a new power house.

WEST MIDDLESEX, PA. — The Shenango Valley Electric Company, Sharon, is considering furnishing electricity for lamps and motors in West Middlesex. Mark Pendleton is superintendent.

FROSTBURG, MD.—The power house, consisting of boiler and engine departments, at Mine 13 of the Consolidation Coal Company, Consolidation, near Frostburg, was recently destroyed by fire. The plant, it is understood, will be rebuilt.

RICHWOOD, W. VA.—The Cherry River Paper Company is planning the erection of a one-story power plant, 40 ft. x 150 ft., to cost, with machinery, about $250,000. George Snyder is assistant superintendent.

HOPEWELL, VA.—The local power plant and waterworks of the Du Pont Chemical Company has been acquired by the Industrial Service Corporation, Hopewell. The new owner, it is understood, will make extensions and improvements. J. F. Muhlig is general manager.

WASHINGTON, D. C.—The Bureau of Supplies and Accounts, Navy Department, Washington, D. C., will receive bids for furnishing the following: Until Nov. 22, Washington, Schedule 8992, 300 porcelain insulators; until Nov. 29, Mare Island, Schedule 8994, 10,000 ft. single conductor lighting and power wire.

North Central States

CLEVELAND, OHIO—An ordinance providing for the expenditure of approximately $52,000 for extensions to the municipal electric light and power system has passed its first reading.

CLEVELAND, OHIO—The City Council has authorized the installation of an ornamental lighting system on Euclid Avenue from East Ninety-third to East 107th Street, and on East 105th Street from Fairmount Street to the proposed extension of Carnegie Avenue, to cost about $40,000.

COLUMBUS, OHIO—Bids will be received by C. L. Steele, secretary of the board of trustees of the Ohio State University, until Nov. 18, for the construction of a power house, 18 ft. x 204 ft., to cost about $300,000. J. N. Bradford, Ohio State University, Columbus, is architect.

MARIETTA, OHIO—The City Council has authorized improvements to the municipal electric light plant, to cost $5,000. The plans provide for replacing the three arc machines now in use with a two-phase, 2,200-volt generator. The distribution lines will be overhauled and stand-arc lamps will be substituted for the present streets lamps. G. H. Gamper, 220 New First National Bank Building, Columbus, is engineer.

STEUBENVILLE, OHIO — The Ohio Power Company is considering plans for the construction of a new substation, to cost about $50,000.

WARREN, OHIO. — The Ohio Public Service Company has disposed of an issue of $5,100,000 in bonds, the proceeds to be used for improvements and extensions to its system.

CONNERSVILLE, IND.—Arrangements, it is reported, are being made by the Interstate Public Service Company, Shelbyville, for the purchase of the local power plant of the Hydro-Electric Company, which will be consolidated with its distribution system. Connection, it is understood, will be made wth the New Castle plant of the Interstate Company, which contemplates extensions and improvements.

SPRINGFIELD, ILL.—Improvements to be made in the near future at a cost of about $3,000,000 are under consideration by the Springfield Gas & Electric Company and the city authorities. The work includes construction of underground conduit for electric light and power wires, ornamental lighting system, purchase of the Fourth Street lighting system by the city, etc. For further information address A. D. Mackie, vice-president of the Springfield company.

BELOIT, WIS.—The Council is considering changes to the street-lighting system in Beloit, providing for replacing arc lamps with incandescent lamps. The proposed new system will comprise 328 units, each requiring a 250-cp. incandescent lamp.

DODGEVILLE, WIS.—The Wisconsin River Power Company, Gay Building, Madison, is planning the construction of a two-story electric substation, 60 ft. x 86 ft., in Dodgeville, to cost about $55,000.

OCONTO FALLS, WIS.—Work will be started soon, it is reported, by the Union Manufacturing Company, which is the hydro-electric power division of the Continental Paper & Bag Mills of New York and serves the paper mills at Oconto and Marinette, Wis., on extensions to its plant. The output will be increased from 1,500 hp. to 2,750 hp.

WAUWATOSA, WIS.—The Board of Administration has appointed Vaughn & Meyer, engineers, to make a survey to determine the advisability of building a central power, light and heat plant for use in connection with the county institutions at Wauwatosa.

BARNESVILLE, MINN.—Improvements to the electric lighting system in Barnesville are under consideration. E. Aamoot is city clerk.

CRANE, MO.—The J. P. Cantrell Oil Company is considering the construction of an electric light and ice plant.

HOLTS SUMMIT, MO.—The Central Missouri Coal Mining Company, 314 Central Trust Building, Jefferson City, is planning the installation of engines, boiler, pumps, conveying apparatus and other power equipment to cost about $75,000, at its properties at Holts Summit. John McManus is secretary and treasurer.

ST. LOUIS, MO.—The St. Louis Lead & Oil Works, International Life Building, has awarded a contract for the construction of a one-story addition to its power house to Fillespie & Daly, International Life Building.

NEMARA CITY, NEB.—The transmission line of the Nebraska Gas & Electric Company will be extended from Shubert to Nemara City to provide electricity for light and power in the latter town.

RANDOLPH, NEB.—Extensions to the municipal electric light pl nt, to cost about $65,000 are under consideration. C. Blizzard is clerk.

NEODESHA, KAN. — Bonds to the amount of $195,000 have been voted for electric light and water improvements. It is proposed to install new engines in the power plant, replacing the steam plant now in use with oil-engines and motor-driven pumps. An ornamental lighting system will be erected on two of the principal streets of the city.

OTTAWA, KAN.—A movement has been started to link Melvern, Lyndon, Waverly, Michigan Valley and Overbrook with the transmission line from Ottawa to Quenemo, on which work is under way.

Southern States

WINSTON-SALEM, N. C.—Bids will be received by the city of Winston-Salem, N. C., until Nov. 16, for the construction of the Academic Arts Building, power house and other work in conection with the Richard J. Reynolds High School. Plans and specifications may be obtained from the office of Wiley & Wilson, Lynchburg, Va., consulting engineers.

GREEN COVE SPRINGS, FLA.—Bonds to the amount of $150,000 have been voted for extensions to the municipal electric light and water plants, construction of sewers, etc.

LAKE WORTH, FLA.—Plans are under consideration for the installation of a larger engine at the municipal electric light plant. Ward Randolph is city engineer.

WHITE PINE, TENN.—The White Pine Power & Light Company is contemplating the construction of an electric power plant, 60 ft. x 60 ft. G. M. Felmet is interested.

WILSON, OKLA.—The Council is considering issuing $70,000 in bonds for extensions to the municipal electric lighting plant and system.

SAN ANTONIO, TEX.—The Texas Central Power Company, recently organized, is planning the operation of electric power plants to supply electricity in Victoria, Cuero, Bishop, Kingsville and other points in this section. R. W. Morrison, San Antonio, is interested in the company.

VERNON, TEX.—The City Commissioners are considering the establishment of electric light and ice plants in Vernon.

WORTHAM, TEX.—The installation of an electric light plant in Wortham is under consideration by the City Council.

Pacific and Mountain States

SEATTLE, WASH.—The Puget Sound Power & Light Company has entered into contract with the Washington Coast Utilities Company of Wenatchee, to supply electricity for the Wenatchee Valley district and Chelan and Douglas Counties. The present plans provide for the erection of a transmission line from the present Snoqualmie plant of the Puget Sound company. The Washington Coast Utilities Company recently took over the properties of the old Wenatchee Gas & Electric Company. William H. McGrath is vice-president of the Puget Sound company.

VANCOUVER, WASH.—The Lewis River Hydro-Electric Power Company, Vancouver, has plans under consideration for the construction of a hydro-electric generating plant on the North Fork of the Lewis River, near Kearns, Wash.

YAKIMA, WASH.—Word has been received from Washington, D. C., that the federal government has authorized the expenditure of $3,600,000 on reclamation projects in Washington during the coming winter, half of which amount is to be spent on the Kennewick unit of the Sunnyside Canal. The project includes a diversion dam, headworks at Prosser, construction of a power canal and pumping plant.

PORTLAND, ORE.—Malcolm J. Anderson of Portland has applied to the state engineering department for authority to appropriate 75 sec.-ft. from the south fork of the Coquille River to develop 13,261 hp. The project includes a dam 100 ft. high and 400 ft. long. The cost is estimated at $750,000.

SAN DIEGO, CAL. — The Bureau of Yards and Docks, Navy Department, Washington, D. C., is contemplating the installation of a street-lighting and fire-alarm system in San Diego. Applications accompanied by a deposit of $10 may now be filed for plans and specifications (4526), and necessary data for bidding will be forwarded in the near future. All communications should be addressed to the chief of the Bureau of Yards and Docks.

SAN FRANCISCO, CAL.—R. W. Hawley, San Francisco, it is reported, has been granted a permit by the Federal Power Commission, Washington, D. C., providing for a power development scheme on Silver Creek. Under this permit it is planned to equalize the flow of Silver Creek by the construction of two reservoirs, the water being utilized through three power plants.

STOCKTON, CAL.—Permission has been granted to the Western States Gas & Electric Company by the Railroad Commission to proceed with the construction of a hydro-electric plant, to have an ultimate capacity of 100,000 hp., on the south fork of the American River. Extensions will also be made to its present plant to provide for an increase in capacity to 56,000 hp.

GLENDIVE, MONT.—The Eastern Montana Light & Power Company is considering extensions and improvements to its distribution system in Glendive.

Canada

WINNIPEG, MAN. — The Manitoba Power Company, Ltd., Winnipeg, Man., has awarded general contract for the construction of its power plant at Great Falls, to cost about $5,500,000 to Fraser, Brace & Company, Ltd., 83 Craig Street, West, Montreal, Que. Separate bids will be asked for machinery and equipment. F. H. Martin is engineer and F. J. Pratt is purchasing agent.

MAMORA, ONT.—The Pearce Company has plans under consideration for rebuilding the power house at its woolen mills, recently destroyed by fire.

Electrical World

New York, Saturday, November 19, 1921

What the World Wants from the Washington Conference

IN our capital this week the great nations have gathered in a conference in the hope that some way can be found to limit armaments. They want to lessen the tax burden on all peoples and to put an end to war.

A few years back many millions of the young men of France, Great Britain, Italy and America gave up their lives in bitter agony. But it was not to win the world war that they marched out and died. It was to stop the war and to win back peace. And the war was stopped. But the peace has not been won. And peace cannot return again while governments with evil ingenuity continue adding to their armaments—which threaten war—and piling up more wasteful debts for war-stricken humanity to pay.

Think! Of all the money that is poured into the national treasury in Washington 93 per cent is spent for navies, armies and the cost of former wars. And in France and England it is worse. The pity and the folly of it that men and women should persistently pursue a course so imbecile! How can we and why should we carry such a load?

Lloyd George, in his Guildhall speech, said that around the entire horizon of the world's affairs today the only bright spot of hope comes from the Washington conference. For economically the world lies paralyzed. The human mind fails to grasp the complexity of the situation. Its all-shadowing menace we do not half see. Yet it is not a theory but a condition of impending peril to all, and something must be done and done at once and done by the people.

There is but one way out—one road to economic health and safety. The world must work. We cannot talk ourselves into prosperity. We cannot argue ourselves into stability. Work alone can save the world—intelligent work—untiring work—work in its most homely sense. And this work must be done not by nations, but by individuals—avoiding the duplication and wastefulness of competition and employing to the full the progressive and constructive power of co-operation—individually, industrially and internationally.

The leaders of the world have come to Washington because upon this conference rests the only hope. We must win back our peace through work. But it must be unthreatened peace of the heart and peace of the mind, and it must be permanent. Therefore the people call upon these men in Washington to see to it *right now* that the fruits of this saving labor be not hereafter perpetually jeopardized and almost entirely wasted in taxation for war. Our lives and treasure must be made secure and safe now. That is what the whole world wants.

Carl Hering

Engineer and scientist who has contributed in a large degree to the development of the science of electrometallurgy.

ONE of the oldest and yet one of the newest phases of the science of electricity is electrochemistry. In the battery the electric current was discovered. In the production of electric heats for metallurgical processes lies one of the fairly recent applications of electricity, one which is [illegible] and bounds. In both of these fields, but more especially the latter, the name of Carl Hering is justly prominent. Since 1886 he has been practicing in Philadelphia as a consulting electrical engineer. A man of many attainments and international reputation, he has all his life been an enthusiastic searcher for a scientific explanation of apparent exceptions to generally accepted physical laws, and as an outcome of this trait he has been a stickler for the correct expression of scientific results in standard units and has contributed considerably to the construction and classification of electrical nomenclature.

Dr. Hering's work in electrochemistry began with extended researches with storage batteries prior to 1890, as a result of which he obtained [illegible] patents. He also investigated the commercial regeneration of spent battery solutions. His electric furnace work dates back to some tests in 1900 for the reduction of arsenic ore. Some six years later, while designing and operating electric furnaces, he began a series of experiments which resulted in the announcement of the discovery of a new internal electromagnetic force tending to contract a conductor through which current is flowing even to the extent of rupture when it is a fluid, and which is now known as the "pinch" effect. He later demonstrated the existence of other effects showing that the electromagnetic forces act on the material of the conductor. In 1909 he applied these forces to impart rapid motion to masses of molten material and on this principle invented an electric furnace now in wide commercial use.

As early as 1883 he began the computation of conversion factors of electrical and mechanical energy, and he published a comprehensive book on this subject in 1904. A few years later he made a recalculation of all electrochem[illegible] analysis of the interrelations of the various quantities of units entering into the calculation of light phenomena. That same year he described an experiment demonstrating a hitherto unrecognized factor in electromagnetic induction tending to show that Maxwell's well-known law of induction should be modified in order to become a universal law.

Dr. Hering was also one of that brilliant group of men who contributed to the [illegible] of the Electrical World as a strong and forceful electrical engi[illegible] technical editor, and in 1893 he originated its weekly "Digest of Current Electrical Literature," both foreign and domestic, which has come to be one of the well-recognized institutions of the electrical industry. This department he conducted for ten years.

He was one of the [illegible] who in the fall of 1901 laid the plans for the [illegible] which he was later elected president. He was also one of those who started [illegible] *and Metallurgical Engineer*. Dr. E. F. Roeber, the first editor of this paper, to whose brilliant work it owes much of its phenomenal growth, was at the time of his appointment Dr. Hering's assistant.

Dr. Hering was born in Philadelphia, March [illegible] and was educated at the University of Pennsylvania and in Germany. He has been a prolific writer on electrical engineering topics and until quite recently has represented American electrical engineers at almost all of the [illegible] French decorations for these activities. He has been unusually prominent in association work and has the distinction of having been president of the American Institute of Electrical Engineers.

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The Sacrifices of Disarmament

WE, AS an industry, are vitally concerned in the present conference on the limitations of armaments being held in the capital city of Washington. The modern battleship, costing complete about forty million dollars, has much electrical equipment, from the turbo-generators which supply the motive power for electric propulsion to the pocket spotlamp of the boatswain. The suggested abandonment of all capital ships on the building program is therefore not without interest to us. It means a large sacrifice from a peaceful industry for the ultimate good of mankind. The opportunity and the necessity are here together, and we gladly embrace both. Obviously nations cannot continue their mad orgy of war, nor can we, as an industry, permit selfishness or petty advantage to stand in the way of the realization of an era of permanent peace. Magnanimous we will be if by that means light may shine upon a darkened world. Unfortunately our civilization is as yet imperfect. We have not attained unto the ideal set for us by the humble Nazarene. Total disarmament is therefore neither expected nor desired. The millennium is not yet, but we are on the road to that blessed day when "nation shall not lift up sword against nation, neither shall they learn war any more," and the electrical industry is prepared to make any sacrifice to hasten that time, far distant though it be.

Standardization as a Weapon of Commerce

POSSIBLY the most significant thing, commercially speaking, that the world war has evolved is standardization. Prior to that eventful time standardization was desultory and squeamish. It neither asserted itself nor was it mildly acquiescent. Like the lily of the field, it toiled not neither did it spin. It simply enjoyed an anemic growth and was tolerated as an engineering fetish. War, however, served to reveal and emphasize our selfish and inefficient individualism and the futility of any hope of success under such handicaps. With the mobilization of all that America possessed—its men, industries, material, wealth and knowledge—came organized and scientific co-operation and an appreciation of the true value of standardization.

But we were not alone in our conclusions. Other industrial nations, like Great Britain and Germany, also realizing the saving grace of standardization, began at once to put it into practice. To what extent Germany has woven standardization into her industrial fabric is indicated in the report of the American Engineering Standards Committee. Needless to say, she has done the job in Teutonic fashion, thoroughly and effectively, and thereon hangs a threat to American industry. We aim in all manufacture today to increase efficiency and minimize industrial waste, but what hope have we of ever bringing this about until we are prepared to embrace standardization wholly and unconditionally? It is of little use to accept it as a principle and then fight foolishly upon its application. We can make no progress until we deal with the subject in a mood of mutual helpfulness. Such is the approach followed by the American Engineering Standards Committee, and it has aided admirably in bringing about the unification of industrial standards. The work of this committee, however, has only just begun because industry does not yet understand that standardization is first and foremost an economic and commercial weapon of immense value. With the broadening of this knowledge the full industrial significance of standardization will be more readily apparent, but it will not grow of itself. Industry must seek it and, having found it, should treasure it. In reasonable standardization lies the solution of many of our industrial and commercial problems.

Like Any Other Kind of Friendship

CUSTOMER relations are made up of little things. A word here, a bit of service there, a chance impression—and the thing is done. If the word is good, the bit of service prompt and cheerful and the chance impression pleasing, a new friend is made. But if these random contacts give offense, harm can be done beyond the power of many costly advertisements and much talking to correct. For such is human nature, and the business of the central-station company with the household is a very human business.

In this issue S. M. Kennedy tells in detail of the manner in which the "greater service" department of the Southern California Edison Company does its work. It is a story of little things consistently combined to make a mighty power for winning friends among the customers of this far-seeing utility. It should be read with closest attention, not only for the interest which it holds but because it offers many good suggestions useful to any company for the improvement of its contact with the community for which it works. Good relations with the public do not come by accident; they are slowly builded of good words and deeds, like any other kind of friendship.

A Comprehensive, Not a Makeshift, Development of Colorado River Needed

WE WERE glad to present last week some details regarding the projects for the development of the Colorado River which are in contemplation. As our readers are well aware, the Colorado is one of the very big streams of the country, carrying an enormous and extremely variable quantity of water, capable of immense good or evil, as the case may be. Running as it does through several states and emptying into the Gulf of California many miles across the Mexican border, it presents problems at once physical, commercial, strategic and political. Its water, now running to wild waste, is needed for irrigation and for power development and must be restrained from going on the rampage.

The report under the Kincaid act presented a few months ago opens the way for a complete study of the development of the Colorado. The hydro-electric possibilities of the projected developments run to nearly 4,000,000 hp., merely including the actual projects on the Colorado already definitely considered. What the electrical growth of this great Western country is to be no one can safely predict. California, of course, has shown very great possibilities and rapid growth of population, but it would be essaying the rôle of the prophet to predict how much the other states reached by the valley of the Colorado may grow in agricultural activities, and how far the demands of California based on normal growth compare with the increase of population due chiefly to tourist enterprise. The possibilities of the irrigation of regions otherwise beyond cultivation by means of pumping must also be taken into account as one of the factors in providing a genuine, though seasonal, demand for power.

It is obvious, therefore, from the start that this development of the Colorado is of vast importance. When begun, it ought to be carried through in a manner thoroughly comprehensive, having in mind not the easiest method of attack for temporary results, but that form of project which will give to the far Southwest the largest possibilities of supporting greatly increased population by rendering fertile territory not yet doing its duty in the service of mankind.

International Exchange of Power Necessary to Development of St. Lawrence

AS PROJECTS for development and distribution of power on a vast and comprehensive scale gradually begin to assume form it is necessary to look about for all the possible unutilized hydraulic privileges as a part of the grand scheme of supply. Whether a "superpower" system in the form which has been sketched will actually come into service is of less importance than the certainty that some general interconnection will eventually be brought into being. In this connection a recent report of the St. Lawrence River projects assumes large importance. It is the result of international study and is directly of international interest, the more so since sooner or later a united plan of power supply must, on some equitable basis, permit the interchange of power between the United States and the neighboring and friendly Dominion of Canada. From Lake Ontario to Montreal the St. Lawrence, carrying the enormous flow of the entire great lake system, is about 182 miles long and in that distance falls 224 feet. The utilization of this fall involves a very large amount of work, for there are no very great single falls and the whole scheme of utilization is involved with the possible provision of a deep-water route from the sea into Lake Ontario.

To a certain extent these two uses of the great stream may seem incompatible, but projects have been worked out for a system of locks and power dams which permit both of navigation and of the development of power in so great amount as to be an important addition to the resources of the continent. The total amount indicated as available under the plans thus far made public is close to 4,000,000 hp.

Of the three great power sites which this report classifies as practicable to develop, the one at the Long Sault, the uppermost of the three, is international in its character and will aggregate about 1,500,000 hp.

Of the two lower projects, one well above Montreal, the St. Francis-St. Louis site, promises at least another 1,500,000 hp., and in addition the proposed Lachine Rapids development can be expanded to nearly 750,000 hp. It is going to be no small task to work out the full engineering features of these plants in their practical development and to arrange the international details of the plan, so involved with the problem of deep-water navigation. Nevertheless, it is entirely clear that the work should be done and should be undertaken at no distant date. The estimated cost of the complete canalization from the Great Lakes to Montreal, including the 1,500,000-hp. hydro-electric development at Long Sault, is figured at about $250,000,000.

Economy in Building Switching Structures

THREE principal elements of cost in the construction of outdoor racks for switching apparatus at distribution substations are the cost of the materials, the labor of erection and the supply of parts. These elements are, of course, axiomatic, but the careful consideration of the relative importance of each has, according to the article elsewhere in this issue by L. J. Moore, resulted in the greatest economy. As a result of experience the San Joaquin Light & Power Company has standardized upon a design of outdoor switching frames which are assembled from standard pipe and fittings. The use of such material has resulted in a low cost for materials and the greatest ease of construction in that no highly specialized labor is required. Of perhaps the most interest is the facility of obtaining the materials. As these are standard, they may be purchased in many places or carried in the warehouse stock at a small idle investment.

The durability of the structures is all that need be desired. To serve a rapidly growing territory it would be impracticable to erect structures designed for a service of three or four decades. Experience has shown that many changes and rebuildings would be required in such a period. The pipe framework is therefore a logical and an economical solution of the problem.

Industrial Electrical Records Pay

SCIENTIFIC management—which may equally well be called systematized common sense in administration—leaves less and less to fallible memory as the size of plants increases. Equipment accounting in industrial establishments is but a fledgling science compared with what we shall see in the future, but the design and application of suitable record systems for the use of the industrial electrical engineer is at last beginning to come into its own. The limitations of personal memory are too great and the value of nervous energy is too high to try to run plants much longer on the old basis of fragmentary—or worse—logs and reports of apparatus performance, which only serve to emphasize the uncertainties of recollection, unsupported by historic evidence in the offices of departmental executives.

In another column J. Elmer Housley describes the record system used by the electrical department of the Aluminum Ore Company, East St. Louis, Ill., embracing a connected motor load of 25,000 hp. As an example of clear-cut system, free apparently from needless complications and so well organized that data upon any portion of the plant covered and for any period since the installation totaled 10,000 hp. can be obtained at a glance, this material deserves much commendation. The care with which stock records, test and service records are prepared—and, what is more, maintained—insures the supply of unusually reliable information to company executives. The installation, indeed, is exceptionally large, but the careful reader will quickly see that the forms and methods described by Mr. Housley can be applied without undue expense to an immense range of smaller plants at present so lacking in these practices as to move even a field editor of an electrical journal to ask, "How long, oh, how long?"

We shall not recapitulate here the good things contained in this article, but in passing favorable comment should be made upon the methods of filing test records outlined and especially upon the careful preservation of graphic instrumental charts. It is nothing less than a triumph to be able to "spot" these months after they have been taken, and along with them to study the tabulations of test readings, repair outlays, etc., which throw so much light upon the fitness of equipment selection for specific tasks. Then, too, the method of keeping track of broken and missing lamps is one of wide possibilities elsewhere, and it is refreshing to find a company which has enough appreciation of its industrial electric trucks as economic tools to compile their written history periodically. Of course, to be of maximum value, such records must be analyzed and interpreted by experienced eyes and heads; but the beauty of the system described here is that it utilizes simple and well-tried means in such a straightforward fashion that one is surprised at the comprehensiveness of the layout. As basic data for graphic studies such records are very valuable indeed, and as time goes on we shall see their general application, modified, it may be, for local conditions, but welcomed and respected by industrial-plant executives who are today unaware of the economic worth of these systems.

Effectiveness of Partly Wet Insulators

NOTABLE work has been done toward developing insulators for lines to operate at voltages higher than any now in service, but thus far one very important phase has not been thoroughly covered. This concerns the changes that take place in the voltage gradient of a string of suspension insulators at the time when rain, fog or dew begins and at the time of drying off at the end of a moist period. These are critical times in the operation of such insulators.

Studies have been made, conclusions drawn and methods of protection against flashovers evolved when the strings are either wet or dry all over and all at the same time. But neither of these cases is in point. Although the voltage gradient and unit voltage duty on a string of dry insulators may be closely determined and controlled so that under normal or expected voltages the stress on the line-end units will be limited to the point where incipient flashovers will not form and be followed by cascading of the entire unit, and although when wet this same insulator string will survive the same voltages, yet flashovers are quite apt to occur under conditions of partial wetness. This is due to the destruction of the voltage gradient forcing the line-end units to undergo strains for which they were not designed. When drying off a similar disturbed condition results.

Practical experience with high-voltage lines has indicated that such a condition of partial wetness of the insulator strings is everywhere a vital one in the operation of such lines. Facilities for carrying on investigations of the nature required to determine an effective method of meeting this problem are somewhat limited, but the urgent need for an answer demands that the problem be attacked with vigor.

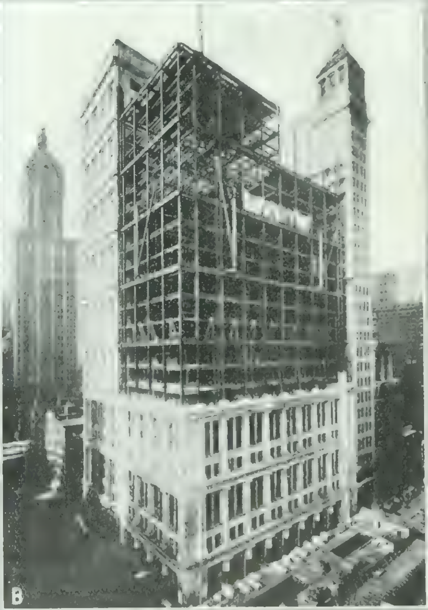
Better Appreciation of Value of Good Lighting

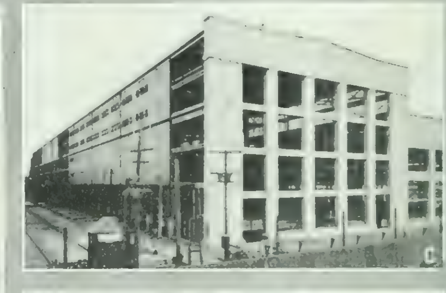
REPORTS of the I. E. S. committee on progress have always brought to view some notable illuminating practices and achievements, and this year's report, part of which was presented in our last issue, is no exception. The general tendency, as shown by the report, is to increase the illumination to an intensity considerably above that which would have been entirely acceptable a few years ago. Floodlighting of important buildings, inside and out, has been resumed, in some cases with rather notable results. The tendency is toward as effective concealment of the sources as is practicable, and where projectors are not used other special fixtures equally efficient in concealing are put into service. Indirect lighting, in this field of large areas and big units, has certainly taken on a new activity, and the semi-indirect methods have also been very largely developed by the improved adaptations of diffusing glass often considerably denser than has been generally utilized heretofore. The same tendency toward brighter lighting has appeared in department stores and other large commercial areas, where intensities are gradually working up into the region between 5 and 10 foot-candles. Indeed, these same intensities are becoming common in the general service of manufacturing.

The report indicates that there is a more complete realization that good lighting is doubly valuable where the operations in hand require quickness in recognizing detail. The demands of illumination for static vision, so to speak, are very much less than for dynamic vision. It is this particular fact that has recently compelled revision of many preconceived ideas about the intensities required for manufacturing operations.

Another rather notable tendency much to be commended is toward a better appreciation of the importance of cleanliness. There has been a good deal of study as to the amount of mischief done by dirt in reducing the illumination of working spaces. It is fully understood now that cleanliness is just as essential as the supply of proper lamps and suitable voltage, and there is a marked tendency to make the "luminaires" as unlikely to catch dirt as conditions permit. A good many finishes once common would not now be tolerated on account of the difficulty of cleaning. There is an increasingly strong inclination to use closed-in structures which can be readily dusted off on the exterior and retain a decent interior surface for a considerable period. The subject still deserves a good bit of study, especially in the rather large industrial units hung fairly high and not altogether easy to get at. The efficiency of any installation is a direct result of the care exercised in keeping it clean, and both methods and apparatus are in need of improvement.

Electrical Business Will Benefit from Increased Building Construction





DURING October over $73,000,000 in construction contracts were let for industrial and public buildings exclusive of federal and home building. Of this nearly $63,000,000 represents public building, which is the largest since May, 1920, and nearly three times the value of contracts let in October of the same year. Industrial construction is 50 per cent larger than it was this summer, there being marked activity in contracts of $100,000 and over.

This goes to indicate that a healthy increase in construction work is being maintained and that the electrical business is bound to benefit likewise. As an indication of the extent to which equipment will be required, five buildings which are under construction or have been completed have been picked at random and are shown here. The Sears-Roebuck Building, Philadelphia (A), alone will require about $400,000 worth of electrical equipment. The American Telephone & Telegraph Company's extension (B) will involve at least $1[illegible] worth of light and power equipment, and the Santa Fé shops (C) at Albuquerque, N. M., will take about $40,000 worth. The Federal Reserve Bank, Boston (D), will require over 200,000 ft. of interior wiring, 485 hp. in motors, thirteen elevators, a large electric kitchen for employees' restaurant and an elaborate signal system. French & Hubbard of Boston are consulting engineers for the bank construction, and the electrical work for all of the other buildings mentioned is to be or has been done by L. K. Comstock & Company, New York City.

How Greater Service Develops Public Relations Into Friendship

Detailed Description of the Manner in Which the "Department of Greater Service" Is Operating in Southern California and the Results that It Is Bringing to the Electric Light and Power Company

By S. M. KENNEDY
Vice-president in Charge of Business Development and Public Relations, Southern California Edison Company, Los Angeles

THE Southern California Edison Company through a recently organized "department of greater service" is deepening and broadening public relations throughout its territory into strong and spreading friendship. The story was told by S. M. Kennedy at the recent convention of the Stone & Webster Managers' Association in Boston. So great was the enthusiasm with which Mr. Kennedy's address was received that a second session was devoted in large part to questioning the speaker closely upon many phases of public relations. H. H. Hunt, of Stone & Webster, Inc., introduced Mr. Kennedy as one of the highest authorities in the country upon public relations, a pioneer worker in this field and a past-master in its development. Amid applause, a rising vote of thanks was tendered Mr. Kennedy for his inspiring address.

The Southern California Edison system now has an annual revenue of about $19,000,000, serving twenty-eight geographical districts with a total developed capacity of 425,000 kw. About sixty offices of the company are maintained in the twenty-eight districts. The system peak this year occurred on a forenoon in July and totaled about 240,000 kw. More than 260,000 customers are served. The greatest difficulty at present is to obtain enough meters to supply the new homes under construction. The experience of this company is, therefore, on a large scale, but the problems and policies have had the test of practice in the small communities embraced in this wide territory and thus are generally applicable. The broader principles underlying the need for such a department of greater service were discussed in an earlier paper by Mr. Kennedy published in the ELECTRICAL WORLD May 28, 1921, page 1280.

ON APRIL 1, 1921, a "department of greater service" was established by the Southern California Edison Company, manned by twenty employees specially trained for their new duties. The purpose of this department was to ascertain by personal calls upon customers whether the service is satisfactory, to give information about the relations of the company and its employees, details regarding rates, welfare and development work, and data upon the broader relations of the public and the utility organization. This department has now expanded to forty men who are constantly traveling about in local districts served by the company and are in intimate and friendly touch with all affairs which are of both general and company interest.

In calling upon a customer, the representative of the greater service department notes the mental attitude of the customer toward the company and later records it for a card-index file, classifying him as (a) in accord with the company, (b) indifferent to the company, (c) antagonistic to the company. A white card is filled out and filed at the office if a customer is in accord with the company, and a blue card is used in case of an unfavorable attitude. During these calls, but purely incidentally and not as a part of the security-marketing routine, the representative refers in passing to the customer-ownership department of the company, perhaps inquiring whether the customer has heard of it, and merely bringing it to his attention in a casual way that often leads to further inquiry and ultimate demand for participation in the stock ownership. The representative then leaves a folder and card and departs, the card bearing a statement of the representative's desire to render service at any time to the customer.

The reception that has been given to these representatives shows that the customers are talking about this new department and its work, and often the advent of a representative in a neighborhood is discussed about the dinner-table to such an extent that the way is paved for the visit. A sort of leaven is spreading through the company as a result of this closer contact with the public through the representatives. Employees are showing themselves more ambitious to render good service in local and general territory, and executives are learning much more about the company and its public relations through the reports which the greater service department men bring back. Community interest is being fostered, and the public good will gained is being held like a military objective which has been captured.

The folders which are used by the representatives of the department are four in number, one only being left with a customer after a call. One folder is entitled "The People's Project," another "Twenty-four Hours per Day—8,760 Hours per Year," a third "Edison and Its Partners" and the fourth "Who Is the Edison Company?" These folders in simple language set forth the interest of the public in the development of the company's service through popular stock ownership, the efforts made to insure continuous reliable service, the size and growth of the utility and the distributed ownership of the company. Wherever a customer becomes a stock "prospect" the fact is recorded on a pink card. All cards are sent to the district office of the representative and thence to the main office at Los Angeles for scrutiny, after which they are returned for filing to the district office.

Popular interest in the greater service department has led to the supplying of a desk for each representative at the district office to facilitate calls upon him by appointment. It was originally expected that these men would spend all their time in the field, but requests for appointments have increased sufficiently to warrant some time being assigned in this way. Clerks, meter readers and other employees have become remarkably "keyed up" to more efficient service as a result of the work of this department. The public appreciates it so much that inquiries are frequently received asking why other utilities do not adopt the same plan of meeting the public on its home territory. The department is now well past the experimental stage.

The company makes every effort to go over its territory literally "with a fine-toothed comb" for complaints and leaves no stone unturned to settle these. There was one instance of a barber who was a customer of a predecessor company since purchased by the Edison system and who had been obliged, he said, to pay $20 years ago for a pole involved in connection with his service. No receipt had been made by the earlier company and no record was on the books. The barber was hostile to the Edison company and talked freely against it, and when the greater service department representative arrived on the scene the reason was divulged. The matter was brought to the company office, and instructions were issued to refund the money. The customer was so pleased that he immediately bought two shares of stock in the company and has since been a consistent friend of the utility. In another instance a woman customer was disturbed because her bills for service greatly exceeded those of her neighbors. An inquiry by the greater service department revealed a much larger use of socket appliances in the first woman's home, and this satisfactorily accounted for most of the difference.

The average district on the Edison system has about 10,000 customers, and the greater service representatives make about 600 calls each per month. The plan is to begin anew after making the rounds. The representatives range in age from thirty-five to fifty-five years, and a technical knowledge of the company's business is not required. Before they went into the field they were given a two weeks' training in the general offices, which included talks on the company organization, its finances, welfare work, development plans, and so on. After about thirty days in the field a man "hits his gait." The cost per representative is about $2,500 per year for this service. The men were all new and none were previously known in the districts to which they were assigned. This plan is proving more effective than utilizing "products" of a district in this newer service. These representatives do not handle troubles, their duties being strictly confined to the greater service department.

The Importance of Appearances

After twenty years' experience we have found that the public is observant and that well-kept properties are vitally essential to the best public relations. Decrepit steam plants, broken fences and fractured windows are a poor advertisement for a company selling securities to its local public. To neglect the appearance of substations in residential districts is a great mistake. Weeds and rubbish should not be tolerated. A tidy, clean and inviting property is a decided asset when scrutinized by the citizen or by the investor. Trimmed grass, clear driveways, well-painted buildings —in short, attractive plants and vehicles and well-kept lines—are of real value in public relations.

The appearance of company offices is of immense consequence from the public relations standpoint. People comment on the condition of these, and the policy of removing obstructions between the public and the employees and executives is one to be cultivated to the limit of practicability. We do not agree with advocates of high railings which keep the customer from coming into close touch with the personnel. In all the Edison offices the company has nothing showing above the level of the counter. Railings make the customer feel that he is an outsider. The company is entertaining guests in a very real sense when customers come into its offices, and it should act accordingly. Clerks should keep their desks clean and managers should have their desks placed where they can see all that goes on and be promptly accessible, as are the officers of many modern banks. In business hours the manager should be visible. The office employee has no excuse for standing behind a counter with an unshaven face or slovenly appearance. The public has a right to expect neatness in employees as well as courtesy from them. A company is judged by the men it keeps. Employees who are constitutionally unable to meet the public cheerfully and in a friendly fashion should be transferred behind the front office.

Open-Handed Publicity Will Win Friends

To let the public know what a company is doing and what it proposes to do is most important. Utilities have nothing to conceal and should be proud to show the public every phase of the business. Proper advertising will help. Utilities should make judicious use of paid advertising space in the press and should also, through local officials and others, make friends with the editorial staffs of the dailies and weeklies. The opportunities for a district manager or other official to tell the utility story to the public are sometimes very attractive. Thus a woman's club may ask a manager to address it, or through proper channels such an opportunity may be obtained. The address to the membership should be at least summarized in advance and handed to the press in time to permit insertion if available, instead of waiting for an assigned reporter to write a "story" after the meeting and then very likely have it "killed" because the edition is already overset or so nearly filled with material that only a few lines can be inserted. Editors are becoming more critical, and real news value must be apparent in material sent to them. There are about 140 newspapers published in the territory served by the Southern California Edison Company, and we endeavor to follow this policy with all of them.

Public relations are no less important than the tangible delivery of kilowatt-hours to customers. To many people unfamiliar with utility problems the apparent tossing about of millions of dollars freely in annual reports seemed to signify ill-gotten gains, but a better understanding is coming. Employees must have the right ideas as to public policies, otherwise excellent plans and the best of managerial intentions are dissipated.

Unless the employees are in harmony with the company's ideas as to cultivating friendly relations with the public, little can be accomplished. You cannot overemphasize the importance of adequately training employees along these lines by repeated instructions and meetings to make clear the company's aims and policies. The employee must be brought to the point of being really interested in this work. Employees' clubs on the Edison system are making many helpful suggestions, and greater efficiency is being obtained. Pleasing, agreeable manners in telephone operators, clerks and others are invaluable, and the plan of testing employees over the telephone by outside calls is sometimes advisable. It is not advisable to keep the same employee at a busy complaint window for more than four hours, in view of the strain to which he is subjected. Smoking is not permitted in employees' sections of the company offices during business hours.

In all this public relations work it is better to express the giving of information to the public as "informing the public" rather than to call it "educating the public," as we sometimes have it put.

It is most important that public utility companies, through their officials and employees, deal with their customers as individuals rather than handle them in groups, communities and districts. It is the injection of personality into business that makes friends—the more personality the more friends. If the individuals are recognized and pleased, then the public must be pleased because it is made up of individuals. Under such conditions the problem of public relations becomes solved, and the utility company cannot ask for anything reasonable from the community which will not be granted.

Efficient Record System for Industrial Electrical Department

Pays for Itself by Insuring that Proper Equipment Is Installed and that It Is Operated Economically and Kept in Efficient Condition—Forms Are Shown for Motors, Lamps and Also for Industrial Trucks

By J. ELMER HOUSLEY
Electrical Engineer Aluminum Ore Company, East St. Louis, Ill.

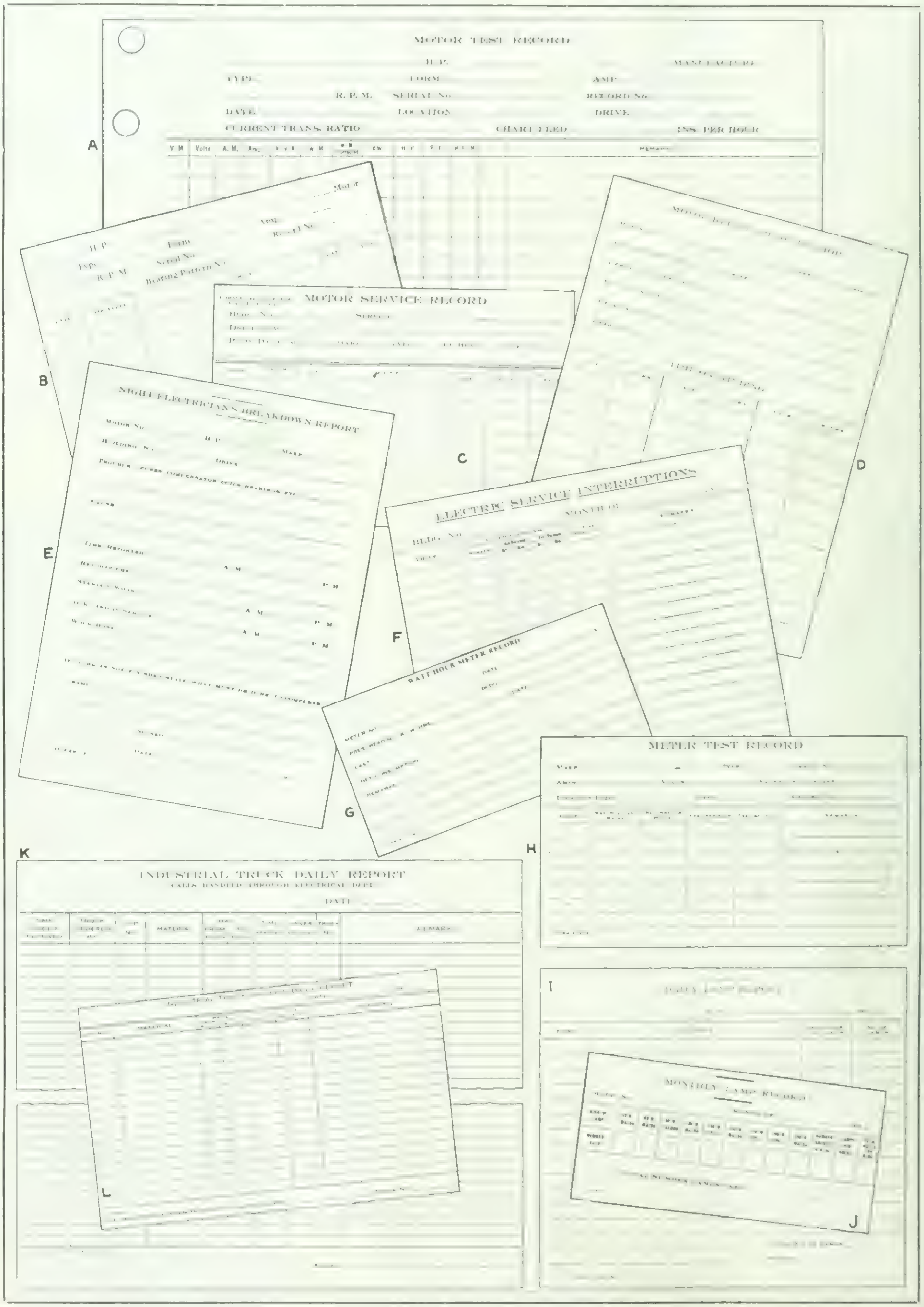
THE heads of the electrical department of a large industrial plant must keep themselves free from a mass of detail work and yet have all facts pertaining to their department instantly accessible. One of the most important details of organization to bring this about is a record system which will leave a history of all that has happened and show the trend toward future conditions. The record system to be adquate should always be such that in the absence of any member of the department no vital information would be inaccessible. The determination of the extent to which the record system should be developed in any plant deserves the most careful consideration of executives of the electrical, accounting, cost, engineering, power and storekeeping departments or of whoever may handle the duties of these departments. Where interchange of data is made between interested departments, the data should be presented either on a form sheet or in mimeographed outline in order that the reports shall contain all essential information and not necessitate further correspondence or consultation between the departments.

The responsibility for the maintenance of the record system with which the writer is familiar has usually been centered in some technical man, as a rule a student just entering the industrial field. The training is in itself valuable to a man just out of college because it quickly gives him a grasp of the extent of the workings of a large electrical department and presents a graphic view of the problems confronting it.

The record system which is described here was developed gradually as the system grew from one employing 10,000 hp. in motors to one having a 25,000-hp. connected load. The service for the most part is twenty-four hours per day all the year around with difficult operating conditions. This would naturally make the number of motor changes during the course of a year run rather high, with a corresponding high mortality among the motor bearings. The first step in the record system is the plant serial number, which is affixed to the motor as it enters the storeroom and is noted on the receiving entry made out by the receiving department. This serial number is also recorded in a loose-leaf book by the electrical department with complete data from the name plate of the motor. Order number and purchase price are recorded in this book and any additional data desired concerning the intended use of the motor and where it should be delivered in the plant or if to be stored for reserve. A form is not used for the loose-leaf book on account of the various types and classes of machines which are received. When slip-ring or direct-current motors are received complete data regarding make, grade and size of the carbon brushes used and the brush rigging are recorded. The essential portion of this record is then transcribed on the "Motor Record Card," which is illustrated at B and shows the data carried by this card. The card is then filed according to horsepower rating. This index is divided into two sections—the "Active Index" and the "Motors-in-Stock Index." The "Active Index" contains all motors which are installed on some job, and the "Motors-in-Stock" are all of those which are in the shop for repairs, the spares which are kept on the shop floor or the motors still held in the storeroom. Space is provided on the card to show the last location of the motor and the date it was placed there. It should be noted here that spare motors under this plan are not charged back into the stores account, since every motor when it is received is charged to a general motor account which covers the entire plant.

An index called the "Motor Service Record" is composed of cards (see C), one of which is made out for each individual or group drive requiring a motor. This index covers information as to class of service—whether it is continuous duty, day or night service, or intermittent duty. Since a large proportion of the drives are on centrifugal pumps, space is provided on the card for data concerning the pump characteristics. A blank line is provided for other data. Space is provided for the date on which each different motor was installed on the

Record System Which Saves Its Cost Many Times


A
B
C
D
E
F
G
H
I
J
K
L

MOTOR TEST RECORD

H.P.
MANUFACTURE
TYPE
FORM
AMP
R.P.M.
SERIAL No.
RECORD No.
DATE
LOCATION
DRIVE
CURRENT TRANS. RATIO
CHART FILED
INS. PER HOUR

V.M.	Volts	A.M.	Amp.	K.V.A.	W.M.		KW	H.P.	P.F.	R.P.M.	REMARKS

H.P.
Form
Type
Serial No.
R.P.M.
Bearing Pattern No.
Amp.
Record No.

MOTOR SERVICE RECORD

NIGHT ELECTRICIAN'S BREAKDOWN REPORT

Motor No.
H.P.
Building No.
Make
Drive
Trouble—Fuses, Compensator, Brushes, Bearings, Etc.
Cause
Time Reported
Received by
Started Work
Work Done
A.M.
P.M.
Signed
Date

ELECTRIC SERVICE INTERRUPTIONS

MONTH OF
BLDG. No.

WATTHOUR METER RECORD

DATE
METER No.
PREV. READING K.W. HRS.
LAST
REMARKS

METER TEST RECORD

INDUSTRIAL TRUCK DAILY REPORT

CALLS HANDLED THROUGH ELECTRICAL DEPT.

DATE

REMARKS

MONTHLY LAMP RECORD

drive, the plant serial number, horsepower and make, and the record of all tests made on each particular drive, giving the date of the test, the average load and the page number of that particular test in the "Motor Test Record" described later. Should detailed information on the test be desired, reference can be quickly made to the page of the "Motor Test Record" book, which gives the complete data covering the test. The recording-meter chart may also be consulted by finding the chart which is numbered to correspond with the page number of the test. These two forms are printed on 4-in. x 6-in. cards.

The former, or "Motor Record Card," has nine spaces and the "Motor Service Record" has eight spaces. When the card is filled it is only necessary to put the filled card in the rear of the file, and a new card is made up with "duplicate" written across the corner. Only in rare instances is it necessary to look up the original card, and consequently it is not necessary to keep the two cards together or to utilize the back of the card.

The "Motor Test Record" (see A) sheets are kept in a loose-leaf binder. The pages are punched for the binder posts and were made 9½ in. x 12 in. in order to give ample room for complete records on any test. When a new page is entered in the back it receives a consecutive number and a numerical list of contents appears at the front of the book. As most of the tests are on induction motors, the form was made out for polyphase meter readings. Space is provided for the original readings taken on the instruments. These readings are always transcribed from a pocket notebook on the day of the test even if the test is not written up that day, in order to eliminate as far as possible any mistake in using meter constants while engrossed in the work connected with making the test. No attempt is made to provide definite spaces for such data as tonnage or volume of materials handled or data concerning the pressures and quantities handled by pumps. All of these data which the test would indicate as necessary are recorded under "Remarks." All tests are made with portable graphic recording wattmeters, and the strip charts from these tests are filed by themselves, each chart being numbered to correspond to the page covering this test in the motor test book. The charts, which are 6 in. wide, are filed in a very convenient method by rolling each chart up tight and fastening the roll at each end with paper clips to a plain 4-in x 6-in. index card. Each card will accommodate five to seven charts and at its top carries the numbers for the charts which are attached to this card. After the rolled chart is filed the chart number is placed on the exposed side of the roll. In this way a large number of bulky charts may be filed in a minimum of space. We have found that it is highly desirable to have these charts easily accessible as it is often advantageous to consult them in order to interpret properly the average figures which are shown in the motor test book and to visualize the load curve where variable loads are encountered.

A large shop force is maintained for the repair and rewinding of the motors coming in from the plant. It is very desirable to maintain complete data as to the amount and nature of repairs as well as on the time required for repairing the various makes of machines, the different departments of the plant and the ability of the different men employed on the repair jobs. This is done on the form illustrated at D. It sometimes develops that a particular type of motor is not at all suitable for certain classes of service in the plant. The selection of the proper motor by the engineering department can often be aided by pertinent data compiled from the shop records of rewinding and repairs as well as from test data compiled from various drives. Data of this kind should not be applied indiscriminately in the choice of new equipment but should be used in the light of personal experience of the men responsible for the repairs.

The form of data covering the rewinding of motors has been particularly valuable in the determination of the proper application of open-slot motors in the 5-hp., 25-cycle size, which is not a standard motor with all manufacturers. Data covering the number of burnouts, the time required for rewinding and the value of various impregnations for the closed-slot type of construction were obtained and demonstrated the poor economy of a motor with slot partly closed for service in the presence of chemicals and excess moisture.

BREAKDOWN REPORTS PERMIT ANALYSIS OF TROUBLES

In order to record properly all electrical breakdowns, a form is furnished which is called the "Electrician's Breakdown Report" (see E). It provides for information covering the motor name-plate data, the building and drive and the kind of trouble encountered, with a statement concerning the time required for the repairs and the time the drive went back into service. Space is provided for mention of any new motors or compensators which may be installed. One of these reports is made out by the shift electrician for each breakdown handled by him. This report is the only clerical work required from workmen, and it is required only from the "trouble-shooters" who handle breakdowns or repair jobs through the plant, because it is much more desirable to keep a high-priced mechanic busy with his tools rather than have him enter the clerical field where less skilled persons can do the work. Such a report as is required should, above all, be accurate as to transfers of equipment, and the men should be held strictly accountable for any errors found in checking reports. From this report are secured the data for changes to the "Motor Record Index" and the "Motor Service Index." As an additional check, each breakdown sheet is checked against the motors which are brought into the shop and those which are taken out of the shop after being tagged "O.K." The form for this "Electrician's Breakdown Report" is printed on sheets 5½ in. x 8 in., which are furnished to the electricians in block form.

Where continuous operation is encountered and it is not possible to provide duplicate drives, it is vitally necessary for the electrical department to have an accurate record of the time during which any particular drive is shut down for electrical repairs, both to clear the responsibility for unnecessary delays and to furnish data concerning reliability of types of motors, systems of oiling or grade of oils and reliability of different types of compensators. This information, taken from the "Electrician's Breakdown Report," is incorporated into a card form called "Electric Service Interruptions" (F). The report is summarized by buildings for each month. Space is provided for data on fourteen drives, and additional cards may be utilized if the space is insufficient. The data noted on the cards give the number of interruptions per drive, the total time the drive was down and the average time the drive was down for each interruption. When desired, the percentage of the time the machine was actually running is shown. Ample space is provided for remarks concerning pertinent information as to causes of the interruption. The causes may be shown as low bearings, coils shorted, coils grounded, coils cut out, compensator failure, etc., and these reasons may be tabulated when investigations of troubles are made or during an unusual run of trouble such as is caused by changing operating conditions, temperature changes or inefficient personnel.

For the benefit of the accounting, cost and power departments a watt-hour meter record card is made out the first of each month covering each meter in the plant (see G). These records on cards are also a valuable aid to the electrical department for use in tracing seasonal or periodic changes in the power demand in various departments. Considerable care should be exercised in planning the power distribution lines with respect to facilities for metering both the present and future power requirements of the various departments. Estimates of power required are never sufficiently accurate, regardless of the methods employed in reaching the estimated figures.

The watt-hour meters throughout the plant are tested regularly and a "Meter Test Card" (H) is made out for each meter upon installation, a new card being made out each time the meter is moved to a new location. Ordinarily the meters are tested about once every year. Should an unexpected variation in reading occur, an immediate investigation is made, and often it is found that a potential fuse has blown.

CAUSES OF LAMP LOSS DETERMINED FROM RECORDS

A large industrial plant will use several thousand dollars' worth of incandescent lamps in the course of a year, and large sums are spent for guards and special fixtures to prevent the unauthorized removal of lamps from the sockets and reflectors about the plant. The ideal method of lighting would be to use large units high enough to be out of reach; but with the many passageways, stairs and galleries in the general run of plant buildings, it is impossible to keep the lamps out of reaching or climbing distance. The various methods taken to prevent the removal of lamps will not be taken up here, but rather the record system which tells what becomes of the 1,500 lamps normally replaced every month. Four lamp washers are responsible for the replacement of missing or broken lamps. Every day they record the lamps replaced on a 6-in. x. 6-in. printed card (I) with thirteen lines, each line providing for the building number, the location or circuit number, the wattage of the lamp used and the number of lamps replaced. For additional record the men are required to put the letter "M" after the number of lamps which are missing, the others replaced being those found with a stub of the bulb or a burned-out bulb remaining. A monthly summary by buildings is made on a printed 2½-in. x 5-in. card which shows the number of lamps of each size used, together with the distinguishing letter as to whether missing or burned out. The total number of lamps used for the month for each building is shown. From these data monthly lamp-consumption curves are prepared and variations are traced down to find whether they are caused by construction work, an unusual amount of repairs or unauthorized removal from the plant by individuals.

A very complete and efficient system to meet the special conditions in this plant was worked out for handling sixteen industrial platform electric trucks, one tractor and four large trailers. The method employed took into consideration that all calls should be handled through the automatic telephone, which makes virtually every building accessible to the truck-dispatching office connected with the garage and electric shop. To schedule the trucks properly it is necessary to have a record of the time the call is received, the time the truck starts and the times the material is delivered. The same is true of the trailers because they will stand idle or keep the loading gangs waiting if not kept on a time schedule for loading, unloading and delivery. The cost of operating each truck is charged to each job number covering the material handled, and the nature and quantity must be known in order to dispatch the proper truck or trailer.

These requirements led to the development of the "Industrial Truck Daily Report" for use of the dispatcher in recording the requests for trucks (see form K). The form is printed on an 8½-in. x 11-in. sheet which has forty-five lines and is furnished in blocks. As may be noted from the illustration, a complete record is obtained which permits of the ready tracing of any material that cannot be found and constitutes a written record in cases of disputes as to the cause of delays in getting a truck to the job. In order to keep a check on each driver and a record of the actual time of delivery, each driver is furnished every day with a printed "Industrial Truck Driver's Daily Report" card (L), 4 in. x 6 in. in size, on which he fills out a line for each delivery made. The card is ruled on both sides with a total space for thirty-three trips, since the average number of deliveries per truck was found to be about twenty-five per day.

Transformer Development Is Recalled by Anniversary

Twenty-five Years Ago 935-Kva., 22,000-Volt Units Operated for First Time on Niagara-Buffalo Transmission Line

By W. S. Moody
Engineer Transformer Department, General Electric Company

A QUARTER century of experience in the development of power transformers, together with certain practical lessons which may be drawn therefrom, is recalled by the celebration this month of the twenty-fifth anniversary of the opening of the transmission line between Niagara Falls and Buffalo. This took place on Nov. 16, 1896, when current from Niagara Falls was first transmitted to operate cars on the Buffalo Street Railway. It marked the complete success of one of the earliest and most important transmission enterprises, which dated from the incorporation of the Niagara Power Company in 1886.

One of the most interesting problems connected with this undertaking involved the building of the transformer equipment.

Such a problem as was then presented—namely, the design of 25-cycle, 935-kva., 2,200/22,000-volt, two-phase-to-three-phase transformers is comparatively elementary today. It is one which might, in fact, safely be assigned to a junior engineer of a few years' practical experience, yet in 1896 it was a serious task and one which was looked upon with certain misgivings.

A review of the state of the art at that time and the manner in which difficulties were overcome holds a lesson not without its practical side for the engineering fraternity today. If, as was the case, engineers were called upon then to build transformer apparatus five times as large as the largest then existing air-cooled units and four times the voltage with which any one had had actual experience—and did it successfully—why should we not look forward with confidence to solving future problems which may present quite as many obstacles?

FIRST TRANSFORMERS IN 1887

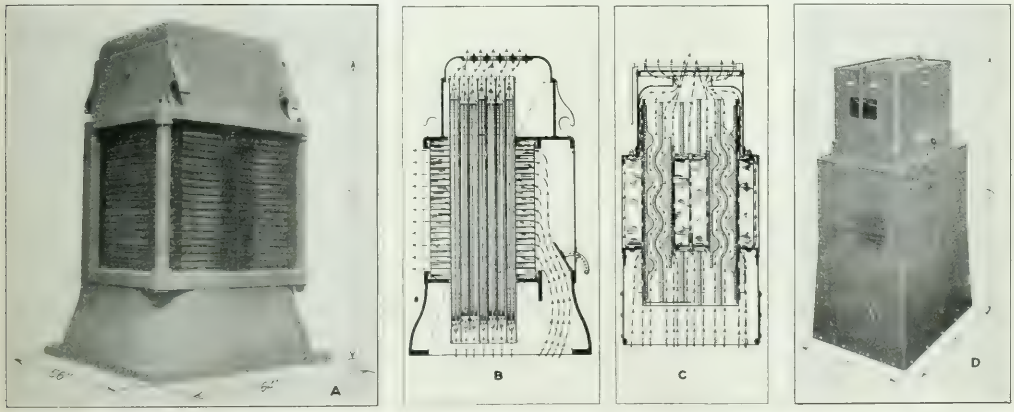
The first static transformers were built commercially in 1887. Five years thereafter the art had progressed only sufficiently to enable 7½-kva., 1,000-volt transformers to be successfully built, and some experienced engineers then made the claim that larger sizes would be impracticable. Three years later, in 1894, however, it was learned how to build successful self-cooled oil-immersed units up to 25 kva. or 30 kva. at 2,000 volts; also air-cooled designs commonly called "natural draft" up to 100 kva. and forced air-cooled units up to 200 kva.

Almost simultaneously with the designing of the 935-kva. Niagara transformers, a limited number of low-voltage oil-immersed transformers running up to 750 kva. in size were constructed, but these were not completed in time to make any real use of the experience in connection with the larger and much higher voltage transformers for the transmission in question. Moreover, oil-immersed transformers in large sizes were then looked upon as experimental, and the possibility of their general use was seriously questioned, because of the supposedly great fire risk involved in such large units if oil-immersed. Both manufacturers and operating engineers looked with distrust at that time on large oil-filled transformers. Experience had not shown how rarely such units would take fire even if internal short circuits should develop. As an outdoor installation was unthought of, the imaginary fire risk seemed prohibitively great.

Consequently, during the two or three years immediately preceding engineers had been called upon to build a large number of transformers cooled by forced air, but they were limited in size to 200 kva. and in voltage to 10,000. None of these had undergone service test when the Niagara units were designed. In these designs the cooling air passed alternately through ducts in the core and ducts between the coils. Therefore no continuous insulation could be placed between the coils and core. Consequently the insulation had to be placed on the individual coils if a reasonable "space factor" was to exist in the winding.

The limitations in voltage set by the earlier construction were foreseen, and a construction was worked out for the 22,000-volt Niagara transformers in which the air ducts in the core and the air ducts between coils were fed from independent air chambers. As shown in Fig. B, the windings could be separated from the core by a continuous housing of insulation of any necessary thickness, because no heat or air has to be transferred through this insulation. With similar insulating barriers between coils or groups of coils, the amount of insulation on the coils could be limited to only that necessary to insulate each turn from the adjacent turn. With such a construction it is unnecessary to carry heat through any considerable amount of insulation before it is delivered to the cooling air.

The Niagara type of construction eventually became standard for all air-blast transformers and has remained so up to the present time, except for the slight modification shown in Fig. C. In this latest construction (made possible by the reduced core losses resulting from the use of improved steel and the improved thermal efficiency that comes from using a construction that does not require the passage of heat from sheet to sheet of the laminated structure) the core ducts are also vertical but still independent of the coil ducts. This construction allows far better space factor in the core than when



EXTERIORS AND CROSS-SECTIONS OF ORIGINAL NIAGARA AIR BLAST TRANSFORMER AND A PRESENT-DAY UNIT

COMPARISON OF MODERN AIR-COOLED TRANSFORMER WITH UNITS INSTALLED TWENTY-FIVE YEARS AGO

	Niagara Units, 1896 Design	Present Practice
Efficiency (per cent)		
Full load	98.20	98.00
Half load	98.90	98.03
Temperature rise, full load (deg. C.)	50	55
Weights (lb.)		
Active material	12,815	7,500
Mechanical parts	6,160	2,240
Total	18,975	9,740
Floor space (in.)	66x64	47x53
Cubical content (cu.in.)	358,000	127,500
Cubic content relative (per cent)	282	100

ducts were parallel to the laminations and separates the iron from all insulation by cool-air ducts. Consequently core temperatures need not be limited to safe insulation temperatures, since modern silicon steel is non-aging.

Unfortunately the first Niagara generators were wound for quarter phase so that the transformers had to be made to transform phases as well as voltage. The early work of Thomson, Scott and Steinmetz had pointed out how this might be done, but little practical experience was available. This part of the problem, however, was so successfully solved as to give the three-phase voltage as perfect balance as necessary under the operating conditions which have existed.

Even at that time it was generally known that primary and secondary coils in a transformer tend to repel each other when carrying load, and that in a unit of this size this force must be considerable at the time of short circuits on the line. However, no one had any definite idea of what these forces were, for no one had even suggested a method by which they might be calculated, and experience was entirely lacking. Fortunately the generators had rather high reactance, and the mechanical layout of the transformer coils and insulation was so substantial that trouble from this source did not become appreciable even later when the total generator capacity at Niagara became very large.

A comparison of operating data, weights, etc., of these transformers and up-to-date design for the same service is here given to show that while great progress has been made in the intervening twenty-five years, yet the old designs were, taken by and large, remarkably good.

Standard Pipe and Fittings for Outdoor Switching Frames

Found More Convenient to Keep in Stock and Transport—Do Not Require Special Labor for Assembly—Can Be Quickly Erected and Stand Service Better than Wood Frames

By L. J. MOORE

Electrical Engineer San Joaquin Light & Power Corporation

STRUCTURAL steel and wood poles are still used and will probably always be required in many cases for high-tension switching frameworks, but the San Joaquin Light & Power Corporation has found that pipe frameworks are very desirable for outdoor structures under some conditions. For example, in the cases where they have been used they have been found cheaper to install than either structural-steel or wood-pole frames. Being convenient to keep in stock, the pipe, fittings, clamps, etc., are always readily available and can be easily transported. It does not require special labor to assemble the parts. The work can be easily done in the field, and the speed of erection is greater than for frameworks of other material.

Outdoor transfer buses have been used for the outgoing feeders of all 11,000-volt substations of the San Joaquin Light & Power Corporation for a considerable time. The feeder switches and main buses are installed inside the buildings at these substations, together with disconnecting switches between the oil switches and the 11,000-volt bus. The disconnecting switches on the line side of the feeder switches, however, are installed outside on the transfer-bus structure. The transfer bus is tapped to the outgoing lines through a set of disconnecting switches for each line, connection being made just outside of the line "disconnects," which are between the line and the oil switch. This connection is shown by the one-line diagram at the left and middle of the accompanying drawing. This transfer bus is very useful in allowing two or more line circuits to be carried through one oil switch, thus making it readily possible to make repairs to oil switches, current transformers and other apparatus without interruption to service. Furthermore, automatic protection is still kept on all circuits, but of course one switch will control two circuits for the time being, instead of one. As the

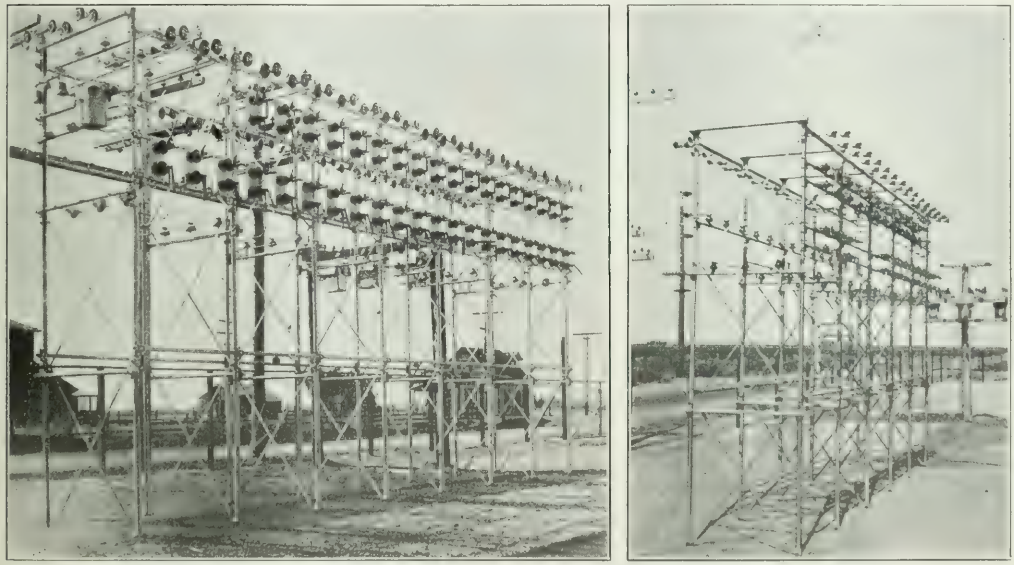
LIST OF MATERIAL FOR PIPE-FRAME OUTDOOR TRANSFER-BUS STRUCTURE

This is [illegible]

[illegible] former Addition	[illegible] Structure	[illegible]
2 [illegible]	2 pieces	[illegible]
	2 pieces	2-in. galvanized wrought-iron pipe, 16 ft 8 in. long, threads one end
	2 pieces	[illegible]
	[illegible]	2-in. x 2-in. x ½-in. extra-heavy pipe T's.
	2 pieces	2-in. galvanized wrought-iron pipe, 20 ft 6 in. long
[illegible]	[illegible]	[illegible]
[illegible]	7 pieces	[illegible]
[illegible]	10 pieces	[illegible]
[illegible]	[illegible]	Wrought-iron bar ¼x1¼ in., 7 ft. 3 in. long
[illegible]	[illegible]	Wrought-iron bar ¼x1¼-in., 7 ft. 6 in. long
2 pieces		Wrought-iron bar, ¼x1¼-in., 7 ft. 9 in. long
8	40	[illegible]
4	20	[illegible]
[illegible]	55	[illegible]
[illegible]		[illegible]
[illegible]		[illegible]
[illegible]	65 in.	[illegible]
8	40	Machine bolts, [illegible] in.
[illegible]		[illegible]
3 pieces	[illegible]	[illegible]
[illegible]	20 pieces	⅝-in. sq. bars, 6 ft. 3 in. long
2 pieces	10 pieces	2x2x¼-in. angle, 2 ft. 0 in. long
[illegible]	[illegible]	[illegible]
	2	[illegible]
	2 pieces	[illegible]
	2 pieces	[illegible]
	2 pieces	[illegible]
	2 pieces	[illegible]
Wiring [illegible]		
[illegible]	2	[illegible]
3	6	LG-seven disconnecting switch pipe mounting
	52 ft	[illegible]
[illegible]		[illegible]
	[illegible]	[illegible]
	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

transfer bus and line disconnecting switches are installed outdoors, it is possible to clean or change entrance bushings when necessary.

The first structures were made of wood, but on account of the difficulty of keeping parts lined up and of keeping the structure from loosening after seasoning such construction has been abandoned. The next step was to use structural steel, and two racks of that construction were made. These were satisfactory except for the fact that in the design too great a height was allowed and it was difficult to operate the "disconnects," especially at night. This problem was solved by providing a raised walkway. Another difficulty was that such a rack usually had to be purchased from a structural-steel shop and slow deliveries might interfere with construction. The pipe frame in the upper part of the drawing was then finally evolved.

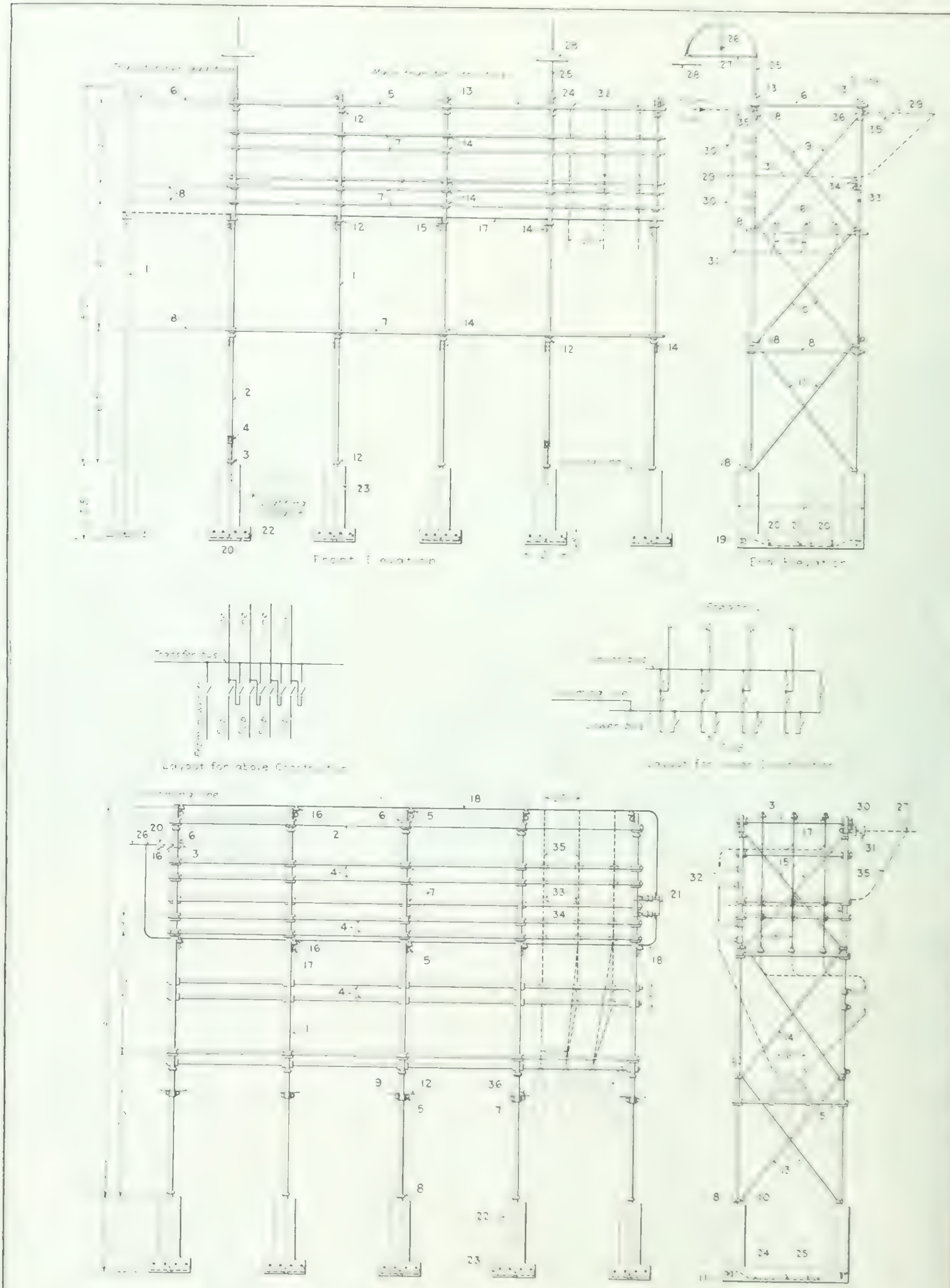

PIPE AND STANDARD FITTINGS MAKE SATISFACTORY STRUCTURES FOR SWITCHING APPARATUS

This is made entirely of standard galvanized pipe connected together with standard clamp-type switchboard fittings. The parts are carried in stock at all times, and a rack can be made up at once to suit any requirement. The cost worked out somewhat less than that for the structural-steel rack. The accompanying table shows the complete bill of material. The structure is designed to stand the pull of three No. 2 copper wires per section for a span of 40 ft. (12 m.) on one side only, and the number of sections or circuits can be increased indefinitely. The fact that there are wires dead-ended to both sides relieves the mechanical stresses until they are practically negligible. A cement-color gray paint is used on all parts, and a very pleasing appearance results. As all switches of one phase are between two of the upright pipes, they provide a safe guide in preventing the operator from opening or closing the wrong disconnecting switches. These pipes can be painted a distinctive color if desired.

The question of suitable lighting so that the switches could be easily operated at night was given consideration. The final result as shown by the drawing is to carry the lighting circuit underground through conduit from the lighting panel inside the building to two or more upright pipes in the structure. Conduit goosenecks are mounted on the top of the upright 2-in. (5-cm.) pipes as shown, and the wires are brought up through the pipes. The result is quite satisfactory, but in a few cases flood lamps have been provided on the substation building, and so placed as to project on the rack.

Many modifications of this transfer rack readily suggest themselves. One which is being used by this company is shown in the lower half of the drawing. In this case a heavy 11,000-volt feeder is being brought to a center of distribution and there broken up into a number of branches. It was desired to protect the branches by automatic switches, which will very likely be made reclosing by some electrical or mechanical device. A second bus and "disconnects" corresponding to the indoor ones in the usual substation were added to the pipe rack, and outdoor-type oil switches were located as shown in the drawing. Such an arrangement could readily take the place of a building entirely at a transformer station, all feeder and disconnecting switches being placed on it and an outdoor metering outfit being installed on the incoming lines, which in that case would be the secondary leads from the transformers.

The San Joaquin Light & Power Corporation has not generally adopted a plan for placing all feeder and metering equipment outdoors, but uses that scheme in isolated cases only. The saving, if any, is small, while the benefits derived from having a small building for housing small equipment are great enough to make it a good investment. Some sort of building would be necessary in any case to house telephone equipment, switching sticks, records, etc., and to provide a place for the operator to stay in case of bad weather, during



CONSTRUCTION OF PIPE FRAMES FOR 11,000-VOLT TRANSFER BUSES

Top: Frame for transfer bus as shown in one-line diagram at left. Bottom: Outdoor distribution frame. Receives energy from an 11,000-volt incoming line and distributes over several feeders as shown in one-line diagram at right. Outdoor oil circuit breakers are employed. A transfer bus also is mounted on the same frame.

MATERIAL REQUIRED FOR OUTDOOR SUBSTATION MADE OF PIPES

This is the four-circuit structure shown in the lower part of the drawing accompanying this article

Quantity	Material
10 pieces	2-in. galvanized wrought-iron pipe, 22 ft. 6 in. long.
2 pieces	2-in. galvanized wrought-iron pipe, 24 ft. 6 in. long.
1 piece	2-in. galvanized wrought-iron pipe, 5 ft. 6 in. long.
9 pieces	$1\frac{1}{4}$-in. galvanized wrought-iron, 24 ft. 6 in. long.
22 pieces	$1\frac{1}{4}$-in. galvanized wrought-iron pipe, 5 ft. 6 in. long
12 pieces	E.E.E. U-bolt clamp cross, No. 5190
89 pieces	E.E.E. U-bolt clamp cross, No. 5189
40 pieces	E.E.E. clamp T clevis, No. 5147.
20 pieces	$\frac{3}{8}$x4 in. machine bolts.
40 pieces	$\frac{1}{2}$x$1\frac{1}{2}$ in. machine bolts.
10 pieces	$\frac{5}{8}$x$3\frac{1}{2}$ in. machine bolts.
10 pieces	$\frac{1}{2}$-in. plate, 3x15 in.
10 pieces	Wrought-iron bar, $\frac{1}{4}$x$1\frac{1}{4}$ in., 7 ft. 9 in. long.
10 pieces	Wrought-iron bar, $\frac{1}{4}$x$1\frac{1}{4}$ in., 7 ft. 11 in. long.
10 pieces	Wrought-iron bar, $\frac{1}{4}$x$1\frac{1}{4}$ in., 7 ft. 2 in. long.
30 pieces	Locke insulator, No. 6512.
30 pieces	E.E.E. insulator pin, No. 4001.
185 ft.	$\frac{3}{4}$-in. copper tubing, standard pipe size.
3 ft.	Hook bolts, $\frac{5}{8}$x4 in.
6	Thomas insulators, No. 1056.
3	G.E. L-G-7 disconnecting switch pipe mounting.
5	Concrete base, $\frac{1}{2}$ cu.yd. each.
10 pieces	2x2x$\frac{1}{4}$ in. Ls., 2 ft. 0 in. long.
15 pieces	$\frac{1}{2}$-in. sq. bars, 2 ft. 0 in. long.
20 pieces	$\frac{1}{2}$-in. sq. bars, 6 ft. 3 in. long.
3	Dossert connectors.
Wiring material for each feeder circuit:	
3	Hook bolts, $\frac{5}{8}$x4 in.
6	Thomas insulators, No. 1056.
9	G.E. L-G-7 disconnecting-switch pipe mounting.
3	Locke insulators, No. 6512.
3	E.E.E. insulators pins, No. 4001.
110 ft.	$\frac{1}{4}$ in. copper tubing, standard pipe size.
4	$\frac{1}{2}$x$1\frac{1}{2}$-in. machine bolts.
9	Dossert connectors.

which time most distribution trouble is likely to occur. Then, too, feeder switches require more adjustment and maintenance than any others, and a shelter is necessary for such work.

Prices on parts have not been given because these are continually changing. Any one who desires can obtain current prices and make up an estimate for any condition desired from the bill of material.

Industrial Standardization in Germany

Significance of the Movement for Mechanical Uniformity that Is Part of Reconstruction Program—Continental and Anglo-Saxon Methods

INSUFFICIENT attention has been given to the rôle which standardization is playing in German industrial reconstruction. The American Engineering Standards Committee states that the German industries are planning and are carrying out a far-reaching program of standardization as a necessary step in building up an unprecedented industrial structure which must rest in large measure on an extensive foreign trade. According to this committee, in no other country except Great Britain is standardization work being carried on upon a scale or with an intensity comparable to that in Germany.

The American Engineering Standards Committee feels that the German work should be of special interest to those responsible for the management of American industries, not only because of its importance, but also because of the similarity in the historical conditions surrounding the national standardization movements in Germany and in America. Accordingly it has issued monographs on the subject.

Prior to 1917 a vast amount of standardization work had been carried out in Germany by individual companies and by engineering societies and industrial associations, but, as was the case in America before the organization of the American Engineering Standards Committee, the work had not been unified along national lines.

As has been the case with all the other national standardizing bodies except the British, which was organized in 1901, the success of the standardization work carried out by the various countries during the World War as a part of their national conservation programs was a chief cause of the formation of the central German body. It is called the Normenausschuss der Deutschen Industrie and was organized by the Verein Deutscher Ingenieure, at the suggestion of the German government, in 1917. The present membership consists of engineering societies, industrial associations and government ministries, and in addition there are 700 firms that are contributing members. The work of the Normenausschuss deals only with those subjects which concern two or more industries or branches of industries.

It is remarkable that the national standardization movement in Germany should have been so thoroughly organized and that so much work should have been accomplished in four years. One hundred and forty-four approved standards sheets have been issued and more than 500 others have been so far developed that they have been published in tentative form. The standards are issued under the general designation of German Industrial Standards (Deutsche Industrie Normen, usually contracted to "Dinorm"). The Germans were the first of the national bodies to publish standards in loose-leaf form. The work is so divided as to make each sheet as nearly independent as possible. Firms purchase these sheets in quantity, issuing them directly to designers, draftsmen and foremen for use as working drawings and data sheets. (This plan is now followed by the Austrian, Dutch, Swedish and Swiss bodies.) The sale of sheets amounts to about 100,000 monthly.

ORGANIZATION AND METHODS OF WORK

The organization and methods of work are similar to those in other countries. Next to the American Engineering Standards Committee, the German organization is the most decentralized of the national standardizing bodies. There is a main committee composed of representatives of the various national organizations supporting the movement, as well as a smaller executive committee. The detailed technical work of each project is in the hands of a working committee, which in Anglo-Saxon countries would be called a "sectional committee"; that is, a committee made up of representatives of all bodies interested in the particular subject in hand.

Proposals for new subjects for standardization must come from some responsible body. The industry concerned is consulted, generally by a conference of the various organizations interested, to determine whether it is the consensus of opinion that the work should go forward. In case it is decided to undertake the work, the conference designates the chairman of the working committee.

The central office digests the information available on the subject for the use of the working committee. When agreement is reached in the committee on the draft of a standard it goes to the central office for editorial work. There it is scrutinized to see whether it is consistent with other standards, whether points have been included which concern other working committees, whether the drawings and nomenclature are in approved form, etc. After this editorial checking the central office has the draft of the standard put into proof form. It is then reviewed by an official clearing house committee, which contains a representative from each major line of work being carried on by working committees. If any change in substance has been made, it goes back to the working committee. If no such change has been made, it is published in the *Mitteilungen*, the official publication of the Normenausschuss, as a tentative proposal. Upon recommendation of the working committee, the standard is mailed to the members of the executive committee with a supporting statement. With their approval it is then republished as an official proposal. Six weeks are allowed for criticism when a standard is finally published unless additional important criticisms are received.

Work in Special Industries

The foregoing refers to the work of the central body only, which is limited to subjects common to two or more industries. In addition there are some fifteen organizations known as special industry committees, each of which deals with the standardization work peculiar to a single industry, such as shipbuilding, electrical, agricultural, automotive, elevator, locomotive, paper, textile and woodworking.

These committees are closely affiliated with but are not strictly an organic part of the central body. They are organized not by the Normenausschuss, but by one or more technical or trade associations concerned with the particular subject in hand. Standards formulated by the special industry committees are published by the organization responsible. In most cases the final standards are published in loose-leaf form modeled closely after that of the standards issued by the Normenausschuss itself. These standards are submitted to the Normenausschuss before publication, in order to keep them consistent with the regular series of German industrial standards.

The volume of work being carried out through these special industry committees appears to be at least as great as that under the direct control of the central body.

Looked at broadly and with exceptions such as must always be made in general statements of the kind, the Continental countries are going much further into dimensional standardization than has been done in Anglo-Saxon countries. This includes interchangeability of supplies and of machine elements, the interworking of parts and of related apparatus made by different makers, and the interchangeability, so far as the use is concerned, of complete machines and apparatus. By far the greater part of the work of the Normenausschuss is dimensional, greater attention being paid to such matters as machine elements, screw heads, bolts and nuts, standard diameters and systems of limit gaging. The Anglo-Saxon mind takes more to matters having to do with purchase and contract, such as specifications for materials and for performance of apparatus, methods of test, etc. The Normenausschuss itself has done very little of this type of work as yet, but it has been highly developed by some of the German special industry committees, for example, in the electrical industry.

There is on the Continent a greater dependence upon theoretical and fundamental considerations, the Anglo-Saxon temperament giving rise to a much larger degree of expediency in adjusting commercial considerations in the process of arriving at agreements.

German manufacturers will go farther in yielding apparent temporary commercial advantages for the sake of advancing their national industry as a whole than is the case in America or Great Britain. Three principal reasons for this are the great economic pressure under which German industry is laboring, the mental trait of more readily acquiescing in decisions affecting national welfare, and the belief that an essential to the rehabilitation of German industry is the rebuilding and great enlargement of their export trade, for which the importance of standardization on national lines is more readily apparent than it is in domestic trade.

The Germans have not yet had their standards translated into foreign languages for use in export, as the British are doing, but they are considering doing so.

As typical examples of the German work, their system of "preferred numbers" and their standard series of handles may be mentioned. The first is a fundamental piece of work, founded on theoretical considerations and of the first importance. It is a simple system of numbers for use in all new standardization work, in which gradated numerical values are required, such as standard gradated diameters of pulleys, thicknesses of plates or capacities of machines. The Germans believe that its use is going to lead to great economies in material, in reducing the number of sizes, ranges, etc., to simplify the carrying of stocks and to facilitate interchangeability. It may be shown theoretically that, under average conditions, a given number of standard sizes laid out according to these numbers will be better fitted to any series of jobs taken at random than would be the same number of sizes laid out in any other way, and this with a minimum of material.

The standard handles furnish a typical example of German love of thoroughness of detail. There are two shapes, each adapted to a particular method of use, and there is a series of sizes for each shape. The profiles have been worked out with the most extreme care, an efficiency engineer having been employed to make time-motion studies to determine the exact profile that would insure the greatest accuracy in operation with the minimum fatigue of the workman's hand. It is felt that by doing a thorough job once for all different industries and firms will be saved from doing the same thing over and over, but always less well, and that at the same time interchangeability is introduced.

Industrial Significance

The standardization movement in Germany is particularly significant since Germany is one of the three leading industrial countries. The industries of Austria, Holland, Sweden and Switzerland are so intimately related to those of Germany on account of geographical and other relationships that they are necessarily affected very largely by developments in Germany.

It appears that the work is being woven very intimately into the industrial fabric. The very large number of standards purchased by the industry and the fact that the central organization has 5,000 firms which are co-operating members are a sufficient indication of this. There seems to be a striking analogy between the present standardization movement in Germany and the research movement developed there a generation ago. Whatever estimate one may place upon the rôle it played in German industries generally, every one agrees that research was fundamental in the development of the great German chemical industries. The rôle which the Germans are expecting standardization to play in all their industries would be not unlike the rôle which research has played in their chemical work.

Letters from Our Readers

This is a readers' forum. Comments on questions before the electrical industry presenting economic, financial, engineering or commercial aspects and new or supplementary viewpoints on published articles are cordially invited

Explaining the Kilowatt-Hour

To the Editors of the ELECTRICAL WORLD:

The writer was very much interested in reading your editorial comment of Sept. 24 entitled "Put the Kilowatt-hour in Its Place." In a recent talk before the Purchasing Agents' Association of Northern California he had the following to say about the kilowatt-hour:

> There are very few commodities which the average man pays for that he knows so little about as he does about the kilowatt-hour, and yet there is no commodity of any nature that he buys that is so definite in character as the kilowatt-hour.
>
> The early inventors of the steam engine turned to things familiar in their selection of a unit of power, and by actual experiment they determined the amount of work done by the English dray horses of that period and called the average amount of work done by one of these animals a horsepower. Unfortunately, the kilowatt-hour does not visualize for us such a concrete picture of power, but when we consider that a kilowatt-hour is 1⅓ horsepower it will bring before us a mental picture of what we are buying. The horsepower is defined as the amount of work which is done in lifting a weight of 33,000 lb. through a distance of one foot in one minute. The kilowatt is, therefore, the amount of work done in lifting a weight of 44,000 lb. through one foot in one minute, or the work done in lifting 440 lb. through a height of a hundred feet in one minute.
>
> Now, if we put the kilowatt to work for one hour instead of one minute, it will have the power to lift 26,400 lb. to a height of 100 ft. If we allow a 25 per cent loss in the motor and the elevating machinery, the kilowatt-hour still has sufficient power actually to hoist 200 100-lb. sacks of flour from the basement to the eighth floor of a flour mill or to lift 2,800 50-lb. lugs of fruit from the first to the second floor of a warehouse.
>
> And now, gentlemen, when you stop and consider that your respective companies pay about 1½ cents for the kilowatt-hour we have just been talking about, I claim that they are getting something for their money.
>
> Your Mr. Gray's company at Crockett handles 1,200 tons of raw sugar in and 1,000 tons of refined sugar out every twenty-four hours on a belt conveyor 700 ft. in length extending between its mill and its warehouse. The actual energy used by this belt costs his company about $4.80 per day. I have figured out that it would take about ten 3-ton trucks working two ten-hour shifts to do the same work, and instead of costing this sugar company $4.80 per day it would cost it at least $600.

The writer feels that it would be a very difficult thing, and perhaps an injudicious thing, to attempt to change the rate schedule from the point of view of eliminating the kilowatt-hour, because the kilowatt-hour is now basically interwoven with other units in the complex fabric of the electrical industry as a whole. He therefore suggests that, instead of attempting to eliminate the kilowatt-hour, the whole industry unite to interpret the kilowatt-hour to the purchaser by means of such simple illustrations as the one shown in the above quotation. This can be done both through the medium of public talks to representative bodies in the industrial organizations and through the wider medium of the press.

The writer has found from his own experience that entirely too much stress is laid upon the mysterious phases of electricity by men within the industry, and they have failed to convey the simple truth to the purchaser that, as far as electricity is concerned, it is one of the most simple and dependable forms of energy.

L. F. LEUREY,
Practicing Engineer.

San Francisco, Cal.

All Reserve Funds Should Be Reinvested in Property

To the Editors of the ELECTRICAL WORLD:

Your editorial of Oct. 8, "Injustice of Large Cash Depreciation Funds," emphasizes the need for a clearer understanding of the principles involved in accounting for replacements due to depreciation of parts of a public utility property.

Each unit or item of physical property eventually reaches a point where owing to decay, wear, obsolescence or inadequacy it is no longer useful and must be abandoned or replaced. Each such item represents a certain investment which must be accounted for when the unit is abandoned. These facts were recognized in the beginning of rate regulation, and commissions and courts have included an allowance for "replacement" or "depreciation annuity" as an operating expense item in almost all rate-making decisions. It is the almost universal practice to base these annuities on assumed average lives for various classes of equipment. The tendency is to overestimate rather than to underestimate these average lives. This is due to the fact that improvements in design or changes on account of growth make it economy to abandon most items of equipment long before they are worn out in service. A very typical case is that of one of the smaller electric companies which since its beginning in 1890 has abandoned in order a direct-current system, a single-phase system, an installation of engine-driven polyphase generators and one of turbo-generators and is now operating machines which could be junked with economy except that they are used only for peak-load service.

The workings of a practical replacement reserve account in use by one utility is as follows: Average lives are assigned to classes of items corresponding as far as possible with the classification of accounts, and an annuity based on these lives with compound interest is set up for each group. A charge is made to operating expense and a credit to the fund at the end of each year. All items of property abandoned or replaced are charged to the fund and credited to capital. All new items, whether replacing others or not, are charged to capital at actual cost. The reserve is not held in cash but used for mortgage sinking funds to repurchase bonds of the company and for extensions and additions to property.

The total reserve fund at any time, if properly calculated, represents the progress of the total investment toward extinction due to the decay, wear and tear, and obsolescence of the items of physical property which represent it. In other words, it is the total amount which the utility should have earned, on account of depreciation, to maintain the investment intact.

Such reserves properly accounted for have two very important uses—first, to enable regulatory authorities to allow utilities to earn sufficient to maintain their investment intact in addition to earning a return; second, to insure that the allowance for this purpose is used to retire securities or extend the system. In other words, it remains in the business and is not paid out to present stockholders at the expense of future stockholders.

The failure of many utilities to earn fixed charges today is due to the fact that they did not or could not in earlier years maintain their investment by means of replacement funds.

A large utility which has ceased to grow and has come to the limit of improvement will eventually reach a stage where the annual total of abandoned and replaced property will be quite uniform. However, with utilities where growth and improvement is as rapid as it is with our electric utilities today, any attempt to base the annuities on current replacement experience is bound to result in allowances very much under what the companies are entitled to if their investment is to be maintained out of earnings, as it must be if they are to remain prosperous.

It should not be difficult to safeguard the reserve to the satisfaction of the commission without maintaining it in cash. In these days of difficult and costly borrowing coupled with large expansion requirements, all reserve or other excess funds not liable to sudden call should be reinvested in the property, and this is particularly true of depreciation or replacement reserves whose sole final purpose is to maintain the investment made by the owners. G. R. Kenny.

East Orange, N. J.

Electrically Heated Steam Boilers Prove Successful in Sweden

To the Editors of the Electrical World:

Although an electrically heated steam boiler appears at first sight to be economically an utterly hopeless proposition, nevertheless, in places where there is access to what may be termed "spillway power" from hydro-electric stations, and even in certain other cases, the electric steam boiler may be used to good advantage, as is shown by several successful experiments reported from Sweden.

The most important electric boiler plant in Sweden was put in operation last year at the pulp and paper mills at Vargön. This plant consists of steam boilers, each of 3,000 hp., which are fed at 10,000 volts directly. The Vargön mills are thoroughly electrified and are supplied from the hydro-electric station at Trollhättan. The steam from the electric boilers is used for various heating processes, and economically the electrification of the boilers was made possible by the Trollhättan plant being able to give up considerable amounts of night and off-peak energy at reduced rates.

In another category come plants where electric heating is used to keep steam boilers in preparedness for emergencies. In the municipal power station at Jönköping, for instance, the old steam-electric generating plant is maintained as a stand-by, while normally the power demand of the city is cared for by a hydraulic station at Huskvarna. Two of the boilers, however, have been provided with resistance heaters, and during seasons of frequent disturbance are continually kept under full steam pressure, ready to take up full load in a few minutes. The boilers being well insulated thermally, the energy loss is rather insignificant.

An auxiliary electric steam boiler used for somewhat different purposes has been in operation for a few years in the state steam-electric power plant at Västerås, Sweden, and has proved to be an economical success, it being estimated that every kilowatt-hour put into the boiler serves about 3 öre—or more than half a cent—in fuel, while the power cost is considerably less. The boiler is designed by N. Forssblad and built for 1,000 kw. and a steam pressure of 15 kg. per sq.cm. (213 lb. per sq.in.), the power being applied at 6,300 volts, directly in the water. The boiler has three tight bushings, insulating for this voltage, and the power may be regulated in the ratio of one to two by simply turning a handwheel. The Västerås plant is a reserve and peak station connected to the state power system in middle Sweden, but the station during a great part of the year is used almost exclusively as a synchronous-condenser plant for voltage regulation. During this period much time and money is saved by using the Forssblad boiler to generate the steam needed for "cooling of the turbines." Steam from this boiler also is used for various other purposes, tests, etc., and during the stormy season one of the ordinary boilers is kept in preparedness by a so-called silent boiler placed at its lowest point and fed by steam from the electric boiler. Oil burners are installed in the boiler, which is thus preheated, and it is therefore capable of picking up full load almost instantaneously.

Among central-station men electrically heated steam boilers are rather popular owing to their good power factor and load factor. It is probable that the electrically heated steam boiler, in connection with the Ruuths vapor accumulator, will be of importance in providing a simple means of utilizing "spillway power" by storing the energy during the night for use next day.

Stockholm, Sweden. Edy Velander.

Electric Heat Used in Boiling Linseed Oil

To the Editors of the Electrical World:

Difficulties, disastrous fires and explosions have occurred in many cases when boiling linseed oil, especially when it is used for the production of linoleums and oilcloth. The engineers of our company have completed both the installation and the test of a new boiling method using electric heat. This process, besides doing away with the distinct disadvantages of the old method, has made possible complete heat and chemical control over the very wide range of temperatures involved.

This installation was made at the works of the Armstrong Cork Company, linoleum section, Lancaster, Pa. It is of considerable size, having a connected load of 75 kw. and handling batches of 2 tons of material at each heat. In approaching the problem it was necessary to consider the inherent characteristics of linseed oil to build up heat within itself during the oxidation period, as well as the fact that viscosity changes materially within a very low degree Fahrenheit range, making definite and exacting control obligatory. The heating method applied is indirect, and therefore the temperature of the ribbon is considerably higher than that desired in the oil. This necessitated the installation of a special cooling system to reduce the exterior heat to the normal oil requirement when stopping the furnace to hold for processing.

General Electric heating units and Leed & Northrup control are used, while the main furnace body and appliances for operation were constructed at the Lancaster Iron Works, which are associated with our company.

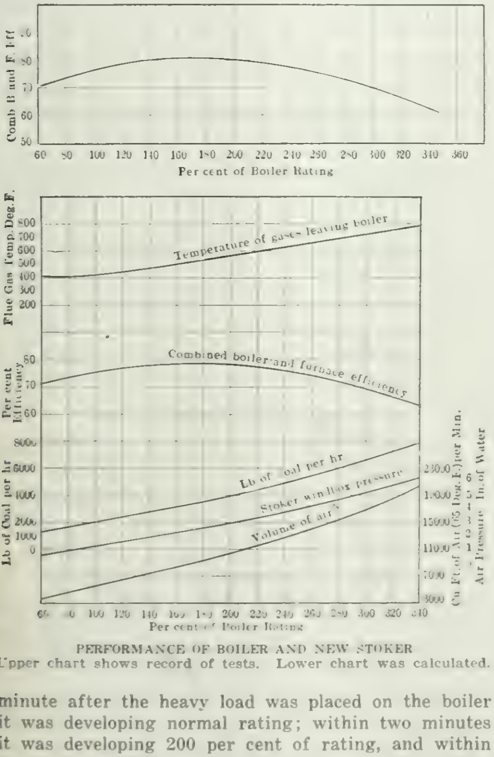
F. J. Ryan & Company, F. J. Ryan,
Philadelphia, Pa. President.

Industrial and Station Practice

Installation, Operation and Maintenance of
Generating and Distribution Equipment and Economical Utilization of Electrical Energy
in Mills and Factories, Including Testing and Repair Methods

Test Shows Flexibility of New Stokers

FLEXIBILITY of a new stoker operating at a range of 60 per cent to 350 per cent of normal boiler rating is shown by the accompanying curves plotted from a test performance. The test was made on a 6,000-sq.ft. water-tube boiler on which the fire had been banked previously for four hours, with the boiler developing only about 10 per cent of normal rating. Within one minute after the heavy load was placed on the boiler it was developing normal rating; within two minutes it was developing 200 per cent of rating, and within four minutes 300 per cent. Two types of this furnace are made. One of these, a single-retort, side-cleaning stoker, is intended for boilers up to 3,000 sq.ft. or 4,000 sq.ft. of heating surface; the other is of the multiple-retort end-cleaning type for larger installations. Among the principal features may be noted a level fuel bed, adjustable rams, auxiliary pushers with independent adjustment, hand-operated end dump, adjustable air intake under the stoker, and adjustable air admission over the fuel bed through ports in the front wall.



PERFORMANCE OF BOILER AND NEW STOKER
Upper chart shows record of tests. Lower chart was calculated.

Retorts and tuyères have been designed to operate at comparatively low air pressures and have been arranged to minimize clinker formation. The air admitted through the tuyères is forced through the fuel bed at right angles to the retorts so that the major portion of the fly ash and soot is kept in the stoker furnace chamber and not deposited in the front bank of boiler tubes. Side-wall tuyères extend above the retorts and protect the brickwork from the clinker formation.

EDWIN FITTS.

Detroit Stoker Company,
Detroit, Mich.

Every Accident Teaches a Lesson

SOME practical lessons in the design and operation of hydro-electric plants should be gleaned from the observations which were made during and following a recent penstock accident where the plant involved operated under a 680-ft. head. The penstock had been subjected to both shop and field tests. At the time of the accident the plant was being subjected to a preliminary try-out, operating without any forebay or surge chamber. Construction of that feature had not been completed, and a bypass or temporary direct connection was being used between the supply tunnel and the 2,800-ft. penstock which fed the plant. This bypass consisted of 150 ft. of pipe having only three-quarters the diameter of the penstock supplied and unfortunately was connected with it at a point not much below the hydraulic grade line. The upper part of the penstock, which was 8 ft. in diameter, contained a 6-in. air vent.

As nearly as the facts can be established from data now available, a short circuit occurred just before the accident, causing a big withdrawal of water from the penstock and apparently breaking the water column below the construction formed by the temporary forebay bypass. Upon clearance of the short circuit the gates closed, retaining what water remained in the penstock as a solid front to the trailing water column. Although there are no data to indicate the force of the impact with which the two columns of water met, it is quite easy to imagine that the trailing column of water must have acquired an enormous momentum in rushing almost unrestrained through the long penstock. At any rate, the weakest part of the penstock in the vicinity of the impact, namely, a cast-iron manhole frame about 200 ft. above the power house, failed, starting a circumferential and longitudinal rip in the penstock itself. Although there were welded seams, they did not fail, which is excellent testimony to their strength.

In general, the following conclusions might be made: Before subjecting a new plant to a try-out it should be protected by all the safeguards that it will have in finished form. In this case the safeguard which was lacking was the forebay. Its absence was accentuated by the bypass which had smaller cross-section than the penstock supplied. This was particularly unfortunate because the bypass section was not under much if any hydraulic pressure. It would also appear that a 6-in. vent on an 8-ft. penstock was entirely too small.

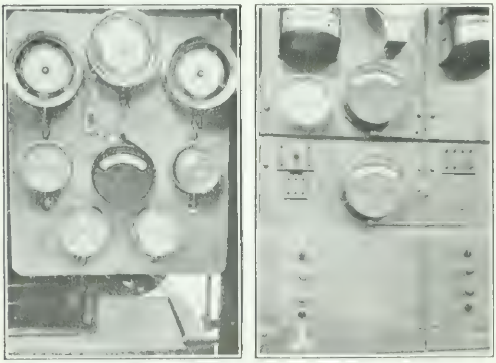
While some weakest spot had to fail, the fact that a cast-iron manhole frame ruptured raises a question whether castings liable to accidental impacts should not be made extra heavy, or possibly whether steel forgings should not be used where the stresses that may be encountered are extreme. From an operating point of view it seems obvious that no high-head wheel should be tested until its governor has been set so that there will be no danger of breaking the water column in the penstocks and, furthermore, so that the water column cannot be retarded so rapidly as to cause dangerous pressures. FIELD EDITOR ELECTRICAL WORLD.

San Francisco, Cal.

Load-Indicating Instruments Facilitate Operation in Boiler Room

FOR the purpose of speeding up power-house operation and improving its reliability, instruments for indicating to the boiler room the kilowatt load carried have been adapted for the plants of the San Joaquin Light & Power Corporation. For indicating the generator load to the firemen an indicating watt-meter in the boiler room is a very useful adjunct, and one is being installed in the company's new plant near Button Willow, Cal. Another instrument for the boiler room is shown in the accompanying photographs, which illustrate an interesting application of a standard Bristol long-distance indicating outfit, consisting of indicators in the boiler room which are set from the operating room.

In this particular instance such an installation was more feasible than installing wattmeters, although the cost was about the same. The scales of the instruments are calibrated in kilowatts, and when the operator sets the transmitting instrument to correspond to the load the receiving instrument in the boiler room takes a similar position. Since this plant is a "block-load" plant, the operator is not particularly burdened in setting the transmitter for different loads. The scheme works perfectly and has proved very useful.



BOILER-ROOM LOAD INDICATOR (LEFT) IS SET BY MEANS OF SIMILAR INSTRUMENT ON OPERATING FLOOR (RIGHT)

Operator sets instrument on his board and pointer in boiler room takes same position.

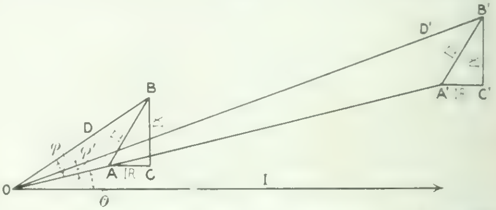
In the hydro-electric plants the floorman or pitman generally has an indication of the load on the unit by the amount of gate opening, which is also generally indicated at the governor head where the floorman can observe it. This virtually obviates the use of special indicating instruments in the hydro plants. From results so far obtained there is no doubt that these devices save much time in power-house operation and at the same time improve reliability and efficiency.

San Joaquin Light & Power Corp., R. C. DENNY,
Fresno, Cal. Operating Engineer.

Possible Errors Through Use of Line Data

TABLES and curves are often prepared for quick reference in obtaining the amount of line drop, owing to a given current passing over a power line of known length and size of conductors. Such data are used in some cases over a wide range of voltages, generally 100 to 6,600. The following examples and vector diagram will show the possible inaccuracy that may arise from using data at any other voltage than that for which it was computed.

For purposes of calculation consider a three-phase, 60-cycle line of No. 4/0 copper, 1 mile in length, carrying 100 amp. at a receiving voltage of 2,200 and a load power factor of 95 per cent lagging. Then:



VOLTAGE DROPS ON SAME LINE WITH DIFFERENT LINE VOLTAGES

$$E = \sqrt{(E' \cos\theta + RI)^2 + (E' \sin\theta + XI)^2},$$

in which:

E = generator voltage from conductor to neutral,
E' = receiving voltage from conductor to neutral,
I = current per phase,
θ = angle of lag between E' and I,
R = the resistance of one conductor per mile,
X = the reactance of one conductor per mile.

E' in this case, will equal 2,200 ÷ 1.732 or 1,270 volts. Substituting the values assumed for the line constants:

$$E = \sqrt{(1{,}270 \times 0.95 + 0.53 \times 100)^2 + (1{,}270 \times 0.312 + 0.56 \times 100)^2} = \sqrt{1{,}259.5^2 + 452^2} = \sqrt{1{,}586{,}343 + 204{,}304} = 1{,}338 \text{ volts.}$$

Or 1,338 × 1.732 = 2,318 volts between conductors. Then 2,318 — 2,200 = 118 volts drop per mile.

If calculations are made for a receiving voltage of 173, there results:

$$E = \sqrt{(100 \times 0.95 + 0.53 \times 100)^2 + (100 \times 0.312 + 0.56 \times 100)^2} = \sqrt{148^2 + 87.2^2} = \sqrt{21{,}904 + 7{,}604} = 171.8 \text{ volts.}$$

Or 171.8 × 1.732 = 298 volts between conductors. Then 298 — 173 = 125 volts drop.

Everything in the two examples given was the same except the voltages, and yet the drop per mile of line was 7 volts greater with one voltage than with the other. It is evident that the error in using data computed for 2,200 volts on lines carrying 173 volts would be too great for any except the roughest computations. The reason for the difference in line drop for changes in voltage is best shown graphically. In the accompanying figure the lower receiving voltage is represented by OA, and the higher receiving voltage by OA'. As IR and IX are the same for both voltages, the triangles ABC and $A'B'C'$ are constructed equal in all their parts. In the triangles OBA and $OB'A'$, angle OAB equals angle $OA'B'$; also AB equals $A'B'$, and the sum of the interior angles of each triangle equal 180 deg. Therefore as ϕ is greater than ϕ', the angle $D'B'A'$ is greater than angle DAB and DB is greater than $D'B'$. As DB and $D'B'$ represent in magnitude and direction the drop in voltage caused by the current I, first at the lower voltage OA, and second at the greater voltage OA', the drop BD for the lesser voltage has been shown to be the greater. It will be seen that if the power factor at the receiving end had been such that IZ and OA fell in the same straight line, the voltage drops DB and $D'B'$ would have been the same for any voltage whatsoever.

In other words, the error in using data or tables for different voltages changes for different power factors, and the error becomes nil when the value X/R happens to equal the tangent of the angle θ. It is when the above condition occurs that we have the greatest possible line drop, for OAB then becomes a straight line, and DB, the drop, equals IZ, the impedance. W. S. GUTHRIE.

Anaconda Copper Mining Company,
Butte, Mont.

Individual Condensers at Motor for Reducing Power-Factor Loss

CAREFUL selection of motor sizes is naturally the first step in obtaining high power factor, but there are cases where a motor must operate for a good part of the time at low load and consequently low power factor. As a means for correcting power factor in such cases an individual type of condenser has been developed for application at the terminals of each motor which has low power factor. An advantage of this method of installation lies in the fact that the low power factor is corrected at the place where it is produced and all line losses due to it are eliminated. The internal losses in the condenser itself are less than one-half of 1 per cent so that the only cost of the correction to the consumer is the interest on the first cost of the condenser and virtually the entire possible saving in current is actually obtained.

SIZES AND WEIGHTS OF INDIVIDUAL CONDENSERS OF VARIOUS CAPACITIES

Capacity (Kva.)	Service Voltage	Test Voltage	Dimensions Approximate (In.)	Weight Approximate (Lb.)
		SINGLE-PHASE CONDENSERS		
¼	220	800	6.75x9.5 x1.44	4.375
½	220	800	6.75x9.69x2.88	8.75
1	220	800	6.75x9.69x5.75	17.5
1	440	1,500	6.75x9.69x .44	5.0
2	440	1,500	6.75x9.69x2.88	10.5
		THREE-PHASE CONDENSERS		
¼	220	800	6.75x9.5 x1.6	5.0
½	220	800	6.75x9.5 x3.25	10.0
1	220	800	6.75x9.5 x6.5	20.0
1	440	1,500	6.75x9.5 x1.44	5.0
2	440	1,500	6.75x9.5 x2.88	10.0

A further advantage lies in the fact that where a number of motors have low power factor the investment necessary for the correction of all does not have to be made at one time but can be made gradually as convenient, the worst cases being picked first.

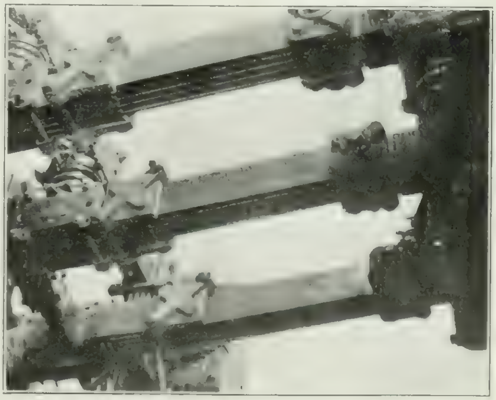
An induction motor on a circuit whose power factor is below a certain point will not carry its full load owing to the dropping of its breakdown point. This is an excuse often used for overmotoring that might be eliminated by the installation of individual condensers. It is obvious that a group installation of condensers at the consumer's meter, while correcting the objections of a low power factor from the standpoint of the company furnishing the electric service, may not raise the service power factor at any individual motor to a point that enables it to carry the load for which it is designed.

Weights and sizes of condenser units made by one manufacturer are shown in the accompanying table. They are made in sizes of ¼ kva. to 2 kva. in single-phase and three-phase types. The units can be combined into a battery of any capacity desired. J. L. MERRILL.

National Electric Condenser Company,
Philadelphia, Pa.

Bus Construction for Heavy Low-Voltage Alternating Currents

A LOW-VOLTAGE bus system for carrying considerable power presents a number of difficulties both from the construction and the operating standpoint. The cost is excessive and much of the equipment is of a highly special nature. The heating of the bus and the magnetic effects of such currents must be considered very carefully or trouble will be encountered. The skin effect in the customary construction of laminated busbars renders a bus of five ½-in. x 5-in. bars about the maximum for economically utilizing the copper. The eddy currents will cause undue heating if thicker or wider bars are used. The addition of more bars adds little to the current-carrying capacity as determined by the heating. Better results will be attained by splitting the bars into two or more sets. Switching equipment for heavy currents requires considerable floor space; thus the bus will be spread considerably more than with a similar amount of power at a higher voltage. If advantage is taken of this point and the feeder switches are arranged in several rows, each with a separate bus, many of the troubles can be eliminated, as the current in each bus can be kept to a reasonable amount.



DROP-OUT LINKS FOR DISCONNECTING BUS SYSTEM

The supporting structures must be very rigid as the weight of the copper is quite considerable and the stresses in case of short circuit are enormous. Great care should be taken to insure clean surfaces and as nearly a perfect fit as possible at all joints. Many of the bus clamps on the market are too light for this class of service and will bow in the center if drawn too tightly. This brings all the contact on the edges of the bars and will cause heating.

The use of even one iron clamp and iron bolts with such currents will add considerably to the heating even though they do not completely inclose the bus. Iron supporting structures will heat to a remarkable degree. The heating from the induced currents in building steel 2 ft. or 3 ft. from the bus is readily noticed. Extra-heavy brass pipe substituted for the iron pipe supports must be insulated at the joints to break up the currents which will circulate through them. The heating effect in the reinforcing rods of concrete floors is sometimes sufficient to cause a sag in the floor. These effects are most noticeable where the buses are brought together for metering. If the bus system is divided into several bus circuits the individual induced magnetic circuits are not so strong and these effects can be minimized. Metering can be accomplished by totaling the individual meters on each bus or by paralleling the current transformers of the various branches of the bus on the secondary side and measuring the combined current on the meters. Either method will avoid the concentration of magnetic fields.

Disconnecting switches between the buses and the oil switches are a necessity for proper inspection and repair. In the larger sizes they are a frequent source of trouble from overheating. Unless operated frequently they gradually become coated with a film of oxide. Once this film is started it will spread very rapidly. The action is cumulative and the heat will rise till the jaws lose their spring temper. The usual remedy for such trouble is to attach carpenter's parallel clamps, and in plants using heavy currents such clamps are kept handy. If the trouble is detected in time it may be remedied by grinding the switch with a fine grade of valve compound.

In a recent installation of 2,000-amp. and 3,000-amp. switches for this class of service the disconnecting switches were eliminated but drop-out links were placed in the bus connections as the accompanying illustration shows. These links were made to serve the purpose of the disconnecting switches, but were clamped in the same manner as a splice in the bus except that one end was drilled and a bolt placed through the center of the joint. This allows greater contact pressure at the joint than can be attained with the disconnecting switch. It also simplified the bus design considerably. A switch of this size is seldom opened except for inspection or repairs to equipment, and a competent electrician is usually present. With the clearances allowed the loosening of the clamps does not present any great hazard if done by a properly qualified man.

For higher voltages and for currents of less than 500 amp. the standard disconnecting switches will probably be more safe and will not usually give trouble.

El Paso, Tex. T. H. ARNOLD.

Tripping Out Motor Automatically at Certain Time

IT OFTEN happens that a motor in some isolated place runs for several hours or even for a few days, at the end of which time a special trip has to be made to shut it down. Where conditions do not warrant the expense of standard automatic time apparatus for performing this function a trip can sometimes be saved by a very simple time relay that costs practically nothing and can be relied upon to act within a few per cent of the desired time to shut down the motor, whether it be one hour from starting or several days. Practically all starters have a holding coil in series with a resistance tube in such a way that when the holding coil is short circuited the starter trips, disconnecting the motor from the line. Therefore all that is necessary is some device that will close a circuit shunting this tripping or no-voltage release coil at the end of the time desired to shut the motor down.

A piece of ordinary soldering wire held by one end in a horizontal position may be used for this purpose as it will bend down gradually and act as a short-circuiting switch. A test showed that a piece of such wire about ⅛ in. in diameter and 6 in. long would yield under its own weight about 1 in. in eighteen hours and 3 in. in about eighty-five hours. This time is about the same for any sample of the same wire, though it might be different for different compositions. A little experimenting on any particular size of solder wire will give the length best suited for a certain case. After that nothing is required except to arrange it so in the circuit that the end as it sags down will make contact and complete the circuit. PHILIP G. BERNHOLZ.

East Orange, N. J.

Cleaning Commutator Bars

IN ELECTRICAL repair shops it is often necessary to re-mica commutators, *i.e.*, put in new mica segments between bars. In doing this the old mica and shellac must be removed from the bars, which must be left thoroughly clean. The old method was to knock the commutator apart, scrape off the mica with a knife and then put the bars against a garnet-paper wheel to remove the shellac and particles of mica adhering to the bars. In nine cases out of ten the wheel removes considerable copper in spots before all the old residue is removed. This method does not make a satisfactory job and, moreover, it takes considerable time.

The following method has been found to save time and shows a decided improvement in the quality of the work. The commutator is knocked apart *i.e.*, the individual bars are separated by hitting the commutator with a mallet. No attention is paid to the mica adhering to the bars except to gage the thickness of one or two samples, but as each bar is separated from the assembled commutator it is dropped into a wire mesh basket, mica and all. When the whole commutator has been knocked down, the basket is suspended in a tank containing a boiling Wyndotte solution and allowed to remain there from three to five hours, depending upon the size of the bars and the number. A tank of any size, such as an old water pail or clothes boiler, will do, provided that the bars are kept away from the bottom. After the boiling the basket is removed and the contents are emptied onto a flat draining surface, when a stream of clean cold water is turned on the bars, which washes away all particles of mica flakes, leaving the bars clean and bright as new. If desired, instead of turning a hose on the spilled-out bars, place the basket in a pail containing clean cold water and remove one bar at a time, shaking the bar while under water to remove the mica flakes.

If the commutator bars do not have risers but have a slot cut for the wires, the armature is stripped by chopping off the leads back of the commutator with a cold chisel and the old wire is allowed to remain in the bar until the commutator has been completely re-micaed. Then it is put in the miller and the necks are milled out.

With the bars that have risers the procedure is to clean in the way already described. Tin the risers by dipping in hot solder. After cutting the mica dip the complete bar in clean shellac, place the bar on a mica segment and allow it to dry. Then trim the mica to fit the bar with a knife and a knife file. The bar with the riser is tinned before applying the mica because with this type of bar the mica does not extend up to the tinned section, hence the part will not get covered with shellac. On the other hand, if the old wires in the low-neck type were cleaned out and the bars dipped in shellac, it would interfere with the soldering.

Dipping the bar instead of painting the shellac on the mica segment has the advantage that when the commutator is heated for the final setting and tightening the shellac will soften and cause the mica to adhere to both sides of the bar, and it is also a quicker method.

The cleaning process requires very little time and attention and can be done by the average shop helper.

Detroit, Mich. A. C. ROE.

Alternating-Current Motor-Control Apparatus for Shop Service

PROPER choice of control apparatus for motors used in industrial applications is one which requires personal knowledge of the different operations effected by these machines. Many purchasers take standard control with whatever motor they buy and find on installation that it is not so satisfactory as they would like to have it. While standard control may be satisfactory in the majority of cases, there are many cases where it would be a great advantage to production and safety to use special equipment.

Many engineers make the mistake of putting on control apparatus without considering the man running the machine. The writer very seldom completes an equipment without talking with the foreman of the room in which the machine is installed, and on a change-over job with the man who operates the machine. They know which is the handiest place for the control, and if it is found that the control will work just as satisfactorily in the place they suggest, it is placed there.

When machines are started and stopped at infrequent intervals and there is no danger to the operator from the machine, the simplest control is the most satisfactory and will require the least attention. For small motors from 7½ hp. down, where there is no heavy starting torque, we use hand-operated oil switches, with all parts totally inclosed and equipped with overload relays. These are further protected with fuses where the line is tapped on the main line. If repairs are necessary on the oil switch, the fuses are removed, which kills the line and the switch.

We have a number of machines equipped with motors from 3 hp. to 10 hp. on which it is impossible to put a large switch or control, either because the machine is continuously in motion, swinging back and forth—for example, polishing lathes—or because the machine is so small that there is no room for large control. On these machines we use remote control, mounted on the wall or overhead, with a push-button on the machine. On the polishing lathes this method is far ahead of any other because the operator uses both hands to operate his machine when polishing and one hand to steady it while shutting down or starting up. The push-button is placed in such a position that he can raise one finger from the machines and stop or start it at will. The cost is practically double the standard control, but the convenience and flexibility and the good will of the operator offset this many times.

The choice of control for motors of from 10 hp. to 25 hp. inclusive depends largely on local conditions. Where there is no heavy starting current required and only one speed, we use a squirrel-cage motor with compensator and a totally inclosed safety switch. This we mount on the machine, if there is room; if not, on the wall nearby. Sometimes, when conditions require it, if the control is on the wall, we run a line from the trip coil of the compensator to the machine and mount a snap switch on the machine so that it can be stopped quickly.

In many localities the power company will not allow squirrel-cage motors of over 25 hp. to be used. In this case the only solution is the slip-ring motor with which we use drum control, either with a safety inclosed switch or with an oil switch, depending on conditions of the individual installations.

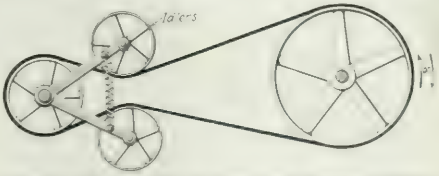
On all motors over 50 hp. it is good policy to use oil switches for safety. An operator sometimes, when excited, may pull out a switch carrying a heavy load before throwing back his controller, and draw an arc heavy enough to short-circuit his switch. With a plain switch he is liable to get badly burned, besides ruining his switch. With the oil switch he is safe, as the oil will quench the arc.

The larger the motor, the more foolproof should be the control apparatus, under ordinary conditions. It is poor economy to buy a large expensive motor and try to save by putting on cheap control equipment. One mistake may cost many times more than one saves in control.

L. N. BURHOE,
Electrical Engineer.
Seymour Manufacturing Company,
Seymour, Conn.

Idlers for Increasing Belt Contact on Small Driving Pulley

IN THE Aug. 6 issue of the ELECTRICAL WORLD, page 273, E. L. Bragdon tells how lost motion was taken up in a waterwheel control. His scheme seems very practical and evidently original, but the writer would suggest as an improvement that the idler pulleys be of generous diameter to reduce the bearing speed and that they bear on the outside of the belt, thus closing it about the smaller pulley instead of opening the belt, which reduces the arc of contact. A further improvement could be introduced by making each of the idler arms independent and drawing them together with a coiled spring which would take up the continued slack of the belt.



IDLERS TAKE UP SLACK OF BELT AND INCREASE LENGTH OF CONTACT WITH PULLEY

H. S. RICH.
Little River, Conn.

Management and Policy

Embracing Central Station Commercial Organization and Management, Customer and Trade Relationships, Public and Financial Policies, Advertising, Selling and Service Methods

Electrical Men Themselves Must Use Appliances

A Frank Criticism from an Address by F. J. Allen, Chairman Merchandising Committee New England Section, N. E. L. A.

THE most serious condition which faces the commercial branch of the electrical industry today is the undisputed fact that we are not functioning properly as merchandisers of electrical appliances. Every one is more or less concerned over the fact that department stores, drug stores and specialty houses, recognizing the worth of electrical appliances, are taking them on—with successful results. But they are not getting down to the two true causes why we are not going ahead and holding the market. First, the various branches of the industry, for one reason or another, fail to support the merchandising department. Second, we as an industry are far from "sold" on the use of the appliances ourselves. When I say that the various branches fail to support the merchandising department I do not mean that this is necessarily intentional.

F. J. ALLEN

The attitude of the general public is that whenever a person is engaged in any form of electrical business, regardless of his actual job, he should know all about the various electrically operated appliances. And the general public is right.

The fact that we ourselves are very much "unsold" on the appliances was clearly evidenced at a recent Commercial Section meeting when, out of about 200 members present, only two were able to say that they used all or nearly all of the appliances which they were trying to sell. There is but one way to get real "honest-to-goodness" conviction on anything you are trying to push and that is to use it or do it yourself. We electrical men are not successful merchants primarily because we do not really know what and how the various devices perform their functions and the unlimited possibilities and economies which they introduce into the home.

In general, the failure to use appliances includes every one in the industry, and possibly the greatest burden and criticism can justly be laid at the door of the men higher up. Very often the homes of these people are largely conducted by servants, and because of this fact little real necessity for labor-saving devices is felt. But this is no excuse for them to hide behind, and the fact that they can better afford these appliances only makes their inactivity more open to criticism.

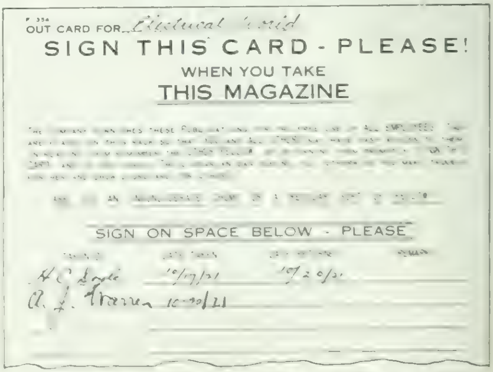
Few commercial managers realize their opportunities to educate all members of their organization to the fullest use of electric appliances in the home. It is true many cannot afford to equip their homes electrically all at once or pay cash for the larger appliances, but very few companies are offering the lowest prices and long terms of payment to employees.

There is another phase of the situation which also clearly shows the attitude of the industry as a whole toward the merchandising department. In many instances the appliance department, which should be given the choice location in the building, is put in the basement or some other equally inaccessible, unattractive place. Are we not all wrong in this attitude toward the appliance department? It is the department to which we look for a large portion of future business, and it must have every possible chance if its growth is to be assured. It is entitled to the best space in the building.

But the appliance manager can only go a certain distance in obtaining these necessary requisites. The executives must see the value of approving such changes as may be required to give merchandising every possible advantage and opportunity.

A Practical Check-Up on the Use of Periodicals

THIS card has proved an effective and almost automatic means of keeping track of the technical journals and other periodicals to which the Chattanooga (Tenn.) Railway & Light Company subscribes for its employees. All magazines are filed in the company's library. When a new copy comes in the librarian writes the name of the magazine on one of the cards and


F 354

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OUT CARD FOR PERIODICALS TAKEN FROM LIBRARY places both the card and the magazine in the same rack. Any one wishing to take a paper from the library simply signs his name on the card with the date and leaves the card in the proper space, and upon returning the magazine the card is again dated.

It is thus possible to tell at all times who has taken any of the papers, and should there be a call for any particular magazine the librarian knows exactly where it can be located. This method has proved much more satisfactory than routing the magazines from one department to another, as there was then no record of their whereabouts and many were either completely lost or long delayed in being returned to the library.

Featuring Local Industries by Electric Utility

WITH a view to acquainting people with the products of local manufacturers, the Hartford (Conn.) Electric Light Company is displaying in its office windows the leading products of concerns using electric power from the company's system. One of these, showing meter testing and protective devices, molded insulation, packing and fuses, produced by the Johns-Pratt Company, is shown in the picture. A very satisfactory co-operation between the electric light and power company and a local electrical manufacturer was thus attained for the commercial good of the community as a whole. Popular interest in these displays is increasing, and the Hartford chamber of commerce has heartily approved showing the citizens finished products of their town, often unrealized outside trade channels.

WINDOW DISPLAY SHOWS PRODUCTS OF LOCAL MANUFACTURER

Handling Customers' Stock for Resale

WHEN an owner of stock in the Central Maine Power Company requests that the utility shall repurchase his shares, as sometimes happens, the company does not guarantee to resell immediately or to buy back the stock. It does not repurchase stock, but in the case of a stockholder who bought his holdings directly from the company every effort is made to dispose of the stock through resale, charging a commission of $2.50 per share for this selling service. When stock is handled for resale it is sold at the same price for which the regular authorized issue is marketed. As a rule the resale transaction takes from three to ten days.

In cases where the stock was bought through a broker who has "traded somebody out" and hence sold it at less than the company price, the company does not plan to resell except at a price agreed upon in each instance. The natural channel for resales in such cases, the company maintains, is the banker or broker with whom the owner dealt. Employees engaged in customer-ownership campaigning, now a continuous program with this company, have been cautioned to make clear to the public that the company does not "buy back" stock.

What Other Companies Are Doing—

Faribault, Minn.—Donald Daube, securities salesman for the Northern States Power Company in its Faribault and southwestern Minnesota divisions, has established a new record in the sale of the company's preferred stock. In the period from Jan. 1, 1921, to Oct. 1, 1921, he added 803 shareholders to the Faribault division list, which nearly equals the 863 shareholders added during the previous five years and represents an increase of 93.5 per cent over the number of shareholders on Jan. 1 this year. In the Montevideo division he increased the number of shareholders from 281 to 499, an increase of 77.5 per cent. It is expected that by the end of this year the increase in both divisions will be at least 100 per cent.

Denver, Col.—An "Electrical Day" was featured at the weekly meeting of the real estate bureau of the Denver Civic and Commercial Association held Nov. 2, at which time the Denver Electrical Co-operative League had charge of the program. The part electricity plays in the modern home, the education of the public in things electrical and co-operation between the real estate interests and the electrical industry were stressed. T. O. Kennedy, chairman of the league's advisory committee, explained to the real-estate men how every dollar spent in the electrical equipment of a home added four dollars in value to the selling price of the property.

Humboldt, Iowa.—In promoting the sale of its securities to customers the Northern Iowa Gas & Electric Company is using an interesting window display which represents in miniature a night scene in a town. Streets are laid out in grass and gravel on the floor of the window and small houses with lamps concealed inside are placed along the street. Street standards about 6 in. high, equipped with Christmas tree bulbs, add to the effect. The entire display is worked out in perspective, and in the back of the window a sign reads, "Let your preferred stock pay your light bill." This display is being sent to the company's division offices and has proved a material help in the campaign.

New Haven, Conn.—Two hundred and twenty-four wiring jobs, totaling 6,760 outlets and 342 meters, have been installed in residences on the New Haven division of the United Illuminating Company, following a campaign of one month along co-operative lines with six local contractor-dealers. Customers were billed at $5 per outlet by the company, which paid the contractors $6 per outlet. The average was 30.17 outlets per job. Ninety-three per cent of the jobs had been paid for six months after the campaign, and the total outlay by the central-station company was $8,138, the campaign expenses being $1,378. D. P. Robinson, sales manager, states that the campaign helped the contractors to keep full forces busy and that it has brought them and the company into closer touch.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
of the World

Generators, Motors and Transformers

Induction-Motor Nomogram. — R. G. Warner. — A method for making a movable diagram for reading all performance characteristics of any three-phase induction motor.—*Journal A. I. E. E.*, October, 1921.

Design of Large Electric Units.—Stanley Parker Smith.—This article explains details of design and shows the method in which field poles are fastened to rotating spiders. Numerous illustrations serve to make the text clear.—London *Engineering*, Sept. 16, 1921.

Brush Discharges in Air and in Oil.—W. Kehse.—The insulation of transformers, switches and other high-voltage apparatus has so far been determined only from experiences gained from tests on actually built machines. The author gives in this interesting paper data to calculate beforehand the beginning of any dangerous brush discharge. As the type of winding used on transformers of very high voltage is invariably of the concentric design, the primary and secondary windings of such a transformer may be considered as concentric metallic layers, and any results obtained from such an arrangement may be used properly for the design of transformers. It has been proved that even short brush discharges under oil damage the insulating paper cylinders. Upon immediate removal of such a cylinder the damage may not be visible, but after standing for a few days in air the upper layers of the cylinder peel off and the carbonized brush-discharge paths become visible. The author gives test results obtained between needle points under oil and along the surface of resin-treated paper surfaces. The primary object of the paper seems to be to advocate air-insulated testing transformers. One illustration is given of an actually built 650,000-volt transformer consisting of three air-insulated units in series. Complete data and drawings are given for a 150-kva., 400,000-volt unit testing transformer of the air-insulated type. This is the second article to appear recently in the European technical press describing and advocating the design of testing transformers of very high voltage which shall be air-insulated. By following certain precautions as to proper distances, materials and specially formed metallic shields European manufacturers seem to have succeeded in building such transformer sets for more than 500,000 volts, showing great savings in floor space, weight and cost. It might be worth while to call the attention of American transformer designers to these types.—*Elektrotechnische Zeitschrift*, Sept. 22, 1921.

Side Wear of Brushes on Motors.—J. S. Dean.—From a study of the side wear on carbon brushes in railway motors it is concluded that if the action of dust and dirt can be eliminated, side wear upon brushes in ventilated motors will be greatly reduced. It is not thought that all side wear is caused by the action of dust and dirt, as mechanical vibration and probably some burning action of the electrical current are contributing factors. Side wear, however, is relatively unimportant compared with the marked advantages of parallel-ventilated motors over closed motors or series-ventilated motors.—*Electric Journal*, October, 1921.

Novel Starting Method for Direct-Current Motors.—M. Vidmar.—The author has developed and patented a new and very simple starting method for direct-current motors having multiple circuit (lap) winding —a method which entirely obviates the starter. It is suitable for all four-pole to eight-pole motors and consists in starting the machines with all but one pair of brushes lifted off the commutator. Assuming a four-pole motor, its armature represents four circuits put in parallel by the four sets of brushes, and the starting current is represented by $I = 4E/r$. If one positive and one negative brush are lifted off the commutator, the starting current will be reduced to only $I = 4E/3r$, or one-third of the first value. If it is attempted simply to disconnect the rest of the brushes from the line, brush fire will result under the remaining brushes. It is, therefore, not only necessary to lift the brushes bodily off the commutator, but with the brushes the commutating field, if the motor has commutating poles, must also be disconnected. This can be easily managed by connecting the brushes directly in series with these auxiliary fields. Actual tests on direct-current motors have proved the full feasibility of this starting method.—*Elektrotechnische Zeitschrift*, Sept. 29, 1921.

Mechanical Causes of Flashing on Railway Motors.—J. K. Stoltz.—An enumeration of the causes of flashing, together with the proper remedies for preventing it. The most common causes are interruption and re-establishment of power supply by jumping trolley, etc., braking by bucking, presence of salt, incorrect brush spacing and jumping brushes.—*Electric Journal*, October, 1921.

Generation, Transmission and Distribution

Economical Generation of Electrical Power.—A. B. Clark.—Design and operation of a plant of about 15,000 kw. average load with peaks running up to 25,000 kw., such as is found in the power plants of steel mills. Discussion includes the size of units to use, the type of condensers, the size of boilers and grates, and various types of auxiliaries.—*Bulletin of Association of Iron and Steel Electrical Engineers*, October, 1921.

Electric Generating Station of the Edinburgh Corporation.—S. B. Donkin.—Some notes on the Portobello electric power station of the Edinburgh Corporation for supplying energy in bulk to the city of Edinburgh and to the Lothian. This is a 30,000-kw. steam plant.—London *Engineering*, Sept. 16, 1921.

High-Pressure Oil-Burning Installation.—A 15,000-kw. plant of the Fall River Electric Light Company converted from coal to oil burning is described.—*Power*, Oct. 25, 1921.

Power Extensions in Manitoba.—A description of the 66,000-volt Morden line installed by the Manitoba Power Commission.—*Electrical News*, Oct. 15, 1921.

Diesel-Engine Power Station of Lugano.—F. REGARD.—The city of Lugano derives its power supply from the hydro-electric station in Gordola, situated 23 km. from the city. In spite of a double high-tension line, operated under 45,000 volts, it happened several times that the supply failed because of the very severe climatic conditions that prevail on the right-of-way of the line, leading over the high Ceneri mountain range. It was therefore decided to erect in the city itself a standby power plant which could be started at a moment's notice. Two 2,200-kva. Diesel-engine generators were installed. They are two-cycle, four-cylinder engines, running at 125 r.p.m. A direct-current motor starter, fed from a storage battery, is employed. To synchronize properly with the Gordola plant, a remote-control regulator is provided on the Diesel engines, covering a speed range of —15 to +8 per cent. The interior of this station is more like a castle than a power house.—*Brown-Boveri Mitteilungen*, October, 1921.

Electrochemistry and Batteries

Rectifier Plant in Switzerland.—B. WALTY.—For the electrolytic manufacture of hydrogen and oxygen from water a large mercury rectifier plant was erected in Bodio, Switzerland, changing over 8,000-volt, 56-cycle, three-phase current into 430-volt direct current. Four 175-kva. steel vessel rectifiers were provided and have been in perfect operation since 1920. One three-phase transformer, connected "open-six-phase," with a ratio of 8,000 volts to 358 volts, operates the battery of rectifiers. To provide necessary regulation of the direct-current voltage a six-phase induction regultor is connected between the main transformer and the rectifiers, with a voltage range of plus or minus 36. The resistance of the electrolytic dissociator, when cold, is sufficiently large (1.6 ohms) to be started up on full voltage and with the high-voltage winding of the transformer in delta. If for some reason the dissociator has to be started up hot, its low resistance of only 0.25 ohm necessitates a start with reduced voltage, which is accomplished by connecting the transformer primary in star. During normal operation a vacuum of 0.001 mm. to 0.01 mm. mercury pressure must be maintained in the rectifier vessels. Two vacuum pumps are provided for this purpose, one of which is kept running from one-half hour to one hour daily. Both pumps consist of a rotary oil pump and a stationary mercury high-vacuum pump. The cooling water for the rectifiers is kept cool in an overhead battery of twelve radiators and is used over and over again.—*Brown-Boveri Mitteilungen*, October, 1921.

Comparison of Electric Furnace Practice with Fuel-Fired Furnace Practice.—N. K. B. PATCH.—The author's experiences are that the cost of metal melted, the melting losses and the solution of gases in metal are substantially the same in the electric and the fuel-fired furnace, provided that there is intelligent operation.—Paper presented before American Electrochemical Society, Sept. 30, 1921.

Recent Developments in Electric Furnaces of the Muffled Arc Type.—H. A. WINNE.—Several types of muffled-arc melting furnaces are described with their features and adaptabilities.—Paper presented before American Electrochemical Society, Sept. 30, 1921.

Installations, Systems and Appliances

Motor Drives on Rolls and Run-Out Table.—A description of special methods adopted in a new steel mill to co-ordinate roll trains and run-out table. Three-phase motors and frequency changers are used. This is the Interstate Iron & Steel Company's mill at South Chicago.—*Iron Age*, Oct. 13, 1921.

Insulation for Steel-Mill Motors.—J. L. RYLANDER.—Insulation on a motor must (1) protect against a short circuit between adjacent turns or other parts of the same coil, (2) protect against the ground strain in the slots or other parts in contact with the core, and (3) protect one circuit from another between which there is possibly full rated voltage, such as between one phase and another on a polyphase alternating-current motor and from the positive side to the negative side of the circuit on direct-current motor. Methods of fulfilling these requirements in steel-mill motors are described in this paper.—*Electric Journal*, September, 1921.

Gathering in Coal Mines.—R. L. KINGSLAND.—A discussion of the various methods of gathering coal and their limitations.—*Journal A. I. E. E.*, October, 1921.

Crane Operating Costs at Blast Furnaces.—GEORGE L. COLLORD.—Locomotive and ore-bridge cranes are shown to save much money compared with the hand methods formerly in vogue. An analysis of the cost per ton is given as well as a description of the motor equipment and the power consumption. The annual cost of operation of ore-bridge, bins and scale cars amounted in this case to about 21 cents per ton of pig iron produced.—*Iron Age*, Oct. 13, 1921.

Electric Auxiliaries on Merchant Ships.—E. D. DICKINSON.—A discussion which shows that electrically equipped ships can be operated more economically on account of the speed and reliability of electrical equipment. Most suitable machinery, wiring equipment and operating voltages are discussed. Costs of loading and unloading, wharfage, etc., are given.—*Journal A. I. E. E.*, October, 1921.

Telegraphy, Telephony and Signals

Magneto-Mechanical Systems Applied to Telephone Receivers.—R. L. WEGEL.—The object of this paper is to reduce the theory of typical magnetic vibratory devices to the simplicity of the electrical network theory. The method involves the manipulation of complex algebra and is illustrated by experimental data on receivers and transmitters. It is applicable to types having any number of circuits or vibratory systems, including galvanometers and meters.—*Journal A. I. E. E.*, October, 1921.

Radiation from Transmission Lines.—JOHN R. CORSON.—Radiation losses from lines on which high-frequency currents are transmitted, as in carrier-wave transmission over wires where frequencies are employed comparable with those used in radio communication, are discussed.—*Journal A. I. E. E.*, October, 1921.

Miscellaneous

Rates for Electrical Energy and Service.—F. W. C. BAILEY.—A discussion of the various types of rates, including the straight-line, step, block, Wright demand rate, Hopkinson demand rate, three-charge and other rates. Curves and concrete applications of the various rates help to explain the article.—*Journal A. I. E. E.*, October, 1921.

Scientific and Industrial Research

(Printed in the Third Issue of Each Month)

A Department Devoted to Reports of Investigations Contemplated or Completed, Research Facilities Available, and Suggestions for Co-operative Work.

Conducted by **Prof. Vladimir Karapetoff**
Cornell University, Ithaca, N. Y.

Research in Progress and Completed

[When investigations which have been completed are, in the opinion of the editors, of wide enough interest to the field we serve, details thereof will be presented in other parts of this paper. Contemplated research or that which appears to have limited appeal will be only briefly reported in this section, but details may be had by communicating with the investigator or institution named in the report. Readers are referred to the department "Digest of Electrical Literature" for investigations reported in other journals. The news and engineering sections should also be followed for research reported before technical societies.]

CIRCUIT BREAKERS, OIL, EXPLOSION CHAMBER FOR.

An improved explosion chamber has been developed for high-tension oil circuit breakers. The arc, which is drawn down by the movable contact at opening, forms gases in the chamber which create pressure, driving the oil into the arc. The remaining oil and gases are then forced through the outlet, thus extinguishing the arc very quickly.—*General Electric Company, Schenectady, N. Y.*

FEEDERS, AUTOMATIC SECTIONALIZING OF.

A switch has been designed to save feeder copper. It automatically ties together two feeders, permitting the flow of current from an idle to a loaded section, thereby obtaining the maximum amount of service. An automatic overload feature is included to limit the exchange of current between feeders to a safe predetermined degree.—*General Electric Company, Schenectady, N. Y.*

RELUCTIVITY, MAGNETIC, EFFECT OF HEAT TREATMENT UPON.

Experiments have been made on the variations of magnetic properties of some eutectoid carbon steel specimens (0.85 per cent carbon) for various kinds of heat treatment, especially at higher values of magnetizing force. A definite relationship has been found to exist between structural changes in the sample and the slope of the reluctivity line.—*Bureau of Standards, Washington, D. C.*

WATTMETER, POLYPHASE, WITH CONNECTING ROD.

A polyphase wattmeter has been developed of the electrodynamometer type in which the two potential coils, instead of being mounted on the same shaft, are mechanically interconnected by an aluminum rod and move like a single unit. The principal objection to polyphase wattmeters has been that, unless they are of the semi-flush type, they project farther out from the switchboard than the other instruments. The total moving element is lighter than that of the usual polyphase wattmeter. Furthermore, instead of pivots and jewels being subjected to the weight of two moving elements, in this design the jewels and pivots are subjected to no greater weight than in the case of a voltmeter or a single-phase wattmeter.—*F. W. Roller, New York City.*

TELEPHONE RATES, DETERMINATION OF.

A study of the economic factors which determine telephone rates has been completed recently. The valuation of telephone plants, their cost and depreciation, the operating revenue, including local and toll telephone rates, were all found to be de- [illegible] *Wright and F. L. McKinney, Ohio State University, Columbus.*

MINES, EXPLOSION-PROOF MOTORS AND SWITCHES FOR.

Investigations and tests have been conducted to determine the danger of ignition of mine gases from electric motors equipped with protective devices and from various types of oil-break and [illegible]

WAVE STUDY BY MOTION PICTURES.

Motion pictures have been made showing the propagation, interference and reflection of water waves. A stream of compressed air was interrupted by passing through a circle of holes in a rotating disk, so that the puffs of air impinged periodically upon a water surface. The waves generated were made visible by flashes of light coming through a second series of holes in the same rotating disk that were reflected upward through the glass bottom of the water tank so as to cast a shadow of the waves on a frosted glass. The photographs were taken of these shadows. The flashes of light came a little less frequently than the waves, so that the latter appeared to move [illegible]

[illegible] in the study of performance of brushes, circuit breakers, etc. The above description illustrates one of the methods of using such a [illegible]]

VACUUM TUBE, DOUBLE-GRID, CIRCUITS FOR.

Some new vacuum-tube circuits have been devised to be used with double-grid tube. The particular advantage of the proposed arrangement is that the locally generated oscillations of the tube cannot excite the aërial and cause disturbances in neighboring receiving stations.—*J. Scott-Taggart, London, England.*

LAMPS, INCANDESCENT, STANDARD SPECIFICATIONS FOR.

New specifications have been adopted which include important changes in the test procedure for tungsten lamps. The most notable of these changes is the abandonment of the long-established provision that the life of test lamps shall be considered as ended when the candle-power has fallen to 80 per cent of the initial value. Now the life is considered as the total life of the lamp since the efficiency of tungsten lamps drops but very little up to the point of burn-out.—*Bureau of Standards, Washington, D. C.*

TELEPHONE CROSS-TALK METER.

A meter has been designed for giving a quantitative idea of the qualities of the various pairs of wires in a telephone cable as regards that irritating feature known as "cross-talk." A telephone receiver is so arranged that it may be shunted [illegible] circuit. The shunt is through a high variable resistance. A switch is so arranged that the telephone receiver may then be quickly put across any other pair of wires in the cable, and the intensity of the sound as heard through the resistance in the main circuit is compared to that heard by induction in the neighboring circuit. The cross-talk factor is found by varying the resistance until there is no change in audibility when shifting from one connection to the other.—*Cambridge & Paul Instrument Company, London, England.*

ELECTROLYSIS, EARTH-CURRENT METER FOR.

Final experimental trials of the earth-current meter have been completed and the utility of this instrument for practical electrolysis survey work has been definitely established. Several of these instruments have been used in connection with the co-operative work of the bureau and the research sub-committee of the American Committee on Electrolysis.—*Bureau of Standards, Washington, D. C.*

PYROMETER, TUNGSTEN-MOLYBDENUM.

A tungsten-molybdenum pyrometer has been developed for measurements of temperatures above the range of ordinary thermocouples. A coating of crystalline carborundum, copper, portland cement and quartz is fused to the thermocouple to prevent oxidation at high temperatures. Numerous tests have shown that the thermal emf. between tungsten and molybdenum reverses when the hot junction passes through 1,060 deg. C.—*George F. Dickins, Stone & Webster, Inc., Boston, Mass.*

Suggestions for Research

PROTECTIVE DEVICE AGAINST CONTINUOUS OVERLOADS.

The usual overload protection of electric motors is set by operators high enough to take care of short-time peak loads. Most motors are without any real protection against continuous overloads which may finally injure them. There is, therefore, opportunity for developing overload devices which will have time elements of five to thirty minutes instead of five to thirty seconds, as is the case with most of the existing apparatus. The longer the time element can be made, the more desirable it is for operation of motors.—*H. D. James, Pittsburgh, Pa.*

TEMPERATURE MEASUREMENT IN EMBEDDED WINDINGS.

A better method is needed for measuring the actual "hot-spot" temperature of stator windings of large alternators and of other embedded copper conductors. On account of a considerable temperature drop across the thick insulation in a high-tension machine, the temperature measured by a thermocouple placed in the slot may be much lower than that of the copper itself. Resistance measurements are practically useless because the cooler parts of the conductors in the end connections are included. A device or method is needed for determining the actual maximum temperature of copper, without any electrical connection with the high-tension winding and without leads that would impair the continuity of the insulation.

CURRENT TRANSFORMERS, SHORT-CIRCUIT STRESSES IN.

Under a heavy sustained short circuit on the line, a current transformer may carry many times its rated current and the resulting mechanical stresses may injure the insulation, thus facilitating a burn-out. Mr. Torchio reports an aggravated case in which the primary winding blew open (*Journal A. I. E. E.*, 1921, page 128). A theoretical and experimental investigation of these stresses is desired, with suggestions for improved design. With a miniature model an investigation may be possible with direct current. If alternating current is used, a motion-picture camera synchronized with an oscillograph will be found serviceable.—*Editorial Suggestion.*

TELEPHONE, AUTOMATIC, TRAFFIC.

An investigation is desired toward establishing and placing upon record once for all a logical method of attack whereby one may calculate the number of trunks in a group required to give good service for a given amount of traffic. The investigation should be partly experimental, involving the recording of traffic over groups of automatic trunks, and very largely mathematical, discovering the proper way to apply the theory of probabilities to this problem. A difference will be found between manual and automatic operations of groups of trunks, and the features of this difference should be incorporated in the complete treatment.—*A. B. Smith, Chicago, Ill.*

HARMONICS IN VOLTAGE WAVE, AMPLITUDE AND PHASE OF.

The development of a readily portable device is desired for the determination of amplitude and phase angles of the harmonics in a voltage wave. An instrument which could be carried about as readily as present types of portable meters would be of value in making investigations of abnormal conditions arising in a high-tension system. The oscillograph is bulky and its transportation is not convenient, especially where power [illegible] *W. P. Dobson, Hydro-Electric Power Commission, Toronto, Ont.*

BOOSTER FOR BATTERY CHARGING.

[illegible] repair shops where batteries are restored to usefulness after hard service, it is necessary to charge and to discharge cells more than once. It should be possible to arrange the routine [illegible] siderable energy could be saved by circulating the same current between the two batteries by means of a booster in series with the charging generator. Details of such an arrangement are desired, an automatic regulating device, the saving involved, etc.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

Alabama Power Leases Muscle Shoals Steam Plant

THE Secretary of War has authorized the execution of a temporary lease of the large steam plant at Muscle Shoals to the Alabama Power Company. The lease may be discontinued on one month's notice and is intended solely to relieve the emergency caused by the continued shortage of water in the streams which furnish the power for many of the industries in the Southeast. Secretary Weeks stated that while he had been disinclined to lease the plant with negotiations for its sale pending, the emergency is such as to justify this step, especially at a time when great hardship would result in adding to the number of unemployed.

London Superpower Proposals Expected Soon

THE Electricity Commissioners of London will report at an early date on plans to obtain cheaper electric power in the metropolitan area and in its vicinity, according to advices to the Department of Commerce. The London County Council proposes to arrange a superpower system which will link several large projected plants with the existing plants. It is claimed that this will make possible decided reductions in the cost of power and will permit of additional electrification of railroads.

Department of Commerce Champions Trade Association Idea

DESPITE the criticisms that have been heaped upon the trade associations and the disinclination on the part of the Department of Justice to attempt to clarify the situation prior to the decision of the Supreme Court in the hardwood lumber case, the Department of Commerce is actively championing the trade association idea. Secretary Hoover and members of his staff are taking pains in their utterances to show that the questionable conduct of a very few trade associations, or aggregations calling themselves trade associations, has resulted in uncharitable criticism of all trade organizations. Mr. Hoover has expressed himself so definitely on the subject that there can be no doubt that he believes trade associations are necessary to the maximum progress of industry. The rapid multiplication of trade associations until they number nearly 3,000 is interpreted by Mr. Hoover to indicate "a great and vital movement and something permanent in our economic system." Other quotations from Mr. Hoover on the subject follow:

"The coming together of manufacturers and producers in the different trades for the purpose of the advancement of their industries as a whole is a profound step toward co-operation in the whole business world. Out of it will be gained tremendous benefits for the business public. The various trade associations present a point of contact with the Government such as did not exist ten years ago.

"I know of no way in which we can undertake the solution of collective questions except by the co-operative organization of the men in the industry. We cannot go on maintaining our standard of living in the face of the foreign competition that we have in front of us unless we can make some progress in the collective sense. The only way that we can hope for it is through the organization of associations that will take up the problems common to all and gain inch by inch the efficiency and stability that make for national efficiency."

F. M. Feiker, assistant to the Secretary of Commerce, in a recent public address said:

"The trade association is the natural organization functioning in the establishment of contacts between the Government and industry. They are indispensable in such matters as the collection of statistics, the detailed promotion of foreign trade and in elimination of excess variety. It is the only avenue that the Department of Commerce sees by which the Government can establish contact with a trade to the mutual advancement of fundamental interests."

Pacific Coast N. E. L. A. Section Changes Name

THE Pacific Coast Electrical Association was selected as the new name of the Pacific Coast geographical division of the National Electric Light Association at a general meeting held in Delmonte, Cal., last week. The new name is felt on the coast to be more expressive of the functions and scope of the organization and less cumbersome than the old. It is not intended that the relations of the association with the National Electric Light Association with which it will continue to be affiliated will be affected. A revision of the constitution is to be undertaken which will more clearly define the status of the Pacific Coast Electrical Association. This revised constitution will come up for adoption at the annual convention which will be held in Riverside, Cal., next May.

Southwest League to Hold Colorado River Conference in December

THE League of the Southwest will hold, at Riverside, Cal., Dec. 8, 9 and 10, a conference on the subject of the Development of the Colorado River, which will be for the purpose of crystallizing opinion on the subject. Nationally known men are expected to be present and address the meeting, principal among them being Herbert Hoover, who has provisionally planned to attend the meeting and deliver an address written by President Harding. The Federal Water Power Commission will be represented by executive Secretary O. C. Merrill, who will outline the policies of that body with reference to power development on the Colorado River. Governors of the several states of the Colorado River Basin have signified their intention of being present and address the meeting as have also representatives of all other bodies interested in this development. Sir Adam Beck of the Hydro-Electric Power Commission of Ontario is expected to present the case for the advocates of political development and ownership.

Complete Service Necessary to Hold Exclusive Territory

IN ORDER to retain exclusive rights in a field a public utility must be serving it to an extent where competition would involve duplication and waste, and in addition it must be alert to render all proper service not only to patrons but to prospective patrons. When the entrance of a new utility into a field will result in greater industrial development it will not be excluded. These principles of regulation were contained in a decision of the California Railroad Commission recently permitting the Great Western Power Company to render industrial service in Butte County over the protest of the Pacific Gas & Electric Company, which charged its competitor with invading its territory. The contest between the power companies arose over the right to furnish power to a lumber company at a mill to be erected near Oroville, an account estimated at $60,000 a year. After carrying on negotiations with the two power companies the lumber firm entered into a contract with the Great Western Power Company. The commission found in effect that the Great Western Power Company had shown more eagerness for the business; in fact, had virtually developed it by inducing the company to use electricity in its mill as well as in its logging operations.

The lumber company had first intended to use electric power only for its logging operations at Moretown, about 25 miles from Oroville, and according to the findings of the commission the Pacific Gas & Electric Company "virtually refused to serve the logging works." After the Great Western Power Company had offered to furnish power to the logging camp and had induced the lumber company to use electricity at the mill also, the Pacific Gas & Electric Company protested against the contemplated mill service, claiming that it had exclusive rights to supply electric power in the vicinity of Oroville.

DUTY TO MAKE EXTENTIONS

That the Pacific Gas & Electric Company failed in service in not doing everything in its power to assist a large industrial concern seeking to enter the state was the conclusion of the commission, which said: "A utility owes a duty to that portion of the public which seeks to obtain service as well as to that portion which is already being served. It is the duty of a utility in proper cases to make extensions in order to serve new consumers and to furnish information to prospective consumers as to the costs or terms under which such extensions may be made. The evidence in the present case shows that the Pacific Gas & Electric Company did not perform its duty to the public in this respect. The lumber company was given no information which would enable it to determine whether or not it was feasible or profitable for it to use electrical energy at its logging camp."

Pointing out that it has consistently encouraged the development of hydro-electric power, the commission asserted that it was not its policy to exclude from a field a company which created new uses for power. Elaborating this position, the commission said: "As it was said in this and other former opinions, whenever the coming of a new utility into a territory will serve to develop such territory and to build it up either industrially or agriculturally and thereby enhance the general prosperity of the state such utility will not be excluded. It appears from the evidence that the Great Western Power Company was largely responsible for the action of the lumber company in changing its plan with regard to the use of power at its mill near Oroville. It is quite possible that had it not been for the efforts of that company electrical energy would not have been used at all at this mill. The state is interested in the development of its natural resources through the development and sale of hydro-electric energy. This commission has encouraged utilities to develop hydro-electric energy. Competition which results in new uses for and the additional sale of electrical energy is not to be stifled unless it appears that such competition actually results in harmful duplication and economic waste. In the present case we do not believe that serious duplication will result. Nor is this a case where one utility is taking the 'cream of the business' by taking a large consumer away from another utility. Rather does it appear here that the Great Western Power Company is developing business which would not otherwise have been developed."

The Great Western Power Company was sharply criticised by the commission for entering into a contract with the lumber company before securing a certificate, and the commission adds that it is difficult to understand how the company could have assumed that a certificate was not necessary.

Few Bond Issues of Electric Light & Power Companies in Default

DEFAULTED bonds of public utility companies are, according to a list compiled by Dow, Jones & Company, New York, fewer in number and less in value than a year ago, the total par value of such bonds being placed at $470,000,000 against $494,858,000 on Nov. 25, 1920. Traction issues make up the greater part of the list, defaulted bonds of traction companies in greater New York alone totaling more than $176,000,000. Among electric light and power companies defaulted paper is conspicuously small, the total among companies doing a lighting and power business in part or entirely amounting to less than $28,500,000, divided as shown in table above.

Allied Light & Power first 5's	[illegible]
Commonwealth Power of Nebraska 6's	[illegible]
Memphis Consolidated Gas & Electric 5's	[illegible]
Merchants Power first 5's	[illegible]
Michoacan (Mexico) Power first 6's	[illegible]
New Orleans Railway & Light refunding 5's	[illegible]
Pensacola Electric 7 per cent notes, 1921	281,900
South Carolina Light, Railway & Power 5's	3,497,000
South Carolina Light, Railway & Power 7 per cent notes, 1921	450,000
United Traction & Electric 5's	9,000,000
Total	[illegible]

Washington Clothed in Illuminating Splendor

IN HONOR of the "unknown soldier" and as a greeting to the delegates to the disarmament conference, Washington was ablaze on Friday and Saturday nights last week with electric light. A jeweled archway, consisting of two obelisks, 85 ft. high, with a jeweled curtain suspended between, served as an approach to the building where the arms conference convened. An avenue of light consisting of thirty-two Roman lamps in rows on each side of Seventeenth Street stretched from the Corcoran Art Gallery to the jeweled archway.

Behind the dome of the Capitol and visible for miles was the "light of the states," an "aurora borealis" with rays of tinted light radiating in all directions. At the base of the Washington Monument were four searchlamps bathing the monument in light clear up to its top. From the top searchlights also played upon the White House, the dome of the Capitol, the United States Naval Observatory, the amphitheater at Arlington, the Soldiers' Home and the Bureau of Printing and Engraving. Other features consisted of illuminated banners of artistic design and rose-tinted lights embellishing prominent buildings.

The illumination was planned by W. D'A. Ryan, illuminating engineer of the General Electric Company. The entire scheme is an adaptation of the illumination originally planned for President Harding's inauguration.

Four Different Proposals for Developing the St. Lawrence

FOUR different ways of developing the St. Lawrence River were placed before the International Joint Commission in Ottawa on Monday of this week, known as the Wooten-Bowden, Hydro-Electric Commission, Connolly and Cooper plans. The first is that submitted last July by W. A. Bowden, chief engineer of the Canadian Department of Public Works, and Colonel Wooten, representing the United States government, for a single power development at the Long Sault and for canalization of the rest of the river to provide a waterway for shipping. Under this scheme 1,450,000 hp. is to be developed.

The Hydro-Electric Power Commission of Ontario made three proposals, the first being identical with the Wooten-Bowden plan, the second and third somewhat similar, though providing in addition to the Long Sault development a smaller one at Morrisburg. The additional power to be thus derived is placed at 100,000 hp.

W. S. Connolly, representing the New York & Ontario Power Company of Waddington, N. Y., in his plan provides for a series of dams from Waddington to Morrisburg, developing 660,000 hp., and a second series at the Long Sault, developing slightly in excess of 1,000,000 hp.

The fourth plan is that of Col. Hugh L. Cooper, consulting engineer of New York. Under this it is proposed to develop 5,400,000 hp. in four stages, utilizing the entire river. Colonel Cooper, in presenting his plan, asserted his conviction that dams could be built at the places he had selected because he had ascertained that the required foundations are there. He also emphasized the handicap the other systems would be under because of ice troubles.

It is interesting to note in this connection a statement attributed to H. G. Acres, hydraulic engineer for the commission, that experiments in heating the water adjacent to generating plants are to be carried out by the commission for the purpose of eliminating ice troubles.

Manufacturers Must Create Demand

PRESIDENT R. J. RUSSELL of the Electric Power Club, in his address at the fall meeting of the club, held at Cleveland on Nov. 14, called attention to the conditions which the electrical industry is now facing and indorsed the general opinion that business has turned the corner. He pointed out, however, that too great a percentage of the business done by some manufacturers is not created by them but just naturally flows to them. Owing to this situation, he believed that in most cases manufacturers should spend more money in developing a demand for the apparatus they manufacture. This activity, he maintained, should, in addition to the various forms of advertising, include a sufficient amount for the training of sales engineers. Another form of development he urged is an increase in the number of machinery manufacturers that will foster the sale of motor-driven units. He pointed out that records show that there were 1,030 electrical apparatus and supply manufacturers in 1914, their product being valued at $335,000,000, and 1,403, or a 40 per cent increase, in 1919, with an increase in value of products to $884,000,000. He urged that these companies should be classified and become members of the American Manufacturers of Electrical Supplies because their policies and acts directly influence public opinion on the electrical industry. He said the Electric Power Club has among its membership a majority of all electrical apparatus manufacturers, these manufacturers producing 85 per cent of the product coming within the scope of the club. He urged the members to become familiar with the work of other electrical associations.

In referring to the activity of the Electric Power Club in establishing standards for the guidance of its members, Mr. Russell voiced a need for the compilation and insertion in the Electric Power Club handbook of those suggested standards which have failed of adoption and are now frowned upon by the club.

Mr. Russell's address was received with enthusiasm, and a recommendation was unanimously adopted to print it and distribute it to all members.

At the second session A. H. Moore of the General Electric Company outlined the work of the National Industrial Conference Board and the formulation of rules covering life hazards in electrical installations. He was followed by Victor Tousley, head of the electrical inspection department of the city of Chicago, who described in some detail the formulation of Chicago rules covering fire hazard and hazards to life and limb. He reported a high percentage of compliance in a number of rules, particularly those referring to the safety switch and the inclosing of motors. He explained the responsibility of municipal inspection departments in the creating and enforcing of safety provisions and pointed out that it was the ambition of his department to co-operate in this work rather than to impose impossible restrictions. He maintained that the Chicago rules bear liberal interpretation and that the same degree of protection is not required in all cases. Certain installations require safety measures against both fire and life hazards, while others, on account of the conditions of installation, require protection from one hazard only.

At this session S. L. Nicholson, at the request of the president, outlined the co-operation which the electrical industry is giving to the government, and particularly to the Department of Commerce in response to an invitation received from Secretary Hoover. This invitation suggested the appointment of committees to act with the Department of Commerce in the reorganizing of the work of the Bureau of the Census, which is seeking to develop monthly statistics on production and stocks and to systematize the relations of the bureau with the specialized fields of industry in connection with the biennial Census of Manufactures. This invitation also referred to similar co-operation with the Bureau of Standards, which is seeking to systematize its relation to the various activities of the industries with which it has heretofore come in contact. Mr. Nicholson explained the nature of labor statistics covering the electrical industry that are now being compiled by the National Industrial Conference Board.

At a banquet on Monday night Col. Leonard P. Ayers, vice-president of the Cleveland Trust Company, gave an interesting lecture on business conditions, in which he continually emphasized that "business is prices." In developing this thought he showed the trend of prices over a long period in the history of this country and interpreted their rise and fall in economic conditions. He showed that from 1810 to 1920 the cycle of price changes has comprised periods of twenty years of increases in prices followed by thirty years of decreases in prices. The first such cycle was started during the war of 1812, when the maximum price index was 250. The second one was started by the civil war, when approximately the same price index was reached, and the third one was started by the world war in 1914. He pointed out that the conditions under which business was conducted during these various cycles were very different and that due consideration of this fact is important in an analysis of any business situation at the present time and in predictions for the future.

50-Deg. Resolution

The morning of Tuesday was devoted to a meeting of the board of governors, followed by a general afternoon session. At this time there came up for consideration the proposed revised constitution and bylaws for the Electrical Manufacturers' Council, which had previously been approved at a joint meeting of the members of the board of governors of the Associated Manufacturers of Electrical Supplies, the Electrical Manufacturers' Club, the Electric Power Club and the council. This action, which proposed a broader scope and more authority for the council, was considered advisable in order to enable the council to handle in a more effective way the important national problems affecting the many branches of the electrical manufacturing industry which are embraced in the three organizations involved. The general meeting unanimously indorsed the proposed revisions. Under the new arrangement the members of the boards of governors of the three organizations will constitute the representatives of their organizations in the council. Direct contact of the boards of governors assures the necessary consideration of matters concerning their interests as a whole and prompt action on them. This action enlarges the membership of the council to a group of thirty-eight representatives.

At this meeting also the question of 40-deg. and 50-deg. motor ratings was presented in a joint report of the fractional-horsepower motor committee, the large-power motor committee and the generator committee. This report presented the recommendation approved by these committees at a joint meeting in Cleveland on Oct. 7 last and, in accordance with instructions from the board of governors dated Sept. 20, brought up for consideration in the general meeting of the Electric Power Club. The recommendation follows:

> Whereas the Electric Power Club has at the present time two adopted standards for open-type continuous-duty motors, described in Rule 5,303 as the 40-deg. rating and the 50-deg. rating; and
>
> Whereas, during a period of progressive development of the use and application of the 50-deg. rating, it has been considered necessary to differentiate between the various uses and applications of the 50-deg. rating and to recognize as a departure the 50-deg. rating where sold for general purposes as distinguished from the 50-deg. rating specially applied; and
>
> Whereas, in the judgment of the Electric Power Club, this differentiation in the use and application of the 50-deg. rating is no longer necessary; and
>
> Whereas the purchasing public now recognizes the two ratings for open-type machines with continuous time ratings, and with proper co-operation on the part of the manufacturers and proper education can intelligently apply whatever rating in its judgment best meets the duty cycle and conditions of service to which the motor or generator is to be applied;
>
> Now, therefore, be it resolved, that all limitations in respect to the 50-deg. rating as an adopted standard of the Electric Power Club be removed, as follows: [Then followed detailed references to items in the handbook with appropriate changes].

This resolution was unaimously approved by members present at the meeting.

This joint report also contained a recommendation to change Rule 1,123 so that this rule will read as follows:

> A machine in which the ventilating openings in the frame are protected with wire screen, expanded metal or perforated covers, the openings in which must not exceed ½ sq.in. in area, must be of such shape as not to permit the passage of a rod larger than ½ in. in diameter, except that where the distance of live parts from the guard is more than 4 in., the openings may be ¾ sq.in. in area, but must be of such shape as not to permit the passage of a rod larger than ¾ in. in diameter.

At this session it was voted to elect a permanent secretary and establish an office of the Electric Power Club at some convenient point.

Chicago Committee to Support Landis Award

REPRESENTATIVE business men of Chicago to the number of 150 from the various business and civic organizations of the city will act as a citizens' committee to bring about full adoption of the Landis building award. The appointments were made by Joseph R. Noel, president of the Association of Commerce, and include Samuel Insull and John F. Gilchrist of the Commonwealth Edison Company and B. E. Sunny of the Illinois Bell Telephone Company. John W. Leary, on whose motion the appointments were made, says of the committee work: "The committee is making no fight on trade unions as such. Those unions which have accepted the Landis award and are working under it will have the support of the committee in their action. Those crafts which withdraw from the award or refuse to accept its conditions automatically place themselves beyond the support of the public."

Western States Gas & Electric Company to Build New Hydro Plant

THE California Railroad Commission has authorized the Western States Gas & Electric Company to proceed with the construction of a hydro-electric power plant on the south fork of the American River and to enlarge its existing plant. The plans of the company call for the development of storage reservoirs on tributaries of the American River and the construction 10 miles above its present plant of a new hydro-electric plant with an ultimate capacity of 100,000 hp. The additional water resources to be developed will be available to increase the capacity of the company's present plant to approximately 56,000 hp.

In order that the bonds to be issued may be a first lien upon the project, the Western States Company has organized the El Dorado Power Company as a subsidiary. All of its stock will be held by the Western States Gas & Electric Company, which will also guarantee its bonds.

Doherty Properties in Ohio to Be Interconnected

FOR the purpose of combining and interconnecting several of the Doherty properties in Ohio the Ohio Public Service Company has been incorporated to act as holding company for the properties in Warren, Alliance, Massillon, Elyria and Lorain. The demand for power has loaded to capacity the plants at all of these places, and additional generating units can be installed only in the Trumbull Public Service Company's plant at Warren, where there is sufficient water available for condensing purposes.

A high-tension transmission line is to be built at once connecting Warren, Alliance and Massillon. Later transmission lines will be built to connect Ashland, Lorain and the intervening territory. In addition it is proposed to construct a transmission line to a site on the Ohio River where a plant will be constructed of sufficient capacity to supply the future demands of the entire system.

Comprehensive Analysis of Rural Service Situation to Be Made

AN ANALYSIS of farm service methods is to be made by the rural service committee of the N. E. L. A., according to plans outlined at its meeting last week in Chicago. The committee intends to select several of these methods, which are more or less alike in principle, differing only in application, and include them in its report with discussions of the advantages and disadvantages of the points wherein the methods differ. It is also proposed to collect data and make such an investigation as will facilitate a more correct determination of the difference in costs between urban and rural service. The committee believes that there should be some standard form for rural-service line construction, and it is consequently going ahead to collect information on present practice. The committee also believes that it is absolutely necessary to educate the farmer to the value of electrical service and is consequently planning to gather information to show in a conclusive way that the farmer can pay a rate sufficient to make this kind of service profitable to the utility. Believing that there is a lack of electrically driven farm machines, the committee plans to point out to manufacturers in a general way the things that are most needed.

Compilation of statistics showing the number of farms in the country, how they are distributed and the number of lines necessary to serve them, and an approximate estimate of the cost of such a system, are among the further plans of the committee.

One Hundred and Fifty Thousand Hear Arlington Exercises

SOUND amplifiers and the latest developments in long-distance telephony made it possible for approximately 150,000 persons in Washington, New York and San Francisco to hear the Armistice Day exercises at the Arlington (Va.) National Cemetery as clearly as if they had been there. This was the largest audience that had ever been able to hear the same speaker simultaneously and the first time that a crowd had been addressed at such long distance. Col. J. J. Carty, vice-president of the American Telephone & Telegraph Company and head of the development and research department which perfected the apparatus used, declared that the exercises could have been heard in many other cities but for the fact that much of the apparatus required was of such recent development that the parts could not be manufactured in time.

PART OF THE THIRTY THOUSAND IN FRONT OF MADISON SQUARE GARDEN IN NEW YORK

Upon being questioned regarding his opinion of the significance of the development, Colonel Carty said: "It constitutes an event of the first magnitude in communication. It enables audiences in numbers and size heretofore undreamed of to hear a speaker's voice or the sound of music at the moment of delivery despite the distance of its origin. With more elaborate preparations it will be possible for the President of the United States, if he so desires, to talk to audiences assembled in every state in the Union without leaving his desk, or the head of an industrial corporation may address simultaneously his workers gathered in plants all over the country. The achievement will even have a marked effect on the future design of auditoriums. No large one will be complete without the loud speaker."

The tremendous physical accomplishment was not the only thing. Colonel Carty went on to say: "The results transcend the importance of the apparatus involved. More important than the scientific aspects was the fact that masses of people separated by nearly 4,000 miles were thereby enabled to pray, to sing and to listen in unison. The results were sublime and impressive The emotions aroused cannot be expressed in print; they must be experienced.

By far the most difficult problems which had to be solved in developing the loud-speaker system were those involving the transmission and reproduction of speech with such perfect fidelity that all individual characteristics and modulation of a speaker's voice would be accurately preserved. These problems were much more difficult than that of simply amplifying the voice. Nevertheless, the present loud-speaker system has proved eminently successful from each of these viewpoints.

In general, the system comprises two distinct sets of equipment, namely, (1) the apparatus for receiving the sound vibrations and amplifying them at the delivery end, and (2) the intervening telephone circuits. The outward appearance of the loud-speaker, as installed at Madison Square Garden, where 30,000 people are estimated to have heard the exercises, is shown in the accompanying illustration. Similar but concealed projectors were employed inside the auditorium. At Arlington Cemetery the projectors were placed on top of the semicircular colonnade of the amphitheater, but there too they were concealed from view of the audience. Tests made by the telephone engineers showed that in general the best acoustic results are obtained by the use of a large cluster of projectors, rather than a number of small horns distributed at intervals over the area to be covered. In the long-distance telephone circuits between Washington and San Francisco there were fifteen small amplifiers or telephone repeaters placed at intervals of about 300 miles. Each of these repeaters amplified the incoming energy about eleven times. Both the repeaters and the loud-speaker amplifiers involved the application of the so-called "vacuum tube," which is rapidly becoming one of the most important items of electrical apparatus. While the vacuum tube is the direct result of many recent discoveries in science, much of the credit for its present state of perfection belongs to the telephone engineers already mentioned and to the laboratories of the Western Electric Company, of which Dr. A. C. Jewett is director.

Southern Power to Build Two New Plants

THE Southern Power Company, with headquarters in Raleigh, N. C., announced this week that it has just let contracts for the wheels and generators for two new stations on the Catawba River, one at Great Falls, S. C., and the other at Mountain Island, N. C. For the first, to be known as Great Falls Power House No. 2, three 18,750-kva. units have been ordered. It is expected to have the plants completed and ready for operation in twelve months. The Southern Power Company already has a dam at this place and a plant developing 40,000 hp.

Construction at Mountain Island will be from the ground up, as there is nothing on the site now but the remains of the old Mountain Island cotton mill, which was washed away in the flood of 1916. Both dam and plant are to be constructed here, besides necessary preliminary work, and it is estimated that it will take two years to complete the job. Four 18,750-kva. units have been ordered for this plant. This will be the second largest station in the company's system, being exceeded only by the station at Wateree, S. C., with 84,000 hp. capacity. To facilitate construction of the plant, the Piedmont & Northern Railway, a subsidiary of the power company, will be extended three and a half miles from Mount Holly to the scene of operations.

The news that the Southern Power Company is to resume construction work, discontinued some three years ago, is received with intense gratification throughout the Piedmont section. For some time there has not been enough power available to meet all the demands, and the power company has not been able to make any important new contracts for a year or more. Although it has been generally known that the company had no power to sell, it has on file now applications for 35,000 hp.

The wheels and generators in the two plants will be of identical design. The wheel contract has been let to the S. Morgan Smith Company and the generator contract to the Allis-Chalmers Company. Contracts for the construction work are to be let shortly.

Open Meeting for Metermen to Be Held in Springfield, Ill., in February

THE national meter committee of the National Electric Light Association will hold an open meeting in Springfield, Ill., on Feb. 15 in the Sangamo Electric Company's assembly hall, at which metermen and men who are interested in the metering of electrical current, especially those who are directly in charge of meter departments, are cordially invited to be present.

The committee in charge has arranged an interesting and educational program and feels that considerable benefit will be derived by those who are in attendance at this meeting. The national meter committee is asking for a large attendance so that it may find out the problems which the men have and help to solve them.

Manitoba Power Building Large Plant on Winnipeg River

THE MANITOBA Power Company, Ltd., is building on the Winnipeg River at Great Falls a hydro-electric plant which will have an ultimate rating of 168,000 hp. The initial capacity will be 56,000 hp., consisting of two 28,000-hp. units. The plant will operate under an effective head of 56 ft.

The company is also building 17 miles of high-tension line from the Great Falls plant to a connection with the existing line from the Pinawa hydro-electric power plant of the Winnipeg Electric Railway Company to Winnipeg.

New Orleans Negotiations Halted

A DECISION of the Louisiana Supreme Court continuing in force the injunction restraining the city of New Orleans from entering into any agreement with the New Orleans Railway & Light Company on car fares caused the negotiations between the city and the company to come to a halt last week. It had been confidently expected that all points in discussion would be amicably settled this week. It is now felt that nothing can be done until the city has got free from the injunction proceedings.

All this time the company is unable to go ahead with electrical development because its plans for extending service are a part of the proposed joint agreement. There are now more than 3,000 unfilled applications for electric light and power service

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Wireless Telephony Carries the Final Speeches of Mayoralty Candidates.—The heated mayoralty campaign in New York City came to an end last week on the eve of election with bursts of wireless eloquence from both candidates. Their final appeals and arguments were spoken into radio-telephonic apparatus and carried to receiving stations everywhere in the Greater City, by which means they were heard by thousands of auditors scattered over a territory many miles in area.

The Youngest President of the A. I. E. E. — In the ELECTRICAL WORLD'S frontispiece sketch of Prof. Charles F. Scott, printed on Nov. 5, reference was made to his election to the presidency of the American Institute of Electrical Engineers in 1902, when he was only thirty-eight years old, and the distinction of having been the youngest of all the Institute presidents was accorded to him. This was an error. Young for such an honor as Mr. Scott was, a man even younger had previously had it conferred upon him, in 1887, when T. Commerford Martin, then in his thirty-first year, was chosen as the man fittest to head the body. Mr. Martin was the third president of the Institute and had already in those pioneer days begun the willing, vigorous and able service in his chosen field that he was for so long to continue.

Engineering Libraries.—The Special Libraries Association, a national body with offices in Washington, has found more than 1,300 "special" libraries in the country, many of which are largely concerned with engineering, technology, electricity, chemistry and industrial management. Engineering libraries of various types are maintained by national and local engineering societies, by colleges and universities, by large manufacturing companies, by professional engineering firms, by public utility companies and by various other agencies. Some of these libraries have been in existence for many years, but many others have only recently been established. The most complete and comprehensive collection is that of the Engineering Societies' Library in New York City. Thirty-six libraries devoted especially to electricity were found. As a result of the association's survey a "Special Libraries Directory" has been issued.

Oil-Immersed X-Ray Apparatus.—An important advance in the development of X-ray apparatus has lately been announced by Dr. W. D. Coolidge of the General Electric Company's research laboratory, in speaking before the American Roentgen Ray Society. Dr. Coolidge described new types of experimental outfits which have eliminated the danger of electric shock to patient or operator by complete isolation of high-tension sources within a grounded oil-filled metallic container. This receptacle contains the X-ray tube, a high-tension transformer and a Kearsley stabilizer, the whole weighing only 20 lb. The metal can is rotatably mounted in a steel-forked bracket giving thorough freedom of motion both vertically and horizontally through a considerable space and with just enough friction to hold it wherever put. The X-rays pass through the top of the sealed container and are focused by a "bakelite" tube attached to the container which also serves as a mechanical contact between the outfit and the patient. The small-sized apparatus for dental radiography operates on 40,000 volts and 10 milliamperes, and the larger apparatus for more general work on 60,000 volts and 50 milliamperes. The tube, which is of the self-rectifying type, is only 5.75 in. long, the smallest yet developed.

Increased Capacity at Lowellville, Ohio.—Work has been begun by the Pennsylvania-Ohio Power & Light Company on the erection of an addition to the Lowellville (Ohio) generating station to house a new 20,000-hp. turbo-generator. This additional unit will bring the capacity of the Lowellville station to 80,000 hp. The greater part of the foundation work was completed some time ago. The need for an increased production at Lowellville has sprung up in the last four months, when industrial and commercial consumers of power have been added steadily in the Youngstown, Newcastle and Sharon districts. The power output in the four weeks ended Oct. 22 showed an increase of 25.5 per cent over the four-week period ended July 30.

Power Project for Lancashire District of England.—Plans for supplying electrical energy to the southeastern part of Lancashire, England, of which the city of Manchester is the center and which includes many smaller manufacturing towns, have been completed which, though they still lack municipal and parliamentary acceptance, will, it is thought, be finally adopted. By these plans it is hoped to save £250,000 in generating costs in ten years. Many existing central stations will, if the plan goes through, be put out of commission, but five or six will be extended and will co-operate with a great station that the Manchester Corporation is erecting at Barton. It is a curious fact, says the London *Engineer*, that within this great industrial area there is no waste heat available, either in the form of gas or of exhaust steam, for use in the generation of electricity, nor any water resources which can be utilized except for condensing purposes.

Electric Steamship Drive Scores Two More Successes.—The first electrically driven cutter in the United States Coast Guard—the Tampa—which takes the place of the boat of the same name torpedoed off the English coast in the last year of the war with a loss of all hands, has had her sea tests, and the drive is pronounced by her officers to be a complete success, especially as regards reversing and stopping the craft. From full speed ahead at better than 15 knots to a dead stop in less than the ship's length was her record. The best that any other cutter has done has been to stop within three ship's lengths, the boat's engineer said. A similar advantage was found in the case of the Victorious, the fifth of the 12,000-ton cargo carriers which are being equipped with electric drive for the United States Shipping Board at the Todd Shipyard Corporation's basin in Brooklyn, N. Y. The average speed attained by the Victorious during her trials showed a gain of 1.6 knots over her speed before the electric drive was installed. From full speed ahead, with the propeller turning at the rate of 100 revolutions a minute, full speed astern, with the propeller turning at the same rate, was accomplished in four seconds. The vessel was brought to a complete halt in two minutes and forty seconds.

University of Illinois Annual Electrical Show. — Plans for the annual electrical show to be given by faculty and students of the electrical engineering department of the University of Illinois have just been made. The show, which will be given next March or early in April, will be a notable exhibit of the most advanced ideas in electrical devices and merchandise. Since the close of the war these shows have been revived and marked interest has been demonstrated in them by faculty, students and the public generally.

Louisville's Electric Home.—Through the efforts of the Electric Club of Louisville, Ky., an electric home was opened to the public in that city on Oct. 24. This eight-room house, with an adjoining garage, has 105 outlets and forty-nine electric appliances including an electric victrola, clock, furnace-heat regulator, refrigerator and clothes drier. Such an interest was shown in this ideal home that during the first four days 9,000 people visited it and became acquainted with the possibilities of service offered by the public utilities.

Valuation of Ohio Utilities.—The 1921 tax valuation of Ohio electric light and power, natural gas, telephone and electric railway companies is $42,068,220 higher than the 1920 valuation, an increase of 8.2 per cent, according to figures compiled by the State Tax Commissioners and circulated by the Ohio Committee on Public Utility Information. The electric light and power, natural gas, telephone and electric railway companies paid $19,000,000 in taxes for 1920. The increased valuations, combined with higher rates in almost all of the counties, mean that more millions must be collected by these companies to pay their higher tax bill for 1921. Electric light and power companies received the biggest increase in their tax valuations, being boosted from $78,097,920 in 1920 to $93,285,450 this year, an increase of $15,187,530, or 19.4 per cent.

Progress of the Rhone Dam.—Preliminary work on the hydro-electric development upon the Rhone, in France, is proceeding satisfactorily, according to the *Engineer's* Paris correspondent. The most difficult part of the undertaking will be the Genissiat dam, which is to have a height of about 330 ft. and which it was feared might be imperiled by possible fissures in the underlying chalk strata. For nearly two years past an elaborate system of soundings and borings has been in progress. This work proved that the foundation for the dam would be perfectly sound. It is hoped that with the termination of the preliminary work it will be possible to proceed with the construction of the Compagnie Nationale de Rhône, which does not appear to be making so much headway as had been expected, first, on account of the financial situation generally and then because public opinion was influenced against it.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies

Decree Impounding Part of Customers' Payments Does Not Empower Commission to Fix Rate Retroactively. In Consolidated Gas Company of New York vs. Attorney-General the United States Court for the Southern District of New York declared that a decree limiting the rate to be charged by a gas company and impounding a certain part of the money collected, to be later distributed according to a rate eventually determined by authority of the state, does not require that the power given to the Public Service Commission shall extend to fixing a rate to be effective retroactively. The time fixed by the decree for impounding was extended for three months after the determination of the appeal in order to give the Public Service Commission time to set a new rate. (274 Fed. 986.)*

Trade Associations May Exchange Price Lists and Other Data.—A point of interest to the three thousand trade associations existing in the United States was settled in the Federal District Court at Chicago when it was held that such associations may lawfully exchange price lists and other trade data. Suit had been brought against the Armstrong Bureau—maintained by thirteen manufacturers of linseed oil for purposes such as those named—as a part of the government's anti-trust prosecutions. "Logic which assumes that because there is an opportunity to fix prices, therefore prices are fixed, is contrary to the genius and logic of our law," said the court. "Every man is presumed to be innocent until he is proved guilty. If the Armstrong Bureau is to be dissolved merely because it afforded the members an opportunity to fix prices, then this court with equal propriety could be asked to dissolve any lunch club where business men meet. This theory hardly warrants discussion."

Federal Court Issues Restraining Order Permitting Increased Rates Temporarily.—In Northwestern Bell Telephone Company and Tri-State Telephone & Telegraph Company vs. Attorney-General, the United States District Court for the District of Minnesota has held that pending an application for an interlocutory injunction against the enforcement by state officials of existing telephone rates and an order of a state commission denying temporary increases where it appears that the existing rates are confiscatory, that the companies have been trying for several months to get temporary relief, and that every day's delay is important and perhaps vital and it cannot be told when the application for an interlocutory injunction can be heard by three judges as required by law, a temporary restraining order granting an increase in rates until the hearing of such application will be granted on conditions protecting customers in case it is finally determined that the increase ought not to have been granted. (274 Fed. 384.)

Contract Rights of Cities in South Dakota.—A preliminary injunction granted to the Water, Light & Power Company against the city of Hot Springs, S. D., was dissolved and the company's bill dismissed by the United States District Court, which held that the constitutional provision that "no law making any irrevocable grant of privileges, franchises or immunity shall be passed" was not violated by a city ordinance granting a franchise for a term of years to an electric company, including a rate contract. In granting a franchise to an electric company, the court held, a city may by a contract accepted by the company fix maximum rates of charge for a stated term, and this contract will be valid and binding during the term, regardless of the fact that the rates so fixed may be or may become confiscatory. (274 Fed. 827.)

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*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities

Funding Bond Discount.—The Indiana Public Service Commission, dismissing an application from the Wabash Valley Electric Company, has declared that a public utility is not permitted under the laws of the state to issue securities for the purpose of funding bond discount.

Motion-Picture Theater Allowed to Go on Power Schedule.—The New York Public Service Commission has granted the application of the Bellevue Theater Corporation for a power rate on the electrical energy used to operate its motion-picture projecting machine at Niagara Falls, instead of the lighting rate which had previously been charged by the Niagara Electric Service Corporation. The fact that the alternating-current energy delivered by the company had to be changed to direct current for the use of the theater was the ground on which the Bellevue corporation claimed the much lower rate now accorded to it.

Rates for Hauling Coal to Central Station Reduced.—The Public Service Commission of Pennsylvania has ordered the Lehigh & New England Railroad Company to reduce to 35 cents a ton its rates for hauling coal from Coaldale, Lansford, Nesquehoning and other places in that neighborhood to the plant of the Pennsylvania Power & Light Company at Hauto. This order sustains a complaint of the central-station company. In announcing its decision the commission said that the contention that the commission had no authority to change rates within the federal guarantee period was without merit. The rates of 40 and 70 cents in effect during the period covered by the complaint are set aside. In regard to a contention regarding switching service charges, the commission said there was no such thing as a foot-rule standard for switching and other charges comparable to that under attack.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

Institute Section Meetings.—Section meetings of the A. I. E. E. for next week are scheduled as follows: Nov. 25, Kansas City, "Diesel Engines," by C. E. Beck; Nov. 25, Toronto, "Instruments and Measurements."

Boston Section, A. I. E. E.—"Electric Waves and Their Application to Radio Telegraphy and Telephony" was the subject of an address before this section on Wednesday, Nov. 16, by Prof. E. Leon Chaffee of the Harvard Engineering School.

Western Inspectors Announce January Convention.—Announcement comes from the Western Association of Electrical Inspectors that the seventeenth annual convention of that association will be held in Chicago at the Hotel Sherman on Jan. 17, 18 and 19, 1922.

Engineers' Club of Philadelphia.—O. C. Merrill, executive secretary of the Federal Power Commission, will discuss "Accomplishments Under the Federal Water-Power Act" before this club at the luncheon on Tuesday, Nov. 22. On Nov. 29 Jacob Billikopf, founder of the Kansas City Board of Public Welfare, will be the speaker.

Dr. Hollis to Speak on Waste.—At the Philadelphia Chamber of Commerce on Monday, Nov. 28, at 8 p.m., Dr. Ira N. Hollis, president Worcester Polytechnic Institute, past-president A. S. M. E. and a member of the committee on the elimination of waste in industry appointed by Secretary of Commerce Hoover, will address a joint meeting of the Philadelphia Section of the Taylor Society, the Atlantic Chapter, Society of Industrial Engineers, and the Industrial Engineering Club on "Waste and Its Relation to the Industries."

Coming Meetings of Electrical and Other Technical Societies

A. I. E. E. Section Meetings—Kansas City, Nov. 25; Toronto, Nov. 25; Minnesota, Nov. 28; Atlanta, Nov. 30; Providence, Dec. 2; Baltimore, Dec. 8; New York, Dec. 14.

A. I. and S. E. E.—Pittsburgh Section, Nov. 23; Cleveland Section, Dec. 12; Chicago Section, Dec. 16; Philadelphia Section, Dec. 20.

Philadelphia Section American Welding Society—Philadelphia, Nov. 21.

Kentucky Association of Public Utilities—Louisville, Nov. 22.

Philadelphia Chapter American Society for Steel Treating—Philadelphia, Nov. 25.

American Physical Society—Chicago, Nov. 25-26; Toronto, Dec. 27-30.

Electrical Supply Jobbers' Association—Cleveland, Nov. 30, Dec. 1-2. Atlantic Division, Cleveland, Nov. 29.

American Society of Mechanical Engineers—New York, Dec. 5-8.

American Society of Refrigerating Engineers—New York, Dec. 5-7.

American Institute of Chemical Engineers—Baltimore, Dec. 6-9.

American Association for the Advancement of Science—Toronto, Dec. 27-31.

American Engineering Council — Washington, Jan. 5-6.

American Society of Civil Engineers—New York, Jan. 18-19.

National Meter Committee, N. E. L. A.—Springfield, Ill., Feb. 15.

Men of the Industry

Changes in Personnel—Responsibilities and Association Appointments of Men Engaged in Professional, Executive, Operating and Commercial Branches of the Industry

John N. Cadby, consulting engineer of Madison, Wis., has been selected as executive manager of the Wisconsin Electrical Association and will take office on March 1, 1922. Mr. Cadby comes to this important work after many years of intimate contact with the public utilities industry of Wisconsin. He was born in Merton, Wis., in 1880 and graduated from the Electrical Engineering College of Wisconsin University in 1903. During the years immediately following graduation Mr. Cadby was employed in designing, contracting, teaching and other engineering pursuits. In 1908 he joined the engineering staff of the Railroad Commission of Wisconsin and for the next ten years was in direct charge of the numerous regulatory operations undertaken by that commission relating to the gas, electric and telephone companies operating in Wisconsin. During these years he visited utilities in numerous cities outside the state to report on the practices and standards in force when no state commission was in existence. In recent years he has frequently been called upon to represent the commission at conferences with the national engineering and public utilities associations and to describe the work of the Wisconsin commission both in technical publications and before such conventions. One example of Mr. Cadby's pioneering work is the Wisconsin telephone standards of service in force since 1914. In 1917 he resigned from the commission's staff and opened a consulting engineering office.

J. N. CADBY

O. G. Gillett has been appointed superintendent of the South Meadow station of the Hartford (Conn.) Electric Light Company, and F. V. Whitney has been appointed to the same post at the Dutch Point station of the same company. Both will report to F. M. Wilbraham, superintendent of power.

Prof. Walther Nernst of the University of Berlin has been awarded the Nobel prize for 1920 in chemistry by the Swedish Academy. Professor Nernst is one of the best known physical chemists in Germany and was awarded the iron cross of the first class for distinguished service of a scientific character for the German army. He is probably best known, however, as the inventor of the Nernst incandescent lamp, which appeared at one time to be about to enter into universal use but was superseded by the tungsten lamp. Dr. Nernst has contributed to the technical press many papers on scientific, physical and electrochemical topics, based upon his original researches.

Philip Torchio, chief electrical engineer of the New York Edison Company, who has been abroad for two and a half months observing engineering developments in Italy, France and England, returned to this country recently. He also visited northern Africa, but most of his time was occupied in Naples, Rome, Florence, Venice, Milan, Paris, London and Birmingham. Mr. Torchio's recent work has been chiefly the development of methods which will increase the reliability and continuity of electric service from central-station systems. Toward this end he has contributed considerably to the industry, he having been responsible for the introduction of thin-plate storage batteries for central-station standby service and being the patentee of various important devices used in connection with underground transmission, such as high-tension cable-joint construction, ground and fault detectors, insulating covering for cables, manhole circuit breakers, reactance coils and protective devices for busbars and cable joints. Although usually associated with the direct-current system of the New York Edison Company, Mr. Torchio has also been closely identified as consulting engineer with the development of the extensive alternating-current network in and around New York City.

S. E. Wolff, well known as a public utility valuation and rate expert, has been elected vice-president of the United States Food Products Corporation. Mr. Wolff is a Western man, having been born and educated in Michigan, where he spent his earlier business life in the operation of public utility and railroad properties. In 1903 he became general manager of the Jackson (Mich.) Gas Company and two years later became vice-president and also vice-president and general manager of the gas, electric light and power and city traction properties in Saginaw and Bay City and the interurban road connecting these cities. In 1908 he removed to New York City and was engaged in the executive offices of Hodenpyl, Walbridge & Company, principally in examination and reports on properties and the reorganization of working forces of such properties as were acquired. He remained with this company until 1911, when it was succeeded by Hodenpyl, Hardy & Company, Inc., for whom he has been constantly engaged in examinations of organizations of working forces and management of corporations, principally public utilities, but embracing also railroad, manufacturing and mining properties. In 1917 he entered the army and was assigned to the Signal Corps and later to the Bureau of Aircraft Production, where he served as the head of the finance division. On his discharge from the army he resumed his duties with Hodenpyl, Hardy & Company.

G. C. Neff, chairman of the newly formed farm-life committee of the National Electric Light Association, is a native of Indiana and a graduate from Purdue University, class of 1907. After short periods of employment with the American Bridge Company and the Sandusky Portland Cement Company, he became the resident engineer on the location and construction of a 68-mile, 44-kv., double-circuit, three-phase transmission line in Wisconsin. On the completion of the line he became the superintendent of construction on the Portage transformer and frequency-changer substation. In 1910 he took the superintendency of the Southern Wisconsin Power Company, and in 1914 was made the general superintendent of the Southern Wisconsin Power Company and Wisconsin River Power Company. To these duties were added those of general superintendent of the Wisconsin Power, Light & Heat Company and Central Wisconsin Utilities Company in 1918, the Mineral Point Public Service Company in 1919 and the Janesville Electric Company in 1921. The six companies own and operate hydro-electric and steam plants with a combined capacity in excess of 50,000 kw., generate annually over 120,000,000 kw.-hr. of electrical energy and serve fifty-five communities in central and southern Wisconsin. He has been a member of the overhead systems and inductive-interference committees of the National Electric Light Association since 1920 and was chairman of the Madison Section of the A. I. E. E. in 1920. He is chairman of the rural lines extension committee of the Wisconsin Electrical Association, which has been one of the leaders in formulating rural extensions rules and policies.

G. C. NEFF

E. R. Johnson of Minneapolis has been engaged by the Ideal Electric & Manufacturing Company of Mansfield, Ohio, to take entire charge of all synchronous-motor sales.

Bernard R. Hensel has been selected by the Los Angeles contractor-dealers to represent them on the joint committee which will direct the new activity of the California Electrical Co-operative Campaign looking toward closer co-operation with the building industry in southern California.

C. H. Mackelfresh has opened a new district office in Cincinnati, Ohio, at 6 Greenwood Building, for the Railway & Industrial Engineering Company of Greensburg, Pa. Mr. Mackelfresh is a graduate of the College of the University of Cincinnati, class of 1909. For several years past he has been connected with the supply department of the Westinghouse Electric & Manufacturing Company, having been previously engaged in central-station and general engineering work.

T. D. MacMullen, secretary and sales manager of the Majestic Electric Development Company of San Francisco, is the chairman of a committee preparing an electrical exhibit for the coming Industrial Exposition at San Francisco. Mr. MacMullen, whose company, organized in 1914, has expanded until it now has a branch factory in Philadelphia, has been active in the affairs of the N. E. L. A., the Electrical Development League and the California Electrical Co-operative Campaign, as well as taking part in civic and general industrial affairs.

Edward M. Eliot has been appointed assistant to the vice-presidency of the Underfeed Stoker Company of America. He has previously been service manager for the Diamond Power Specialty Company, Detroit. Mr. Eliot was engaged in power-plant design and construction for eight years with the Oregon Electric Railway Company, the Electric Bond & Share Company and other companies and for the last seven years has specialized in the organization of service work and repair sales. He is a graduate of Massachusetts Institute of Technology.

Martin J. Wolf, until recently vice-president and sales manager of W. N. Matthews & Brother, Inc., of St. Louis, has been appointed sales manager of the Bussmann Manufacturing Company of that city. Mr. Wolf entered the electrical field in 1910 with the Hobson Electric Company of Dallas, Tex., as assistant sales manager. Early in 1913 he went to Chicago as sales manager of the Hot Point Electric Heating Company. His aggressive methods in connection with this organization in some measure were responsible for its remarkable success in the merchandising of electrical appliances. In 1914 Mr. Wolf joined the organization of W. N. Matthews & Brother, as manager of sales, becoming vice-president and a director in 1916. In this company he retains his identity as an officer and stockholder. Mr. Wolf has always been an exponent of vigorous but strictly ethical sales policies, and has preached and practiced co-operation between the various elements of the electrical industry. He is a close student of business administration, business economics and the psychology of salesmanship and has lectured upon the last-named subject before business, fraternal and civic organizations in many parts of the country.

W. P. L'Hommedieu, manager of the power department, San Francisco district, Westinghouse Electric & Manufacturing Company, has been elected chairman of the San Francisco Section of the American Institute of Electrical Engineers. Mr. L'Hommedieu has been an untiring factor in the promotion of Institute and engineering interests in central California and has helped to strengthen the power industry of that section in its commercial aspects. For three years he has been on the executive committee of the local section of the A. I. E. E. and he is serving for the fourth time on the engineering committee of the Pacific Coast Geographic Division of the N. E. L. A.

G. R. Watson, formerly Cincinnati representative of the Crouse-Hinds Company, has just been made sales manager of the Wadsworth Electric Manufacturing Company. For seven years he was electrical supervisor of the Pullman Car Company in Chicago. The next three years were spent as assistant to the New York manager of the Crouse-Hinds Company, after which he took up the work in Cincinnati from which he has just resigned.

G. R. WATSON

J. G. Sharp, head of the works financial division of the Western Electric Company at Hawthorne, has recently been made assistant treasurer. Mr. Sharp's Western Electric career began in October, 1893, at Chicago, where he was hired in the old Clinton Street factory by J. Mason Jackson, then secretary and treasurer of the company. For the first few years Mr. Sharp was switched about through several positions to afford him an acquaintance with the company's shops and business methods. About 1896 he was put in charge of the time office, to which payroll work was added in 1898. During 1901 and 1902 he was chief of the machine expense and time-posting department. The following year he had charge of shop costs. On Oct. 15, 1904, he took the helm in the ticket auditing and record room, being transferred to Hawthorne in the same capacity four years later. He was made cashier and head paymaster at Hawthorne in December, 1910, and chief of the financial division in April, 1917. His appointment as assistant treasurer took effect on June 14 last.

H. E. Rice, commercial manager of the Atwater-Kent Manufacturing Company, has resigned that post to become associated with the American Bosch Magneto Corporation as assistant to the president. Mr. Rice, who was with the Atwater-Kent company for nearly twelve years, has a business experience in the electrical and engineering field covering a period of more than twenty years. Trained as an electrical and mechanical engineer, he has held positions of responsibility in different electrical manufacturing organizations and for a long period devoted himself to experimental and development work in connection with electrical instruments, measuring devices, signaling equipment and small refrigerating machinery. On leaving his former associates he was presented with a gold watch. In the American Bosch organization Mr. Rice will be closely identified with the intensive and substantial sales and engineering program of the new organization in connection with the lighting, starting and ignition equipment now included among its products.

Obituary

Rayner M. Bedell, an electrical engineer in the laboratories of Peter Cooper Hewitt until Mr. Hewitt's death in Paris last August, died of tetanus Nov. 5, at Montclair, N. J. He was forty-one years old and a graduate of Cornell University, class of 1902. Mr. Bedell was a candidate for the Assembly on the single-tax ticket in the recent election.

John A. Perkins, who died on Oct. 27 from apoplexy, while on a hunting trip near his home at Lockport, N. Y., was well known both in the electrical field and in the gas industry. His capacity for hard work and his mastery of the industries with which he was identified earned for him the highest esteem of public utility men. Mr. Perkins was born in South Bend, Ind., Sept. 2, 1877. At the age of sixteen he entered the employ of the South Bend & Mishawaka Gas Company, of which his father had been the manager some years before. He stayed with this company sixteen years, working up through the organization step by step, and by the time he left South Bend in 1906 he had a knowledge of the gas business probably second to that of no man in the industry. With this background Mr. Perkins joined the United Gas & Electric Engineering Corporation as superintendent of the gas department of the Altoona (Pa.) Gas Light Company. Two years later he was sent to the Richmond (Ind.) Light, Heat & Power Company as general manager. In 1910 he went to Bloomington, Ill., as general manager of the Union Gas & Electric Company, and in May, 1916, he became general manager of the Lockport Light, Heat & Power Company. Later he became vice-president of the company as well as general manager, which positions he held at his death. Mr. Perkins was not only an executive but a leader and companion of the men working for him. He possessed two great business qualifications —an apparently inexhaustible fund of energy and a capacity for mastering, applying and enjoying detailed knowledge and experience.

Trade and Market Conditions

Business Reviews, Together with Market Letters
from Important Trade Centers, on the Supply, Demand and Prevailing Prices of
Electrical Apparatus and Supplies

Foreign Heating Appliance Imports Attracting Attention

REPORTS emanating from various sources in the electrical industry indicate that there are a considerable number of foreign-made heating devices being brought into this country. Actual figures on the numbers being brought in are not available, some authorities frankly stating that they have no idea what they are, while others are positive that the numbers are very great. For instance, one manufacturer in Connecticut has recently declared that a shipment of German-made electric flatirons, numbering 500,000, has been brought into this country since the first of August. Most of these devices, it is understood, are coming in from Germany, while a few are imported from Austria.

The present import duty on articles of this sort is only 20 per cent of the foreign prices and inasmuch as German flatirons, for instance, are reported to be sold at wholesale in this country for from $1.32 to $1.75, it can be seen that even a 100 per cent ad valorem import duty would not suffice to bring these articles up to American price levels.

So far only the following devices have been brought to the attention of American manufacturers: An electric flatiron weighing 6 lb., a traveling iron in leather case weighing 2 lb., a cooking kettle and water heater with a capacity of 1½ kg., several types of disk stoves and a reflector heater. The heating unit in the 6-lb. flatiron has been analyzed, and it has been found that this unit contained nickel chromium alloy. The use of this alloy in heating appliances as a heating element is covered in the United States by the Marsh patent, and the owners of the patent have announced that they intend to do everything necessary to protect not only their interests but those of the licensees.

The retail selling price of these products averages lower than prices of similar products of American make, the 6-lb. flatiron selling for $3.95, the 2-lb. traveler's iron in leather case for $6.50, and the water heaters and cooking kettles for $5.

Spain Best 1920 Customer for Control Devices

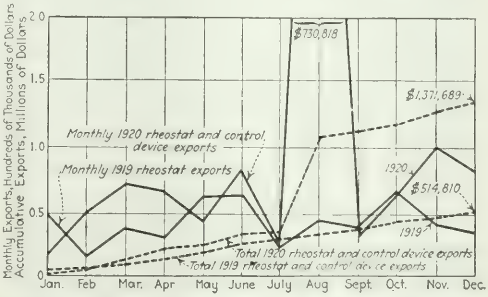
A STUDY of the exports of control devices, including rheostats, for the calendar year 1920 reveals some interesting figures in regard to the foreign markets for this class of material. The value of the exports for the year was $1,371,689, an increase of 167 per cent over the exports of the year 1919, when they amounted to $514,760. The increase over 1918 is even more marked, the value for that year being $288,757, so that 1920 was 376 per cent in advance.

In the accompanying table, figures for which were complied by the ELECTRICAL WORLD from data received from the Bureau of Foreign and Domestic Commerce, it is shown that in the year 1920 only fourteen countries imported American-made rheostats and control devices in amounts over $15,000. These countries took practically 94½ per cent of the American exports, while South American countries, excluding Brazil, took 3½ per cent, and thirty-three other countries took the remaining 2 per cent divided between them.

RHEOSTATS AND MOTOR CONTROL APPARATUS EXPORTS IN 1920

Spain....	$727,140	France	$29,490
Canada..	95,673	Australia	28,336
Japan..	92,945	Italy	25,609
Belgium	52,367	New Zealand	22,339
Cuba	51,255	Brazil..	21,395
England	48,860	Mexico	18,509
South America (excluding Brazil)	46,433	Thirty-three other countries importing control devices ..	34,921
British India	39,190		
Norway	37,227		
Total			$1,371,689

European countries took $920,693 worth, or over 66 per cent of the total. Spain proved by far the most important customer of the year, buying $727,140 worth, this being 52 per cent of the total exports to all countries. The greater part of this amount, or $703,128 worth, was purchased in the month of August and was evidently intended for one or several large installations, since exports to that country were not particularly high in other months. Canada was a poor second in yearly total, taking $95,673 worth, but proved to be one of our best month-to-month customers. Japan was only slightly behind Canada, with $92,945. Only small amounts separate the rest of the countries on the list. Departing from her relative position in the importation of other electrical commodities, Mexico is at the foot of the list of countries importing rheostats. It is interesting to note that British India stands comparatively high in imports of this sort of equipment, having purchased $39,190 worth from the United States. This would indicate that that part of the Orient is a better market for electrical equipment than has been commonly supposed.



AUGUST, 1920, EXPORTS NEAR TOTAL FOR TWO PREVIOUS YEARS

In general the curves of monthly exports for 1920 and 1919 followed each other closely. The only great divergence is noticeable in August, that month in 1920 including the large shipment to Spain. November and December, 1920, showed some increase over the same months in 1919.

Basic Conditions Show Betterment

SINCE the first of the year there has been a widespread belief among business men that one of the first and best indications of returning prosperity would be heavy buying by the large railroad corporations. According to this an era of good business is at hand, as railroad buying, since the last week in October, has been exceptionally heavy. Orders have been booked or are soon to be placed, mostly by Western roads, for 105 locomotives and more than 13,000 cars, valued at approximately $32,000,000. There have also been inquiries for up to 400,000 tons of steel rails. This buying, which in reality is larger than normal for the roads concerned, may well be accepted as a sign that things are improving, for unless they were able to see a distinct upward trend to their traffic and to business in general, there is no reason to suppose that they would be making such active preparation.

Another straw to show the way the wind is blowing is the issuance by municipalities of $94,000,000 worth of bonds. More than $60,000,000 in municipal bonds have been disposed of recently in thirteen states, and more than $34,000,000 worth in addition have been offered for sale. Besides this, $10,000,000 worth of state bonds have been sold, and an equal amount has been offered for sale. This comes as a result of lowered interest rates, and it shows better opportunities for industrial securities also. These municipal and state bonds mean an almost immediate aid to business in the form of construction of schools, filtration plants, waterworks, bridges, lighting systems, court houses and municipal light and power plants.

One more very favorable sign is the large number of building contracts let during the last two months. Figures just compiled by the F. W. Dodge Company show that October contracts were 25 per cent greater than those for October, 1920, and only 10 per cent under September, 1921, which was a record month. The total value of the month's contracts was $222,480,000. Considering the large volume of construction started in the past eight weeks, it appears that activity will continue at a very substantial rate through the winter months, an outlook which is particularly inviting to manufacturers and distributers of electrical and building supplies. According to the statement of the Dodge company, residential building continued to lead in importance, but industrial building showed a large increase, being 63 per cent ahead of September.

Taking all these hopeful signs into consideration, representative men in electrical circles and business men in general express themselves as satisfied with the trend, and the opinion seems to be common that the improvement is not a flurry but will be gradual and lasting.

Motor Situation Improving with Popular Size Stocks Low

SALES of industrial electric motors up to 50 hp. have improved somewhat during the last sixty days, according to a statement made to a representative of the ELECTRICAL WORLD by a sales executive of a leading motor manufacturer. It is his belief that the improvement is due as much to strenuous sales efforts as it is to a general improvement in business conditions, inasmuch as the sales are being distributed equally well over dozens of industries, no one industry showing any extraordinary demand. The sales curves for the Eastern territory are about 10 per cent under 1919 to date, and while other sections of the country may not have done quite so well, their records will compare favorably with the 1919 records. However, he stated, motor business for the first ten months of 1921 shows a decrease of approximately 20 to 25 per cent from the same period of 1920.

During the summer it was felt that the large stock of motors in the hands of used-motor distributors would take a very long time to move, but it has been found that the stocks of second-hand popular sizes are getting low and the effect is being felt in the movement of popular sizes from the manufacturer. The same condition is found in contractor-dealers' stocks, and some contractor-dealers are starting to buy the popular sizes. Motors of special types and sizes are having their usually slow movement, and second-hand contractor-dealer stocks of these are still heavy.

The condition of the fractional-horsepower-motor market remains bad, he continued, but there has been some betterment, due mainly to increasing production of washing machines. Motor manufacturers feel that the outlook for the washing-machine industry is one of the brightest spots in business. One particular manufacturer of washing machines in the Middle West reports better business during October than in any month since the first of the year, and this condition is thought to be fairly general.

The question of prices is one which is engaging some attention, but, according to this manufacturer, it is difficult to find a basis for much of a reduction. The costs of raw material and labor are fairly low, he declared, but nearly all manufacturers have to contend with overhead expenses, which are greatly increased as compared with pre-war conditions. A chart, based on July, 1921, figures, shows prices to be slightly over 20 per cent ahead of the 1915 price level, while the average of all commodities stands at 60 per cent ahead of 1915 levels. Manufacturers, therefore, are looking forward to a reduction in freight rates as the most logical method of reducing their prices.

Conduit Prices High in Southeast

INVESTIGATION by a representative of the ELECTRICAL WORLD discloses the fact that jobbers' prices on rigid iron conduit in the Southeastern section of the country are unstable but will average higher than those quoted in the Middle West, New England and the New York territory. A few jobbers in Atlanta are quoting the following prices in lots under 2,500 ft. to the contractor trade: Black, ½-in., $7.22; ¾-in., $9.42; 1-in., $13.58, and 2-in., $29.56 per 100 ft. Galvanized is being quoted at $7.64, $10, $14.44 and $31.40 per 100 ft. on the same sizes respectively. This is about 50 per cent higher than the quotation in Chicago, where the ½-in. black conduit is quoted at $4.82 per 100 ft. in lots of 1,000 ft., and about 40 per cent higher than the New York price, the quotation there being $5.08 per 100 ft. in lots of 1,000 ft. Other large jobbers there are making a somewhat lower price on lots of over 2,500 ft., the lowest price being $6.28 per 100 ft. of ½-in black, in less than carload lots. In other parts of the territory prices are generally lower, but the average for the whole territory is higher than in any other section of the country. There is, however, a tendency on the part of smaller jobbers to make sharp cuts in order to move stocks of certain sizes. A canvass of Southeastern jobbers shows that on small lots the average jobbers expect to make a gross profit of from 12 to 18 per cent.

There is no unusual demand in the section for conduit, though it is moving very satisfactorily in popular sizes. While improved conditions are to be noted all over the section as a result of the higher prices of cotton, the increase has not been sufficient for boom conditions anywhere in the territory. Additional freight charges, it is stated, will account for some increase in the Southeastern market price over those of New York and Chicago.

Metal Market Situation

THE week opened with a strong market with prices ⅛ cent to ¼ cent higher than last week. Some producers are taking only a few orders at 13¼ to 13⅜ cents delivered per pound, and two large ones have gone out of the market entirely. The market is partially controlled by the producers, but a sharp price increase is not looked for as it would be unhealthy for the industry in the end. Domestic demand remains active in the anticipation of higher prices about the first of the year. One of the brightest spots in the industry is the larger buying of copper by brass manufacturers in the last two weeks. Most of them are said to have covered their requirements for the rest of the year, some even for January and February. Foreign sales are fair with Germany, France, Japan and England prominent among the buyers.

NEW YORK METAL MARKET PRICES

	Nov. 7, 1921	Nov. 14, 1921
Copper	£ s d	£ s d
London, standard spot	66 0 0	67 0 0
	Cents per Pound	Cents per Pound
Prime Lake	13.25	13.25
Electrolytic	12.50	13.12½
Casting	12.37½	12.37½
Wire bars	14.50	14.75
Lead, Am. S. & R. Co. price	4.70	4.70
Antimony	4.70	4.70
Nickel, ingot	[illegible]	[illegible]
Sheet zinc, f.o.b. smelter	[illegible]	[illegible]
Zinc, spot	5.20-5.25	5.20-5.25
Tin, Straits	28.62½	28.75
Aluminum, 98 to 99 per cent	24.50	24.50

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	10.50 -10.87½	10.50 -10.87½
Brass, heavy	5.00 - 5.25	5.00 - 5.25
Brass, light	4.75 - 4.87½	4.75 - 5.00
Lead, heavy	3.75 - 4.12½	3.75 - 4.12½
Zinc, old scrap	2.00 - 2.25	2.50 - 2.75

THE WEEK
IN TRADE

Prices When Quoted Are Those Prevailing at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

BUSINESS in all sections of the country seems to be well sustained, but there are very few high spots. Construction is active in New England, New York, the Middle West and the South, a great deal of it being of the residential type though there are quite a few industrial projects being considered. There have been only a few price changes, including a 10 per cent cut on watt-hour meters, and a 10 per cent additional discount on locknuts and bushings. Boston reports a slight softening of prices on pole-line hardware and rigid conduit.

Washing machines are reported to be moving sluggishly in New York but manufacturers declare October was a good month and dealers in other cities are having good sales. Vacuum cleaner sales are good while heating device movement seems somewhat spotty.

St. Louis jobbers are finding a good market in Arkansas where municipalities are buying for light and power plants. Outside of that state, however, line material does not appear to be moving fast. Transcontinental freight rate cuts have been announced in San Francisco but not on any electrical items as yet.

NEW YORK

Jobbers report that activity in electrical lines is being well sustained and that there is a good current demand for wiring supplies and schedule material. This is attributed partly to a gradual increase in building operations, and indications point to their continuation through the winter. Jobbers and contractor-dealers are going ahead with more confidence, and they are of the opinion that conditions will continue to improve for the remainder of the year. Stocks generally are kept moderate but are sufficient to meet the demand with the exception of flexible armored conductor, of which there is still a shortage.

Heating appliances, household devices and hollow ware are moving fairly well. However, jobbers and dealers are both ordering carefully. Of the large appliances vacuum cleaners are in most active demand. One jobber reports having handled nearly 1,000 during the past month and finds the market still very good. Washing machines are moving somewhat sluggishly here.

Conduit.—Prices on this material remain virtually the same as last week. Jobbers quoted the following prices: For ½-in. black pipe in 2,500-ft. lots, $48.29; ¾-in., $62.06, and 1-in., $88.51 per 1,000 ft. Galvanized pipe in the same sizes was quoted at $53.19, $55.93 and $98.19. Jobbers, stocks are ample to meet the present demand.

Rubber-Covered Wire.—Little change has been reported in the condition of the wire market. Demand is moderate. No. 14 rubber-covered is quoted at $6.50 to $6.77 per 1,000 ft. in 5,000-ft. lots, although on orders for larger quantities it is understood that these prices have been shaded slightly.

Flexible Armored Conductor.—Shortage of armored conductor is not quite so acute as last week, but jobbers' stocks are still very low and orders for large quantities cannot be accepted with a definite date of delivery. No. 14, two-wire, single-strip, is quoted at $44.50 to $46 per 1,000 ft. in lots of that quantity. Double-strip is quoted at $46.50 to $48 per 1,000 ft.

Lamps.—All jobbers report that their lamp sales have been very satisfactory this year. The gas-filled lamps are becoming more popular in all sizes. Commercial unit-type fixtures have been moving very well, and the demand for industrial fixtures is increasing.

Loom.—Demand is very light and stocks are purposely kept small. No change in price has been noted. The $\frac{7}{32}$-in. size is quoted at $16.50 per 1,000 ft. and the ¼-in. size at $18 per 1,000 ft. in that quantity.

Locknuts and Bushings.—An additional 10 per cent discount on locknuts and bushings was announced by a leading manufacturer this week. Formerly the maximum discount to the trade in standard package lots was 75 per cent off list. Jobbers are now quoting a maximum discount of 75 and 10 per cent.

Vacuum Cleaners.—There has been a brisk demand for cleaners this fall. One jobber reports sales of 1,000 cleaners since Oct. 1 and has placed orders for 10,000 additional for immediate delivery.

CHICAGO

Sales of electrical equipment have been steady this week, especially of wiring materials for use in the construction of residences in the suburbs and also for apartments in the city. This activity has developed into a greater magnitude than is generally realized. Jobbers are aware of this situation and competition is very keen so that prices quoted by several dealers vary from 10 to 15 per cent. An index of this building activity is given by the number of permits issued for the month up to Nov. 10 reaching 188, with a valuation of $3,434,800. This is an increase of 123 over the same period last year.

A significant movement in the building controversy was made this week by completion of the organization of the committee of more than 150 men representing civic and business organizations. The avowed purpose is full support to contractors, labor organizations and material dealers who observe the Landis award and the outlawing of organizations that refuse to support it.

Wire.—Jobbers report good sales on No. 14 rubber-covered this week, which is indicative of building activity in the suburbs. The price on this material varies from $6.60 to $6.75 per 1,000 ft. in 5,000-ft. lots. The base on bare wire remains 16½ cents and the demand is fair to good. Weatherproof is also selling for 16½ cents a pound in 1,000-lb. lots and is moving well.

Flexible Armored Conductor.—Demand is reported brisk, and No. 14 two-wire, double-strip, is selling at prices ranging from $48 to $52.50 per 1,000 ft. in 5,000-ft. lots. Stocks are fair, but in most cases not excessive.

Conduit.—Movement on conduit has been steady during the past week, but there has been no price change. A representative price on ½-in. black pipe runs from $47 to $49 per 1,000 ft. The same size in galvanized pipe costs between $51 and $52.

Lamp Cord.—This material is keeping pace with the sale of portable lamps and heating devices. The $\frac{1}{64}$-in. insulation, No. 18 cotton, twisted, sells for $13.50 per 1,000 ft.; the $\frac{1}{32}$-in. insulation in the same size and material sells for $19.72 per 1,000 ft. The silk-covered, twisted, No. 18, costs between $24 and $26 per 1,000 ft.

Loom.—The demand is very poor and jobbers are not overstocked. In 1,000-ft. lots the $\frac{7}{32}$-in. size sells for $16 and the ¼-in. size for $18.50.

Washers and Cleaners.—Dealers report fairly good sales because of intensive sales effort which overcame the disturbing effect of the recent price cuts. More attention is paid to quality characteristics of the sale than to attempting to procure quantity sales. Dealers' stocks are sufficient to supply the trade.

Safety Knife Switch.—Trade on this switch is also brisk and jobbers report stocks ample. A representative price on a 30-amp. two-pole safety switch is $1.75.

High-Tension Equipment.—Activity in the steel mills is reacting on a manufacturer of high-tension equipment, who reports sales of outdoor substations to the mills. Another manufacturer has sold seventy-five 15,000-volt lightning arresters to southern California and about sixty 100-amp. 25,000-volt fuses to Australia.

BOSTON

Trade runs along without much change in volume at present, but small-order business is well sustained and comparisons with earlier periods this year reflect improved conditions. Central-station outputs in a number of cases show substantial gains over corresponding weeks of 1920. Building and engineering contracts for the week ended Nov. 8 in New England totaled $4,361,000, comparing favorably with most pre-war years and exceeding many weekly records of the past summer. Stocks in jobbers' warehouses are not accumulating to any extent, nor are orders on the factories being placed for much more than current requirements. Prices softened somewhat last week on pole-line hardware and rigid conduit.

Motors.—Small-order business features the market, with good stocks and steady prices. Deliveries are easy.

Electric Radiators.—Moderate sales are being made, owing to mild weather. These devices are gradually getting into the staple class, however, and their seasonal popularity is increasing. Stocks are ample for present requirements.

Wire.—Rubber-covered No. 14 wire sold Monday at $6 to $6.25 per 1,000 ft., in 5,000-ft. lots, with close competition and fair movement. Demand for weather-proof is quieter and not much bare wire is moving, despite upward tendencies in base prices.

Lamps.—Sales are excellent and on mill-type lamps of 25 watts and 50 watts rating there has been a slight shortage until very recently. Deliveries ran between three and five weeks, but some sales are now going through on a ten-day delivery basis. The demand for lamps is very diversified and commercial exhibits are yielding good returns.

Farm-Lighting Sets.—Last year's sales are being exceeded in New England, and the summer-cottage business has been good until lately. Stocks are very satisfactory, one dealer reporting more than two carloads on hand ready for immediate deliveries. A representative outfit of 300-watts rating and an 80-amp.-hr. battery sells for $250.

Rigid Conduit.—Demand is not very active, but prices are easier, approximately 5 per cent lower than a week or two ago. On less than 5,000 lb. the following prices were reported Monday: Galvanized, ¾-in., $77.22 per 1,000 ft., and black, $71.84; galvanized, ½-in., $59.63 and black, $54.53, per 1,000 ft. Shipments are coming through easily.

Fixtures.—Business is much better than earlier in the year, but it still suffers from small orders multiplied by diversified buyers, so to speak. It is felt that when building activities improve more, the fixture trade will respond.

Porcelain.—Stocks appear to have recovered from the recent flurry which took effect in a shortage in some quarters where "Nail-it" knobs were wanted. The current quotation is $18.50 per 1,000 in barrel lots.

ATLANTA

This week has brought a noticeable increase in the number of inquiries being received by the more substantial contracting firms in this section for estimates on large industrial plant undertakings. One of the more prominent jobbers reports having all the inquiries and work that he can handle, while sixty days ago he had little work on hand. The report for Georgia of the United States Department of Agriculture, while disappointing in some respects, sounds a real note of optimism regarding the outlook in the rural districts, particular attention being called to the growing tendency toward a greater diversification of crops throughout the state. Residential and commercial building continues active, and some heavy construction in industrial lines is at last beginning to get under way. Interviews with bankers seem to indicate that the sections of north Georgia and Georgia south of Macon are the most prosperous at this time, there being, however, a belt running from a few miles south of Atlanta to Macon in which conditions are rather unsatisfactory. A close survey seems to indicate that approximately 35 per cent of all commercial paper will be liquidated when due, but bankers and mercantile institutions will be forced to renew the remaining 65 per cent.

Vacuum Cleaners.—Campaigns on the part of one or two of the larger jobbers have been productive of good results in this line, purchases by retailers being heavier than for some time past. Stocks are in good condition with shipments satisfactory. No recent change in price is reported.

Electric Churns.—These continue to move fairly well, especially in the smaller towns, though few are sold in the large cities. Stocks are only fair and prices remain firm.

Lead Cable.—Varnished-cambric cable is moving very slowly, but duplex lead-covered cable sales are reported as fairly good in the larger centers. Local sticks are fair.

Commercial Lighting Fixtures.—The completion of schools and municipal buildings is doing much to sustain the excellent demand for this line. The demand is for both the moderate and the high-priced types, the semi-indirect unit being very popular. Local stocks are in good shape.

Flexible Non-Metallic Conduit.—The movement of this item continues rather sluggish, with the price on ¼-in. at $18 per 1,000 ft. Stocks are in good condition.

Tape.—The movement in this line continues to hold up satisfactorily, the buying of the duplex variety becoming more noticeable. Prices, friction, 100-lb. lots, 30 cents per pound; duplex, 75 cents per pound.

Air Heaters.—Apparently sales in this line have come to a standstill and present prospects are that the larger jobbers will have about a 30 per cent carry-over, despite their efforts to clean up their holdings.

Distributing Transformers.—An increase in the demand for the popular sizes has been noted for the past few weeks. The recent storm in Florida is responsible for heavy orders being received from the companies that suffered damages to distribution lines. Local stocks are in fair to good condition. There is an increase also to be noted in the sales of high-tension transformers for industrial plant operation.

ST. LOUIS

Building permits here for the month of October amounted to $1,557,173, as compared with $1,055,730 for the same month of last year. No large jobs were included, as was the case in September, but the construction of factories and workshops showed a better tone, the money value represented by them being larger than for any preceding month since July, 1920. Virtually all of the permits were for residences, and very healthy progress is observed in that field.

To reduce non-employment and to further building the St. Louis Building Trades Council and the contractors are in conference to work out a scheme for reduced wages if a substantial increase in building can thereby be effected. Prospects for some adjustment are more promising than they have been for some time, and it is understood that work aggregating about $20,000,000 awaits only lower construction costs.

More buying strength on the part of the municipalities in Arkansas is apparent, a number having plans under way for either new power plants or additions to their present equipment. The situation will be further improved by the $1,000,000 loan of the War Finance Corporation to the Arkansas Rice Growers' Association, as has just been announced. This money is to be used for promoting the milling and marketing of rice.

Meters.—A reduction in price of about 10 per cent was made effective Nov. 7 on both direct-current and alternating-current watt-hour meters. They have been moving well, particularly the residential lighting type, and stocks are maintained in good condition. The three-wire residential type is selling for about $8.50.

Transformers.—Movement of distribution transformers is not keeping pace with meters, as stocks in the hands of utilities were larger and line extensions had previously been made to care for the coming winter load.

Lightning Arresters.—A few small sales of the compression chamber type are being made, but utilities are now very well supplied with their requirements and virtually no additional protection is being installed on existing circuits.

Portable Drills and Hammers.—This business is noticeably quieter. The numerous inquiries on hand some time ago did not develop into sizable orders.

Insulators.—Immediate factory shipments can now be given for all ordinary orders. There are numerous inquiries and orders, but they are all for small lots. Utilities are not buying as well as a few weeks ago, there being a decline in the amount of small extension work in the surrounding territory.

Cross-Arms.—Sales are slower, though there are a number of inquiries for good amounts. Representative prices of fir arms, size 3¼-in x 4¼-in., are: 3-ft., $40.43 per 100; 4-ft., $53.90; 6-ft., $80.86; 10-ft., $135, all f.o.b. St. Louis.

Motors.—Considerable improvement in demand was experienced last week, the demand being for sizes up to 50 hp. There is some demand for fractional motors, but it is comparatively quiet. A large manufacturer reports sales as being about 50 per cent of normal.

Hollow Ware.—Jobbers report that buying by dealers for the holiday trade is slowly getting under way. A good business is predicted, and stocks are ample.

Farm-Lighting Outfits.—Sales much better than anticipated are reported, though the decline in prices on farm products is tending to hold back a good many purchases. The latter effect is particularly noticeable in the sections where wheat and corn are chiefly relied upon.

SAN FRANCISCO

Although store business is now in a slight slump because of the interseason period, contracting business is very brisk. A new wage schedule that will probably be based upon a figure of $1 per hour for the standard trades will soon become effective. New freight rates on a number of commodities that represent a cut of about 20 per cent are announced for transcontinental freight shipments, but so far there are no electrical items affected. The San Francisco Industrial Exposition, opening Nov. 19 and featuring local products, is practically oversubscribed for space, and its success is assured. Dealers report increasing call for curling irons. These are becoming more popular than curling-iron heaters, although sales of the latter are also increasing in number.

Plugs and Clusters.—In conformance with the local policy of decreasing the maximum quantities necessary to secure maximum prices some plugs are now sold to dealers at 10 cents each in lots of 100 and plug clusters at 58½ cents each in lots of ten. There is a brisk demand.

Knobs and Cleats.—Prices on the split portion of knobs are quoted at a decrease of 10 per cent from previous prices, No. 5½ split being sold in barrel lots at $17.75 per 1,000 and tenpenny "Nail-it" knobs in barrel lots at $22.50 per 1,000. Two and three-wire unglazed cleats in barrel lots are selling at $20 per $1,000 or $36 per 1,000 if glazed. Local stocks are good.

Fuses.—New code non-refillable fuses are selling in standard package lots for $9.15 per 100 and 31-amp. to 60-amp. of the other type for $16.20 per 100. This marks a 10 per cent decrease on the small size and 20 per cent on all larger sizes. The demand is not very good, however, and is restricted to one or two standard sizes, other sizes being purchased only in very scattering quantities.

Metallic Flexible Conduit.—The ⅜-in. size in coil lots is selling for $8.40 per 100 feet and the ½-in. for $11.25 per 100 ft. Six-coil lots take a 10 per cent better price, with the privilege of assorting various sizes in full coils to secure the assortment. Flexible armored conductor in coil lots is selling for $57.30 per 1,000 ft., these prices being quoted generally. Local stocks are rather low.

PORTLAND—SEATTLE

In common with many other sections of the country, the Northwest, it appears, will have to face the problem of non-employment. The numbers out of work have decreased in some sections and increased in others. The situation in general is bad and there are many heads of families without employment. Almost all the larger cities are planning extensive municipal improvements during the coming winter to give work to the unemployed and thus help to relieve the situation.

Business in general seems to be holding up very well, and the slump that was predicted to follow the gains made in September and October has failed to materialize. Business volume continues to be an aggregate of many small and diversified items, no large contracts having characterized the sales of recent weeks. Conditions in the lumber industry remain good, production for the past week being only 13 per cent below normal. Building continues active.

Electrical jobbers report stocks in good shape generally, although there has been a temporary shortage in wiring-device stocks which is now rapidly being overcome. Jobbers have been buying short in these lines for some time past, and when an unusual demand came upon them a few weeks ago they were unprepared. Shipments to replenish stocks require from thirty to sixty days, most of them now coming by water, which means sixty days. Prices are becoming more stabilized in the standard lines, and although dealers are carefully guarding against overstocking, they are buying in larger quantities than heretofore. Buying is generally on a thirty-day basis at present. Activity continues in vacuum cleaners and electric ranges in Portland as a result of campaigns being conducted by the electrical dealers and the power companies.

Seattle reports much activity in lamps due to darker weather. A marked reduction in the price of "Mazda Type C" lamps was the principal price change of the week in this territory. Portland reports a drop of 3 to 4 per cent in the price of conduit during the week.

Heaters.—Air heaters have been moving well during the past few weeks, sizes ranging from 500 watts to 5,000 watts. In Tacoma 2-kw. and 3-kw. sizes are most popular.

SALT LAKE CITY—DENVER

Business prospects are still brightening slowly but surely. Electrical dealers are buying in slightly better quantities, and the outlet for overstocked jobbers is correspondingly widening. Buying for the holiday season has begun, but not with anything like the old-time volume. It looks, however, as though a great deal of hollow ware will move out to the ultimate consumer during the next two months. In the Denver jobbing area business has shown quite a brisk pick-up in the past two or three weeks. Conditions there on the whole are better than elsewhere in the Intermountain territory. The farmers have had a good year and have been able to liquidate in a satisfactory way with the banks. The copper shut-down has not been felt to so damaging a degree in Denver as in the Salt Lake region.

All jobbers report stock on electrical lines ample to meet their requirements and in many instances too heavy. Factories are making good deliveries. The jobbers' big problem just at present is how to reduce stocks in spots where there is an overload. Collections are on a better basis than they have been in two years. Nov. 15 was the biggest pay day the farmers of the Intermountain territory have had, the occasion being the distribution of several million dollars to sugar-beet growers by the sugar companies. What attitude the country banks will assume in the matter of collecting on notes is problematical. It is believed they will be as lenient as the larger banks controlling their activities will permit. If the farmers are allowed liberal extensions of time, business from now to the end of the year is sure to show marked improvement, whereas if collections are forced marked depression will follow.

Wire.—The opinion seems to be that wire is a good "buy" at present prices. A sharp stiffening is expected in the near future.

Wiring Devices.—A steady though rather limited demand has characterized the fall market. The large volume of cottage construction now in progress is consuming considerable stocks. Prices are back to a pre-war basis.

Washing Machines.—The past week has recorded an improvement in the market, with the Dolly type of washer decidedly in favor. Dealers are ordering in quantities barely sufficient to meet their current needs.

Manufacturers' Activities

Devoted to the Business Side of Manufacturing, Distribution and Sales, News from Jobbers and Foreign Fields and a Record of New Devices and Trade Literature

Sales of Woods Motors Rapidly Increasing

During the past three or four months sales of motors have increased at the rate of about 50 per cent per month, according to M. F. Fitch, sales manager, motor division, S. A. Woods Machine Company, Boston, Mass. Although this concern has only lately entered the field of motor building, it has been obliged to enlarge its manufacturing facilities almost continuously since placing its product on the market. Orders are now coming in at a rate which greatly encourages the officers of the company. Since June the working force has been increased more than 100 per cent. Mr. Fitch states that gratifying sales resulted from the company's display at the recent Boston textile show.

Hoover Preparing Advertising and Sales Drive

Plans are being prepared by the Hoover Suction Sweeper Company, North Canton, Ohio, for its annual week of intensified local advertising and dealers' sales. The date has been set for the week of Dec. 8-15. One of the events planned is the national window-display contest, attractive cash prices being awarded to those dealers designing the most attractive and effective window exhibit featuring the product of the company. It is stated that dealers in all parts of the country are arranging to stage a large number of home and store demonstrations, and the campaign, coming only two weeks before Christmas, is expected to show good results in sales.

Greenfield Tap & Die Reports Moderate Improvement

There has been a slight improvement in the business of the Greenfield Tap & Die Corporation in the last thirty to sixty days, according to a public statement of the concern, resulting in an increase in operations to about 30 per cent of capacity and the employment of about 550 men. The plants were shut down tight on July 1, 1921, and operated with only a skeleton organization for the greater part of the summer. Shipments have run about 40 per cent of the 1920 volume to date, but in per unit size they have been disappointing. Incoming orders have been somewhat less than this, but, according to Francis G. Echols, vice-president and general manager, there is at the present time a considerable improvement in this matter over the midsummer. Jobbers and retailers are reported to be running with extremely low stock, but until there are more distinct signs of revival the Greenfield concern will manufacture on an exceedingly conservative basis, inventory still being disproportionately heavy.

It is interesting to note that, though the size of the average bookings has appreciated perhaps 40 per cent from the low monthly level of the year, it is only 25 per cent of the 1920 figures. Foreign business is holding up well, running about 25 per cent of total business.

Ward Pamphlet Deals with City Delivery Waste

The biggest cost in city delivery is ignorance, according to a new pamphlet just issued by the Ward Motor Vehicle Company, Mount Vernon, N. Y. The booklet discusses the value of the electric truck in making city deliveries, as compared with gasoline truck and horse delivery.

"If business executives will get into the delivery situation again," says the pamphlet, "get the real facts and take a good square look at them they can cut their city delivery costs 20 per cent to 35 per cent, and in some cases 50 per cent. Looking at the coming ten years, with the return to normal business, normal margins of profit and keen competition, the money saved by eliminating extravagance in city delivery may make the difference between a losing and a profitable business."

The pamphlet includes discussions of horse delivery, gasoline truck delivery, the proper length of truck life, the economy of electric trucks, the value of the worm drive and other subjects.

Century Entertains St. Louis Engineering Societies

A meeting of the Associated Engineering Societies of St. Louis was held at the plant of the Century Electric Company, 1811 Pine Street, St. Louis, on Oct. 26, under the auspices of the St. Louis Section of the American Institute of Electrical Engineers. Among the speakers were J. L. Hamilton, chief engineer of the Century Electric Company; Prof. A. C. Lanier, professor of electrical engineering, Missouri State University; Hans Weitzel, designing engineer, Wagner Electric Company, and H. W. Eales, electrical engineer for the Union Electric Light & Power Company, St. Louis. Previous to the presentation of the papers the guests were taken on an inspection trip through the entire Century plant.

Allis-Chalmers Unfilled Orders Large

The unfilled orders on hand as of Sept. 30, 1921, on the books of the Allis-Chalmers Manufacturing Company, Inc., Milwaukee, Wis., aggregated $7,260,574.89, almost $2,000,000 ahead of the total sales during the three months of July, August and September. These figures were obtained from a statement of earnings issued by the company for the third quarter of 1921. Sales billed for July, according to the statement, were $2,063,242.93, for August $1,785,901.22 and for September $1,520,468.17, making a total for the quarter of $5,369,612.32.

Beardslee Issues "Ad" Series to Dealers

It is the belief of the Beardslee Chandelier Manufacturing Company, Chicago, that the average electrical contractor-dealer on account of the demands of his business can find very little time to prepare advertising matter for local papers. To offset this disadvantage the Beardslee company has for the second time prepared a series of home-lighting fixture advertisements, accompanied by electrotypes, for the use of its dealers. Recently the company sent out a "ready-made ad" circular to electrical dealers, and more than 300 took advantage of the offer, 70 per cent requesting electrotypes to go with the full series. A large percentage of the dealers used the advertisements just as they were written, showing willingness to co-operate along advertising lines and an appreciation of the value of newspaper advertisements. The results of the first series of "ads" were so good that the Beardslee company decided to prepare another series, and, according to F. L. Farmer, manager of the Denzar division of the company, these are being mailed out at the present time.

Standard Underground Rebuilding Pittsburgh Plant

The Standard Underground Cable Company, whose general offices are in the Westinghouse Building, Pittsburgh, Pa., is rebuilding its Pittsburgh plant, the pioneer plant of the industry in its line. In addition to some lesser alterations and additions to the original plant, it has under erection a new four-story-and-basement, steel frame and brick-construction building, 100 ft. x 292 ft., to provide for a general increase in the manufacture of lead-covered cable, cable accessories, etc. These additions are expected to be completed by spring of 1922.

Simplex Company Conducting Campaign in Dailies

To stimulate local demand for its "Sunbowl" heater, the Simplex Electric Heating Company, Cambridge, Mass., is conducting a somewhat unusual campaign in the daily press of Boston, Philadelphia and Chicago, nine papers with a total circulation of 2,630,000 being utilized. R. P. Ingalls, sales manager, informed a representative of the Electrical World that the company is buying space in these dailies with the idea of co-operating to the utmost extent with local jobbers and dealers in establishing a closer contact with the public and in bringing home to the latter the comfort, convenience, safety and cheer of radiant heater service from the lamp socket. The campaign began early in October and will continue to Christmas.

Four dailies in Boston, three in Philadelphia and two in Chicago were selected for the publicity work required. The usual display is a 100-line "reader" advertisement twice a week and a 300-line feature advertisement once a week. Each display includes an illustration of some application of radiant heater service, the standard retail price, and pithy phrases emphasizing the value of this type of equipment at this season. Extensive dealer helps have been sent out by the company to facilitate tying in local displays of dealers with the newspaper publicity. The results have been very satisfactory, Mr. Ingalls stated. Jobbers have enlarged their stocks and a noteworthy increase in buying by the general public is apparent, despite a season most trying from the standpoint of the unusually long-continued non-freezing weather.

American Steel & Wire Improves Plant

The American Steel & Wire Company, Worcester, Mass., contemplates an expenditure of $100,000 on its Worcester works at once to give employment to its men who would be idle otherwise. This is the local share of the $10,000,000 which the United States Steel Corporation has voted to expand in the extension of its manufacturing plants.

Jeffery-Dewitt Voluntary Bankrupt—To Reorganize

The Jeffery-Dewitt Insulator Company, Kenova, W. Va., filed a voluntary petition in bankruptcy in the United States District Court at Huntington, W. Va., on Nov. 2. The action, according to a statement given out to the trade, is entirely a friendly one and was taken to aid in the reorganization of the company on a more solid financial basis. Walter M. Dailey, formerly assistant secretary and treasurer of the company, has been appointed receiver and will carry on the business until the reorganization is completed. Over 70 per cent of the liabilities are held by A. B. Jeffery, J. A. Jeffery, M. C. Dewitt, the Jeffery-Dewitt Company, and the Champion Spark Plug Company, all of whom are interested in the company. A notice has been sent out to other creditors notifying them that there is no possibility of loss. It was also announced that during the receivership the business would be carried on as usual and that guarantees would be maintained as before. The condition of the business is good, according to officers of the company, a profit having been realized in September, while there is considerable business on the books and in sight.

New Electrical Machinery Insurance Policies Issued

Two large insurance companies have just announced that they are prepared to quote rates on electrical machinery insurance and to issue policies to indemnify against loss or damage on account of mechanical breakdown and electrical burn-out of machinery covered. The policy of the Ocean Accident & Guarantee Corporation, Ltd., of London, England, covers damage to the property of the assured and to the property of others for which the assured may be liable It may be indorsed to cover liability for injury to employees or public or both, and may also be indorsed to cover loss of use. The second policy, issued by the Travelers' Indemnity Company, protects the assured against loss or damage sustained by him on account of mechanical breakdown and electrical burn-out of the insured machines accidentally caused. Rating information required is virtually the same in both cases, it being necessary to furnish the name of the manufacturer, the capacity, the speed, motor, kind of current generated or used, phases, various diameters, pressure in the case of steam turbine, etc.

Wadsworth Company Holds First Sales Conference

The Wadsworth Electric Manufacturing Company held a sales conference Oct. 26 and 27 to discuss sales and to assist in developing means by which the electrical industry could be informed of the use of inclosed switches for the purpose of safety. Comment was made during the meeting on the entrance safety switch for electrical homes to insure the development of good will on the part of the customer toward the power companies and to eliminate trouble and expense formerly experienced with fuse blowouts and renewals.

The industrial field was also discussed, and it was the opinion of all the representatives that the inclosed-switch idea is more widely appreciated among electrical engineers than formerly and that the use of safety switches of the inclosed type is becoming more widely understood and applied. G. R. Watson, formerly Cincinnati representative of the Crouse-Hinds Company, has been appointed general sales manager of the Wadsworth Electric Manufacturing Company and will assume his duties at once.

WADSWORTH SALES ORGANIZATION GETS TOGETHER TO DISCUSS PROMOTION OF INCLOSED SWITCH

Fort Wayne Works of General Electric to Increase Output

The meter department of the Fort Wayne (Ind.) works of the General Electric Company, now employing between 400 and 500 men four days a week, according to Walter S. Goll, assistant manager, will be put on a full-time basis at once, while the small motor department, now employing about the same number of men on the same basis, may also be put on full time in the near future. Following the decision of the officials to increase the time of the present force in these departments, the question of increasing the time in the fractional-horsepower motor departments is also being considered. This is almost the first rift in the clouds for the Fort Wayne plant of the General Electric Company, which first felt the business depression a year ago this September and which has been running with greatly depleted forces and on only a part-time basis since the first of the year.

Richardson-Phenix and Bowser Consolidate

An announcement has been made of the consolidation of the Richardson-Phenix Company and the S. F. Bowser Company. The former is well known for its development of lubricating devices and appliances for filtration and reclamation of lubricating oils, while the latter is equally prominent as a manufacturer of pumps and storage systems for oils and gasoline. The name and personnel of each company remain unchanged. Executive headquarters will be established in the new office building of the Bowser company at Fort Wayne, Ind. S. F. Bowser is president of the Bowser company. S. B. Bechtel, vice-president of that company, becomes vice-president and general manager of Richardson-Phenix, while J. William Peterson, president of the latter company, becomes vice-president of the Bowser company. L. E. Strothman, vice-president and general manager of the Richardson-Phenix Company and vice-president-elect of the A. S. M. E., has been in ill health for some time and is to have an extended leave of absence.

Charles Cory & Son, Inc., 183-7 Varick Street, New York City, have secured the American sales rights of the "Cory-Record" ohmmeter, manufactured by the Record Electrical Company, Ltd., Altringham, England.

The Mohawk Electrical Supply Company, Syracuse, N. Y., has discontinued its retail business and moved from its old location at 325 South Warren Street to the Great Northern Warehouse Building, 348-360 West Fayette Street. At the present time the company is doing a wholesale business only.

Foreign Trade Notes

THE CANADIAN AUSTIN MACHINERY, LTD., Woodstock, Ont., incorporated under the laws of Canada, will act as manufacturer and distributor in Canada of the complete line of products manufactured by the Austin Machinery Corporation of Chicago.

HYDRO-ELECTRIC DEVELOPMENT ON THE JORDAN, PALESTINE.—Concessions have been granted by the Palestine government and the Colonial Office to a Mr. Rutenberg to develop the water power of the Jordan, the Yarmuk and other rivers in Palestine to generate electricity, which will be distributed throughout the country.

DEVELOPMENT OF WATER POWER IN ROUMANIA PROPOSED.—A law recently drafted provides for the development of water power in Roumania. The law has the approval of the appropriate committees of both houses of the Legislature and is expected to be enacted practically as drafted. As the coal resources of the country are poor, it is expected, that the water power will probably be developed extensively.

HYDRO-ELECTRIC DEVELOPMENT AND RAILWAY ELECTRIFICATION IN SWITZERLAND. — The development of water power, in spite of the present high cost of installation, according to a commercial and industrial handbook on Switzerland issued by the Bureau of Foreign and Domestic Commerce, Department of Commerce, is being pushed as never before in Switzerland. The most important part of this work is being carried on by the government in connection with the electrification of the federal railways, and a number of important installations are now under construction or contract. The first important stage of the general electrification program was nearing completion at the end of 1920. For furnishing the electrical energy two large installations are being made. The first is the Ritom works on the south side of the Gotthard tunnel in the Canton Tessin, which utilizes the water of the Ritom Lake. In this plant four high-pressure turbines of 12,000 hp. each have been installed, with provision for two more turbines of the same rating, bringing the total capacity to 72,000 hp. The other power plant for the Gotthard line, the Amsteg installation, is in the Canton of Uri on the northern side of the tunnel and utilizes the water of the River Reuss. This plant is now under construction and is designed to have an initial installation of 60,000 hp., to be increased later to 90,000 hp. The program of electrification on which the government is now launched forsees the electrification of practically the entire federal system of some 1,750 miles within a period of twenty years, and the total cost of the work is estimated at more than a billion francs. The average amount of power required for the entire system is estimated at 200,000 hp., with a maximum of 600,00 hp. Considerable progress has been made on the electrification of the so-called secondary lines, which are for the most part privately owned, but further development is being impeded by the lack of financial resources, which the federal railways are better able to command. One of the articles which the railway authorities have had the greatest difficulty in obtaining in satisfactory quality and quantity for electrification purposes is heavy porcelain insulators for high-tension use. Insulators of the kind specified by the railway engineers are not obtainable in Switzerland. Switches for outdoor use in high-tension transmission lines along the right-of-way are also in demand, as difficulty has been experienced in obtaining proper apparatus of this kind from the domestic market. Inquiries for information in connection with this work should be made to the management at Berne (Direction des Chemins de Fer Federaux).

Foreign Trade Opportunities

EQUIPMENT FOR ELECTRIC PLANT AT BUENOS AIRES.—Bids will be received by the Board of Sanitary Works of the Nation, Buenos Aires, Argentina, until Jan. 19, 1922, according to *Electrical Industries*, for furnishing and erecting a new electric generating station, previous bids having been asked for in 1919, 1920 and June 3, 1921. The equipment will include three four-cycle Diesel engines of 375 hp. each, adapted to run on crude petroleum and three three-phase alternators, each of 250 kw., 2200 volts between phases, 50 cycles.

ELECTRICAL EQUIPMENT FOR MUNICIPAL PLANT, MELBOURNE. — The City Council of Melbourne, Australia, according to *Electrical Industries*, will receive tenders until Feb. 20, 1922, for a 2,000 kw. rotary converter and transforming accessories, and also a 6,600 volt, 50 cycle, three-phase switchgear.

TURBO-ALTERNATOR AND CONVERTERS FOR SYDNEY.—Tenders will be received by the Municipal Council of Sydney, New South Wales, Australia, until April 24, 1922, according to *Electrical Industries*, for furnishing and erecting a 10,000 kw. turbo-alternator and two 2,000 kw. rotary converters.

New Apparatus and Publications

THE BLACK & DECKER MANUFACTURING COMPANY, Chicago, has placed on the market a light-weight, ¼-in portable electric drill with pistol grip.

RECORDER.—The Yarnall Waring Company, Chestnut Hill, Philadelphia, is distributing a leaflet describing the "WR CO2" self-contained recorder recently developed by the company.

ELECTRIC CLOCK.—An electric clock, which requires no winding, for use in offices, homes, motor cars, etc., has recently been placed on the market by the Keith-Landis Corporation, 332 South La Salle Street, Chicago.

ELECTRIC GRINDER. — The Black & Decker Manufacturing Company, Baltimore, Md., has recently brought out a new grinder known as an 8-in. electric bench grinder.

ILLUMINATING GLASSWARE. — The Beardslee Chandelier Manufacturing Company, 216-220 South Jefferson Street, Chicago, has issued a new net price list on its illuminating glassware carried in stock, which is illustrated in catalog G-S-1.

TRANSFORMERS.—"Power Transformers" is the title of bulletin No. 1,108 issued by the Allis-Chalmers Manufacturing Company, Milwaukee, covering its different types of transformers.

ELECTRIC IRON. — The Tommy Iron Manufacturing Company, 1900 Oliver street, St. Louis, has placed on the market a new electric iron, known as the "Tommy iron," designed for use of milliners, dressmakers, manufacturers and for domestic purposes.

PULL CHAINS. — The Bryant Electric Company, Bridgeport, Conn., has developed a line of decorative pull chains to match stands and shades of table and floor lamps.

FLUSH PLATES.—Several types of flush plates with a new finish, known as "Perma," are being produced by the Bryant Electric Company, Bridgeport, Conn.

HOSPITAL CONTROL SWITCH. — A manually operated toggle hospital signal-system control switch has recently been placed on the market by the Bryant Electric Company, Bridgeport, Conn.

BABBITT METAL.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., is distributing folder No. 4,474, covering the Westinghouse lead-base babbitt metal.

BALL BEARINGS.—"Good Fractional Horsepower Motors Made Better" is the title of a booklet issued by the Norma Company of America, Anable Avenue, Long Island City, N. Y., describing the "Norma" precision ball bearings.

CEILING AND WALL OUTLETS.—Bulletin No. 17-7, issued by Harvey Hubbell, Inc., Bridgeport, Conn., describes its "Elexit" devices.

LIGHTING FIXTURES.—The St. Louis Brass Manufacturing Company, St. Louis, has issued catalog BC-11, describing its different types of residence lighting fixtures.

VALVES, GOVERNORS AND REGULATORS.—The Atlas Valve Company, 282 South Street, Newark, N. J., has issued junior catalog No. 21, describing its "Atlas," "Ideal" and "Victor" reducing valves, pump governors, pressure regulators, etc.

AUTOMATIC ELECTRIC STOVE.—The William Campbell Company, Detroit, is distributing a circular describing its "automatic rapid electric cook stove," and also a leaflet covering equipment and list of parts for the electric stove.

BALL BEARINGS.—The November issue of the *Dragon*, issued by the Fafnir Bearing Company, New Britain, Conn., contains a description of a testing machine for demonstrating the relative power consumption of ball bearings and plain bearings.

ELECTRIC MOTORS.—The Metropolitan-Vickers Electrical Company, Ltd., Trafford Park, Manchester, Eng., has issued special publication No. 7855/2, dealing with the choice of motors for industrial work.

LIGHTING DEVICES. — Bulletin No. 17-5, issued by Harvey Hubbell, Inc., Bridgeport, Conn., describes several new devices added to its products, including interchangeable "Knostrain" plug caps, polarized cord connector, round flush receptacle and separate red lamp for Hubbell "Signalite."

ILLUMINATION.—"Eye Comfort" is the title of a folder inclosing leaflets being distributed by the National X-Ray Reflector Company, 235 West Jackson Boulevard, Chicago, covering its reflectors for show-window lighting, showcase lighting, indirect lighting and crystal fixtures for theater lighting.

SWITCHES. — Harvey Hubbell, Inc., Bridgeport, Conn., is distributing a four-page leaflet describing its toggle flush switches.

New Companies

THE ATLANTIC ELECTRIC LAMP COMPANY, Danvers, Mass., has been organized by V. A. and William W. Trotter and John H. O'Neil, all of Danvers. The company is capitalized at $15,000 and proposes to manufacture incandescent lamps.

THE THOMAS PRODUCTS COMPANY, Seattle, Wash., has been organized with a capital stock of $50,000 to manufacture electrical and mechanical fittings, fixtures, devices and searchlights. Baushman, Oldham, Bullitt & Eggerman, 1408 Hoge Building, represent the company.

THE CLEVELAND (VA.) LIGHT & POWER COMPANY has been incorporated with a capital stock of $10,000. The officers are S. C. Couch, president, and D. E. Campbell, secretary.

THE STANDARD ELECTRIC & RADIO CORPORATION, Wilkinsburg, Pa., has been incorporated with a capital of $5,000 to manufacture electrical equipment. T. K. Lewis, Wilkinsburg, is treasurer.

THE AUTOMOTIVE ELECTRIC SALES COMPANY, 2637 South Michigan Avenue, Chicago, Ill., has been incorporated by Philip and Benjamin Siegal. The company is capitalized at $50,000 and proposes to manufacture and deal in electrical devices, etc.

THE FRANKLIN LIGHT COMPANY, 127 North Dearborn Street, Chicago, Ill., has been organized with a capital stock of $10,000 to manufacture and deal in electrical fixtures, supplies, etc. The incorporators are Harvey Adams, Benjamin H. Kanue and G. Litka. Weil & Chaikin, room 1208, 137 North Dearborn Street, represent the company.

THE BUCKEYE ELECTRIC LIGHT COMPANY, Lima, Ohio, has been incorporated with a capital stock of $10,000 by A. E. Henry, H. V. Swinehart, G. M. Kindell and others.

THE H. E. GELHART & COMPANY, 2030 Seventh Avenue, Rock Island, Ill., has been chartered with a capital stock of $50,000 to manufacture electrical supplies and fixtures. The incorporators are H. E. and C. Gelhart and Willard E. Hartman.

THE COLONIAL LAMPS & FIXTURE WORKS, 5634 Lake Park Avenue, Chicago, Ill., has been chartered with a capital of $50,000 to manufacture and deal in electric lamps, fixtures, etc. The incorporators are Leon Hornstein, Eugene H. Joseph and Albert Hornstein.

THE ECONOMY ELECTRICAL SUPPLY COMPANY, Brooklyn, N. Y., has been incorporated by C. A. Carlson, C. A. Loscalzo and C. Kearney. The company is capitalized at $[illegible] and proposes to manufacture electrical equipment. I. Konigsberg, 114 Liberty Street, represents the company.

THE UNITY ELECTRIC COMPANY, West Unity, Ohio, has been organized with a capital of $[illegible] by Charles F. Chapman, Frank M. Coburn and others.

THE HAVERHILL-LAUREL ELECTRIC COMPANY, Laurel, Iowa, has been organized with a capital stock of $50,000. Peter Neuroth, Haverhill, Iowa, is president.

Record of Electrical Patents

Notes on United States Patents

(Issued Oct. 18, 1921.)

1,393,806. AUTOMATIC TELEPHONE SYSTEM; Talbot G. Martin, Chicago, Ill. App. filed Oct. 13, 1917. Private automatic exchange.

1,393,859. SYNCHRONIZER FOR TALKING MOTION PICTURES; Kenneth M. [illegible], Chicago, Ill. App. filed Feb. 17, 1917. For maintaining synchronism between phonograph and motion-picture machine.

1,393,878. METHOD OF BUILDING COMMUTATORS; Vincent G. Apple, Dayton, Ohio. App. filed Aug. 6, 1919. Bars inserted in grooves of ring.

1,393,888. CIGAR LIGHTER; Francis B. Farnsworth, Montreal, Que., Can. App. filed Sept. 30, 1919. For use in automobiles.

1,393,921. ELECTRICAL UNCAPPING KNIFE; Henry C. Swann, Spokane, Wash. App. filed May 11, 1920. Electrically heated.

1,393,939. OVERHEAD TROLLEY OR COLLECTOR FOR ELECTRIC TRAMWAY AND RAILWAY VEHICLES; Thomas Blaney and David Williams, Walton, Liverpool, England. App. filed June 6, 1921. Means for absorbing sudden jar.

1,393,945. ELECTROLIER; Le Roy G. Clark, Detroit, Mich. App. filed Nov. 5, 1919. Repairs made without disturbing wiring.

1,393,946. TELEPHONE-EXCHANGE SYSTEM; Henry P. Clausen, Mount Vernon, N. Y. App. filed March 21, 1917. To attract operator's attention when called subscriber answers.

1,394,020. INSULATOR CHANGER; Tomlinson F. Johnson, Jr., Atlanta, Ga. App. filed March 16, 1918. Holds live line while changing insulator.

1,394,026. RADIO SYSTEM; Lloyd M. Knoll, Philadelphia, Pa. App. filed April 2, 1920. Minimum of interference.

1,394,044. WATER-COOLED TRANSFORMER; Howard O. Stephens, Pittsfield, Mass. App filed March 25, 1919. For transformers used on welding machines.

1,394,055. RESISTANCE-UNIT TERMINAL; William C. White, Schenectady, N. Y. App. filed March 15, 1920. Terminals dipped in carbonizable material.

1,394,056. SIGNALING SYSTEM; William C. White, Schenectady, N. Y. App. filed July 3, 1920. Energy from alternating current of commercial low frequency.

1,394,057. ELECTRIC COUPLING DEVICE; Harry F. Woernley, Pittsburgh, Pa. App. filed May 4, 1918. For connecting electric train-line circuits.

1,394,062. MEANS FOR AND METHOD OF REDUCING CROSS-TALK IN FOUR-WIRE CIRCUITS; Otto B. Blackwell, Garden City, N. Y. App. filed May 20, 1918. Repeater system.

1,394,064. PRINTING-PRESS ATTACHMENT; William H. Chapman, Portland, Me. App. filed July 27, 1921. For drying the ink.

1,394,090. VALVE OF WIRELESS TRANSMISSION SYSTEMS; Cassius E. [illegible] and William J. Davis, London, England. App. filed May 19, 1919. Thermionic.

1,394,101. ELECTRIC HANDLAMP; Bert A. Little, Tulsa, Okla. App. filed Sept. 8, 1919. Tubular type.

1,394,121. ELECTRICAL APPARATUS; Ivar[illegible] H. Sclater, Pittsfield, Mass. App. filed June 12, 1919. Transformer-core construction.

1,394,143. X-RAY APPARATUS; William D. Coolidge, Schenectady, N. Y. App. filed Oct. 24, 1919. Tank completely filled with oil.

1,394,144. INCANDESCENT CATHODE APPARATUS; William D. Coolidge, Schenectady, N. Y. App. filed Oct. 24, 1919. Operated in oil.

1,394,145. THERMIONIC DISCHARGE APPARATUS; William D. Coolidge, Schenectady, N. Y. App. filed Nov. 15, 1919. For continuous operation with high energy input.

1,394,147. ELECTROLYTIC REFINING OF METALS; Frederick D. Crane, Montclair, N. J. App. filed Dec. 18, 19[illegible].

1,394,171. ELECTRIC NEEDLE; Mary E. Hall Chicago, Ill. App. filed May 2, 1921. For removing superfluous hair.

1,394,187. RESISTOR; Elmer E. F. Creighton, Schenectady, N. Y. App. filed March 15, 1920. Of unusual stability.

1,394,189. REPEATER-CONTROLLING SYSTEM FOR FOUR-WIRE CIRCUITS; Charles S. Demarest, New York, N. Y. App. filed Feb. 24, 1919. For controlling connection of telephone repeaters.

1,394,190. TESTING SYSTEM FOR FOUR-WIRE CIRCUITS; Charles S. Demarest, Ridgewood, N. J. App. filed July 24, 1920. For controlling connection of telephone repeaters.

1,394,211. APPARATUS FOR DISCHARGING STATIC CHARGES; John H. Morgan, Holyoke, Mass. App. filed April 21, 1917. Especially from paper.

1,394,220. BAKING OVEN; William Roberts, Winnipeg, Man., Can. App. filed Jan. 4, 1919. Low consumption, even heat and easy control.

1,394,279. SEPARATOR PLATE FOR STORAGE BATTERIES; Frank A. Coleman and Joseph J. Hoffman, Denver, Col. App. filed March 12, 1921. Non-short-circuiting.

1,394,325. FREQUENCY CHANGER; Friedrich W. Meyer, Milwaukee, Wis. App. filed Nov. 15, 1917. Simple static means.

1,394,439. CODE-TRANSFORMING APPARATUS FOR TELEGRAPH SYSTEMS; Donald Murray, London, England. App. filed Jan. 20, 1919. Printing-telegraph system.

1,394,450. BREAD TOASTER; Charles P. Strite, Mineapolis, Minn. App. filed June 22, 1920. Automatically cut off after bread has been toasted.

1,394,462. PROCESS AND APPARATUS FOR REFINING LIQUID MIXTURES; Seth F. Alden, San Francisco, Cal. App. filed Dec. 23, 1916. To break up liquid mixtures or emulsion.

1,394,466. STORAGE-BATTERY SEPARATOR AND METHOD OF PRODUCING SAME; Harry L. Boyer, Trenton, N. J. App. filed Sept. 29, 1919. Composed of porous and nonporous portions.

1,394,503. DENTAL X-RAY-FILM PACKET; Raymond R. Taylor, Rochester, N. Y. App. filed Jan. 8, 1919. May be used in patient's mouth.

1,394,507. TROLLEY-HARP CARRIER; Charles J. Dorrance, Chicago, Ill. App. filed April 21, 1920. Shock-absorbing device.

(Issued Oct. 25, 1921)

1,394,518. ELECTRIC HEATING UNIT; Charles C. Abbott, Pittsfield, Mass. App. filed Oct. 30, 1919. Conductors inclosed in metallic sheath.

1,394,528. ELECTRIC METER CONSTRUCTION; Donald J. Angus, Indianapolis, Ind. App. filed May 20, 1918. The metering parts and the record and record-making parts are in separate compartments.

1,394,535. ELECTRIC MOTOR; Edward Bretch, St. Louis, Mo. App. filed July 12, 1920. Motor-starting arrangement.

1,394,555. ELECTRICAL TRANSFORMER; Harry L. Idem, Springfield, Ill. App. filed Oct. 6, 1920. For radio use.

1,394,560. APPARATUS FOR TRANSMITTING RADIANT ENERGY; Frederick A. Kolster, Washington, D. C. App. filed Nov. 27, 1916. Telegraphy, telephony or any other signaling or control purposes.

1,394,563. TELEPHONE INSTRUMENT; Hubert A. Leise, Meriden, Conn. App. filed May 27, 1920. Vented diaphragm chamber.

1,394,565. ELECTRIC SIGN; John E. Long, Hot Springs, Mont. App. filed Aug. 24, 1917. Flashing type.

1,394,569. INCREASING THE EFFICIENCY OF X-RAY TUBES; William Meyer, Chicago, Ill. App. filed Aug. 19, 1918.

1,394,575. SUSPENSION MEANS FOR ELECTRIC LIGHTING FIXTURES; Ira L. Park, Washington, D. C. App. filed Jan. 28, 1920. Wire concealed in supporting chain.

1,394,600. WIRELESS-TELEGRAPH RECEIVER; George M. Wright, London, England. App. filed June 8, 1916. Noises due to atmospherics reduced.

1,394,601. THERMIONIC DEVICE; George M. Wright, London, England. App. filed May 1, 1918. Any desired magnification.

1,394,604. METHOD OF MANUFACTURING RAIL BONDS; William P. Bovard, Mansfield, Pa. App. filed Feb. 10, 1921.

1,394,642. ELECTRIC SIGNALING SYSTEM; Ralph L. [illegible], Hawthorne, N. J. App. filed Nov. 12, 1919. Machine-switching telephone.

1,394,647. TIME-INDICATING SYSTEM; Alfred L. [illegible], Chicago, Ill. App. filed Feb. 24, 192[illegible]. Electromagnetically wound master clock.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

GRAY, ME.—The Cumberland County Power & Light Company, Portland, is considering the erection of a transmission line from Gray Corner to East Gray.

HOLYOKE, MASS.—The Hegy Company, Inc., South Main Street, has had plans prepared for the construction of a one-story power house.

Middle Atlantic States

BOLIVAR, N. Y.—Plans are under consideration by the local electric light committee to secure electricity for domestic and power purposes in Bolivar. The project includes the erection of an electric transmission line. H. L. Hulett is chairman of the light committee.

BROOKLYN, N. Y.—Plans are under consideration by the Brooklyn Edison Company for the construction of a power plant, 80 ft. x 130 ft., on Sixty-sixth Street, to cost about $120,000. G. L. Knight, 360 Pearl Street, Brooklyn, is engineer.

BROOKLYN, N. Y.—Plans have been prepared by the New York Dock Company, 41 Whitehall Street, New York City, for the construction of a one-story power house at Furman and Montague Streets, Brooklyn.

BUFFALO, N. Y.—T. Kennard Thompson and Peter A. Porter have applied to the New York State Water Power Commission, Albany, for preliminary permit for hydroelectric development at Foster Flats on the lower Niagara.

CLINTON, N. Y.—The Madison Power Company has petitioned the Public Service Commission for permission to erect an electric transmission line from the substation of the Utica Gas & Electric Company at Clinton to Hamilton, a distance of 20 miles.

NEW YORK, N. Y.—Arrangements are being made by the Electric Bond & Share Company for an increase in its capital stock from $20,000,000 to $25,000,000, the proceeds to be used for extensions to its plants and system.

NEW YORK, N. Y.—The Sheffield Farms Company, Inc., 524 West Fifty-seventh Street, has had plans prepared for the construction of a three-story ice and refrigerating plant on Webster Avenue, to cost about $125,000. Frank A. Rooke, 15 East Fortieth Street, is architect.

OLEAN, N. Y.—The Bradford Electric Railway Company and the Olean, Bradford & Salamanca Railway Company have been consolidated under the name of the latter company, with a capital stock of $3,808,000. Improvements and extensions to plant and system are under consideration. J. B. Mayer and others are incorporators.

OSSINING, N. Y.—Plans are being prepared by C. F. Rattigan, superintendent of State Prisons for the installation of a new underground feeder system, pumping plant and auxiliary equipment at Sing Sing Prison.

SPENCERPORT, N. Y.—A company is being organized in the town of Parma for the purpose of furnishing electricity to residents on [illegible] Road and as far north as Peck Road. Electrical energy will be purchased from the village of Spencerport.

CAMDEN, N. J.—The Harbor Engineer, Room 11, City Hall, Camden, it is reported, is receiving bids for [illegible] electric traveling crane of locomotive type, electric tractor with eight trailer trucks, and two portable electric winches, to be installed at the city harbor, Spruce Street pier. George W. Bradley is chairman of harbor committee.

LAKE HOPATCONG—N. J.—The ice plant included in [illegible] of Brady Brothers, was recently destroyed by fire, causing a loss of about $[illegible].

NEWARK, N. J.—Arrangements have been made by the Public Service Corporation, Public Service Terminal Building, for an issue of $[illegible],000,000 in stock, the proceeds to be used for improvements and extensions.

VENTNOR CITY, N. J.—A new contract has been entered into with the Atlantic City (N. J.) Electric Company, by the City Council, under which a new street-lighting system will be installed.

BENTLEYVILLE, PA.—A contract with the West Penn Power Company, Pittsburgh, has been approved by the Borough Council for the installation of a new street-lighting system in Bentleyville.

FAYETTEVILLE, PA.—The Fayetteville Electric Company and the Greene Township Electric Company have arranged a territorial agreement and contemplate the extension of their transmission lines to neighboring sections.

PHILADELPHIA, PA. — Improvements and extensions to the pumping plant for the waterworks department at Lardner's Point are under consideration by the Water Bureau.

PITTSBURGH, PA.—Plans are under consideration for the installation of a burglar alarm and police signalling system in Pittsburgh. Robert J. Alderdice is director of public safety.

BALTIMORE, MD.—One of the plants of the Maryland Brick Company, Maryland Trust Building, including power house, etc., was recently destroyed by fire, causing a loss of about $100,000. Warren Griffiss is manager.

BETTERTON, MD.—Plans are being prepared for the construction of a two-story power house, 60 ft. x 150 ft., for the Hotel Colonial. Clark & Dudnick, Drexel Building, Philadelphia, are architects.

CUMBERLAND, MD.—Thomas B. Finan of Cumberland, and Townsend, Scott & Son, 209 East Fayette Street, Baltimore, it is reported, have purchased the systems of the Cumberland Electric Railway and the Edison Electric Illuminating Company subject to the approval of the Public Service Commission of Maryland. The purchasers are planning to organize a new company and consolidate the railway and power and lighting plants under one management. Extensions and improvements, it is understood, will be made to both systems.

CUMBERLAND, MD.—The Jamison Coal & Coke Company is considering the installation of electrical equipment for operation of its Jamison Mine No. 9. Electrical energy will be furnished by the Monongahela Power & Railway Company.

HAVRE DE GRACE, MD.—Plans are under consideration by the Susquehanna Power Company for the construction of a large dam above Conowingo Bridge on the Susquehanna. Extensive charter rights in Maryland and Virginia have been obtained. The company, it is understood, proposes to build another dam further down the river, and ultimately a third a short distance above Port Deposit. The power developed will be furnished to towns in Pennsylvania and Delaware. Francis T. Homer, 40 Wall Street, New York City, is reported interested.

AMHERST, VA.—The Amherst Light & Power Company, recently organized, is planning to install an electric lighting system in Amherst. W. A. Baldock is president.

North Central States

BLOOMINGTON, MD.—The installation of a new ornamental lighting system in Bloomington is under consideration by the City Council.

BLOUNTSVILLE, IND.—Kilmer Brothers, operators of an electrical distribution system in Blountsville, have requested the Indiana Public Service Commission for permission to discontinue the plant. Should the Kilmer plant be closed, electrical energy will be obtained from a nearby transmission line.

UNION CITY, IND.—The Union City Electric Company has filed notice of increase in its capital stock from $50,000 to $100,000.

CHAMPAIGN, ILL.—Plans are under consideration by the City Council for the installation of a lighting system in the University district, to cost about $82,000. A total of 540 lamps will be required.

CRYSTAL LAKE, ILL.—Negotiations are under way between the residents of Crystal Lake and the Rockland Lighting Company of Suffern to supply electricity for lighting in Crystal Lake.

DODGEVILLE, WIS. — The Wisconsin Light & Power Company, Madison, is planning the construction of a substation in Dodgeville.

NEENAH, WIS.—The Valley Paper Mills Company, recently incorporated with a capital stock of $1,000,000, it is reported, is planning the construction and equipment of a plant, to cost about $800,000. The main two-story and three-story mill will be about 80 ft. x 600 ft., with separate hydro-electric power plant with steam auxiliary. A filtration will also be built. Contracts, it is understood, will be awarded about Dec. 1. E. A. Wettengel, Appleton, is architect. George W. Burnside, Neenah, is secretary and treasurer.

OSHKOSH, WIS. — The Council has adopted revised plans and specifications for the installation of an ornamental lighting system in Oshkosh. Bids, it is understood, will be advertised for immediately.

WAUTOMA, WIS. — Dahlke, Giese & Wedkl are having plans prepared for the construction of a hydro-electric plant at White River. The project includes a dam, pipe line, etc. Jacobson Engineering Company, 533 Metropolitan Bank Building, Minneapolis, Minn., is engineer.

WHITEWATER, WIS.—Plans are being prepared for the construction of a one-story heating and power plant, 60 ft. x 150 ft., at the State Normal School at Whitewater. W. Kittle, Capitol Building, Madison, is secretary of the Board of Normal Regents. A. Peabody, State Capitol, is architect.

BRONSON, MINN.—The construction of a power plant in Bronson is under consideration. E. F. Behrendt, Foley, is interested.

ST. PAUL, MINN.—Under a reorganization scheme the plants of the General Utilities Company of St. Paul, at Devils Lake, Carrington, Enderlin, New Rockford, Oaks and Sheldon have been purchased by Edwin White of Gates, White & Company, St. Paul, for the stockholders and will be operated by Savage & White, St. Paul. The new owners, it is understood, contemplate improvements, including extension of electric service to the lake from St. Paul.

JASPER, MO.—The local electric light plant has been purchased by W. N. Vaughan, W. L. Collier and W. E. Vaughan. A company known as the Jasper Electric Light Company has been organized to operate the plant. The installation of new equipment, including oil engines, is under consideration. W. L. Collier is manager.

KANSAS CITY, MO.—The Kansas City Power & Light Company has been authorized to issue $2,000,000 in bonds, part of the proceeds to be used for improvements and extensions.

CASTLEWOOD, S. D.—The City Council has been authorized to purchase the electric lighting system owned by the Castlewood Telephone Company. The telephone company, it is understood, will make necessary improvements preliminary to the plant being taken over by the city.

Southern States

ASHEVILLE, N. C.—The Council is considering plans for extensions to the street lighting system.

GOLDSBORO, N. C.—Plans have been prepared by the Building Commission of the State Hospital for the Insane, Goldsboro, for the construction of a new power house and ice plant, to cost about $75,000. Nathan O'Berry is chairman.

GREENSBORO, N. C.—The installation of a new street-lighting system is under consideration by the Council.

MOUNTAIN CREEK, ALA.—The Alabama Power Company, Birmingham, is planning to erect an electric transmission line over a distance of 6 miles, to provide lighting service for the buildings and campus at the Alabama Old Soldiers' Home at Mountain Creek. Spur lines will be extended to Marbury, Graphite Mines, Verbena and Mountain Creek.

SAN MARCOS, TEX.—A committee has been appointed to investigate the matter of installing an ornamental lighting system in San Marcos from the Missouri, Kansas & Texas Railway station to the Southwest Texas State Normal College.

SLATON, TEX.—The Slaton Light & Power Company is reported to be considering extensions to its plant.

Pacific and Mountain States

BREMERTON, WASH.—The Council is considering an issue of $250,000 in bonds to establish a municipal electric lighting plant.

SEATTLE, WASH.—A report recommending extensions to the city lighting system [illegible] $1,500,000, has been submitted to the City Council by J. D. Ross, superintendent of lighting. The plans include tie lines at Spokane Street, to cost $100,000, and a like amount for insulator and switch changes; [illegible] ground wiring, $500,000; Spokane Street substation, $183,000; Seventh Avenue substation, $72,000; Ballard substation, $48,000; and $15,000 for Hillman, West Seattle and Fremont substations.

CANYON CITY, ORE.—The city authorities are considering the installation of a light and power system or the purchase of the local equipment of the Consolidated Electric Light Company, John Day, Ore.

McMINNVILLE, ORE.—Application has been filed with the State Engineer for a permit to construct a reservoir at the headwaters of the Nestucca River for the storage of 6,000 acre-ft. of water and to appropriate 35 sec.-ft. of water through a pipe line and tunnel, 5 miles long, for the development of 5,807 hp. under a head of 1,460 ft., for municipal purposes. The cost of the project is estimated at $350,000.

OREGON CITY, ORE.—E. C. Latourette, Oregon City, has applied to the state engineer for permission to appropriate 5 sec.-ft. of water from a small stream tributary to the Williamette River for light and power purposes in East Canby Gardens.

YAMHILL, ORE.—The city authorities are considering issuing $10,000 in bonds for the purchase or construction of an electric light and power system.

FAIRFIELD, CAL.—The installation of an electrolier system on a portion of Texas Street, to cost about $10,000, is under consideration.

FILLMORE, CAL.—The City Trustees are considering improvements to the street-lighting system in Fillmore.

FRESNO, CAL.—The San Joaquin Light & Power Corporation has applied to the State Water Commission for water rights on the south fork of the Merced River and to create an artificial lake at Wawona. The project involves the construction of a large dam and four power houses. R. C. Starr, Fresno, is engineer.

LOS ANGELES, CAL.—The Southern California Edison Company has been awarded contract for a lighting system in the Jefferson Lighting District.

QUINCY, CAL. — T. Gansner has purchased the plant of the Quincy Light & Power Company.

SAN FRANCISCO, CAL.—The Mokelumne River Power Company, 502 Flatiron Building, has applied to the State Water Commission for permission to divert 500 sec.-ft. direct and 51,000 acre-ft. per annum for storage from the Mokelumne River for power purposes. The amount of power to be developed will be about [illegible] hp. The diversion works will consist of canal [illegible] flume about 21 [illegible] long. The cost is estimated at $6,000,000.

BOISE, IDAHO.—The Murtaigh Irrigation District has filed application with the State Department of Reclamation to appropriate 1,000 sec.-ft. of water from the Snake River for power purposes. The project includes the construction of a power plant and a pumping plant, to cost about $494,500.

BONNERS FERRY, IDAHO.—The purchase of equipment, including generator, switchboard and transmission line, in connection with the proposed power plant at Moyie Springs power site, is under consideration. H. H. Hughes is manager of the city electric light and water system.

LAVA HOT SPRINGS, IDAHO.—The village authorities have applied to the State Reclamation Department for permission to build a hydro-electric light and power plant and dam at Beaver Falls on the Portneuf River. The cost is estimated at about $30,000.

Canada

YARMOUTH, N. S.—The plant of the Yarmouth Light & Power Company, at Carleton, it is reported, was recently damaged by fire.

Electrical World

New York, Saturday, November 26, 1921

Are Electrical Men in Earnest?

AN architect usually lives in a good-looking house. A man in the automobile business usually drives the kind of a car he sells. The fur man's wife usually wears a handsome coat. But the electrical man's family has almost no electrical appliances.

What is the matter with the electrical man? Is he blind or can't he see?

Manufacturers, jobbers, central-station men, contractors, dealers—all agree that electricity is a wonderful thing. They believe that the day is coming when every household will be cooking, washing, ironing, sweeping, heating, refrigerating and doing all the hard housework electrically. They know what this will mean to all the industry. But still they go on talking about selling the public and they buy nothing themselves.

Where is our vision and our sense of humor—we electrical men?

In some of the large cities there are electric shows where once a year many people look upon many appliances. In smaller cities there have been "Home Electric" demonstrations that have exhibited complete electrical equipment in a house. The people come and see and go away and wonder when such things will be in general use. They fail to appreciate that they could be enjoying these comforts right now, because they find in homes they visit only one or two or three appliances. And no one has ever heard of anybody *living* in a real electric home.

In these United States, however, there are six thousand and more central stations. In each one of them there are from a dozen to a hundred men—officials and directors, stockholders and employees—all personally interested in demonstrating to the people that electrical appliances *can* be used. *Then why don't they use them themselves?* Here are, say, 300,000 men who should be living this very day in electric homes, so that their friends will see and tell their friends, who'll tell their friends and spread the word and swell the wave of buying. And Heaven knows how many manufacturers and jobbers, contractors and dealers should have their homes equipped in the same way—and haven't. If all these men should order now all the appliances they should have bought long since to help their business—to say nothing of their families—the industry would be snowed under with rush work and profits.

Are we electrical men in earnest or are we not? If we are, then let's quit standing back and waiting for the rest of the world to use electrical appliances first. The rest of the world will naturally wait for us—unless we tire them out. We must equip ourselves. And it will pay richly to help the employee finance his purchases and even pay part of the cost to get a lot of living "Electric Homes" in each town.

Samuel Lindzey Nicholson

An executive with an analytical turn of mind who as chairman has guided the activities of the Electrical Manufacturers' Council since its organization.

AT THIS time when it is proposed to broaden the scope and increase the authority of the Electrical Manufacturers' Council, it seems fitting to speak of S. L. Nicholson, assistant to the vice-president of the Westinghouse Electric & Manufacturing Company, who has served as chairman of the Council since the day of its organization in the early part of 1916. Possessed of a keenly analytical mind and a strong desire always to get at the bottom of things, he has actively and carefully guided the activities of the Council during this initial stage of its existence. The Council, which it is now proposed shall be composed of the boards of governors of the three constituent members, the Associated Manufacturers of Electrical Supplies, the Electric Power Club and the Electrical Manufacturers' Club, has since its organization been composed of four representatives from each of these bodies and has acted as the co-ordinating body in reference to general matters affecting the relations of electrical manufacturers with other organizations. The accomplishments of the Council have been many and fundamental. They include a uniform cost accounting system, recommendations for standard catalog sizes and formation and participation in the work of the Electrical Safety Conference. Much of the work of the Council has naturally been of a more routine and of a less public nature, but has nevertheless been of considerable importance to electrical manufacturers. The co-operative work of the Council with various governmental departments has been particularly effective and has attracted much attention. The organization of the electrical manufacturers through the Council has been one of the reasons why the electrical manufacturers have in this way been able to function so conspicuously as an industry.

Mr. Nicholson was born in Philadelphia and began his electrical career in the Novelty Electric Works of that city in 1887. Shortly afterward he entered the employ of the Chadbourne-Hazelton Company, which was the sole representative of the Sprague Electric Railway & Motor Company. As this company, through a subsidiary, was engaged in the construction and often in the operation of public service companies, Mr. Nicholson has been engaged in almost every phase of this work from installing motors to managing traction properties and central stations.

Thus it will be seen Mr. Nicholson has been associated with the electrical industry almost from its very beginning as a commercial art. His name will always be linked with the development of the single reduction motor, the gearless motor and the Cutter circuit breaker It was he who exploited this breaker for the Cutter Electric & Manufacturing Company in the early days when it was the first high-tension breaker on the market. He was also associated with the C & C Electric Company in sales work in New York. Then in 1897 he was appointed sales representative of the New York office of the Westinghouse Electric & Manufacturing Company. Here his previous experience proved of special value and within a short time he became manager of the company's newly created industrial division located in New York. Five years later he went to East Pittsburgh as manager of the company's industrial department, and in 1909 was made sales manager of the company. Then it had but a small sales force and during the seven years he was so engaged he built up the Westinghouse sales organization. In 1917 he was called into the executive department in order to give the company the benefit of his wide knowledge on matters of policy.

Mr. Nicholson was instrumental in the formation of the American Association of Electric Motor Manufacturers, now known as the Electric Power Club, was its first president, and has served on its board of governors almost continuously from the beginning. He also assisted in the formation of the American Gear Association and the Stoker Manufacturers' Association and was a charter member of the Electrical Manufacturers' Club. He is chairman of the tariff committee of the Council and represents the electrical industry on the National Industrial Conference Board. He is also a fellow of the American Institute of Electrical Engineers.

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Shall We Support Our Labor or the Japanese and German?

ABOUT $300,000,000 worth of foreign goods are coming into the United States each month. It is our experience that not less than 90 per cent of the cost of a manufactured article—from raw material to finished product—represents labor. This means that America is now sending abroad about $250,000,000 a month to employ German, French, English, Japanese and Chinese labor, while our own workers walk the streets. For German labor now earns about 65 cents a day and Japanese labor about 18 cents. We cannot employ our labor at our price and compete with these foreign workers. We cannot sell the goods we make as cheaply as the foreigner can sell his goods. And so if we would have our labor employed, we must create an artificial balance, that our products may be sold in our own market somewhere near the same price as competing importations.

There are just two ways in which this thing can possibly be done. Either our workers must lower their living standard to the level of the German and the Japanese, or the price of the imported goods must be raised by a protective tariff to a point where American industries can offer competition. There is no other alternative, and it requires no second thought to make selection. American labor must have employment, and the American worker must live according to our established standards. Therefore the protective tariff is absolutely vital to affected industries—and electrical manufacturers are particularly concerned.

Sixty Years of Service to Electrical Progress

ON BEHALF of the electrical industry of America the ELECTRICAL WORLD extends its congratulations to the *Electrician* of London on the occasion of its diamond jubilee, just celebrated. The *Electrician* is "the oldest weekly journal of electrical engineering, industry, science and finance" in the world. It has served electrical progress since November, 1861, and through the recognition of this service has won its high position, long maintained, as the leading electrical journal of the Old World.

The *Electrician* was born in the days when electricity meant to most men the telegraph and the art of electrical experiment. What changes it has been the part of this fine old journal to influence and to record! The telephone has come and established itself as an essential of modern life. The motor has come and been generally adopted for industrial and transportation purposes. Electric light has come and grown to be the universal standard of illumination. Alternating current has come and made possible the broad service of electric power to mankind. Wireless telegraphy and telephony have been discovered and the viewless air made to carry the world's messages. Electric comforts and labor-saving appliances have been devised and diversified until they are destined to be the servants of all homes in every nation. And the *Electrician* has watched and helped it all; for the influence of its progressive and constructive thinking through these many years has been a beacon to accomplishment and a guide past pitfalls.

The "Diamond Jubilee" issue of the *Electrician* reviews in a most interesting way this long record of its participation in the evolution of the electrical industry. The fortunate few in this country to whom this English paper comes will prize the issue highly as a mirror of the past. For, although American and British electrical journals may differ somewhat in matters of appearance and may have held divergent views from time to time on points of theory and practice, in purpose they have been ever single-minded to protect, promote and prosper the science, profession and business of electricity. May there be sixty more years, and then more, in which the *Electrician* shall continue its good work, which is part of a common service to the electrical men of all the world!

Water Power Development Hampered by Red Tape

WHEN in the summer of 1920 the President affixed his signature to the water-power act it was very generally supposed that all restrictions on water-power development were removed and that from then on work would be started in earnest. Indeed, so popular was this belief that applications began to pour into the offices of the Federal Power Commission, and up to date applications for over 16,000,000 hp. are on file. Not all applicants have been granted permits, however, and such work as has been undertaken has been essayed principally by existing utilities. The trouble is not with the act itself—little fault can be found with the law—but with its interpretation. Great interest therefore centers around the hearing held in Washington this week before the Federal Power Commission, at which time the National Electric Light Association, supported by the manufacturers of waterwheels, the Investment Bankers' Association and others, protested against certain of the rules and regulations as prejudicial to water-power development and inimical to the public welfare. Opposition was directed particularly against the proposed classification of accounts embodied in regulations 16 and 17. The National Association of Railway and Utilities Commissioners after several years of study by its accounting committee adopted a uniform classification of accounts for public utilities. To this classification all of the public utilities of the country subscribe. Provision is made in it for a retirement reserve which is ample to cover the requirements of steam as well as of hydro-electric properties and certainly the requirements of the water-power act making it obligatory on licensees to maintain adequate reserves. This classification of accounts which prevails throughout the country, however, differs greatly from that proposed by the Federal Power Commission, and objection is made to the latter because it involves keeping two separate systems of accounts, which is an unnecessary waste. However, that is trifling compared with the chief objection to the proposed system of accounts, which is that it imposes a hardship upon public utilities and hampers their proper and adequate financing. To companies operating in a virgin field the regulations are particularly onerous, and few if any could operate under them. The experience of manufacturers and operators was singularly convincing on this point. The shops of the former are idle, while the latter cannot raise the money with which to make the developments. We have therefore reached an impasse, and unless some change is made water-power development will come to a standstill. The utilities cannot serve two masters. They are operating under state regulation and are content to do so. They are therefore already publicly controlled, and there is force in their argument that this should suffice. The general understanding of the Congress which passed the enabling legislation was that the Federal Power Commission would be a supervisory and not a regulatory body. On that account any attempt toward bureaucracy cannot be too quickly killed in the public interest. It simply adds needlessly to expense, which must be reflected in increased rates, and discourages development, and that is not what the act was designed to do.

Unanimity of Opinion on Mitigation of Electrolysis

MITIGATION of electrolytic corrosion of underground structures has been attempted in this country by devoting greater attention to track bonding, by "draining" of neighboring pipes and cables, and more recently by the use of insulating joints. Notwithstanding the use of these preventive measures, the trouble from electrolysis is becoming increasingly important by reason of the rapid increase in traffic on electric railways. Therefore, in view of the difficulties which most companies have experienced in investigating and combating this trouble, they should receive the report of the American Committee on Electrolysis with a great deal of gratitude. Besides being a comprehensive treatise on the subject, the report should be particularly valuable because it represents unanimity of opinion on the part of nine important national engineering organizations.

The committee emphasizes the necessity of a practical means for measuring current density across contact surfaces of pipes and earth and for the determination of polarity of structures and adjacent earth. Fortunately, this need has been answered to a large extent by the recent work of the Bureau of Standards, which has developed an instrument that will, it claims, measure the mean current density in a sphere of soil as small as 3 in. or 4 in. in diameter. This qualification is particularly important since it makes it possible to select the point of observation close to the underground structure being investigated. The necessary measurements may be made by driving a small pipe into the earth, removing it and inserting in the hole a rod carrying the requisite electrodes. However, it should be remembered that the dangerous corrosion usually takes place over very small surface areas of pipes. Consequently, even though the instrument mentioned represents a long step in advance, it does not yet permit actually getting to the vital part on the surface of the pipe. A further development of the method, as promised by the Bureau of Standards, will be awaited with interest.

Electric Service and Farm Productiveness

THE National Electric Light Association has started this year a committee on rural line extensions which will take up a pressing and much-needed work. It is not generally appreciated that one of the biggest problems facing the farmer is that of substituting mechanical power for the labor, both human and animal, that has been the mainstay of the farm. The gas and steam engines have already played a large part in transportation, and the tractor is rapidly assuming a larger share in the same work. The farmer is in the same position with reference to the use of electricity that the manufacturer was in twenty years ago. It represents a means of pulling him out of some of the economic difficulties he is facing and enabling him to employ labor-saving devices to a degree comparable with other industries.

Not only must methods of providing the supply of electricity be developed, but the farmer must be educated in its use and equipment for his purposes must be developed. Not the least important factor is the possibility of improvement in the farm-home problem. Few women are so greatly overworked as the farmer's wife without help. She must cook, wash, sweep and busy herself about the house and farm from early morning till night. In fact, hers is largely a life of drudgery, and on her strength and ability to care for and feed the farmhands depends to a large measure the size of the farm. Obviously, electricity can do much in easing her household burdens and making farm life more attractive to her and to her children, and few there are who appreciate its advantages more. The question of farm productivity does not always depend on getting farm hands, but on the ability of the farmer's wife to care for them, and in studying the whole question of rural line extensions the National Electric Light Association is doing a truly national service of immense social and economic value.

The Illumination of Metal-Working Plants

METAL working is a broad term covering all sorts of shop work from the coarsest stamping and roughing out to the finest lathe work. There is, however, a certain consistency about it in that on the average the body of the work is dark while surfaces exposed to tooling may be astonishingly light, presenting therefore the double requirement of very good illumination on the work and the minimum possible glare. A. L. Powell's notes on the proper method of lighting such plants to increase production, published elsewhere in this issue of the ELECTRICAL WORLD, are very much to the point in showing the kind of thing which has to be done. Whatever the exact lighting equipment, Mr. Powell's advice that the walls and ceilings should be of light color is thoroughly sound. In these days of general use of electric drive and appreciation of cleanliness in shops, some illuminating value from paint and whitewash may fairly be counted on. There are various classes of metal working demanding a wide range of intensities of illumination. Mr. Powell's specifications for good practice run from 4 foot-candles up to 12 foot-candles, according to the nature of the work. The variations which have proved actually to be desirable are probably even greater than this.

A factor often neglected in dealing with requirements for illumination is the effect of automatic and semi-automatic operations of various sorts. In running certain machines the operator is simply going through a series of regular movements requiring under ordinary circumstances very little ocular attention. The work may not be necessarily such as would be classified as rough, but it makes no demands on keenness of vision. Some operations of this type require no more light than the very coarsest kind of machine work. Others, at first glance not dissimilar, differ in that while the operations are nine-tenths of the time semi-automatic, the variations from this orderly procedure require very keen vision. In such cases the illumination has to be pushed up considerably beyond the point which would otherwise seem necessary. Then, too, while the speed of recognition of detail increases materially with added illumination, there are a good many operations in which the speed is fixed entirely by other considerations.

These points are mentioned merely to show how far the illumination of shops still is from a state for which a prescription can be written out. One phase of this matter Mr. Powell emphasizes, namely, the desirability of departing from so-called general illumination, not in decreasing the total amount of light to be furnished but in changing its distribution so that it will do the greatest possible good in lighting specific machines. This is really nothing more than recognition of the almost self-evident fact that on few manufacturing floors is there a wholly uniform and orderly disposition of the machines with relation to the outlets more or less thoughtfully provided by the architect. The weakest point in general factory illumination is the fact that the wiring is too often planned without the slightest reference to the installation which must through it be provided with light.

A Triumph for Long-Distance Oratory

PRESIDENT HARDING'S address at Arlington on Armistice Day was transmitted to New York and San Francisco and was heard by an audience estimated in the aggregate at 150,000 persons. This telephonic triumph emphasizes again the important achievements of recent research in that field. Considered from the standpoint of engineering, the feature demanding perhaps greatest admiration was the maintenance of the purity of the speaker's voice throughout the whole range of transmission. Virtually every step in the long sequence of equipment presented danger of distortion of the complicated current waves corresponding to a speaker's voice, but the demonstration showed that at each one of these danger points study and development have succeeded in transmitting the current wave almost undisturbed.

Long-distance oratory has appealed to the imagination ever since its first announcement several years ago and has excited further admiration with its perfection. However, it must be remembered that speech so transmitted to long distances and delivered broadcast in increased volume to large audiences is still subject to the imperfections attendant upon everyday telephonic transmission and which are imposed by the limitations of the transmitter and receiver as we have them today.

Design of 220,000-Volt Power Transformers

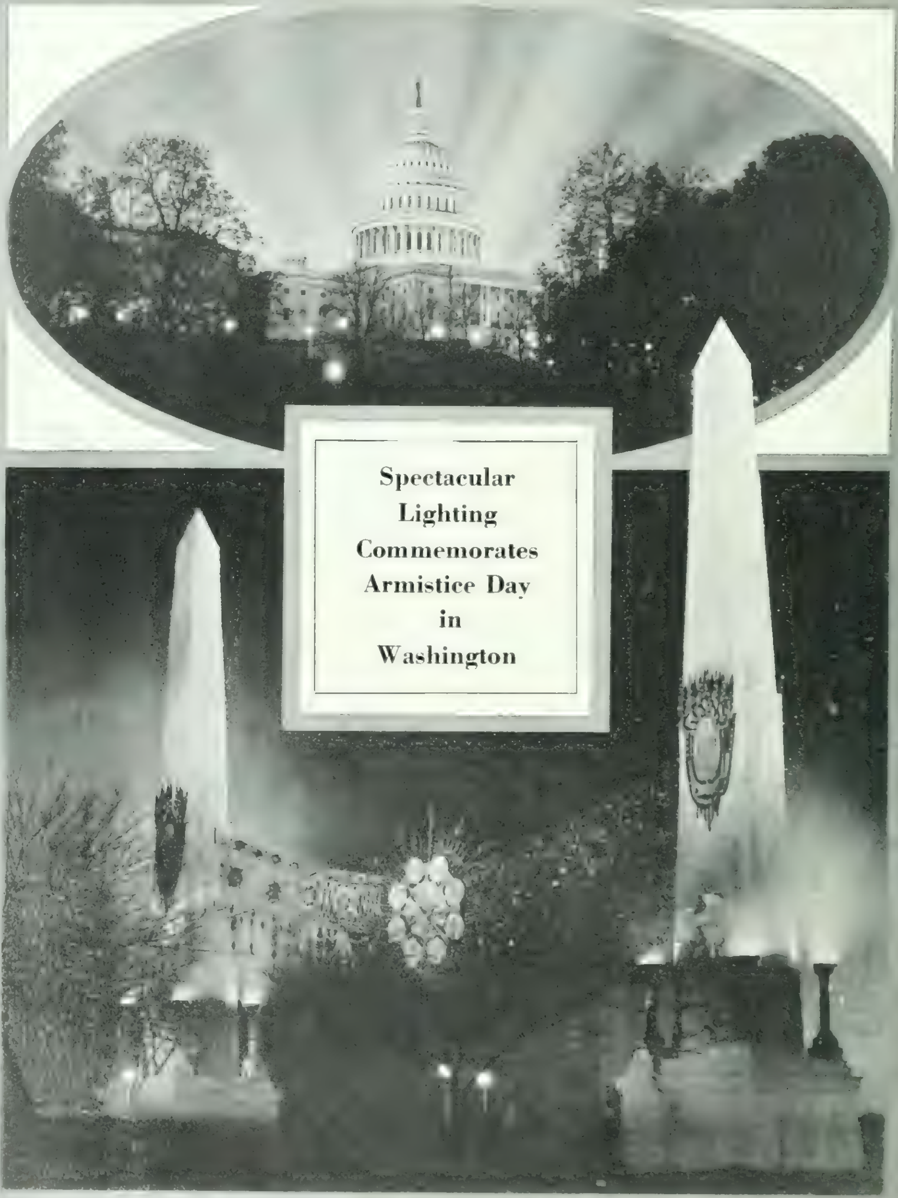
IN THE frequent discussion during the past few years of superpower systems and higher voltage transmission in general, manufacturers' engineers have invariably expressed confidence that the necessary transformers would be forthcoming when needed and would possess the certain reliability indispensable to so vital an element in the complete system. Some of the grounds for this confidence have been revealed recently in the published accounts of several noteworthy instances of transformer construction. The completion and successful operation of transformers for 1,000,000 volts, even though for testing purposes only, would seem to indicate that the problem of insulation is well in hand. Even greater interest perhaps attaches to the 220-kv. power transformers.

Details of design are now becoming available and we present in this issue an account by Walter M. Dann of the principal features of design of six 16,667-kva., 220,000-volt transformers for the Fall River transmission of the Pacific Gas & Electric Company. The article indicates forcibly the dependence of the design of this last word in the manufacturer's art on years of observation of transformer performance and the most careful study of and attention to every detail of assembly. For the transformer remains in its essential elements the same simple device which first appeared some thirty-five years ago. Its principle permits no radical improvement. Its growth, its increasing ability to meet all demands, has been solely due to a better understanding of its limitations in performance and a steady betterment in the materials entering into its construction.

The new designs are characterized by several new tendencies in further precaution against insulation and temperature troubles. The coil construction and assembly are such as to place the high-tension end of the winding as far as possible from the body of the core. The permanent grounding of the neutral of the high-tension Y-connection aids materially in enhancing this feature. Moreover, there is a more rational distribution of insulating material throughout the windings than ever before. Part of the low-tension winding, for example, is bare, and the insulation per turn varies in individual high-tension coils.

Perhaps the most striking features are those bearing on the dissipation of the losses and the maintenance of uniform temperature. The usual vertical ducts and the spaces between coils and coils and iron are increased in number and size, and now in addition the core itself is in two parts, one within the other, with liberal space between for coil circulation. The impression given is that the transformer is gradually assuming a cagelike form with all solid parts honeycombed in every direction, in sharp contrast with the early idea of a compact solid mass in which coils and iron were brought into closest relation in the interests of economy of material. In the race for reliability electrical performance has not been forgotten. A full-load efficiency better than 99 per cent is announced, with other interesting figures.

Spectacular Lighting Commemorates Armistice Day in Washington



ELECTRICITY, the ever-ready servant on all occasions, made possible at Washington on Armistice Day one of the most elaborately executed lighting displays since the Panama-Pacific Exposition. Searchlights and floodlights totaling 4,950,000,000 beam-candlepower bathed Washington Monument and public buildings, including the Capitol and the White House, in illuminating splendor. The display culminated in an illuminated archway, an avenue of light leading to the Pan-American Building and an "aurora borealis" back of the Capitol. W. D'A. Ryan, director of the illuminating laboratory, General Electric Company, planned the effects.

Features of 220,000-Volt Transformers Available for First Time

Rated at 16,667 Kva. Each, the Pacific Gas & Electric Transformers Constitute the Largest 220,000-Volt Units Built to Date — Unusual Coil Arrangements, Insulation and Departure in Ventilation Make Them of Particular Interest

By **WALTER M. DANN**
Engineer Westinghouse Electric & Manufacturing Company

UNDOUBTEDLY one of the first 220,000-volt lines to be put in operation will be that of the Pacific Gas & Electric Company from its Fall River No. 1 generating station on the Pit River to the San Francisco Bay District, about 250 miles (400 km.) distant. At the start the development will have an output of 70,000 kva., but ultimately its generating capacity will be in the neighborhood of 450,000 kva. While the lines will in the first instance be operated at 175,000 volts, they will be energized for 220,000 volts in the near future. The transformers which will step up the voltage from the 11,000-volt generators are particularly interesting because of the unusual coil arrangement provided, the insulation of both the low-tension and high-tension windings, and the departure in ventilating practice. These and other features will be described in the following article, which also contains results of tests of important characteristics. The transformers are the logical successors of the 16,667-kva., single-phase experimental transformer for 220,000-volt service that had previously been designed, built and tested at the manufacturer's plant. Extensive tests made on these transformers proved what had been anticipated, namely, that there were no reasons why units of such size and for such a high operating voltage could not be built as successfully as for much lower voltages.

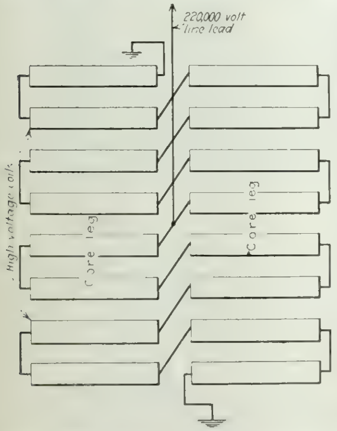


FIG. 1—SCHEMATIC DIAGRAM OF INTERCONNECTIONS BETWEEN HIGH-VOLTAGE COILS

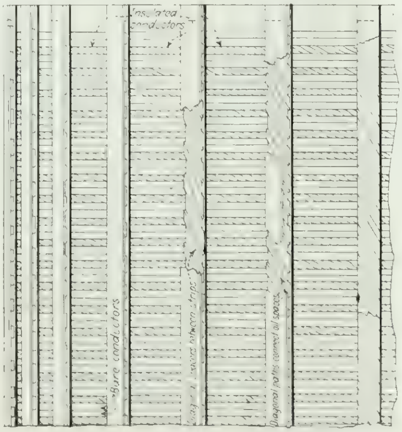


FIG. 2—VENTILATED SPACING STRIPS USED TO SEPARATE LOW-VOLTAGE COILS FROM ADJACENT INSULATION

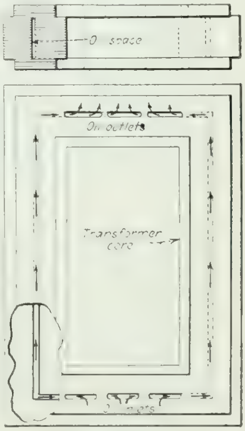


FIG. 3 — THE CORE IS CONSTRUCTED SO THAT OIL WILL CIRCULATE THROUGH IT

Two 50,000-kva. banks of transformers will be installed in the Fall River station, each bank to consist of three single-phase, oil-insulated, 16,667-kva. transformers, which are cooled by water circulating through internal cooling coils. The high-tension windings are connected in star and the low-tension in delta, the high-tension windings being arranged so that they may be operated at 110, 125, 175 or 220 kv.

Since the 220,000-volt transmission line is to be operated with its neutral point directly grounded at both ends of the line, the voltage stresses in the transformers will be greatly reduced, and the insulation can be tapered from the high-voltage line end to the neutral point. Although the usual test voltage applied to transformer windings is twice the operating voltage plus 1,000 volts, experience with transformers operated on three-phase lines with the neutral point directly grounded has proved that the operation in service is successful if the test applied is based upon the actual voltages to ground which are developed in the windings. The Fall River transformers have been designed on this basis and the high-voltage windings have received a one-minute test of 350,000 volts, which is induced in the winding by applying 30,000 volts at a suitable frequency to the low-voltage winding. This is the most searching kind of a test that can be applied to a transformer.

Owing to the grounding of the neutral point it has been possible to arrange the coils in a very unusual way, quite different from the ordinary core-type winding, but similar to the arrangement used by the Westinghouse company for the past ten years in high-voltage testing transformers of the core-type. The high-voltage coils of the transformer are divided into two circuits connected in parallel, one made up of the coils in the top half of the transformer and the other of the coils in the bottom half. The 220,000-volt line terminal is connected to a coil near the middle of the stack in each leg, and the coils in each half are connected in series back and forth between the stacks, as indicated in an accompanying illustration. Since the other end of the winding is grounded, the coils next to the top and bottom yokes are practically at ground potential. This arrangement makes the difference of potential between any coil of one stack and the adjacent coil on the other stack equal to the voltage of only two coils. For this reason very little separation is required between the two stacks of coils, and virtually no insulation is necessary between the yokes and the high-voltage coils at the top and bottom of the transformers. Because of these features it has been possible to make the transformers relatively small and compact compared with what would be expected in transformers designed to operate at the voltage for which these are intended.

The high-voltage winding is composed of 132 pancake coils, sixty-six in each stack, placed concentrically over cylindrical low-voltage windings. For the high-voltage coils use is made of rectangular copper strap inclosed in a sleeve made up of a number of paper and treated cloth strips formed continuously over the conductor as the coil is wound. The sleeve, which has a very high dielectric strength in itself, is supplemented by insulating material placed between the sleeved conductors. This spacing of solid insulation between conductors tapers from a very substantial amount at the high voltage end turns to a smaller amount in the body of the winding and is again gradually increased to a considerable amount at the grounded end of the winding. Between adjacent high-voltage coils are spacers which form ducts for circulation of oil past the face of coils.

During the drying and impregnating process, and until the coils are finally assembled on the core, the stacks of coils are clamped between heavy rings by means of bolts. After assembling, the temporary bolts are removed and the permanent clamping from the end frames holds the coils in place. This practice prevents the swelling of the coils due to absorption of moisture and assures the correct dimensions of the stack when finally mounted.

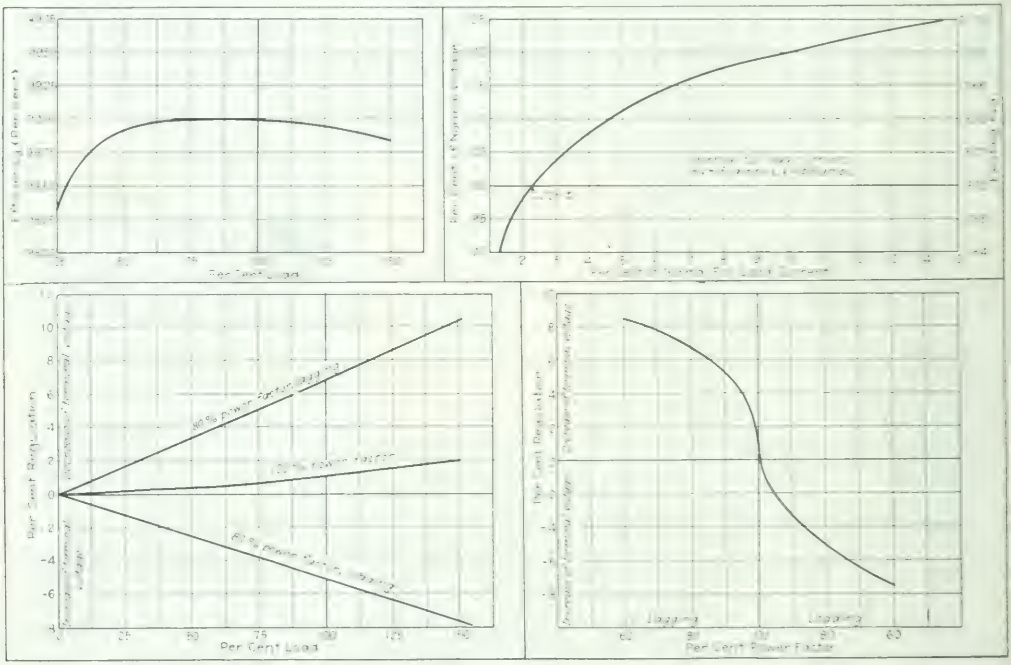


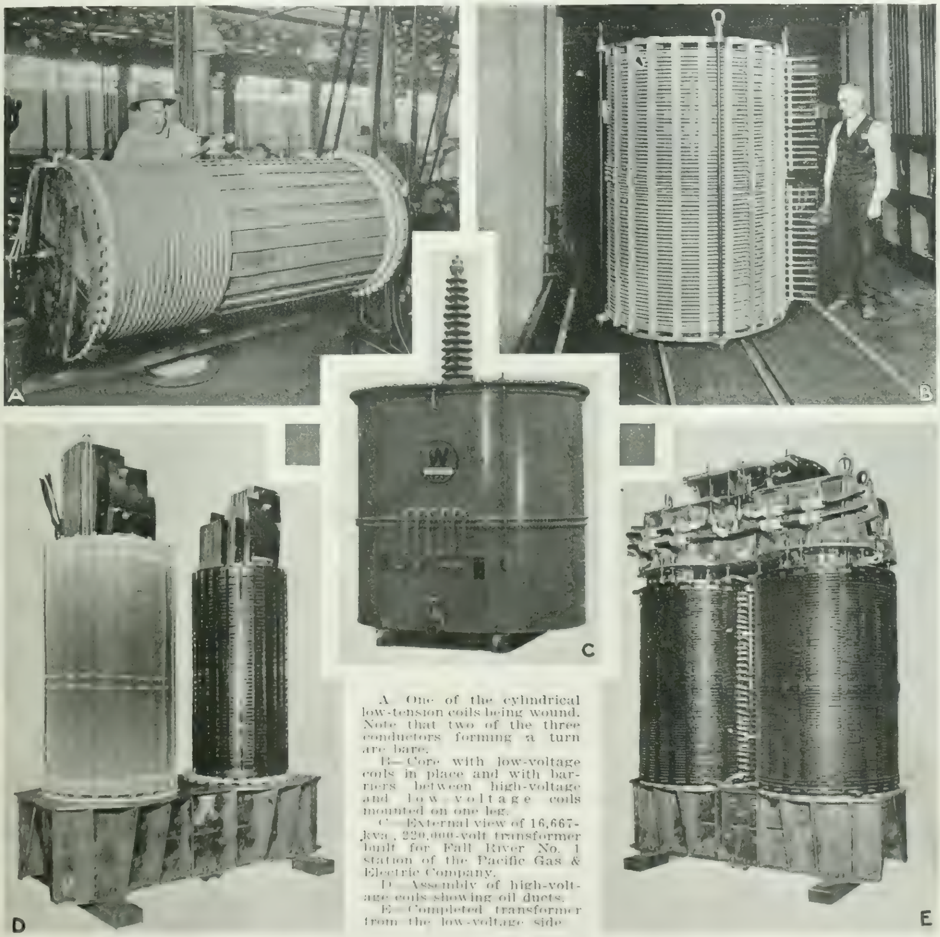
FIG. 4—TOP, LEFT, EFFICIENCIES OBTAINED AT VARIOUS LOADS. TOP, RIGHT, EXCITING CURRENT AND KILOWATT-AMPERES AT VARIOUS IMPRESSED VOLTAGES. BOTTOM, LEFT, REGULATION OF TRANSFORMER AT DIFFERENT LOADS AND POWER FACTORS. BOTTOM, RIGHT, REGULATION WITH NORMAL FULL-LOAD CURRENT AT DIFFERENT POWER FACTORS

The low-voltage coils also have novel features not found in most core-type windings. The windings, which are cylindrical, are placed on micarta tubes, one placed on each leg of the core next to the core. The winding consists of three copper straps in parallel, one outside conductor being insulated and the two remaining conductors bare, so the covering of the single conductor plus an insulating strip forms the insulation between turns.

Another feature of the low-voltage winding is the ventilated spacing strip used to maintain separation between the winding and the micarta tube on which it is wound and, in addition, to afford a path through which oil may circulate past the conductors of the coil. Although solid spacing strips have been used heretofore almost universally for this purpose, the spacers in these transformers are made of molded material set at an angle between two thin inclosing strips. Being set on a bias, the internal spacers afford firm support to every conductor and at the same time provide ducts through which a free interchange of oil can take place between adjacent ducts.

The bare conductors of the low-voltage coils and the ventilated spacing strips are both important factors in producing the uniform temperatures and freedom from hot spots which the tests of these transformers disclosed.

Coil Arrangement, Insulation and Ventilation Are Features of This 16,667-Kva., 220,000-Volt Transformer



A One of the cylindrical low-tension coils being wound. Note that two of the three conductors forming a turn are bare.

B—Core with low-voltage coils in place and with barriers between high-voltage and low-voltage coils mounted on one leg.

C—External view of 16,667-kva., 220,000-volt transformer built for Fall River No. 1 station of the Pacific Gas & Electric Company.

D—Assembly of high-voltage coils showing oil ducts.

E—Completed transformer from the low-voltage side

Between the high-voltage and low-voltage windings are tubes of insulating material interspersed with oil ducts. The coil stacks rest directly upon the end frames of the transformers, great care having been taken in the assembly of the coils to make the heights of the high-voltage and low-voltage columns exactly the same so as to eliminate any differences in the magnetic centers of the coils. In this way it is expected to minimize the short-circuit forces which would otherwise tend to cause vertical movement of the coils.

Only one high-voltage bushing is required per transformer to carry the line lead through the cover. The other end of the winding is grounded permanently to a stud in the cover, and a terminal is provided to which an external ground connection can be made. The well-known condenser-type bushing is employed. It is an extension of the standard line of condenser bushings which has been made for interchangeable use on transformers, circuit breakers and lightning arresters. The lead from the transformer windings can be fished through the bushing after it is mounted in place, making its installation an easy matter.

The bushings have received a test of 375,000 volts at 60 cycles for one minute under rain conditions, *i.e.*, with 0.1 in. (2.5 mm.) of water per minute directed toward the bushing at an angle of 45 deg. It would require in the neighborhood of 525,000 volts to produce a flashover under these conditions.

The magnetic circuit of a large core-type transformer requires more than ordinary attention in the design if troubles of various kinds are to be avoided, since it represents a considerable bulk of material with a relatively small radiating surface. If no special attention were given to the ventilation of such a core, the result would be high temperatures at the innermost parts of the core, a gradual breaking down of the insulation between laminations and finally fusing of the iron. This train of events would spread over quite a period of time, not becoming evident perhaps for months, but in the final stages of deterioration would move swiftly to a failure of the transformer which would be more or less complete.

For the foregoing reason a departure has been made from the ordinary practice of ventilating the core of a core-type transformer by making the inner part of the iron circuit virtually of two separate cores, one set within the other, with a space 1 in. (2.5 cm.) wide formed between the two parts and extending completely around the length of the magnetic circuit. Slots are punched in the yokes at the top and bottom of the core to form a passageway into the internal duct. By this construction an internal circulation of oil is set up along the yokes and vertically through the legs of the core. The advantage of this construction is shown by tests made with thermocouples well distributed throughout the core during a heat run. The thermocouples showed that the internal temperatures were uniformly moderate and that there were no hot spots.

In order to make the coils fit properly over the core and relieve them from unnecessary mechanical strain, the cores are accurately aligned and held rigid by angles and stiffening strips. The bolts which clamp the laminations together are attached to heavy insulating tubes of micarta and are well insulated at the ends to prevent contact with the core. Additional insurance against misalignment of the laminations and unnecessary air gaps was provided by assembling the laminations on cradles and using temporary pins in place of the permanent bolts with their insulating tubes in place. The temporary pins eliminated the wear and tear to which the insulating tubes would have been subjected if the core had been built up around them. The laminations were held in the cradle until they are raised into a vertical position in order to avoid abnormal strains.

MEASURING THE TEMPERATURE

Until quite recently it has always been the practice to use the temperature of the hottest oil in a transformer tank as an index of the operating temperature of the winding, but this sort of measurement gives a very incomplete idea of the proper temperature. Instead of employing this method in the Fall River transformers, temperature measurements are made on a small auxiliary coil which is heated by current proportional to the load current and subjected to the same radiating conditions as the main windings. The bulb of a thermometer is embedded in this coil, which is mounted inside the transformer case. The bulb temperatures which correspond at all loads to the temperature of the hottest parts of the main winding are read directly on a dial attached to the outside of the transformer case. By observing the indicator the operator is enabled to load the unit intelligently and to avoid dangerous temperatures.

For cooling the transformer copper-tube cooling coils placed in the upper part of the transformer case are used. The coil is made of three equal lengths of tubing in parallel in order to reduce the pressure required to circulate the water. Since the transformers are to be operated out of doors, the inlets and outlets of the cooling coils are brought through the walls of the tank at a point below the lowest level of the coils in order that the water may be drained if the transformer is to stand idle in cold weather. It may be interesting to know that almost a half mile of tubing is required in the complete cooling coil.

Since the over-all dimensions of the tanks for these transformers were large enough to prevent shipping them from Pittsburgh to their destination in one piece, it was necessary to build them in two parts with a joint around their girth. When the tanks were received at their destination the two parts were assembled, riveted together and calked. The core and coils complete weigh 29 tons—the case weighs 17 tons, and the transformer complete with oil weighs 79 tons. The floor space required is 11 ft. 9 in. x 14 ft. 5 in. (3.5 m. x 4.3 m.).

PERFORMANCE OF UNITS

Results of some of the tests conducted on the completed transformers in the works of the Westinghouse Electric & Manufacturing Company at East Pittsburgh are shown in accompanying curves. In comparison with most electrical and mechanical machines the efficiency obtained is remarkable, especially in view of the extremely high voltage for which they were insulated. The losses at full load are a trifle less than 1 per cent of the rated output, giving an efficiency under standard A. I. E. E. conditions of slightly more than 99 per cent. On account of the care used in designing and building the core, the iron loss amounts to only four-tenths of 1 per cent of the output. Measurements also showed very low exciting-current characteristics. At normal voltage and frequency the exciting current is only 2.25 per cent of the normal full-load current. For impressed voltages as high as 120 per cent of normal it remains within 10 per cent of the full load current. The regulation characteristics under various conditions of load and power factor are shown in an accompanying curve. The impedance voltage at normal frequency and with full-load currents in the windings amounts to 10 per cent of the normal voltage.

Two of the transformers were tested before shipment under full load and normal excitation for a period long enough to obtain steady temperature conditions. Measurements by thermometer and by the resistance method showed that temperature rises were within the guarantee of 55 deg. C. The insulation tests described previously were successfully applied while the transformers were hot.

Wisconsin Taxes Municipal Plant

FOR the first time in the history of Wisconsin the tax commissioners of that state are to levy an impost on a municipal utility, the electric plant of Stoughton having made itself amenable to state taxation by extending its service outside the city. Stoughton will be forced to apply to the Public Service Commission for permission to increase its rates to meet the tax.

Selling Utility Securities in Alabama

Recent Experience in Restoring the Old-Time Method of Financing Public Service Corporations by the Sale of Junior Securities Widely Distributed Among the Consumers and the Local Public

By **F. D. MAHONEY**
Manager Alabama Power Company, Birmingham, Ala.

THE electric light and power company executive of today—contemplating his efficient generating stations, adequate transmission and distribution systems and his corps of trained men—no doubt has a feeling akin to pity for his predecessor of the early nineties. And it is true that the present-day central station compares with its prototype of the period referred to as the modern machine gun compares with the flint-lock musket of bygone days. However strange it may seem, these ultra-modern central-station companies are reverting without hesitation to the ancient but disregarded policy of customer ownership of securities, which was so largely responsible for the upbuilding of our great industry.

The majority of the pioneer lighting and power plants were promoted and financed by progressive citizens of the communities in which they were built. A keen personal interest in the utility as a home institution pervaded the public mind, and inadequate and costly service was overlooked. A spirit of co-operation between utility officials and the general public usually existed in the same degree as that in which securities were held in the districts served, and harmony was the watchword of progress.

THE BACKGROUND OF CUSTOMER OWNERSHIP

As the cities increased in size and population more capital was needed for development of the utilities, and the financial requirements rapidly exceeded the resources of local banking institutions. The expanding properties called for more and more capital for plants and extensions, and as time went on the financial control of the majority of utilities gradually passed to the great banking interests in centers usually remote from the home district of the utility concerned. In the interest of economy in operation and stability of earnings through consolidation, many syndicates and holding companies were formed, and thus the physical as well as the financial control of the utilities passed from local to foreign interests.

Of course, nothing so interwoven with civic life as the utility supplying the public with transportation, light, heat and power could hope to escape the attention of the political element, and as a football between the parties in power and the aspirants for office the average utility was misrepresented until it was generally placed in an unenviable position before the public and the hue and cry against "absentee landlordism" echoed throughout the land.

So even before the world war, to counteract all this, certain central-station companies—fortunate in having far-sighted leaders—experimented with the idea of selling junior securities in small lots and at especially attractive prices to employees and customers.

The advent of the high-price era during and following the late war changed this policy from one of public relations promotion to one of grim necessity. Material and equipment prices soared beyond reason, and to accentuate further the difficulties of the operators the cost of obtaining money kept pace with the rising cost of other materials and commodities. In order to dispose of public utility securities in large blocks it became necessary to sell them at a sacrifice to make them yield the high rate of interest demanded by inventors. Even with a high yield, the precarious condition of the majority of the utilities, their inability in many instances to pay bond interest, and in some cases even failure to earn operating expenses, made investment in public utility securities an unattractive one for investors who were readily attracted to industrial and more speculative securities bearing higher interest rates.

It was then that the urgent requirements for new capital drove home the fact that a fertile field for the sale of junior securities in small blocks existed at home, and a trial of the plan invariably convinced its sponsors that it was not only feasible but would probably prove the salvation of many companies that were unable otherwise to obtain sufficient money to carry on the mandatory extensions to their facilities brought about by the general prosperity in industry. The success of the plan was immediate and opened a field that is seemingly inexhaustible, possessing as it does the twofold advantage of obtaining money at reasonable rates and at the same time laying the foundation of a firm friendship for and an active interest in the company on the part of every person buying its securities. The latter result is an asset of greatest value under the present system of state regulation of public utilities. The regulating authorities are keenly alive to the manifold advantages of customer ownership, and many state commissions have gone on record as favoring this policy.

PREPARING FOR THE CAMPAIGN

The Alabama Power Company was one of the pioneers in this movement in the South. In the early part of June, 1920, a sales campaign was launched to dispose of 10,000 shares of $100 each, par value, 7 per cent cumulative preferred stock, to be sold at 93 plus accrued interest, to yield 7.53 per cent. The potential sales force consisted of the 1,200 employees of the company, directed by an investment department, consisting of a department manager and a "clean-up squad" of two or three men. Before placing this stock on the market a careful study was made of the methods and practices employed with success by other companies, and a sales policy was outlined incorporating those features deemed most applicable to our territory and situation. Attractive literature descriptive of the physical property and the financial condition of the company was prepared and an intensive advertising campaign waged in the daily and weekly papers of the state. Bulletin boards were erected at convenient points on the system, and instructive and inspiring bulletins were published frequently.

The campaign was formally opened at a mass meeting of employees at headquarters, followed by similar meetings at each operating center. Inspirational and instructive talks on methods of selling stock and the urgent necessity therefor were delivered by executives and directors of the company, and each employee was requested to make stock selling a part of his daily work. As an inducement to investment by wage earners and people of limited means a partial-payment plan was devised whereby a small initial payment could be made on each share and the balance paid in seventeen equal installments. Interest on partial payments was allowed and the privilege of withdrawal at any time was extended.

As an incentive to placing the stock commissions were offered to all employees on the basis of $2 for the first share sold on time payments and 50 cents for each additional share. Three dollars was offered for the first share sold for cash and 50 cents for each additional share. The commission on cash sales is paid promptly, but on the time payment sales $1 of the commission due is paid immediately and the balance when $40 on each share is paid to the company. To further stimulate sales cash prizes were offered to employees and to departments selling the greatest number of shares each week.

Actual Results in Sales

The campaign was a success from the start. The sales of stock mounted steadily until in the early part of 1921 the total issue of 10,000 shares had been subscribed. Of this issue our employees had purchased or subscribed for 1,500 shares, or 15 per cent of the total offering. It is interesting to note that approximately 50 per cent of the shares sold were disposed of for cash and the balance on the time-payment plan.

So successful was the first attempt at security sales locally that stock selling now has become an important part of our daily operation routine. To assist in financing our second large hydro-electric development on the Coosa River, we expect to raise several millions of dollars by sales of preferred stock to our customers and to our employees, and this offering is now being absorbed as fast as can be expected under the economic conditions prevailing in our section.

The present issue differs from the original only in the fact that the shares are without nominal or par value, instead of being $100 par value as before. Contrary to the general idea, this fact has been no deterrent to the sale of this security, and our experience shows that the small investor is more concerned with the reputation of the company and the integrity of its representatives than he is with the engraving on the certificate. It goes without saying that this confidence must not be shaken or disastrous results may be expected.

The Value of a Bogie for Each Town

The Liberty loan and other patriotic drives demonstrated the value of having a mark to shoot at, and we have endeavored—for competitive purposes—to set up an allotment of stock to be absorbed by each operating division of the company and for each of the many towns in our territory. In arriving at the allotment or "bogie" for future sales careful consideration was given to the results obtained from the first sale. The sales record was analyzed to show the number of shares sold per capita and per customer, and likewise the number of dollars of savings bank deposits, post office receipts and lighting revenue per share sold.

The results in towns where we supply lighting and power service directly to the ultimate consumer were segregated from those towns which are served by a separate operating company not allied to our own but purchasing energy from our system. A weighted average involving all factors was arrived at, and the stock allotments were placed by years for the ensuing three-year period. Interest and enthusiasm can thus be maintained over a long period, as the mark—although absolutely equitable and attainable—is a high one.

The Effect on Public and Personnel

The visible effect of this policy upon the general public and upon the employee salesmen has been most interesting. The public generally has welcomed the frank statements contained in our advertising matter, and much favorable editorial comment has been received. The shareholders have become stanch partisans of the company and defenders of its policies. Frequent expressions of surprise are heard that stock selling was not started sooner, in view of the unquestioned favorable effect it has had on public opinion. The rank and file of our employees have been benefited by their efforts to sell as well as by their own purchases of stock. Expert salesmen have been developed as well from the substation operators and accounting department as from the local managers and commercial forces, who are accustomed to meeting the public daily.

It is particularly noticeable that our wholesale power customers have generally invested in our securities, and we feel that this is a concrete evidence of their satisfaction with our power service and of their desire to see our company grow and develop in advance of their own power requirements. In almost every instance these consumers have cordially recommended the purchase of our stock to their employees and have been of material assistance to our salesmen in this connection. Another striking feature is that original purchasers of securities among the industrial workers are acquiring more stock as their means permit. The regular payment of quarterly dividends undoubtedly has a stimulating effect on "repeat" sales.

Four of the Many Benefits Derived

In conclusion, it can be said that the experience of the Alabama Power Company gained in the sale of preferred stock to its customers and employees has proved successful in many ways, four of which are here set out in the seeming order of their importance:

First—As a means of interesting and educating the general public in the affairs of the company and building up a more friendly and co-operative spirit between producer and consumer.

Second—As a ready method of financing extensions and improvements by the company at a reasonable cost.

Third—As a means of educating the employee stock salesman in the policies and financial condition of the company and likewise increasing his sense of responsibility to the company.

Fourth—As a means of heightening the morale of the organization by giving to each employee owner of stock a financial interest in the welfare of the company over and above that of his daily wage or salary.

Lighting Metal-Working Plants to Increase Production

Proper Intensities, Spacings and Fixtures for Benches, Machine Tools, Sheet-Metal Work, Assembling, Painting, Etc.—General or "Localized-General" System of Illumination Is Satisfactory in Most Cases

By A. L. POWELL
Edison Lamp Works, Harrison, N. J.

ECONOMY in production is most essential at all times, but just now the question is of supreme importance in view of the present necessity for lowering costs. A mere curtailment of certain expenses does not necessarily mean a reduction in cost. Lighting might be cut down and the power bill reduced, but under the low intensity every movement would be slowed down and the costs per unit of output would mount at a surprising rate. To go further, lighting expense might often be increased to make desirable increases in plant efficiency, as high-level illumination without doubt makes it possible for each operator to turn out more work per day. Furthermore, good lighting will reduce unnecessary expenses in the form of compensation to injured workmen. Careful investigators have shown that a high percentage of industrial accidents are avoidable and that improper lighting is responsible for many of them.

GENERAL ILLUMINATION BEING WIDELY ADOPTED

In shops as well as elsewhere, although localized lighting has advantages for certain operations, it has been in a large degree superseded by general illumination with more efficient, larger lamps. One reason for this replacement has been the movement toward the prevention of glare. With a well-designed general lighting system work can be carried on effectively, relatively few outlets are required, and efficient lamps can be used.

The most widely applicable system of machine-shop lighting has been termed "localized-general." Usually a higher intensity is required along rows of machines or benches, while a lower illumination is sufficient for the remainder of the room. This effect of varied intensity is accomplished by placing medium-sized lamps relative to the machines at a height of 9 ft. or 10 ft. (2.7 m. or 3 m.). The maximum intensity is then delivered on the work from the correct direction, and the spread light takes care of the surrounding areas, aisles, etc.

When the arrangement of a shop is such that the greater part of the area needs only a relatively low intensity of general illumination but some few operations require much higher intensity an economical plan is to supplement overhead lighting with local lamps judiciously placed. This is especially true of machine shops with automatic machinery, where a local lamp may be necessary when setting the tool.

The RLM standard dome reflector and bowl-enameled lamp is the most widely used equipment for general or localized-general illumination. The combination gives a desirable distribution of light with adequate illumination on vertical surfaces. It is efficient, easy to clean and so designed that direct glare is reduced to a satisfactory minimum. For use in drop lamps or portables the mill-type "Mazda" lamps are desirable.

Whatever system of illumination is chosen, it is good practice to provide light-colored walls and ceilings and refinish these at frequent intervals. Thus light which would otherwise be wasted is conserved. The importance of a well-supervised carefully planned system of cleaning lamps and reflectors cannot be overemphasized.

In many plants lighting circuits are not separate from the power circuits, but it is most desirable to separate them and provide 110 volts for lighting.

There are two characteristic types of buildings devoted to metal working which require different methods of lighting:

A. Those having relatively high ceilings, from 20 ft. to 60 ft. (6 m. to 18 m.), with a crane traveling the length of the bay (center bays). Figs. E and F show typical structures.

B. Those with low ceilings, from 10 ft. to 15 ft. (3 m. to 4.5 m.), having machines frequently driven by overhead shafting (side bays). Figs. A, B, C and D illustrate different forms of construction.

In the first case units must be hung high above the crane travel or angle reflectors placed on columns below the crane track. In the second case shafting and belts are likely to cast shadows. Larger, rougher work is usually carried on in the high-ceiling room and finer work in the side bays.

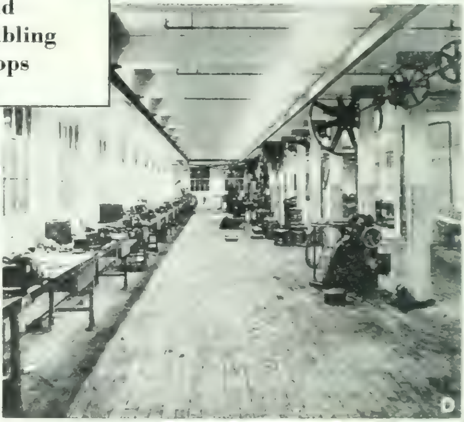
Overhanging parts of many metal-working machines tend to cast shadows on areas where good lighting is vital unless the proper direction of predominant light is obtained. This is of particular importance in the room where units must be hung low, for any individual machine generally receives most of its light from only one unit. In the other case, with lamps well above the floor, each machine receives light from a number of units, thus reducing the tendency for dense shadows to be produced.

The operations in the metal-working industry may be divided into four general headings: (a) Bench work, (b) machine-tool work, (c) sheet-metal work, (d) assembling, painting, etc.

LIGHTING REQUIREMENTS FOR BENCH WORK

Benches fall in two general groups, single benches 2 ft. or 3 ft. (0.6 m. or 0.9 m.) wide along the walls and single or double benches away from the walls. Single benches along the walls should be lighted by a row of lamps about 6 in. (15 cm.) in from the forward edge of the bench spaced on 6-ft. to 10-ft.

Good Lighting Practice for Metal-Working and Assembling Shops



A—Typical machine shop well lighted by 200-watt "Mazda C" lamps in dome-enameled steel reflectors with glass diffusing globes on centers 10 ft. x 12 ft. and 11 ft. high.

B—A general lighting arrangement in a well lighted shop. Outlets are spaced 15 ft. x 14 ft. and the 300-watt "Mazda C" lamps in reflecto-cap diffusers are hung 11 ft. high.

C—General illumination of a power press room where 100-watt bowl-frosted Mazda lamps in deep-bowl steel reflectors are hung 9½ ft. high on 10-ft. centers. The illumination at the machine is 4 foot-candles.

D—Well lighted benches and assembly area. The 150-watt "Mazda C" lamps in glass-top [illegible] reflectors are spaced on 8-ft. centers. Units for general illumination are close to the 12-ft. ceiling, while those over the benches are 8 ft. high. Outlets are located between vises.

E—Assembly floor of a shop devoted to heavy work. The 300-watt "Mazda C" lamps in dome reflectors are hung above the crane travel 20 ft. above the floor on centers 25 ft. x 28 ft.

F—Plant devoted to the assembly of textile machinery. The 300-watt and 500-watt "Mazda C" lamps in RLM standard dome reflectors are 18 ft. high on 20-ft. centers. A uniform intensity of 10 foot-candles is secured.

(1.8-m. to 3-m.) centers, with from 40-watt to 100-watt bowl-frosted or bowl-enameled "Mazda" lamps in deep-bowl or RLM standard dome reflectors. The size of lamp will depend on the fineness of the work and the spacing on the location of the vises or working points. It is desirable to locate units between vises rather than directly above them, for with this arrangement light is received from two sides and the operator is less likely to cast a shadow on the work. The units for bench lighting should be hung about 5 ft. (1.5 m.) above the bench.

Where general illumination is used for the shop with outlets symmetrically spaced—as, for example, four outlets on 10-ft. (3-m.) centers per 20-ft. (6-m.) bay—it is often feasible to move the first row of outlets 2 ft. or 3 ft. (0.6 m. or 0.9 m.) nearer the wall than would be necessary with a strictly symmetrical arrangement, and thus obtain satisfactory bench lighting with but little sacrifice of general illumination and a minimum number of outlets. Such a scheme is followed in the plant illustrated in D, where outlets are on 8-ft. (2.4-m.) centers.

For benches away from the wall general illumination is quite satisfactory, provided that fairly close spacing of outlets, not over 10-ft. or 12-ft. (3-m. or 3.6-m.) centers for ordinary conditions, is adhered to. Where the ceiling is very low or the work exacting, localized general illumination with the units arranged as suggested for benches along the wall is sometimes necessary. Again, where minute parts are handled, such as in a watch factory, or for very close inspection work, local lighting with low-wattage lamps in deep-bowl reflectors offers the most economical means of providing the high intensity (50 foot-candles and upward) which is necessary. This should, of course, supplement general illumination.

The intensity for bench lighting depends on the type of work carried on and ranges from about 6 foot-candles for soldering to 20 foot-candles for accurate fitting of machine parts.

It is almost always desirable to avoid specular or image reflections of the light sources from polished surfaces, yet there are a few exceptional cases. When inspecting glossy surfaces with natural light, the inspector holds the object so that the sky is reflected from its surface and thus detects irregularities. With artificial light it is necessary to duplicate this condition by having a relatively large diffusing source so placed that the inspector can view the reflection of this in the surface of the metal.

LIGHTING MACHINE-TOOL WORK

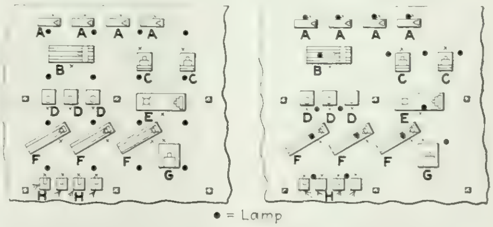
There are a few processes, including deep boring, punching and pressing of large blanks and lathe work on minute parts, such as watch mechanisms and the like, which require a local lamp. With these few exceptions machine-tool work can be most effectively carried on with the artificial lighting by overhead units. This statement is borne out by numerous satisfactory installations in constant use. Many mechanics will argue otherwise, thinking they cannot work unless there is a drop lamp directly over the tool, but this is largely a question of psychology.

The system to use for lighting machine tools depends on the type of building as pointed out. Strictly general illumination—that is, a symmetrical arrangement of outlets with reference to the bays is quite satisfactory in the high structure, as indicated in Figs. E and F There are many degrees of precision requiring different amounts of light. The following table indicates good practice for general lighting of machine tool work:

	Foot-Candles	Watts per Sq.Ft
Rough work	4 to 6	0.6 to 0.75
Average work	6 to 8	1.0 to 1.25
Fine work	8 to 12	1.5 to 2.0

The RLM standard dome reflector with clear "Mazda C" lamps, when the hanging height is more than 20 ft. (6 m.), is probably the most universally applicable unit for these conditions. The size of lamp will depend on the spacing and intensity desired. The spacing in turn depends on the hanging height and size of bay. A safe general rule for a satisfactory installation in a machine shop of this nature is that the spacing should be about equal to the distance above the floor.

Where the ceiling is low in order that the predominant light may come from the proper direction, it is usually advisable to employ localized general lighting which is an intermediate practice between general and local lighting with common sense used in the placement of outlets. In the accompanying diagram is shown the difference in arrangement between a general and a localized-general lighting layout. In the case of the symmetrical arrangement an analysis shows that many of the units are quite ineffective. In the other half of the diagram lighting units are arranged so that the correct direction of light results, the position of each machine being taken into consideration.



"LOCALIZED-GENERAL" LIGHTING USED WHERE CEILING IS LOW

This is a typical section of a machine shop. At the left is shown the arrangement of outlets for symmetrical general illumination in which many of the units are ineffective. For example, two are located directly behind the shapers, where they would be of little use. The lighting of the lathes along the wall is from the wrong direction as the headstock would cause a shadow on the work. At the right in the localized general arrangement the units have been placed with regard to the position of each machine. The abbreviations are: A—lathe (engine); B—large planer; C—shaper; D—drill press; E—lathe (turret); F—automatic screw machine; G—universal miller; H—emery wheel and buffer; O—lighting outlet; X—position of operator

One might justly bring up the criticism that this is nothing but an extravagant system of local lighting providing a rather large lamp for each machine. On the other hand, one would be willing to grant that with our present standards four 100-watt or 150-watt lamps in a 20-ft. (6-m.) bay was not extravagant for general lighting. If the number of units in the four bays pictured is tallied, the general lighting system would show sixteen and the localized-general seventeen. Analyses similar to this of entire shops have been made time and time again, and the power required for a localized general system checks up very closely with the power required for a general lighting system. With an arrangement like this each machine receives the kind of lighting it requires. All the advantages of general lighting are obtained and the disadvantages of local lighting eliminated. (See Figs. A, B and C for examples.)

The size of lamp required for this scheme depends, as before, on the fineness of the work. For rough work 75-watt bowl-frosted "Mazda C" lamps in RLM standard dome reflectors arranged approximately as shown will prove satisfactory. For average work 100-watt and for fine work 150-watt units of the same type are used. Where "Reflecto-cap" diffusers or similar devices are used to obtain additional diffusion, it is usually desirable to employ the next larger size of lamp than specified.

The following general rules indicate the desirable direction of light for the different types of machines:

Lathes.—From above to the right of the chuck, very slightly forward.

Millers and Shapers.—From above, in front, and preferably both sides.

Planers.—Large machines, above center of bed when at end of cutting stroke; small machines, see shapers. On planers where it is advisable to supply only moderate general illumination. A small lamp with reflector may often be mounted near the tool.

Drill Presses.—From above, in front, unless overhanging parts prevent, then slightly from the side.

Buffers, Grinding Wheels, Etc. — Above the wheel, slightly forward.

Saws.—In line with the saw, slightly forward.

Proper Illumination for Sheet-Metal Work

Many of the processes in a sheet-metal plant are similar to those treated under machine-tool works. Punching, pressing and stamping, contrary to the general impression, can be satisfactorily illuminated by the overhead system with the predominating light from the front and from the left or right of the operator. It is true that where very large pieces are pressed overhanging parts may be such as to make it quite essential to install drop lamps in the mechanism of the punch or press. On the other hand, the practice of having a bare unshielded lamp lying on the bed of the press continuously in the operator's field of view should be abolished. Eye strain is severe, fatigue is increased, and the glaring effect with its attendant after-image is very likely to be the direct cause of a crushed hand. One certainly can work with a greater degree of safety in a room lighted as pictured in F, where the white side walls eliminate shadows, than under the conditions too frequently noted in a punch room.

Cutting, shearing, edge setting, rolling, polishing, burnishing and similar processes can be satisfactorily illuminated by a system of general lighting providing an intensity of from 4 foot-candles to 8 foot-candles, depending on the fineness of the work and the degree of accuracy required.

General illumination is entirely satisfactory for the assembling, painting, etc., of the metal-working plant. This work usually takes place in the high center bay, and the rules laid down for machine-tool work in this area apply. The RLM standard dome reflector with clear "Mazda C" lamps symmetrically spaced above the crane travel as pictured in F or a combination of this unit and angle steel reflectors with bowl-enameled lamps below the crane travel are the two most nearly universal methods of applying light applicable here. The angle equipment has the advantage of directing the light from the side and producing excellent illumination on vertical surfaces. It is rarely of service alone and should be supplemented by overhead units to prevent the dense conflicting cross shadows.

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Unit Costs of New Bedford Generating Station

Economical Construction and Efficient Operation Shown — Analysis Prorated on Capacity Basis Yields Interesting Results

Begun about five years ago and completed to a present rating of 72,000 kw., the Cannon Street station of the Edison Gas & Electric Light Company, New Bedford, Mass., represents a construction cost of $4,027,029, or $58.98 per kilowatt, according to data filed recently by the company with the Massachusetts Department of Public Utilities. A description of this station was published in the Electrical World of Feb. 23, 1918, page 397, and April 13, 1918, page 771. The plant now contains twenty-four boilers, aggregating 15,600 hp., and seven turbo-generators, of which one is rated at 20,000, two at 15,000, one at 10,000 and three at 4,000 kw. Surface condensers are used. and the plant is a tidewater installation supplying energy to many points in southeastern Massachusetts and to Cape Cod.

The cost summary printed below was prepared at the request of the company by Stone & Webster, Inc., designers and builders of the plant. In a letter accompanying the summary Stone & Webster stated that the costs of steam-power stations, usually expressed in dollars per kilowatt, are apt to be misleading unless the basis of computation is known, especially as regards the load-carrying capacity of the boiler plant relative to the installed turbo-generator capacity, the number of reserve units and the ultimate capacity of the condensing water tunnels. Published costs, the letter pointed out, are usually much lower than figures fairly representing the actual investments.

The following comparative schedule of costs contrasts the Cannon Street station with other modern plants:

	Per Kilowatt
1. Cost of Cannon Street (72,000 kw. and twenty-four boilers)	$59
2. Average comparable cost of other representative modern plants on which Stone & Webster have accurate data is about	76
3. The Cannon Street station if constructed now (summer of 1921) would cost about........	73 to 80
4. Present-day power stations in general of about the same capacity as Cannon Street, constructed now (summer of 1921), cost on the average about.....	90 to 110

The comparable cost of this station prior to the last extension (No. 7 unit and eight boilers) was about $48 per kilowatt. It would be permissible to reduce the above stated cost of $59 per kilowatt by modifying slightly the assumptions in the computations, but a conservative figure of 104,000 kw. was taken as the capacity of the ultimate station in prorating items of construction and equipment now completed but designed to serve the fully developed station. The actual installed generating capacity, however, will be 132,000 kw., and this figure could be used in prorating costs if special effort were made to arrive at a minimum cost per kilowatt. It was thought better to adhere to the figure stated above, as this will be more in line with the load-carrying capacity of the ultimate plant.

The reference to other modern plants of greater cost was intended to apply to stations of the type recently built by Stone & Webster, Inc., at Philadelphia and now being constructed in New York and Chicago. In each instance these stations are only one of a number of plants composing the generating systems of those cities, and, as they are expected to operate at much higher load factors than would be possible in New Bedford, the ratio of fuel costs to fixed charges is correspondingly higher. This justifies the use of economizers with higher steam pressures and superheat, with other features and refinements necessary to obtain the highest obtainable fuel economy. The additional investment required for such power stations, the letter states, would not be warranted in New Bedford, because a large percentage of the load is derived from mills and factories operating only five and one-half days per week. The load factor is comparatively low, so that the additional annual charges and labor costs would be more than the saving in fuel.

LATEST STATION OF NEW BEDFORD COMPANY

OPERATING COSTS FOR FISCAL YEAR 1920-21

Coal (1.02 cents per kw.-hr.)	$831,518
Oil waste, packing	5,140
Water	8,793
Station wages	116,575
Station expense	3,883
Station structure repairs	23,819
Steam plant repairs	52,427
Electric plant repairs	8,233
Total manufacturing expense	$1,050,390
Total manufacturing expense per kw. in cents	1.283
Maximum load, kw	31,800
Coal used, tons	73,379
Coal per kilowatt-hour, lb	2

Completed station will include 132,000 kw. in turbo-generators and forty boilers. In prorating costs, however, 104,000 kw. has been taken as the ultimate capacity of the station, as this is assumed to be approximately the load-carrying capacity on a stoker-fired coal burning basis and with the largest unit out of service. The prorating of costs as follows gives a basic cost per kilowatt for the various portions of the competed station. In general the station as completed (June, 1921) was considered as from 60 to 65 per cent of the ultimate station development.

The above-stated cost of $59 per kilowatt indicates that the Cannon Street plant cost is very low, even if considered on the pre-war basis of prices, and the station today has a value correspondingly advantageous, its more modern equipment being considerably more reliable and efficient than corresponding equipment previously installed.

CONSTRUCTION COST ANALYSIS NEW BEDFORD STATION

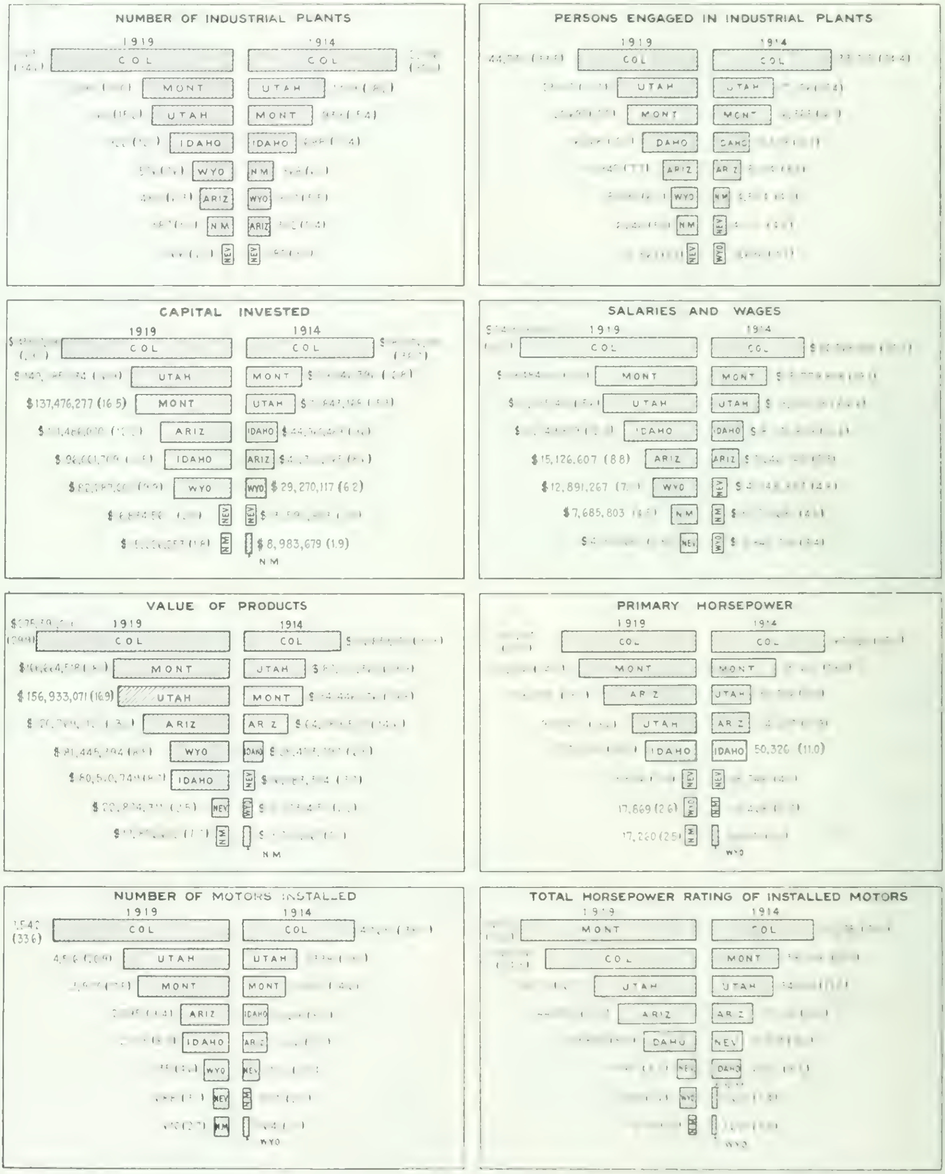
Item	Basis of Unit Cost (Kw.)	Cost Total	Cost Per Kw.
Dredging	104,000	$1,071.87	$0.01
Wharves	104,000	928.20	0.01
Station yard:			
Removing sheds, grading, fill, fencing, walks	72,000	11,226.69	0.16
Building:			
Turbine room	72,000	$182,400.00	$2.54
Electrical galleries	72,000	140,127.61	1.95
Boiler room	62,400	338,700.00	5.42
Total		$661,227.61	$9.91
Machine foundations:			
Turbine foundations	72,000	$22,671.57	$0.31
Turbine supports	72,000	30,683.38	0.43
Auxiliary foundations	72,000	12,652.79	0.18
Total	72,000	$66,007.74	$0.92
Boiler plant	58,700	563,331.61	9.60
Draft system:			
Stacks	58,700	$47,207.37	$0.80
Smoke flues, dampers, etc	58,700	90,298.36	1.54
Forced-draft fans	58,700	30,282.42	0.52
Forced-draft air ducts	58,700	24,245.07	0.41
Total	58,700	$192,033.22	$3.27
Feed-water system:			
Pumps and heaters	58,700	$23,942.68	$0.41
Feed-water regulators	58,700	3,597.46	0.06
50,000-gal. water tank	104,000	5,129.28	0.05
Total		$32,669.42	$0.52
Condenser system:			
Tunnels in building	92,000	$112,054.98	$1.22
Tunnels outside building	104,000	30,000.00	0.29
Screen well and fittings	104,000	15,000.00	0.14
Condensers and auxiliaries	72,000	459,759.96	6.39
Total		$616,814.94	$8.04
Piping system	62,400	304,623.41	4.89
Coal and ash-handling plant:			
Coal unloading towers	104,000	$115,446.89	$1.11
Coal unloading trestle	104,000	21,950.00	0.21
Coal distributing auto railway, locomotive cranes, cars, tracks in yard	52,000	42,171.18	0.81
Traveling coal larries	104,000	18,501.51	0.18
Coal bunker (1,000 tons), skip hoist, receiving hopper, extension hoppers	58,700	65,154.39	.111
Ash hoppers, track spits	58,700	53,503.14	0.91
Ash bunker	104,000	21,976.95	0.21
Total		$338,704.06	$4.54
Generators:			
Turbo-generators	72,000	$770,696.91	$10.70
Air washers, ducts	72,000	30,720.12	0.43
Exciter sets	72,000	26,856.52	0.37
Total		$828,273.55	$11.50
Transformers:			
Bus-tie transformers	72,000	$24,340.86	$0.34
Station power and lighting	72,000	2,252.43	0.03
Total	72,000	$26,593.29	$0.37
Switchboard and wiring, generator, exciter, station lighting and power, mercury-arc rectifier and control battery panel and wiring, control battery, arc rectifiers, conduit cables and wiring	72,000	306,188.22	4.25
Auxiliary equipment:			
Traveling crane (50-ton)	104,000	$12,444.50	$0.12
Compressed-air system, oiling system, telephone system, low-service pump equipment, instruments, painting, etc.	72,000	40,949.57	0.57
Total		$53,394.07	$0.69
Machine-shop equipment	104,000	6,694.48	0.06
Testing and preliminary operation	72,000	17,246.70	0.24
Duct lines and manholes not included	....	....	....
Grand total		$4,027,029.08	$58.98

Stone & Webster state that in their opinion the low cost of this plant and the excellent economies obtained in operation over the period of years since the station was started place it among the best in the country.

From the company's return to the Massachusetts commission for the year ended June 30, 1921, it appears that the plant generated 1,112 kw.-hr. per ton of coal used. Its yearly load factor was 29.3 per cent, and the cost of coal was $11.09 per ton used and unaccounted for. The output for the year was 81,691,800 kw.-hr., and the cost of production at the station was 1.283 cents per kilowatt-hour delivered at the buses. The itemized station cost was as shown in table above.

An accompanying tabulation shows the unit costs for the major items of construction and equipment. Land, waterfront development and station supplies on hand are not included.

Mountain States Make Great Strides from 1914 to 1919



The Mountain States are fast overcoming their past isolation. The above data, taken from the 1919 census of manufactures, indicates that this large section of the nation showed the same large industrial growth during the census five-year period from 1914 to 1919 that was experienced in other more intensely industrial sections. A glance at the diagram will show that practically every state showed substantial growth.

Colorado leads the section in every item except horsepower of installed motors, in which Montana takes the lead. But some of the other states are rapidly coming to the front, as is evidenced by the fact that in every item the position of Colorado has declined several per cent since 1914. It does not seem likely, however, that Colorado will be displaced as the leader of the section for some years to come.

Industries of Mountain States Highly Electrified

Census of Manufactures for 1919 Indicates that More than 37 per Cent of Primary Power Is Electrical—Metal and Metal Products Industry Other than Iron and Steel Has Largest Amount of Electrified Power

IT APPEARS from data recently issued by the Census Bureau in connection with the 1919 census of manufactures that industries of the Mountain States made unusual strides during the five-year period from 1914 to 1919. In 1914 the total horsepower of the prime movers of the industries in this section was given as 460,278. This figure increased to 703,294 hp. in 1919, or more than 65 per cent. It is doubtful if any section of the country will show more favorable returns for the same period.

Table I gives the number of engines and motors and their horsepower as reported by the industries of the Mountain States in five-year periods beginning with 1899, at which time the first national census of manufactures was taken. Since 1899 the number of engines and motors has increased from 2,610 to 21,500, and their combined rating has increased from 122,514 hp. to 703,294 hp. The rapid development in the utilization of electrical energy as the source of power by the industries of this section is most interesting. In 1899 almost 96 per cent of the machinery was steam-driven and less than 5 per cent was electrically driven. During the twenty-year period from 1899 to 1919 a distinct change took place. In 1919 the proportion of the plant machinery driven by steam power had decreased to less than 63 per cent, while electrically driven machinery increased to more than 37 per cent.

That this large increase in the use of electrical energy for industrial purposes was a direct result of the expansion and service facilities of the central generating companies of the Mountain States is apparent from the figures in the table. The geographical section is one of unusually long distances and also one which, from the nature of its primary industries, lends itself to the successful development of the isolated or private generating plant. It is, therefore, of special significance that while in 1899 less than 50 per cent of the total rating was supplied by central-station energy, in 1919 this figure had increased to 74 per cent.

Table II shows the horsepower rating of the prime movers in the various industries of the Mountain States and also the prominence of the isolated electric generating plant in the various industries of the section. These figures indicate that the metal industry leads in the rating of installed electric motors, with the food industry a close second.

TABLE I—SOURCES OF POWER OF THE INDUSTRIAL PLANTS OF THE MOUNTAIN STATES

	Number of Engines or Motors					Horsepower									
						Amount					Per Cent Distribution				
Prime Mover	1899	1904	1909	1914	1919	1899	1904	1909	1914	1919	1899	1904	1909	1914	1919
Primary power, total	2,610	3,340	8,141	12,164	21,500	122,514	240,639	400,885	460,278	703,294	100 0	100.0	100.0	100.0	100.0
Owned	2,420	2,427	3,575	3,385	3,498	117,170	225,546	332,741	357,223	442,288	95 7	93 7	83.1	77.6	62 9
Steam	1,938	1,865	2,909	2,498	2,423	97,772	204,931	307,010	326,841	399,946	79.8	85.1	76.7	71.0	56.9
Engines	1,938	1,865	2,909	2,498	2,283	97,772	204,931	307,010	326,841	322,388	79.8	85 1	76 7	71.0	45.9
Turbines	*	*	*	*	140	*	*	*	*	77,558			..	....	11.0
Internal-combustion engines	166	233	421	609	868	1,237	2,296	4,188	6,871	9,971	1 0	1.0	1 0	1.5	1.4
Water	316	329	245	278	207	18,161	18,319	21,543	23,511	32,371	14.9	7.6	5.4	5.1	4.6
Water wheels and turbines	316	208	212	197	180	18,161	17,803	21,345	18,788	32,023	14 9	7 4	5.3	4.1	2.2
Water motors	*	121	33	81	27	*	516	198	4,723	348		0.2	0.1	1.0	2.4
Rented	190	913	4,566	8,779	18,002	5,344	15,093	68,144	103,055	261,006	4.3	6.3	16.9	22.4	37.1
Electric	190	913	4,566	8,779	18,002	4,031	12,105	66,956	102,293	259,619	3.2	5.1	16.7	22.2	36.9
Other	[illegible]	0	0	0	0	1,313	2,988	1,188	762	1,387	1.1	1.2	0.2	0.2	0.2
Electric	190	913	6,721	12,312	22,411	8,545	35,419	113,984	190,525	351,224	100.0	100.0	100.0	100 0	100.0
Rented	*	*	4,566	8,779	18,002	4,031	12,105	66,956	102,293	259,619	47.2	34.2	58.8	53.7	74.0
Generated by private plants...	190	913	2,155	3,533	4,409	4,514	23,314	47,028	88,232	91,605	52.8	65.8	41.2	46.3	26.0

* Not reported separately.

TABLE II—PRIME MOVERS INSTALLED BY THE VARIOUS INDUSTRIES OF THE MOUNTAIN STATES

	Steam Engines (Horsepower)		Steam Turbines (Horsepower)		Internal-Combustion Engines (Horsepower)		Waterwheels and Turbines (Horsepower)		Horsepower Rating of Installed Motors			
									Run by Purchased Energy		Run by Energy Generated in Private Plants	
Industry	1919	1914	1919	1914	1919	1914	1919	1914	1919	1914	1919	1914
Chemicals and allied products	2,211	0	714	......	500	2	500	0	2,186	475	320	0
Food and kindred products	42,089	44,445	1,529	......	3,774	1,720	5,696	3,392	42,106	12,863	6,360	5,724
Iron and steel and their products	698	1,465	248	......	115	178	0	0	13,824	5,906	806	253
Leather and its products	140				6	3	0	1	909	206		1
Liquors and beverages	1,774	4,767	13	......	0	50	151	153	1,020	1,469	0	897
Lumber and its products	64,500	67,723	12,606	......	764	583	1,203	797	8,125	4,998	10,728	8,249
Metals and metal products other than iron and steel	36,720	35,386	41,241		230	442		0	24,658	6,374	25,363	13,700
Paper and printing	117	763	0		766	654	17	42	6,969	3,714	63	363
Railroad repair shops	19,908	16,548	1,333	......	461	277	138	201	30,975	11,798	7,995	5,102
Stone, clay and glass	4,022	4,819	2		479	283	22	1,250	15,506	4,433	215	1,981
Textiles	75	0	0		0	1	0	0	353	217	0	0
Tobacco	0	0	0	......	0	0	0	0	15	12	0	0
Vehicles for land transportation	87	0	6		1,250	73	11	0	5,321	271	33	0
Miscellaneous	150,047	150,905	19,866		1,626	2,605	24,285	12,952	107,652	49,557	39,722	51,962
Totals for all Mountain States	322,388	326,322	77,558		9,971	6,871	32,023	18,788	259,619	102,293	91,605	88,232

Letters from Our Readers

This is a readers' forum. Comments on questions before the electrical industry presenting economic, financial, engineering or commercial aspects and new or supplementary viewpoints on published articles are cordially invited

While We Wait for Congress

To the Editors of the ELECTRICAL WORLD:

Permit me to compliment you on the editorial appearing in the issue of the ELECTRICAL WORLD of Oct. 29 entitled "How Long, O Lord! How Long?" Your remarks are particularly pertinent at this time, and I agree with you that it is the duty of the business men to let their senators and representatives in some way know that we are wholly dissatisfied with the situation. I am writing all of the jobbers in Philadelphia today calling their attention to this editorial and suggesting that they try to do something to get action.

While writing you, I should like to call your attention to the article appearing in the September issue of *The Reminder*, page 12, entitled "The Federal Trade Commission." What do you suppose it cost the taxpayer to go through all the motions in connection with this silly order? It would not be impossible for any of us to give the commission cases of unfair competition that would make the giving of a few neckties as a premium to a salesman look like a trifle. F. R. ELLIOTT,

Elliott-Lewis Electrical Company, Inc., President.
Philadelphia, Pa.

Says Dimming Lights to Flash Time Is Impracticable

To the Editors of the ELECTRICAL WORLD:

The editorial in the ELECTRICAL WORLD of Aug. 6 and L. M. Klauber's comments on the Uruguayan practice of dimming lights to indicate the correct time have just come to my notice. Perhaps a few more remarks on this practice may prove not to be without interest.

In a town supplied by a single station, or a group of towns supplied by a single power plant, where all lighting service is fed by alternating current and where tramway service is supplied by induction-motor-driven generators, the thing would be relatively simple. After the public had been educated to the fact that dimming the light is a reminder to set their watches, the Uruguayan scheme would doubtless be a satisfactory way of indicating the time. The public can generally grow accustomed to anything.

Mr. Klauber indicated a few of those who would be particularly enthusiastic over the scheme, but it seems to me that he omitted some of those to whom it would really be a boon. I refer in particular to certain power company employees—those whose duty it is to smooth the fur of the peevish customer. They would have a stock excuse or explanation for all service complaints, and the load dispatchers of an extensive interconnected system would be provided with a routine operation in which they would only have to insure abnormal and simultaneous operation of voltage regulators at power houses, voltage regulators on synchronous condensers, induction-type voltage regulators on feeders and battery control switches in direct-current substations.

When the operating engineer saw the graphic record of voltage, instantaneous load, "morning newspaper" and other little reminders of what life really is, he would certainly be pleased to note that in carrying out the little Uruguayan operation the operators and dispatchers between them had managed to flash not only the time but also a couple of 100-kv. bushings, that 20,000 kw. of load had been lost for ten minutes or so, and—oh, well, what is the use?

To the man in charge of the physical operation of a large generating and transmission system it is quite a surprise that any one should favor what would amount to a deliberate daily interruption of service.

Riegos y Fuerza del Ebro, F. M. GILLESPIE,
Barcelona, Spain. Operating Engineer.

Suggestion to Bring Out Six Leads to Terminal Block of Motors

To the Editors of ELECTRICAL WORLD:

In the plant with which the writer is connected there are motors operating on both 60-cycle, two-phase, four-wire alternating current and 25-cycle, three-phase, three-wire alternating current. When we have trouble with the two-phase motors it is very easy to "ring out" the two single phases for grounds or short circuits as all four wires are outside leads to the motor. To do the same testing with a three-phase, three-wire motor, however, one has to remove the end bell over the stator connections and disconnect the star or delta connection before ringing the separate phases. This inconvenience could be eliminated if more manufacturers would make motors that have some kind of an easily uncovered connection block on the outside of the frame to which all six wires could be brought out. Then to make a test for short circuits or grounds it would be an easy matter to remove the connections and "ring" the single phases without removing an end bell. N. S. DAVIS.

Batavia, N. Y.

Base Demand on Kilovolt-Amperes

To the Editors of the ELECTRICAL WORLD:

Referring to the editorial in the ELECTRICAL WORLD for Oct. 29 in regard to power factor, it seems to me that the question as to whether the kilovolt-amperes should be taken at time of maximum load of the customer or maximum load on the station has been largely solved in the present rate schedules, in which the demand is based on kilowatts. It would seem to me that the proper solution would be simply to change the basis of demand in the present rate schedules from kilowatts to kilovolt-amperes. F. V. GALLAUGHER.

Lake Charles Railway, Light & Waterworks Company,
Lake Charles, La.

False Representations

To the Editors of the ELECTRICAL WORLD:

In a recent letter to your paper regarding false representations of electrical engineering I inadvertently used the expression "emblazoned with Niagara's turbines." The New York Electrical School uses a cut similar to this in its advertising, and as I had no intention of hurting that school or, for that matter, any other legitimate school, and have only good will toward it, will you kindly print this explanation?

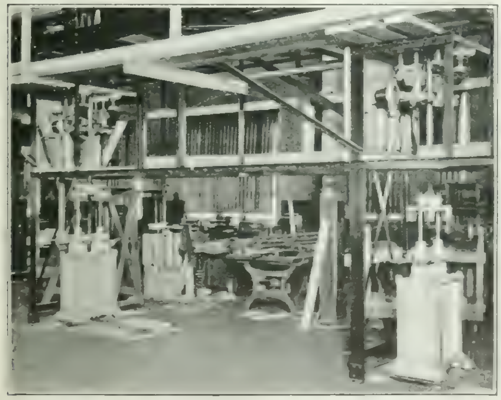
Fulton, N. Y. FRANK E. WOOLEY.

Industrial and Station Practice

Installation, Operation and Maintenance of
Generating and Distribution Equipment and Economical Utilization of Electrical Energy
in Mills and Factories, Including Testing and Repair Methods

Operation of Oil Switches on Isolated-Phase System

ALTHOUGH the switching equipment of the new Calumet station of the Commonwealth Edison Company was mentioned in an article on page 761 of the April 2, 1921, issue of the ELECTRICAL WORLD, a more detailed description of the switch operation may be of interest. As stated in the former article, the system is known as the isolated-phase system, in which all breaker poles, disconnecting switches and bus work of any particular phase are installed in cell structures isolated from other phases, thus preventing all possibility of interphase short circuits. The switching equipment is mounted in three stages or tiers, one above the other. The lowest comprises the oil circuit breakers, the second the disconnecting switches, and the top the main operating mechanism and the unit mechanisms.



ISOLATED-PHASE CIRCUIT BREAKER AND DISCONNECTING SWITCH FOR NEW CALUMET STATION

Each breaker is operated by a heavy main operating mechanism which consists essentially of strong spiral springs and a motor. It is so constructed that the motor acts to compress the springs, thereby storing up sufficient energy in them for both the closing and the opening strokes of the oil circuit breakers. The springs, released, actuate a series of operating pipes which act on three unit mechanisms to throw the breaker to either the closed or the open position. The main operating mechanism is controlled by a three-button control switch with visual indicating signals. A white light indicates that the breaker and disconnecting switches are open and the compression springs are relaxed. When the first control switch is closed the motor compresses the springs, closes the disconnecting switches, and a green light indicates that all is in readiness for the closing of the oil circuit breaker. The second control switch is then closed, which causes the mechanism to close the oil circuit breaker, a red light indicating that the circuit breaker has been closed. When it is desired to open the breaker, the third control switch is closed, and the breaker trips out, the disconnecting switches open, and the white light appears.

The breakers and disconnecting switches are both operated from the breaker mechanism, the latter being timed to open shortly after the breaker opens. When the circuit is opened it cannot be closed again until the springs of the main mechanism are compressed by the motor and energy for the closing and opening stroke restored. The disconnecting switches are adapted to manual operation, but, as a safety measure, interlocks between them and the breakers prevent the opening or closing of the switches when the breaker is closed.

The breakers and disconnecting switches are of General Electric Company manufacture. They are triple-pole, single-throw, and are made in two ratings of 600 amp. and 2,000 amp., 150,000 volts.

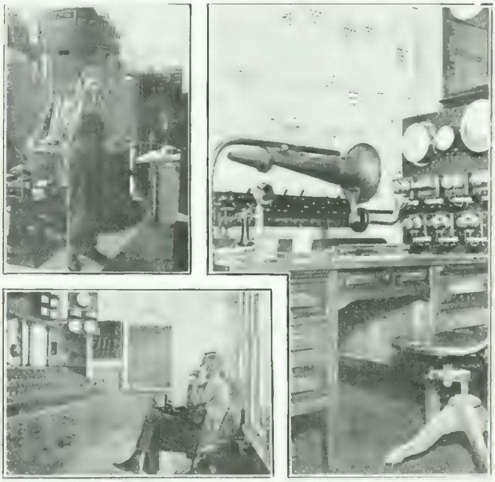
Loud-Speaking Telephones and Signals Assist in Power-House Operation

RELIABLE and efficient operation of any power house, whether it be hydro or steam, depends to a very great extent upon thorough co-operation among the operators and oilers or engineers and firemen. Likewise the co-operation of the station operators with the dispatcher greatly influences the operation of the system as a whole. Realizing the vital importance of such co-operation and desiring to promote it to a high degree, the San Joaquin Light & Power Corporation has been installing modern systems of signaling, indicating and communication in the power houses of its system.

The first step in this direction was taken several years ago when a high-power loud-speaking telephone was installed in the dispatchers' office of Fresno. The telephone lines of this company, like those of many other power companies, are carried along on the same pole lines with high-voltage transmission circuits and are more or less subject to inductive interference. The use of repeating coils and relays such as are employed by the commercial telephone companies is out of the question on such lines, owing to frequent high-voltage disturbances due to transmission-line failures.

This dispatching set, known as the "Wonder-phone," shown in the accompanying photograph, is simply a telephone set on a big scale designed to transmit a greater volume of power and to amplify greatly the received energy. The set has proved a decided success in "getting through" over lines on which ordinary telephone apparatus would be inoperative. This set has other good features worthy of mention. For instance, owing to the fact that it virtually "talks out loud," the dispatcher does not have to hold a receiver to his ear. Thus he has both hands free to work with his notes and records and is not subject to the sharp "raps" in the ears which he would get if he had an ordinary receiver over them.

Until the advent of the "Magnavox" telephone transmitter the use of an ordinary telephone in power houses was very unsatisfactory, to say the least, except when installed in a soundproof booth. The use of booths is not conducive to the best co-operation, particularly in summer weather, as the operator does not care to engage in an extended discussion with the dispatcher about operating conditions. The principal objection to the booth, however, is that it takes the operator away from his switchboard, where load and power factor conditions may be changing even as he is talking to the dispatcher, or trouble may develop that would demand his immediate presence at the board. Use of the loud-speaking telephone is being extended to all the power houses of the San Joaquin system. The accompanying photographs show its use in the Kerckhoff power house. It will be noticed that the operator does not have to leave his position in front of the board to talk to his floorman, who in turn is at his post of duty with the machines in full view. The oiler in the turbine pit also has a telephone so that all three men may communicate with each other amid the noise of the plant, none of the side tones being transmitted.



LOUD-SPEAKING TELEPHONES INCREASE CO-OPERATION BETWEEN DISPATCHER, OPERATOR, ENGINEER, ETC.

Left, upper—Floorman does not have to enter a booth to talk to operator (left, lower), who remains in front of his board. Right—Dispatcher's set which allows communication over noisy lines.

In the steam plants the loud-speaking instrument is even more valuable for intercommunication between operating gallery and boiler room. The fireman requires a certain amount of notice before load may be picked up or dropped and it is only through his close co-operation with the operator that the plant may be operated reliably and efficiently.

For signaling in large and noisy plants a steam whistle—or a compressed-air horn operated by a magnet valve if the plant is run by water power—has been found very satisfactory. The compressed-air horn gives a pleasing tone of great volume, easily distinguished in the noisiest plant. The magnet valve is operated from the exciter bus through high-voltage push-buttons at the telegraph stations. An ordinary vibrating-type electric bell is used for signaling the operator. In the steam plants the same type of magnet valve is used, but it operates a steam whistle for signaling.

R. C. Denny,
Operating Engineer.

San Joaquin Light & Power Corporation,
Fresno, Cal.

Indicator Stick Tells Whether Circuit Is Alive or Dead

Before working on cables it is absolutely essential to know that they are not energized, and for this purpose a "live-wire indicator" has been developed by the Consolidated Gas, Electric Light & Power Company of Baltimore. It is the practice in this company for the purpose of safeguarding men who are to work on cables to place grounds on all three conductors at both ends of a 13,200-volt underground cable. There is considerable hazard involved, however, for the men who apply the grounds unless they can be absolutely sure that the cable is dead. The "live-wire indicator stick" affords a very reliable means for determining whether a conductor is alive or not before the operator attempts to attach any ground wires. The details of this indicator are shown in the accompanying drawing, from which it will be noted that the construction is rugged.

It consists essentially of a micarta tube inclosing a copper tube which connects with a binding post outside. It is easy to handle and weighs only 7 lb. When the metal contact of the indicator touches the conductor of a 13,200-volt, 25-cycle circuit and is drawn away, there is a spark approximately ½ in. long. The noise from this spark is clearly audible and serves as an indication even though the spark may not be seen. A reliable indication is given on a three-phase circuit with a potential as low as 4,000 volts even when the frequency is as low as 25 cycles.

The application of the indicator stick may be better understood by reference to the rules of the company for high-potential conductors, a portion of which are given below.

Instructions for High-Tension Circuits

The following shall be the procedure for grounding 13,000-volt or 26,000-volt circuits or apparatus:

1. Instructions must come from load dispatcher.
2. Be sure that circuit is clear.
3. Put up safety boards, covering the phases of the adjacent circuits.
4. Call the station to which the cable connects and satisfy yourself that the oil switch and "disconnects" are open. This must be done in addition to instructions given by the load dispatcher.
5. Test for potential with indicator stick to satisfy yourself that the cable to be grounded does not show any spark or sizzling sound. Then repeat test with indicator stick on a live cable to make sure that the indicator stick is in good shape. After live cable has been tested for comparison, again test the conductor of cable to be grounded, so as to be doubly sure the cable is dead, before actually applying the grounds.
6. If this test indicates that the circuit is clear and dead, call the system operator and say, "I am going to short-circuit and ground No. — cable." If the system operator tells you to go ahead, place a ground wire on a long pole and touch conductors to be grounded with the ground wire.
7. Put on the regular grounding jumpers provided for this purpose. The grounding jumpers should then be connected to ground. Then apply the ground to the first conductor of the circuit in such a manner that a solid connection is made from the beginning, because, should the

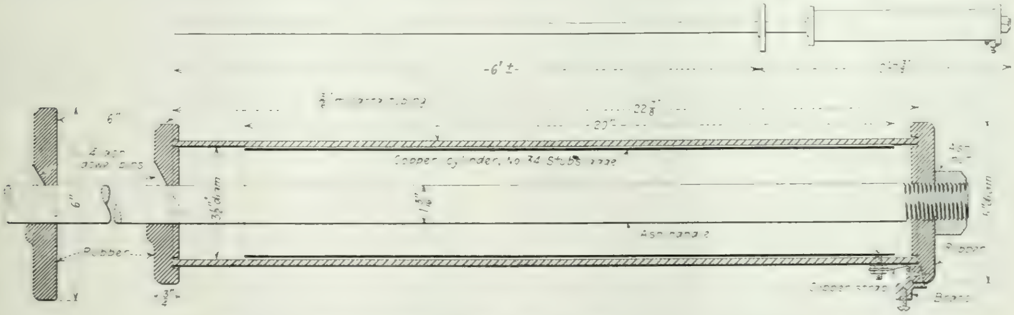
conductor have been made alive since testing, the making of a quick solid connection prevents the formation of a bad arc and injury to the workman. Make the connection to the second and third conductors of the circuit in the same way, assuming in every case that the circuit might be alive when the ground is applied.

Never allow any part of the body to touch a conductor on which the ground has not been made. The fact that one conductor has been successfully grounded does not necessarily indicate that the other conductors are clear, and, furthermore, the static effect on an ungrounded transmission-line conductor caused by neighboring live circuits is in some cases sufficient to cause death.

In removing a ground the same precautions must be observed, namely, not to touch the conductors after the ground connections have been removed. The jumper should be disconnected first from the line conductors and last from the ground connection.

The load dispatcher will order all short circuits and grounds applied to and removed from any transmission or distribution circuits.

When receiving orders over the telephone pertaining to switching of any kind, you will, in addition to repeating the order, spell the number. For example, if you receive this order: "You are ordered to cut out No. 999 feeder," you will answer as follows: "I am going to cut out number nine hundred and ninety-nine feeder," and immediately spell the number.



THIS TEST STICK DRAWS A LOUD BUZZING SPARK FROM A LIVE HIGH-TENSION LINE

Operators in stations will not permit assistant operators to ground any circuit or apparatus after it has been made clear without a personal inspection to make sure that the circuit is clear and ready for grounding.

Besides the foregoing use, the indicator stick is of very definite value in phasing out circuits, and in determining the continuity of an overhead transmission circuit.

R. H. Lang,
Chief Operator.

Consolidated Gas, Electric Light & Power Company,
Baltimore, Md.

Simple and Quick Method of Locating Correct Brush Position

A NUMBER of articles on locating the neutral point on commutators have been read by the writer, but none of the methods described is so simple or quick as that employed in the shop with which the writer is connected. In this shop every motor and generator is tested as follows while running. The floor man has a piece of lamp cord which is skinned back about 1½ in. and the wires fanned out. This is held against the end of the commutator and moved back and forth. The intensity of the spark at the center of the fanned-out wires locates the neutral point.

A. C. Roe.

Detroit, Mich.

Betterment Work in Industrial Plants Improves Operating Conditions

IN ELECTRICAL distribution systems long-continued operation gives opportunity for unfavorable conditions to develop unless checked by close inspection and prompt action. This is no criticism of the reliability of electric service, which has long since become famous for its ability to withstand both neglect and abuse, but in order to keep installations up to "concert pitch" and thus obtain the most efficient performance possible systematic analyses of operation are essential. As a guide to others in checking bad conditions a few examples of easily remedied cases encountered in practice will be cited here. Some of the faults noted were due to improper selection of equipment and others to its neglect in service. Taken in group, they emphasize the importance of so-called "little things" in the performance of electrical apparatus.

In one industrial plant examined a field rheostat in a generator excitation circuit was found to have too few points to permit a graded control of voltage. It was found that when the generator was operating at 117 volts one division adjustment of the rheostat reduced the potential to 100 volts. This was due to the fact that the generator field at normal voltage was operating at a point just below the knee of the magnetization curve, or at a point which gives maximum change of terminal voltage for variations in the field current. In another case a switchboard was installed where a wooden door swung back against a large rheostat when closed. The shunt leads for the ammeters were uninsulated, and temporary lines for charging batteries were left for permanent use.

The failure to maintain the lighting installation in an industrial shop led to the gradual loss of reflecting material from shades and to resulting poor illumination. Open wiring in a tidewater shop led to the gradual corrosion of leads with actual breaks in some cases. The fire hazard of this installation was thus increased, apart from the loss of service threatened. Carelessness was also noted in regard to the installation of lamps on motor circuits instead of on independent lighting leads. Motor-starting switches are often left without cleaning for long periods. In one case it was found that the arms of the starter handles did not return to the "off" position owing to the amount of residual magnetism in the starter magnets. It was recommended that this be prevented by the use of shellac and very thin paper to break the actual contact.

In another establishment it was found that the motors were not all purchased for the same standard voltage. In several cases 110-volt motors were used and run above their normal speed on 115 volts. Too high fusing of motors for proper protection was encountered, with exposed runs of bare wiring near motor frames. Fuses of 400-amp. rating were installed for a motor which was properly fused at 250 amp. Another case occurred where wiring passing over a motor came in contact with piping and also changed size without electrical reasons therefor. Abrasions on the insulation of control coils, burned and neglected starting-box contacts, inoperative springs on starters and non-adjustment in contactors were also found in this installation. Two starters were found inclosed in a box containing rags, cans, etc. Moisture-proof and properly lined cabinets were advised here, together with the listing of all starters of which the contacts tended to burn and the maintenance of a few spare parts for starting switches.

Unclean fuse and cut-out contacts were found to cause annoying heating effects in one industrial plant. This was especially noticeable on knife-blade types of fuse clips and contacts rated at 85 amp. and over. The absence of asbestos backing and the mounting of switches and cut-outs directly on wooden backs without asbestos protection were also encountered in an old plant which had not enjoyed proper supervision from its staff or from outside inspectors. There was a tendency toward the multiplication of switches and cut-outs through non-standardization, thus cutting down the number of spares required. In one case vibration of a floor due to operating machinery led to the falling out of fuses from clips placed on bases attached to the ceiling below, and for future work it was advised that no more ceiling fuse installations be made. The former location also made it a slower and more difficult task to renew fuses in case of blowing. Some overloaded circuits were also noted in this establishment.

The foregoing examples illustrate that many weaknesses in service result from the lack of acute inspection and subsequent revision at low cost of undesirable practices. The expense of systematic maintenance through proper inspection, locally or from without a plant, is not to be weighed in the same scale as the petty economies of short-lived character that appear to be possible where installations are allowed to run with little care.

E. S. Lincoln,
Portland, Me. Consulting Engineer.

Methods of Stripping a Stator

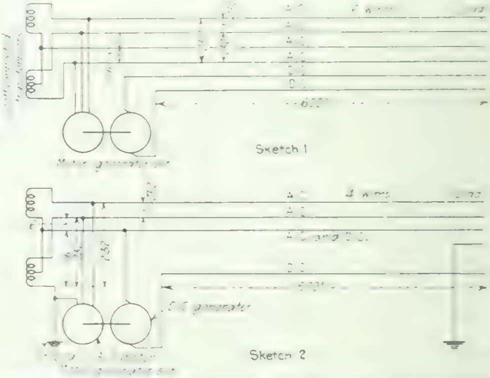
Stripping the coils from a stator with partly closed slots is a job which is rather difficult to do satisfactorily. Some repair shops drive out the wedges and remove the coils by lifting the wires out of the slots one by one. This method is not bad if the motor is completely burned out, but most motors have only a few coils burned, and then the method is slow, tedious and expensive. We generally cut off one side of the coils all the way around with a sharp, flat, long-tapered chisel, making the cut as close to the laminations as possible. Then, laying the motor flat on the side where the coils have been cut, we hook a chain fall on the other end, taking out four or five coils at a time. The greatest objection to this method is that it pulls the laminations out of alignment, and unless the winder is careful, he will get into difficulty inserting the new coils as some of the sharp edges of the laminations will puncture.

Another method we sometimes use is to connect a low potential across one or two poles in series and allow enough current to flow completely to burn insulation and wedges. This method perhaps has fewer drawbacks than the previous one. The last two methods apply also to closed-slot machines.

Arthur R. McDonald,
McCleary, Wallin & Crouse, Chief Electrician.
Amsterdam, N. Y.

Alternating and Direct Current Carried Temporarily on Same Wire

To save copper feeders in a recent temporary installation at the factory of a large publishing house, both alternating and direct current were carried over the same wire. Three-phase alternating current at 232 volts, single-phase at 116 volts and 230-volt direct-current were supplied over four wires, using the ground for a fifth conductor. Operation of both alternating-current and direct-current motors, as well as supplying current for photographic arc lamps, besides the usual lighting problems, required this complex service. The alternating current was obtained from the three-phase side of Scott-connected transformers fed from the two-phase lines of the power company, with a middle tap on one of the power transformers for 115 230-volt three-wire service. A motor-generator set supplied the direct-current service.



FEEDER CONDUCTORS ELIMINATED BY CARRYING ALTERNATING AND DIRECT CURRENT ON SAME WIRE

The original installation was destroyed by fire, and while the plant was being rebuilt and re-equipped a small temporary factory was served by the original transformers and a temporary belted motor-generator set. The temporary factory was about 600 ft. distant from the original factory and temporary motor-generator set, so the transmission of even small blocks of power required considerable copper. To save this copper it was decided to use the temporary service wires for wiring the new plant. There were six of these wires, and the problem was to release as many of them as possible for use in wiring the new plant before the temporary plant was shut down.

The writer remembered having seen in the Electrical World some time ago a brief reference to the possibility of using the same wire for both alternating and direct current, and it was decided to try this plan. The six wires supplying service for the temporary plant were arranged originally as shown at the top of the diagram. Then one leg of the direct-current circuit was eliminated, tapping the ends to one leg of the three-phase circuit. This worked out so well that another step was taken and one leg of the three-phase circuit was eliminated, using the ground in place of it, as shown at the bottom of the diagram. Under these conditions the temporary plant was satisfactorily operated for two months without any voltage disturbance between the circuits. The voltage on either circuit seemed to be entirely unaffected by the load on the other circuit. This was proved visually on the lighting circuits and by means of a voltmeter on both circuits.

The remaining temporary service wires were eventually taken down and used as feeders in the permanent plant, thus avoiding a heavy investment in copper. The temporary service, of course, was interrupted at this time.

F. H. GAGE,
Pacific Press Publishing Association, Superintendent.
Mountain View, Cal.

Load Test on Induction Motor Without Special Apparatus

IT IS often a problem to load up induction motors without regular testing apparatus and intruments to get comparative results of their behavior under load. Such a problem is likely to arise when a firm contemplating the purchase of a large number of motors wishes to satisfy itself as to what make suits it best and therefore orders sample machines of different makes to compare and try out.

In such a case the sample induction motors would most likely be of the same horsepower and speed, especially if of the smaller sizes. One of the best methods for testing would be to belt two motors of different makes together with pulleys having diameters of such ratio that when one motor is running at the full-load speed the other motor will be driven at synchronous speed plus the slip as given on the nameplate. For instance, if the nameplate is stamped 1,720 r.p.m. synchronous speed is 1,800 r.p.m. The slip is therefore 80 r.p.m., and when belted together one motor should run at 1,720 r.p.m. and the other at 1,880 r.p.m. The two machines are then separately tried out to see that they run in the same direction, after which both are put on the line. The motor with the large pulley will act as a motor while the one with the smaller pulley will act as a generator. Slip is slightly less running as a generator than running as a motor, which would make the load slightly high but near enough for an ordinary tryout. The two machines, although working slightly overloaded, take but a small amount of power from the line, just enough to supply the losses of heat friction, etc. For close comparison on heating, thermometers should be placed on the laminated core and winding and covered with putty. Readings must be taken for a definite length of time or till constant temperatures are attained. Repeating the operation with the pulleys changed on the two machines so as to make the one formerly running as a motor run as a generator and vice versa give the best basis for comparison.

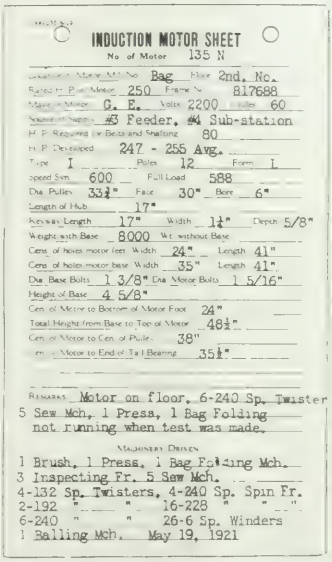
On large machines run in the manner described the work done and the temperatures are quite nearly alike whether acting as a generator or as a motor. On small machines the difference is greater, owing to their lower efficiency, greater slip, etc.

Machines of the same dimensions and speed are simpler to connect together, but it is not necessary that they be alike in these respects if the right pulleys are selected. The essential requirements are that the horsepower ratings must be equal and that the pulley sizes are such that when hooked together by a belt the driving machine will have to drop down to full-load speed while the driven machine is pushed on above synchronous speed till it pumps all the energy received from the driver (minus the losses) into the line. Any adjustment in load must be made by changing the pulley ratio.

East Orange, N. J. PHILIP G. BERNHOLZ.

Motor Record for Large Plant

A PERPETUAL inventory of about 2,000 motors in service at the Amoskeag Manufacturing Company's plant in Manchester, N. H., is maintained by the electrical department in the form of 4½-in. x 7½-in. loose-leaf sheets. One of these, designed for induction-motor use, is reproduced herewith. In this compact space provision is made for about thirty-eight data items as location, make, rating, dimensions, drive details, machinery driven and loading information. The record is unusually complete in listing driven machinery, the source of energy supply and mechanical dimensions useful in shifting motor locations.



INDUCTION MOTOR SHEET
No. of Motor 135 N
Location of Motor Mill No. Bag Floor 2nd. No.
Rated H. P. of Motor 250 Frame No. 817688
Make of Motor G. E. Volts 2200 Cycles 60
Source of Supply #3 Feeder. #4 Sub-station
H. P. Required for Belts and Shafting 80
H. P. Developed 247 - 255 Avg.
Type I Poles 12 Form L
Speed Syn. 600 Full Load 588
Dia. Pulley 33¾" Face 30" Bore 6"
Length of Hub 17"
Keyway Length 17" Width 1¼" Depth 5/8"
Weight with Base 8000 Wt. without Base
Cens. of holes motor feet Width 24" Length 41"
Cens. of holes motor base Width 35" Length 41"
Dia. Base Bolts 1 3/8" Dia. Motor Bolts 1 5/16"
Height of Base 4 5/8"
Cen. of Motor to Bottom of Motor Foot 24"
Total Height from Base to Top of Motor 48½"
Cen. of Motor to Cen. of Pulley 38"
Cen. of Motor to End of Tail Bearing 35½"

REMARKS Motor on floor. 6-240 Sp. Twister
5 Sew Mch. 1 Press. 1 Bag Folding
not running when test was made.

MACHINERY DRIVEN
1 Brush. 1 Press. 1 Bag Folding Mch.
3 Inspecting Fr. 5 Sew Mch.
4-132 Sp. Twisters. 4-240 Sp. Spin Fr.
2-192 " " 16-228 " " "
6-240 " " 26-6 Sp. Winders
1 Balling Mch. May 19, 1921

COMPLETE INFORMATION ON THIS SHEET

Amoskeag Manufacturing Co., FRANK L. CLARKE,
Manchester, N. H. Chief Electrical Engineer.

Emergency Operation of Self-Cooled Transformers

ON ACCOUNT of self-cooled transformers being designed on an ambient temperature of 40 deg. C., advantage of the full rating of the transformer may not be obtained where temperatures are above this point. This happened in a substation of the Southern California Edison Company, and artificial cooling became necessary. To meet the conditions air ducts were installed around the base of the 5,000 kva., single-phase, maximum-rated, self-cooled radiator-type transformer and so arranged with openings between the radiators as to direct the flow of air supplied by a motor-driven blower. With this method of artificial cooling these maximum rated transformers will carry 25 per cent overload continuously with the same winding temperatures as at full load without artificial circulation of air.

San Francisco, Cal. FIELD EDITOR ELECTRICAL WORLD.

Management and Policy

Embracing Central Station Commercial Organization and Management,
Customer and Trade Relationships, Public and Financial Policies, Advertising,
Selling and Service Methods

The Need for Closer Association

Extracts from a Recent Address by
Stephen I. Miller Before the British
Columbia Electrical Association

ELECTRICAL development fulfills two economic laws: First, as you develop electric power you decrease the unit cost of a kilowatt-hour and thus the cost of electric service; second, no matter how much you develop that power you never exhaust it. The importance of all this is made clear when it is appreciated that at the present rate of consumption the petroleum supply of the United States will be exhausted in ten years. Every available hydro-electric horsepower must therefore be harnessed to preserve the continuity of industry.

A kilowatt of electricity is generally divided among four interests—the central station, the manufacturer of appliances, the jobber of appliances and the merchandiser. These four interests are inseparable, and the lack of a mutual understanding on the part of these groups will retard not only individual interests but also the public welfare. It is high time therefore that the electrical industry should appreciate the power of association, organization and concentration.

Electrical co-operative associations and leagues have come into existence as an economic medium for the promotion of better business methods in the industry. A man with no knowledge of his wiring and merchandising costs, with poor methods of salesmanship, with an unattractive store interior, with display windows unappreciated, and with no knowledge of the benefits of advertising, is a menace to good business.

Leagues and associations constitute a rallying point for the promotion of service and intelligent business methods. Co-operative effort may express itself in electrical exhibits, electrical homes, co-operative newspaper advertising, salesmanship, classes, merchandising classes and motion pictures. Electrical exhibitions and electrical homes are among the most effective means of publicity. I consider these, above all, as an aid to the spirit of co-operation.

In the electrical business we have manufacturers who put out inferior articles, jobbers who extend credit to the wrong people, contractor-dealers who dump everything into their stores, outlaw jobbers, "curbstoners," men who won't speak to the man across the street, and so on. Not one contractor-dealer out of forty has any idea of his cost of doing business. Associations to straighten out these tangles are meant to lift the electrical business to a higher plane, and to provide the publicity needed to raise capital to develop power.

Electrical organizations in the United States are making a modern mass move for the extension and betterment of electrical service. Men capable of such co-operation will be the leaders in industry tomorrow. If, by normal evolution, it is possible to reach a certain stage in the use of electricity without any organization or effort, and by co-operation and organization we can reach that point only twenty-four hours earlier than we would otherwise have reached it, how much that will mean in human welfare and net profits. If we hand on to posterity only one day's acceleration, this organization will have amply repaid itself.

Three Hundred and Fifty Thousand Baby Trout Planted by One Central Station

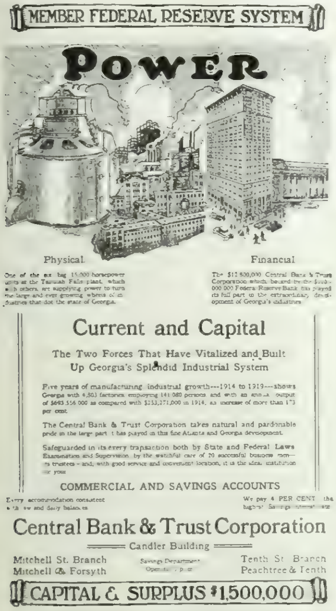
LAST month the San Joaquin Light & Power Corporation planted 300,000 small trout along Kings River, in California, where the company now has in course of construction a hundred-million-dollar hydro-electric development. The fish ranged in length from 1 in. to 2 in. and were obtained by the power company from one of the hatcheries of the California Fish and Game Commission. The picture shows the 125 15-gal. cans containing the trout being loaded on the company's trucks at 6:30 in the morning. They were immediately taken to the end of the wagon road in the Kings River country, where part of the trout were liberated. The remainder were loaded on pack trains and carried to the higher mountain streams. This was in addition to 50,000 trout planted in Kings River ten days before.

The hydro-electric development of this section has made necessary the building of good roads, substantial bridges and better means of communication in a country that heretofore has been inaccessible, except on horseback. Now motor travel is increasing, with a large number of fishermen coming in. The San Joaquin company in adopting this method of propagating trout in the mountain streams is performing a public service which is appreciated by every angler who visits the Kings River country. It is just another evidence that utilities are really builders of the public domain and not destroyers of natural scenery as has often been charged

LOADING 350,000 SMALL TROUT ONTO SAN JOAQUIN COMPANY'S TRUCKS

A Suggestion for Bank Advertising

One of the leading banking houses of the South, the Central Bank & Trust Corporation of Atlanta, Ga., recently published this advertisement in the local papers for the purpose of impressing upon the public the importance of the light and power company as a factor in industrial and economic development. It is a fair and honest appraisal by a conservative financial house of the part utilities play in advancing the public welfare and community interest. This is a type of constructive bank advertising that might well be suggested by a utility to its local banking institutions. Many of them would undoubtedly be glad to apply the idea and it would result in much good influence in suport of the public service corporations, creating, as it does, good will for both the bank and the utility company at the same time.


MEMBER FEDERAL RESERVE SYSTEM

POWER
Physical
Financial

Current and Capital

The Two Forces That Have Vitalized and Built Up Georgia's Splendid Industrial System

Five years of manufacturing industrial growth---1914 to 1919---shows Georgia with 4,503 factories employing 141,080 persons and with an annual output of $693,556,000 as compared with $253,271,000 in 1914, an increase of more than 173 per cent.

The Central Bank & Trust Corporation takes natural and pardonable pride in the large part it has played in this fine Atlanta and Georgia development.

Safeguarded in its every transaction both by State and Federal Laws, Examination and Supervision, by the watchful care of 20 successful business men—its trustees—and, with good service and convenient location, it is the ideal institution for your

COMMERCIAL AND SAVINGS ACCOUNTS

Central Bank & Trust Corporation

Candler Building

Mitchell St. Branch
Mitchell & Forsyth

Tenth St. Branch
Peachtree & Tenth

CAPITAL & SURPLUS $1,500,000

A CONSTRUCTIVE BANK ADVERTISEMENT

How Old Employees Were Turned Into Successful Appliance Salesmen

By F. M. Houston

Sales Engineer Elmira Water, Light & Railroad, Elmira, N. Y.

At the beginning of this year, the outlook for business in Elmira was very poor, because of the fact that practically every industry was at a standstill and business in general was very poor. We decided that the best thing to do was to try to increase our lamp socket load by the selling of small appliances. During the war, when the industries were paying enormous wages, some of our oldest employees left us and went with the different factories around the town. When the slump came they were naturally thrown out of a job and as they never worked for any other company but ours, they naturally turned to us for something to do. It was while trying to take care of these men that we hit upon the scheme of selling small appliances. These men were mostly men who had been with the company for anywhere from twelve to twenty years, consequently were glad to get work on almost any terms. We, therefore, devised this proposition.

We would pay them $1.00 a day salary and a commission on small appliances as follows: Irons $1.00, toaster stoves $1.00, toasters $1.00, vacuum cleaners $6.00, washing machines $7.50 and $12.50. In addition to this a 5 per cent commission was paid on all lamps sold. We furnished each salesman with a grip in which he could carry one flatiron, one toaster stove and about ten lamps, and started them out on a straight house to house canvass. We started originally with two men and have added since then eight more.

A sales meeting is held each morning and the men are required to give an account of prospects which are filed away according to dates. We have a large blackboard showing the daily, monthly and yearly record of each man and we also give them a quota in dollars for the month. We did about four times as much advertising as we did last year and the results secured have been perfectly amazing, considering the fact that all the men were absolutely green at the selling game and had to be instructed as to the proper way to approach a prospect and close a sale.

The result of this plan is that in the first nine months of this year we have sold $15,000 worth of merchandise more than the entire year last year, and have exceeded any year's business for the past seven years. The mark we are shooting at and which we fully expect to hit is to double last year's sales.

The salesmen have fared very well in regard to the amount of money drawn and our selling expense has been averaging about 15 per cent of our selling price. While this figure is high, yet when we consider the additional benefit we are getting from increased load, we feel that it is justified.

What Other Companies Are Doing

Chicago, Ill.—August is usually the lightest season of the year in customer ownership preferred-stock sales, but the Byllesby subsidiaries placed a total in excess of $415,000 par value among customers during that month. Compared with August a year ago, sales increased 10 per cent. Sales of preferred stock direct to customers during September aggregated $575,000 in 1,250 separate sales. This compares with $483,000 in September, 1920, and is an increase of 19 per cent over last year.

California.—During the first eight months of this year 2,534 electric appliances were sold by the dealers in a certain district in this state. Some of the outstanding items which made up this total were 704 electric flatirons, 167 toasters, 158 percolators, 460 fans, 124 curling irons, 164 washing machines and 210 vacuum cleaners.

Muskogee, Okla.—Walter G. Humphrey, meter reader of the Muskogee Gas & Electric Company, claims to have established a record for speed in reading meters. According to a story in the Muskogee *Times-Democrat*, Mr. Humphrey read 500 meters in 315 separate households in six hours.

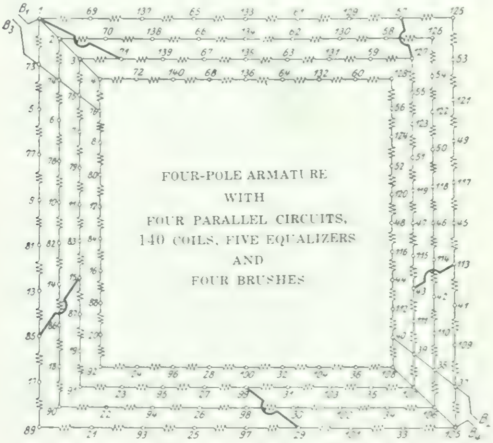
Boston, Mass.—An active effort to increase the use of electrical appliances in the homes of officers and employees of central-station companies managed by Charles H. Tenney & Company of Boston is in progress. Statistics presented at the recent New London convention of the New England division, N. E. L. A., brought home the importance of cultivating this development within the central-station household, and the Tenney companies were among the first to take to heart the conditions revealed and seek more thoroughly to "sell themselves" the electrical idea.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
of the World

Generators, Motors and Transformers

Simplified Representation of Direct-Current Armature Windings.—J. BOJKO.—It is customary to show a direct-current armature winding cut open parallel to the shaft and developed into a plane. If it is desired to show all of the coils and their connections with one another and with the commutator bars, a very complex drawing will result, with innumerable crossings of lines, forming a rather bewildering picture. Still more complication is introduced in the case of larger machines when there are equalizing bars and their connections to be shown. The author suggests a method which is simplicity itself, complete and very clear. Instead of showing the individual coils as they are arranged bodily upon the armature, he shows their electrical arrangement, which is essentially a multiple series-parallel connection. To make the picture still more comprehensive, a four-pole machine winding is represented as a square, a six-pole machine as a hexagonal, etc. All electric connections and the location of positive and negative brushes become logical and clear. The author claims that such a representation is a great help in hunting down trouble with the aid of a millivoltmeter.—*Elektrotechnische Zeitschrift*, Oct. 6, 1921.


FOUR-POLE ARMATURE
WITH
FOUR PARALLEL CIRCUITS,
140 COILS, FIVE EQUALIZERS
AND
FOUR BRUSHES

Lamps and Lighting

Tendencies in Electric Lighting.—HAYDN T. HARRISON.—Description of good lighting practice for factories, workshops, schools, offices, etc. The importance of high intensities and suitable reflectors is emphasized. —London *Electrician*, Oct. 7, 1921.

Use of the Ulbricht Sphere in Measuring Reflection and Transmission Factors.—ENOCH KARRER.—A survey of the methods and instruments used in measuring reflection factors embodying recent suggestions of the use of the Ulbricht sphere. A transmissometer based on the same theory and a simpler reflectometer that will enable determination of reflecting factor to within 10 or 15 per cent are described.—*Bureau of Standards Paper No. 415.*

Difficulties in School Lighting.—FRANK H. WOOD.—The requirements governing the lighting of schoolrooms are stated succinctly as follows: Windows to be grouped on the left of the pupils, opposite their desks and not beyond the line of the front desks; windows to extend to ceiling and be equal to one-fifth of the floor area, their height from the floor to be at least one-half the width of the room; windows must be without transoms, and there must be no unnecessary width of mullions.—*Transactions I. E. S.*, Vol. 16, No. 6,

Generation, Transmission and Distribution

Electricity Supply Systems in Large Cities.—PHILIP TORCHIO.—A lecture on the best operating practices in the large cities of the world and a history of the development of the industry that has led up to these practices. Details of distribution features are thoroughly covered.—*Bulletin of the Johns Hopkins University, School of Engineering*, 1920-21.

Use of Static Condensers to Improve the Power Factor.—R. VARRET.—The author gives formula and graphic charts for the determination of the proper amount of capacity to be used for different inductive loads on alternating-current lines. The use of easily assembled batteries with 25-mf. condensers is advocated, the author being a manufacturer of these units. The elements represent small cylindrical containers, 105 mm. in diameter and 230 mm. high, and are tested with 600 volts for 220-volt lines. Each unit contains an inbuilt fuse to cut it out of service in case of puncture.—*Revue Générale de l'Electricité*, Oct. 22, 1921.

Application of Reactances to Large Systems.—W. A. COATES.—Account of a specific investigation of a system where two existing stations are to be linked to a third new plant by means of a high-voltage cable network. —*Beama* (British Electrical and Allied Manufacturers' Association), October, 1921.

Testing High-Tension Insulators.—An enumeration of the methods for testing high-tension insulators employed by the Central Electrotechnical Laboratory, France. Electrical and mechanical tests are both described.—*Electrical Times*, Oct. 13, 1921.

Calculations on Three-Phase Mercury Arc Rectifiers.—H. NIELSON.—In this mathematical paper the author derives all necessary formulas for the calculation of three-phase mercury rectifiers which are fed from "Y-Y" connected transformers. The current distribution in the auto-transformer with or without a series inductance is considered. A very simple equation is given to determine the relation between the primary reactance and the desired voltage drop. The algebraic results are further explained by two concrete examples. —*Elektrotechnische Zeitschrift*, Oct. 20, 1921.

Herlandsfossen (Norway) Hydro-Electric Plant.—An unusual feature in the construction of this plant is an unlined pressure tunnel having a static head of 450 ft. at its lower end. This and other hydraulic features of the 14,000-hp. plant are discussed.—London *Engineering*, Oct. 7, 1921.

Traction

Electrification of Swiss Railways.—A discussion of three-phase, single-phase and continuous current as used by railways in other countries and their future application to the Swiss railways. The conclusion is that for Switzerland the energy will be single-phase or continuous current and the choice will depend upon economic conditions.—London *Engineer*, Sept. 30, 1921.

Electrification Progress on Italian Railways.—Giovanni B. Santi.—Electrification of lines with grades and heavy traffic has been carried out to some extent in Italy, and at the present time other lines are being electrified. This article tells of the past accomplishments and the plants for the future.—*Railway Electrical Engineer*, October, 1921.

Installations, Systems and Appliances

Electrical Development in Steel Mills.—R. B. Gerhardt.—Report of the progress made during the past year in extension of electric drive to steel mills. Advances made in control equipment are also discussed. The use of electrical energy for heating in the electric furnaces and also in the apparatus operated at lower temperature and the possibilities of electrifying railroad yards are explained.—Paper presented before Association of Iron and Steel Electrical Engineers.

Dynamic Versus Mechanical Braking.—George W. Richardson.—A comparison of the two forms of braking as applied to cranes and hoists employed around steel mills.—*Journal of Engineers' Club of Philadelphia*, October, 1921.

Performance and Cost of Superpower System.—Arthur R. Wellwood.—An enumeration of the power and energy requirements, past and estimated future loads, load factor and diversity, present generating facilities, fuel requirements, investment cost of future systems and possible saving.—*Power*, Nov. 8, 1921.

Units, Measurements and Instruments

Two Pyrometers for Measuring Very High Temperatures.—G. Keinath.—The principle of neither of these instruments is new. One measures by the contrast between a hot lamp filament and the hot body. The other concentrates the heat from the hot body upon a small thermocouple the emf. of which is measured on a millivoltmeter calibrated in degrees. These pyrometers give the desired reading within a few seconds, with an accuracy of ± 10 deg. C. The article seems to favor the thermocouple type called "ardometer" and gives a detailed description of it. The thermocouple itself is a tiny disk 2 mm. to 3 mm. in diameter and is inclosed within an evacuated glass bulb. At the highest temperature (2,000 deg. C.) a potential of 15 millivolts is obtained. Plotting the curve on logarithmic co-ordinates, the relation between the emf. of the thermocouple and the temperature is almost a straight line. Contrary to the method used in previous instruments of a similar type, a glass lens was used to concentrate the heat upon the disk, instead of the very much more expensive lens of fluorspar.—*Siemens Zeitschrift*, September, 1921.

Telegraphy, Telephony and Signals

Recent Advances in Long-Distance Telephony.—Frank B. Jewell.—An outline of the important advances which have been made in long-distance telephony in the past ten or twelve years. The development and use of loading coils and the more recent advances which have been made in carrier-wave transmission, making possible transcontinental communication, are discussed.—*Bulletin of the Johns Hopkins University, School of Engineering*, 1920-21.

Pilotless Warboat.—L. Chauveau.—A boat built by the French Navy during the war was controlled from an aëroplane. The construction of the control mechanism is described in this article. This boat was patterned after a German pilotless boat which attacked a French pier. The German boat was driven by a gasoline motor and electrically controlled by means of a 50-km. one-conductor cable. The boat contained two gasoline motors such as are used on zeppelins, operating twin-screw propellers capable of giving the boat a top speed of 40 knots per hour. Seven distinct operations of the engine and the rudder could be performed by means of the remote electric control. The control was essentially by means of a ratchet mechanism, a different number of ratchet impulses corresponding to certain actions of the boat. A small gasoline-electric generator set and a storage battery furnished the energy for the operation of the different motions. A special time relay was in series with each of the seven distinct positions, so that every one of the different operations was executed only after the contact-making ratchet mechanism stopped for a certain minimum time on a given position. In case of imminent danger to the boat an eighth position of the contact apparatus was provided for the self-destruction of the boat by ignition of its own charge.—*Radioelectricité*, Sept. 21, 1921.

Miscellaneous

Electric Propulsion of Ships.—W. E. Thau.—This paper deals with the electric propulsion of ships and compares it with other methods of driving as regards reliability, weight, space, cost, operation and maintenance.—*Journal A. I. E. E.*, November, 1921.

Insulating Materials.—W. H. Nuttall.—Some theoretical chemical considerations regarding insulating varnishes, solid substances and synthetic gums.—London *Electrician*, Oct. 14, 1921.

Electric Towing of Ships Along Canals.—C. Reindl.—The large number of canals in Europe and the heavy traffic along them make this paper of great interest for European countries. The author gives many data, gained from actual experience, on towing locomotives and storage-battery-driven boats and comes to the conclusion that both storage-battery locomotives and storage-battery power boats give good and economical service, the former, however, only in conjunction with a trolley system, which is discontinued at places where it interferes with structures along the canal.—*Elektrotechnische Zeitschrift*, Oct. 20, 1921.

Physical and Electrical Tests of Slate.—Merton O. Fuller.—The object of the tests reported was to determine the suitability of slate for use in the electrical industry. Tests were made for porosity, tensile strength, compression, flexure, toughness, hardness, expansion, results of high temperature and ohmic resistance.—*Bulletin of Fritz Engineering Laboratory, Lehigh University*, 1921.

Books of Technical and Industrial Interest

Elements of Direct-Current Electrical Engineering. By H. F. Trewman and G. E. Condliffe. London: Sir Isaac Pitman & Sons, Ltd.

This work has been prepared to bridge the gap existing between the elementary textbooks on magnetism, simple current electricity, etc., and the more advanced books written from the point of view of design. It will present to students the theoretical principles underlying direct-current engineering without superfluous details. Typical examples of various machines are described and explained in such a manner that the principles of other types of instruments and machines will be readily understood.

The Engineering Index. 1920. New York: The American Society of Mechanical Engineers. 586 pp.

Nearly 14,000 items referring to articles in about 700 engineering and allied technical publications are listed in the new "Engineering Index" just issued by the American Society of Mechanical Engineers. The alphabetical dictionary arrangement found so convenient and satisfactory in the 1919 volume has been retained. This method is being used in place of the divisional arrangement previously employed. Each item contains the exact title of the article indexed, the author's name where the article is signed, the name of the periodical in which the article appears, the volume, number and date of publication and the number of pages and illustrations in the article. It also includes a brief note summarizing the articles indexed. This feature, together with the numerous cross references throughout the volume, makes it possible for any one consulting the index to confine his search to those particular articles which bear directly upon his problem.

Tables of Complex Hyperbolic and Circular Functions. By A. E. Kennelly, Cambridge, Mass.: Harvard University Press, 1921. Second edition, 240 pages.

The second edition of this well-known book has recently appeared after an interval of some seven years and is essentially a reprint of the first edition, with the following additions: (a) The fundamental tables (I to V), which were originally computed for the range of 45 degrees to 90 degrees in the slope of the argument of the entering vector quantity, have been extended to include the range of 0 degree to 45 degrees. The new material is intended for use in track-signal computations and other circuits of low frequency, small capacitance, and large leakance. (b) A table similar to Table XI has been added which expands its region so as to make it applicable to short lengths of alternating-current line having negligible inductance and leakance per unit length. (c) A collection of formulas on hyperbolic functions has been reprinted from the Smithsonian "Hyperbolic Functions" by Baker and Van Ostrand.

Dr. Kennelly deserves considerable credit for having published these tables and also the atlas in which hyperbolic functions of complex quantities are represented in the form of curves. It would be a mistake, however, to consider the task as completed. In the present tables the steps between consecutive entries are too large, and the use of the tables therefore involves considerable labor in double interpolation. The author himself realizes this fact and states in the explanatory text, on page 153, that his applications for financial assistance were unsuccessful and therefore the steps had to be made larger than originally intended. Because of this drawback it seems that at the present time a shorter method of computation consists in resolving a hyperbolic function of a complex variable into the real and imaginary parts and using the Smithsonian tables of real hyperbolic functions and ordinary good tables of circular functions. It has been the experience of educators that students invariably get tired of double interpolations in Dr. Kennelly's tables and prefer the second method. It is to be hoped that financial aid will be forthcoming and that detailed tables will be published, making an interpolation in many cases unnecessary or very simple.

In his explanatory text the author seems to emphasize the geometric interpretation of hyperbolic functions too much, presumably for the sake of the charts in the atlas. In actual experience in electrical problems such a geometric interpolation is superfluous and rather confusing. It might be well in the next edition to add a purely analytical definition of hyperbolic functions, in terms of exponentials and of infinite series, by analogy with circular functions, the latter being also defined analytically and not geometrically. This will save the reader the necessity of going over several tedious pages of properties of hyperbolas and ellipses not necessary for an understanding and use of the tables.

A chart atlas supplements the tables, enabling interpolations to be effected from direct inspection to a moderate degree of precision for most practical purposes. The charts are numbered to correspond with the tables. By means of this atlas the hyperbolic sine, cosine or tangent of any complex quantity can be directly read between the limits $x = 0$ to $x = \pm 4$ and $y = 0$ to $y = \pm$ infinity, expressed either in rectangular or polar co-ordinates.

Théorie du Coup de Bélier. By Lorenzo Allievi. Translated from the Italian into French by the author and D. Gaden. Two volumes, 64 illustrations.

The investigations of Allievi on hydro-dynamics are well known. His works have been cited by many other authors and his experiences have often been the basis on which others have made further investigations. The present books deal with the theory of what is generally termed "water hammer," that is, the motion of a column of water in a conduit at the moment of opening or closing. The entire investigation is purely mathematical, very original methods of analyzing being employed. Special attention has been paid to the difficult problem of resonance in pipe lines. In all cases the results obtained mathematically are plotted as curves or tabulated, so that by introducing concrete values actual numerical results may be quickly arrived at. Of the two volumes composing this work one contains the text proper and the other sixty-four illustrations (curves and diagrams).

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

Rain Comes to the Aid of Southeastern Power Companies

FAIRLY general rains in the past few days have served to assist materially in relieving what had all the appearance of a water shortage among the Southeastern power companies. The Tennessee Power Company, the Columbus Power Company and the Georgia Railway & Power Company have water going over the dams at their low-head developments, while the Central Georgia Power Company has been able materially to increase its storage. The Georgia Railway & Power Company was likewise able to accumulate additional water in its impounding reservoir above the Tallulah Falls development, and while the Alabama Power Company has at this time not begun to feel the effect of these rains at its developments, this company will be benefited in the next few days.

It will be recalled that the Carolina Power & Light Company, Raleigh, N. C., was forced to curtail service during the month of August because of low water and obtained partial relief through the transfer of power from the Alabama Power Company to the Georgia Railway & Power Company, the latter company in turn delivering to the Southern Power Company for delivery to the Carolina Power & Light Company.

Utility Operators View Secondary Inflation with Alarm

WORD comes from the Middle West that public utility operators in that section are beginning to view with some alarm what appears to be a secondary inflation of the prices of general commodities. Prices of steel products, copper, oil and other materials are beginning to advance, and operators are asking themselves if this is the beginning of a general increase in prices all along the line.

"The secondary inflation period has become of serious moment," one important operator of utility properties said. "Unless there is a halt in the upward trend of prices, the utilities may find themselves in worse shape than they were two years ago and forced to ask for increased rates."

Business and Industry Report Increased Activity

THAT there is a real basis for the general statement of improved business already issued by the Department of Commerce is revealed by the detailed departmental survey for October just issued. A careful study of the figures presented shows that, considered as a whole, business and industry have moved forward. In the majority of industries production and consumption increased and stocks declined.

Textile consumption figures continued to advance and exports of raw cotton were substantially larger than a year ago. The iron and steel industry evinced a slight improvement during September and copper production turned upward. Bituminous-coal production for September increased slightly over August, while anthracite production showed a slight decline. Reports on building and construction contracts awarded in twenty-seven Northeastern states showed a gain in value of 11.5 per cent over August in place of the usual seasonal decline. The September total in value of new construction is the largest monthly total this year and is the largest September total on record.

Business failures declined in number by 6 per cent, and in extent of liabilities by 13.8 per cent, as compared with August. New incorporations were 15.7 per cent less than in August, but September provided an increase of 48.5 per cent in new capital issues, the largest month since April.

Indiana Commission Explains Why Utility Rates Cannot Be Slashed

REDUCTIONS of public utility rates to correspond with the marked decline in prices of other commodities cannot be expected by utility patrons because the rates were not advanced commensurately with the general increase of prices during the war period, according to the annual report of the Indiana Public Service Commission, which has been completed by Frank B. Faris, examiner for the commission.

"The past year has been one of rather marked decline in most commodity prices," the report says, "and has been characterized by a business depression. The commission is aware of the fact that the public is impatient to see lowered rates for public utilities. It is impossible, however, for the commission radically to reduce utility rates to correspond with the decrease in farm products, etc. During the past year there were only 538 formal cases filed, as against 827 the year before, a reduction of 35 per cent.

"There is, however, a sound distinction to be made between the cessation of demand for increased rates on the part of the utilities and a slashing of utility rates on the part of the commission. Utility rates did not increase in proportion to or contemporaneously with the rapid increase of prices during the year 1919 and a part of 1920. Had utility rates been increased in direct proportion to and simultaneously with all commodity prices and labor costs, they could have been reduced in direct proportion to the decrease in these elements in utility expense."

In another part of the report, however, the commission expresses the hope that the economic readjustment will work for a reduction of rates commensurate with utility costs. "It was during the fore part of this fiscal year," the report says, "that prices reached the maximum upward limit. It is some satisfaction to make the observation that prices of materials and labor have started on the decline, which ultimately will result in better public service, a more liberal policy of making public utility extensions and finally a reduction in rates commensurate with the reduction in cost of utility service."

Constructive Series of Electric Vehicle Lectures in New York

AN INTERESTING series of talks is planned for the winter by the electric vehicle bureau of the New York Edison Company. The program, still in a tentative form, has been designed for the interested prospective user who wants facts from those who have operated electric trucks.

The first meeting is scheduled for Dec. 2, in the company's auditorium on Twenty-seventh Street. The topic of the evening, "The Field, Application and Economy of the Electric Street Truck," will be discussed by Arthur Williams, general commercial manager of the company; C. G. Lambert, general manager Westcott Express Company, New York, and H. S. Baldwin, General Electric Company, West Lynn, Mass. James H. McGraw, president McGraw-Hill Company, will act as chairman at the opening meeting. The program arranged for the other meetings is as follows:

2. Symposium on the construction of electric street truck drive by truck manufacturers.
3. "The Application of Electric Trucks in Postal Service."
4. "Proper Charging of Electric Truck."
5. "A Word from the Oldest Users of Electric Trucks in New York City."
6. "Winter Operation of Electric Trucks."
7. "Electric Trucks in Department Store Business," "Electric Trucks in Laundries" and "Electric Trucks in Ice and Ice Cream Business."
8. "Industrial Trucks."
9. Talk by advertising agency.
10. "Tires and Lubrication."

Conference Held This Week on International Radio Regulation

A SUMMARY of the results of the international radio meeting held this summer in Paris has been prepared by the Bureau of Standards. This work of the Interallied Technical Committee on Radio Communication was done in anticipation of an international conference on communication. Feeling that it was desirable that plans be formulated to insure suitable representation of United States communication interests at this conference when held, Secretary of Commerce Herbert Hoover invited interested radio concerns to send representatives to a conference held on Friday of this week at the Engineering Societies Building, New York.

Radio communication is now regulated in accordance with the London convention of 1912, and the revolutionary developments in radio since that time have made new regulations imperative.

The Interallied Technical Committee, which sat at Paris from June 21 to Aug. 22, considered primarily a set of fourteen questions prepared by the preliminary communications conference of the five principal powers, which met in Washington in 1920. Two delegates of the Department of Commerce were present. One of the fundamental questions was the classification of waves. The final conclusion really adopts two wave classifications, one by types and one by classes.

The Paris conference did not attempt to allocate particular ranges of long waves to particular countries, but formulated the technical principles on which such an allocation should be considered by the next International Communications Conference. The technical principles adopted were in brief these: (a) Lower-frequency waves should be used for the longer distances and higher-frequency waves for the shorter distances; (b) stations situated in the same general locality and working at similar distances should in principle use adjacent frequencies; (c) each nation should use only the smallest possible number of wave lengths necessary to carry on its radio communication, and (d) use should be made of the directional properties of radio whereby the number of communications carried on in a given region may be increased by employing the same frequency a plurality of times.

Postmaster Hays Indorses Proposed Department of Public Works

THE Postmaster-General expects to see the Department of Public Works become a reality. In an address on Nov. 15 before the Fifth Avenue Association of New York Mr. Hays commented on the reorganization of the federal government. His opinion at this time, when the final report on reorganization is about to be made, is regarded as being of much significance. Mr. Hays said in part:

"I would not presume to suggest, of course, the final detail of this effort, but it would seem natural to expect the creation of a Department of Public Works; the establishment of a Department of Public Welfare, independently or merged with labor, with which it is so intimately connected, to have charge of all bureaus and offices which handle relief work for the veterans of the war with Germany, including the Bureau of War Risk Insurance, the Federal Board for Vocational Education, hospitalization, the division of public health, and all those bureaus which would deal with health questions generally and with educational and social welfare; the stripping of the Treasury Department of all except its proper fiscal functions; the transfer of all non-military work from the War Department and the Navy Department to the regular civilian departments of the government; enlargement of the Department of Commerce and transfer to that department of all agencies which have to do with the promotion of commerce and the protection of navigation; establishment of a centralized purchasing agency to do the buying of all branches of the executive establishment: full functioning of the budget system, and altogether a reorganization which will bring a material reduction of the overhead expenses."

To Make New York Industrial Lighting Code Mandatory

HEARINGS will take place during the third week in December on the proposed rules of the industrial code, as amended, relating to lighting of factories and mercantile establishments in the State of New York. Hearings will be held in Buffalo on Dec. 13, in Rochester on Dec. 15, in Syracuse on Dec. 17 and in New York City on Dec. 21.

The table of intensities of all of the factories of the state is made mandatory instead of tentative as under the rules now in existence. Here and there intensities have been increased slightly. The rule relating to shading of lamps has been strengthened by specifying that the shades must be of non-inflammable material.

New York Supreme Court Declares Service Charge for Gas Illegal

IN THE case of the City of Rochester versus the Rochester Gas & Electric Corporation the Appellate Division, Third Department, of the Supreme Court of New York recently handed down a decision declaring illegal a service charge on bills to gas consumers. This decision is contrary to one rendered last spring and is based on Section 66 of the transportation corporation law, which provides: "No gaslight corporation in this state shall charge or collect rent for its gas meters either in a direct or indirect manner." No opinion was expressed by the court as to the equity of the charge, and it is interesting to note that two of the judges dissented from the decision, and in another case, that of the town of North Hempstead versus the Public Service Corporation of Long Island, the New York Supreme Court sustained the service charge. The cases have been referred to the Court of Appeals.

While the decision does not affect electric companies as the law applies only to gaslight corporations, considerable significance is attached to it. Frequently unsuccessful attempts have been made within the past few years to redraft the law to include electric companies.

Interconnection of New York Companies Is Urged at Empire State Meeting

AN INTERCONNECTING system for the companies of New York State and various production and distribution topics were discussed at a meeting of the Empire State Gas and Electric Association at Albany, N. Y., Nov. 17 and 18.

The interconnection project was advocated by E. P. Peck, general superintendent electrical department, Utica Gas & Electric Company, who pointed out that such an interconnection would reduce production costs and would enable a general enjoyment of the benefits to be received from the superpower system. As a practicable plan to accomplish this interconnection Mr. Peck suggested that on all new or revised construction equipment be installed which can be connected to trunk lines of suitable frequency and voltage for such a system. Although this frequency and voltage will have to be decided by the companies concerned, he suggested 60 cycles and 66,000 volts as most logical. As the load of practically every company lies within about a 50-mile radius, he thought that no higher voltage would be satisfactory. Sixty cycles, he stated, was becoming generally recognized as most suitable for ordinary transmission. One company, he said, was already buying new equipment for 60 cycles instead of its old frequency of 40 cycles. Transmission lines built now should be spaced for 66,000 volts and insulated for present voltage, while transformers should be purchased with 66,000-volt taps, according to Mr. Peck.

Such an "interpower" system, he claimed, would do as much good comparatively in New York as the superpower scheme will do for the larger territory it covers. It would cut down plant capacities necessary, as well as cutting down interruptions and low-water and high-water losses.

A symposium of operating practices of power companies having various combinations of steam and hydroelectric plants was given by engineers of the companies. A particularly interesting method of load dispatching was described by Mr. Hague of the Rochester Gas & Electric Corporation.

In a discussion of transformer loading it was stated that the Elmira Water, Light & Power Company disregards connected load, as it has found that the peak on nearly all transformers where no range loads are present is about 0.2 kva. per service to each customer (0.24 kva. on dark days). About 500 watts per customer is allowed in transformer rating.

J. K. Waterhouse, New York & Queens Electric Light & Power Company, said that to decrease the number of tree grounds on distribution lines his company used a certain twine-braid, rubber-covered wire which was cabled together with heavy twine for use in thick woods and used separately in thinner trees with hardwood molding where necessary.

Princeton Establishes New Engineering Lectureship

IN CONNECTION with the expansion of the engineering schools of Princeton University made possible by the Frick bequest and the university's endowment fund, the Cyrus Fogg Brackett lectureship in applied engineering technology has been established by the Princeton Engineering Association of New York City. The first lecture under these auspices will be delivered to the engineering faculty and undergraduates at Princeton on Dec. 1 by Samuel Insull, president of the Commonwealth Edison Company, Chicago, whose topic will be "The Production and Distribution of Electrical Energy in the Central Portion of the Mississippi Valley." Other lectures on public utility engineering and management will follow Mr. Insull's, and among the lecturers will be Charles L. Edgar, president of the Edison Electric Illuminating Company of Boston; John W. Lieb, vice-president of the New York Edison Company; Joseph B. McCall, president of the Philadelphia Electric Company; William C. L. Eglin, chief engineer of the Philadelphia Electric Company, and Herbert A. Wagner, president of the Consolidated Gas, Electric Light & Power Company of Baltimore, all of them past-presidents of the National Electric Light Association.

Mortgages on Memphis Gas & Electric Property to Be Foreclosed

PURSUANT to bills filed against the Memphis Gas & Electric Company in the interests of New York and Chicago controlling interests, foreclosure proceedings on mortgages of which payment was guaranteed by three bond issues of the Memphis utility company have been authorized in the United States District Court. The Memphis company has been in the hands of receivers for some time, and their control is continued by the court order. The bond issues on which interest is in default include one of the Memphis Gas & Electric Company for $20,000,000, of which $2,263,000 was sold; one of the Memphis Consolidated Gas & Electric Company for $10,000,000, of which $5,728,000 was sold, and one of the Merchants' Power Company. The last two companies were merged into the one first named.

The franchises of the Memphis Gas & Electric Company will be affected in no way by the action of the mortgagees, but local holders of the securities are likely to be heavy losers, and of such holders in the city and state there are said to be many. All the bills were filed for the Central Union Trust Company of New York, representing the Brady interests of New York and the Billings interests of Chicago. The result of the foreclosure will probably be a sale at auction to the highest bidder, and there is thought to be little doubt that the metropolitan interests will bid the property in.

A. S. M. E. Will Discuss Heat Balance and Fuel Waste

POWER problems are to come in for a large share of attention at the annual meeting of the American Society of Mechanical Engineers, which will be held from Monday to Friday, Dec. 5-9, in the Engineering Societies Building, New York City. On Monday there will be a session on the elimination of waste in industry and an evening session on education and training in the industries.

The main feature on Tuesday will be a power waste session, which will take up the whole morning. It will be in the nature of a "heat-balance symposium" and will comprise four papers on the heat balance of the following stations: Connors Creek station of the Detroit Edison Company, by C. H. Berry and F. E. Moreton; Colfax station of the Duquesne Light Company, Pittsburgh, by C. W. E. Clarke; Delaware station of the Philadelphia Electric Company, by E. L. Hopping, and Hell Gate station of the United Electric Light & Power Company, New York, by J. H. Lawrence and W. M. Keenan. Simultaneously with the power waste session there will be a machine-shop waste session and a railway session.

Wednesday will be devoted to business. On Thursday morning four papers will be devoted to fuel waste as follows: "Boiler Plant Efficiency," by Victor J. Azbe; "Fuel Saving in Relation to Capital Necessary," by Joseph Harrington; "Developments in Boiler and Furnace Design," by D. S. Jacobus, and "Producer Gas for Industrial Furnaces," by W. B. Chapman. Papers on "Testing of Emergency Fleet Boilers Using Oil Fuel," by F. W. Dean, and "Steam Condensing Plants," by Paul A. Bancel, will be presented on Friday.

Basis of the New Orleans Settlement that Was Halted by Court

NEW ORLEANS newspapers publish what purport to be the principal points of the agreement reached by the conferees who had under advisement a settlement of the utility troubles in that city. This agreement, as reported in the ELECTRICAL WORLD for Nov. 19, page 1042, was halted by the continuing of an injunction from the Louisiana Supreme Court restraining the city from entering into any agreement with the New Orleans Railway & Light Company on car fares. In this plan, which its supporters still hope to make effective by inducing the state to drop its suit against the city, detailed provision is made for the financial readjustments that are necessary, though some points are still in dispute between the city and the company.

The outstanding underlying bonds are not to be distributed, and the outstanding 4½ per cent general mortgage bonds, due July 1, 1935, are to be exchanged for 25 per cent cash and 75 per cent new general lien bonds, due July 1, 1935. The new 4½ per cent bonds are to have a preferred position in that they will rank after the new first and refunding open mortgage bonds. Two reserve funds are provided, and provision is made for the creation of a fund of $200,000, 50 per cent of which is to be used for betterments and improvements, and the remainder for purchase and retirement of the new 4½ per cent bonds at their lowest bid value.

No new securities are to be issued by the company without the consent of the Council, the city to have a perpetual option on the property of the company at the valuation stipulated as of Dec. 31, 1920, plus such additions as may have been made.

Electric light and power rates are, by the contemplated agreement, to remain unchanged for the test period of twelve months, and sufficient funds are to be provided the receiver by the security holders' committee for the purchase and installation of needed equipment for the electric light and power plants.

Committee on Electrolysis Report Is Compilation of Present-Day Knowledge

THE American Committee on Electrolysis has just issued its 1921 report, superseding its preliminary report of 1916, in book form. It is primarily a marshaling of the general and specific knowledge regarding the causes of electrolysis and methods of electrolysis mitigation, and in no way attempts to lay down specific recommendations as to best methods of preventing or mitigating electrolysis troubles.

From one angle, the book or report might be regarded as a complete text on electrolysis, and in a way it is so presented and arranged. A good synopsis of principles with definitions of terms is placed at the beginning of the report.

More than one-third of the 204 pages of the book are devoted to discussion of the design, construction, operation and maintenance of railways and of underground structures affected by electrolysis and to a discussion of measures involving the interconnection of affected structures and railways, ending with a summary of good practice as analyzed by the committee.

The other chapter headings in the book are "Electrolysis Surveys," "European Practice" and "Electrolysis Research."

The committee making this report is a joint committee of the following nine organizations, each having three members on the committee: American Institute of Electrical Engineers, American Electric Railway Association, American Railway Engineering Association, National Electric Light Association, American Gas Association, Natural Gas Association of America, American Telephone & Telegraph Company, American Water Works Association and the National Bureau of Standards. Bion J. Arnold is chairman.

Woman's Public Information Committee Appointees

MISS O. A. BURSIEL of Boston, secretary of the New England Division, National Electric Light Association, has been appointed chairman of the recently formed woman's public information committee of the Public Relations Section of the national association. Other members are Miss R. E. McKee, Middle West Utilities Company, Chicago; Mrs. Paul Rittenhouse, Northern States Power Company, Minneapolis; Miss Clotilde Grunsky, *Journal of Electricity and Western Industry*, San Francisco; Miss B. H. Lowrey, Henry L. Doherty & Company, New York, and Miss Clare Zilleson, Philadelphia Electric Company, Philadelphia.

Federal Power Commission Hears Protest of Electric Utilities and Others

THE National Electric Light Association made a vigorous protest to the Federal Power Commission at a hearing in Washington on Monday of this week against General Regulations 16 and 17, dealing with depreciation and amortization reserves. Appearing for the association were Milan R. Bump, president; Franklin T. Griffith, vice-president and chairman of the water-power committee; S. Z. Mitchell, H. G. Bradlee, Guy E. Tripp and O. D. Young of the public policy committee; W. E. Robertson of the executive committee; H. M. Edwards, chairman of a special accounting committee; W. J. Myers, chairman of the committee on uniform classification of accounts; Guy W. Talbot, president of the Pacific Power & Light Company; Thomas Martin, president of the Alabama Power Company; H. J. Pierce, president of the Washington Irrigation & Improvement Company; Gen. George H. Harries, Dennis T. Flynn and F. W. Stehr of H. M. Byllesby & Company; W. Paxton Little of the Niagara Falls Power Company, W. C. Lang of the Electric Bond & Share Company, G. F. Nevins of the Pacific Power & Light Company, and George F. Oxley and Fred Herbert of the association's headquarters staff. Dr. William McClellan appeared for the American Institute of Electrical Engineers and Colonel Hugh Cooper for the consulting engineers. The Investment Bankers' Association sent as its spokesman H. M. Addinsell of Harris, Forbes & Company, chairman of its public utility securities committee. Oscar Fogg, executive manager of the American Gas Association, and R. A. Carter, chairman of its rate fundamentals committee; H. M. Brundage of the Empire State Gas & Electric Association, and W. H. Onken, Jr., editor of the ELECTRICAL WORLD, were also in attendance.

The manufacturers of electrical apparatus and of waterwheels sent a strong delegation, which included, besides Guy E. Tripp of the Westinghouse Electric & Manufacturing Company and O. D. Young of the General Electric Company, W. W. Nichols of the Allis-Chalmers Manufacturing Company, C. Elmer Smith of the S. Morgan Smith Company, W. D. Ward of the Pelton Water Wheel Company, Edwin S. Church of the Wellman-Seaver-Morgan Company, H. B. Taylor of the I. P. Morris department of the William Cramp & Sons Ship & Engine Building Company, and A. F. Sparks of James Leffell & Company. The Electrical Supply Jobbers' Association was represented by W. E. Robertson of Buffalo.

INDUSTRY ANXIOUS TO PROCEED

Objection was made to the principle and theory of depreciation embodied in Regulation 16, the National Electric Light Association maintaining that this regulation is economically unsound and not required by the provisions of the water-power act. A recasting of the regulation was suggested so as to eliminate the life-table method and to substitute therefor a proviso that depreciation reserves shall be maintained by the licensee sufficient to keep the project in a condition of repair adequate for efficient operation by providing for necessary renewals and replacements when made. With reference to Regulation 17 it was again urged by the association that in effect it penalizes the conservatively financed licensee and puts a premium on the unsoundly or extravagantly financed licensee. Statements were filed by M. R. Bump, Franklin T. Griffith, H. J. Pierce, H. M. Addinsell, H. M. Edwards, W. J. Myers and O. D. Young.

In his opening address at the hearing President Bump outlined the objections to the regulations and expressed the hope that the restrictions would be removed. He said the water-power act was created to stop an enormous national waste; to promote and make possible the development of the water resources of the country, to render these resources quickly available to the general public. From the standpoint of conservation of the coal and fuel supplies, the re-employment of labor and the reclamation of desert lands, the act is of vast importance. He believed that the machinery set up under the act governing the granting of permits and carrying out the terms imposed by the act did not and does not contemplate the interpretation placed upon the act nor did it contemplate the harmful regulations which the staff now proposes. The act, he said, limits the making of rules and regulations to such as are not in conflict with the act, and he held that the proposed rules and regulations are in conflict with the act because, among other things, their effect is to defeat its purpose.

A careful survey of the entire electrical industry indicates the need for an expenditure of $1,000,000,000 annually over the next five years, a large portion of which is dependent upon water-power development. Mr. Bump said that the industry stands ready to proceed today with the largest program of development in its history, provided that the water-power act is interpreted in a constructive way in accordance with both its spirit and letter so that the financing of these improvements will be made possible.

OBJECTIONS TO TENTATIVE CLASSIFICATION

Franklin Griffith, speaking for the water-power committee, likened the differences of opinion which existed between the utilities and the commission as the difference between practice and theory. Under the provisions of Regulation 16, he said, a reserve is required to maintain 100 per cent of physical value based upon theoretical depreciation of the units of the project property, founded upon estimates of the operating life of such units, which estimates are guesses and necessarily inaccurate. In practical operation, he said there is no necessity for the gradual accumulation in a depreciation reserve account of a large credit balance in excess of that required for the actual renewals and replacements as made. Moreover, he declared, the regulation does not take into account the vicissitudes of the business, nor the necessity of safeguarding the financial structure of the project, which, if disregarded, would make it impossible to maintain and expand the physical structure.

It was pointed out by Mr. Griffith that a licensee's credit and power to obtain investment funds for expansion depends upon its ability to make a regular return upon the investment in its securities. It would therefore be a cruel and disastrous rule which required investors to forego a return upon their legitimate investment in order to enable a licensee to build up in a depreciation reserve a fund not required for actual renewals and replacements. He did not contend that no depreciation should be provided, but that the depreciation reserve should be only such as would be necessary to maintain the project works in efficient operation. The plan which he suggested was that adopted by the National Association of Railway and Utility Commissioners, and a recasting of Regulation 16 was submitted in conformity with these regulations. As for the amortization reserve, Mr. Griffith suggested that none would be created unless and until the licensee shall have received a minimum definite return of at least 10 per cent. This, in exceptional cases, might be increased, depending upon the hazard involved.

ECONOMIC FEATURES OF DEPRECIATION

The brief of H. M. Edwards was devoted entirely to proving that the straight-line theory on depreciation bases on life tables, which Regulation 16 prescribes, is wrong and unsound because it is contrary to the facts of the business. Mr. Edwards also showed that the alternate plan recommended by the National Electric Light Association not only conformed with the requirements of the act but also adhered to the facts of the business. His contention was that the regulation as now worded attempts to force into the utilities' books and accounts mere matters of opinion, estimate or conjecture, whereas books and accounts should reflect only facts and the actualities of the business. The regulation requires that a reserve should be created against every unit in service, beginning six months after installation, whether it is to be ultimately retired or not. Such reserves against units remaining in service inflate the cost of operation and are not in fact reserves for depreciation, but are provisions for the amortization of the investment. The method outlined by the National Electric Light Association for meeting the requirements of the act as regards depreciation reserves represents, Mr. Edwards maintained, the matured opinion of the entire central-station industry of the country and is the method followed by the great bulk of the individual corporations engaged in the business. They are similar to those adopted by the National Association of Railway and Utility Commissioners, which system was adopted after long conference with all types of public utilities.

W. J. Myers filed a memorandum objecting to the form of annual report required by the commission, which he said called for much information beyond the scope of the federal water-power act. He suggested that the annual report might be confined to four pages, one for the annual income account, the next two for a comparative balance sheet, and the fourth for such statistics as the commission legitimately needs to gather.

THE INTENT OF CONGRESS

H. J. Pierce, who was in Washington from 1913 until the water-power act was enacted in June, 1920 reviewed his impressions of how Congress intended the act to be interpreted and administered. He said that Congress did not intend the Federal Power Commission to be a regulatory body, nor did it expect that the commission would adopt such drastic and restrictive regulations as those proposed by the staff. This, he said, was indicated by the appropriation of $100,000 to administer the act, a sum which the next Congress refused to increase. His impression was that Congress intended that the act should be simply administrative and that regulation should be left to the states. In his opinion the regulations as adopted by the commission are too restrictive and technical and tend to destroy the entire benefits of the act.

H. M. Addinsell of Harris, Forbes & Company, in referring to Regulation 17, said the simpler and clearer the regulations are made, having in mind the protection of the consumers, the government and the security holders, the better it will be for all concerned. If, he said, we are to go forward on the vast program of development of water powers that economists and students of the affairs of our country had hoped would be made possible by the enactment of the federal water-power act, we must necessarily make the financing of those water powers and the resulting securities attractive to the investment public. There is no great central reservoir of capital waiting to be invested in these enterprises. A rate of return, before amortization sets in, of at least 10 per cent in any case should meet this objection to the present regulation. It should be borne in mind, he said, that the rate of return under discussion is, moreover, merely permissive and not guaranteed. It imposes a limitation on maximum profits, but gives no insurance as to any minimum return.

THE VIEWPOINT OF THE MANUFACTURERS

O. D. Young, vice-president of the General Electric Company, acted as the spokesman for the various manufacturing interests represented. He made no pretensions, he said, to understand the various theories of depreciation involved, but was willing to abide by the judgment of those who are purchasers of equipment. His recent visit to Germany indicated that the large electrical manufacturing companies there were working 100 per cent on electrical apparatus and supplies intended not only for German consumption but for export to the Scandinavian countries and to Italy. The same condition, he said, prevailed in Japan, which he also recently visited. Mr. Young contrasted this condition of affairs with that existing in this country, where the manufacturers are operating only about 25 per cent of their capacity. Inquiry, he said, revealed that the hydro-electric construction program was being retarded because of differences over Regulations 16 and 17. He hoped, therefore, it would be possible to reconcile these differences so that the utility companies would be enabled to finance new developments and place orders with the manufacturers of waterwheels and electrical machinery. This, he maintained, would go a long way toward solving the unemployment problem which now confronts the industry and would permit the country to take its proper place in catering to the larger needs of the world.

No decision was reached by the commission on the questions involved, but the expectation is that after a perusal of the briefs some modification would be made in Regulations 16 and 17.

Pennsylvania Edison Reached Its Maximum Output in October

THE highest hourly peak load ever reached on the Pennsylvania Edison Company system, which supplies the city of Easton and other places, was carried during the month of October, when it rose to 17,330 kw. That this was not merely a momentary demand, but was an indication of an improvement in industrial conditions, is shown by the fact that the kilowatt-hour output for the month was also the highest recorded in the history of the company. The figure, 8,108,270 kw.hr., was more than 500,000 kw.hr. above the total for the previous month, which was 7,538,750 kw.-hr.—up to that time the highest.

These encouraging records were made notwithstanding the fact that the largest of the power customers are using less energy than in normal times. The increase is thus due to the large number of new customers taken on during the past year and the fact that many of the smaller communities are using an increasing amount of energy.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Electric Yacht on Pacific.—The first electrically driven yacht built on the Pacific Ocean is under construction at Los Angeles for Capt. G. Allen Hancock, oil operator. It will have a cruising radius of 6,000 miles and when completed next summer will go on a cruise of the South Seas.

New Municipal Plant in Ohio.—Following discontinuance of the Springfield, Troy and Piqua traction service because of financial troubles, the village of North Hampton, Ohio, found itself cut off from electric light and power service. The village has in consequence just installed a municipal plant supplying street, residence and business service at 110 volts.

University of Toronto Opens New Electrical Building.—The new electrical building of the University of Toronto, Canada, which was in partial use last session, has been completed and was formally opened on Nov. 4 in connection with the annual reunion of the Engineering Alumni Association of the university. The new building, which forms a group with the mining and mechanical engineering buildings, is 225 ft. x 68 ft. in area. Two-thirds of the space is occupied by the department of electrical engineering and one-third by the departments of civil engineering and applied mechanics.

How Norwegian Hydro-Electric Company Avoids Pipe Lines on Hillside.—The disfigurement of the scenery by exposed pipe lines on the hillside has been obviated by one of Norway's newest hydro-electric systems—that at Herlandsfossen. Here the water is conveyed from the service reservoir to the turbines by an unlined pressure tunnel the static head of which at its lower end is 450 ft. This, *Engineering* believes, is by far the highest head for which an unlined tunnel has been devised in Europe, if not in the world. From the foot of this tunnel the pipe lines run through a horizontal tunnel to the power house. The power produced is used mainly for lighting and general purposes in the neighboring towns and villages. The power station has been built for a maximum capacity of 14,000 hp.

Grand Opera by Wireless.—The possibilities of wireless telephony were once more demonstrated recently in Chicago when Edith Mason, lyric soprano of the Chicago Grand Opera Company, from the Auditorium Theater sang to 50,000 persons in Kansas City, Minneapolis, Cincinnati, Pittsburgh and intermediate points. The test was made under actual opera conditions and consisted of an opening address by Mary Garden, an orchestra selection and Miss Mason's solo. High up in the wings of the theater, almost out of sight of the audience, a small instrument caught the music of the orchestra and the voice of the singer and carried them by wire to the roof of the Commonwealth Edison Company, where they were transmitted to 50,000 receiving instruments. For days a notice of the test had been going out over the wireless to the operators within a radius of 1,000 miles, and when the announcement, "This is station KYW, Chicago," was sent, all were "listening in." The Westinghouse Electric & Manufacturing Company, which is conducting this work, has also broadcasted on a 360-meter wave length, without relaying, entire operas and will continue to do so during the season.

More Electric Steam Boilers.—For some time past there have been in operation in Italy, Switzerland and France boilers in which the steam is generated by the passage of electric current through the water they contain. *Le Génie Civil* describes a large boiler—one of two working on this principle—which is of the Bergeon-Frédet type and which has been supplied by the Etablissements Joya of Grenoble to paper works at Brignoud, in the Department of Isère. Actually the installation at the works comprises three of these electric steam boilers, but one of them is only half the size of the others and was laid down experimentally. The results obtained with it were, however, so successful that the two larger boilers, each of which is sufficiently large to absorb 3,500 kw. of electrical energy, were ordered.

Electrification of London Railway.—A comprehensive scheme for the electrification of the London suburban lines of the Southeastern & Chatham Railway is reported in the *Electrician.* The scheme embraces the lines within a radius of about 30 miles from Charing Cross. Section A of the route has a mileage of 94 and Section B a mileage of 140. It is hoped to gain government aid and to proceed with the work of electrification by three stages. Increased speed and service will be the great advantages. The equipment will be of the direct-current third-rail type, supplying energy to the train motors at 1,500 volts from substations which will receive and convert high-tension alternating current. Rolling stock will be of the motor-car type with multiple-unit control. Two motor coaches and one trailer coach will constitute a unit, and trains of three, six or nine coaches, accommodating 256, 512 and 768 passengers respectively, will be run.

New Indiana System Developed.—An order just issued by the Indiana Public Service Commission to the Browne-Mills Electric Company of North Manchester reveals the development of a small electric system in northern Indiana by the Bippus interests of Huntington. In petitioning for relief from part of a previous order, the Browne-Mills company told the commission that the Bippus interests have already built an electric transmission line from Huntington, where they have a private electric plant, to Goblesville and to Bippus, nearby places. The Bippus Utilities Company is being formed. By January or February, the Browne-Mills petition said, the new company will have connected the North Manchester system, now operated by the Browne-Mills Company, with Bippus lines, which now are within about 5 miles of North Manchester. Because of this fact the Browne-Mills company requested the commission to relieve it from certain improvements which the commission ordered should be made in the North Manchester service.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

New York Electrical Society.—Dr. Charles P. Steinmetz spoke on "Long-Distance Power Transmission" before the meeting of this society on Nov. 25.

Institute Section Meetings.—Section meetings of the A. I. E. E. for next week are scheduled as follows: Nov. 28, Minnesota, "Theory of the Vacuum Tube and Its Engineering Applications," by C. M. Jansky, Jr.; Nov. 30, Atlanta, "Waterwheels"; Dec. 2, Schenectady, "The Superpower System," by W. S. Murray; Dec. 2, Providence, "Recent Developments in Electrolysis Testing," by E. R. Shephard.

St. Louis Electrical Board of Trade.—The executive committee of this organization has voted to hold an electric show in St. Louis during the spring of 1922. A preliminary committee to canvass the trade reported that 60 per cent of the space was spoken for by St. Louis firms in the course of ten days' work. This committee was composed of E. J. Spencer (chairman), C. E. Michel, F. A. Rick, L. F. Philo, J. J. Roche, H. T. Bussmann and A. C. Brandt.

Worcester A. I. E. E. Section Forms Program.—The Worcester (Mass.) Section of the American Institute of Electrical Engineers has planned the following program for this year's meetings under the chairmanship of George M. Hardy, superintendent of distribution for the Worcester Electric Light Company: Dec. 15, "Meters," by A. R. Rutter, meter engineer with the Westinghouse Electric & Manufacturing Company; Jan. 19, 1922, "Electric Traction," by W. S. Murray, consulting engineer, New York City; Feb. 16, paper on "Telephony," speaker to be announced; March 16, ladies' night, "Electrical Household Appliances"; April 20, prize competition paper by local member; May 18, annual meeting.

Coming Meetings of Electrical and Other Technical Societies

A. I. E. E. Section Meetings—Minnesota, Nov. 28; Atlanta, Nov. 30; Providence, Dec. 2; Baltimore, Dec. 8; New York, Dec. 14.

A. I. and S. E. E.—Cleveland Section, Dec. 1; Chicago Section, Dec. [illegible]; Pittsburgh Section, Dec. 19; Philadelphia Section, Dec. [illegible].

Electrical Supply Jobbers' Association—Cleveland, Nov. 30, Dec. 1-2. Atlantic Division, Cleveland, Nov. 29.

American Society of Mechanical Engineers—New York, Dec. 5-9.

American Society of Refrigerating Engineers—New York, Dec. [illegible]-7.

American Institute of Chemical Engineers—Baltimore, Dec. 6-9.

American Physical Society—Toronto, Dec. 27-30.

American Association for the Advancement of Science—Toronto, Dec. 27-31.

American Engineering Council — Washington, Jan. 5-6.

Western Association of Electrical Inspectors—Chicago, Jan. 17-19.

American Society of Civil Engineers—New York, Jan. [illegible].

Lighting Fixture Dealers' Society of America—Milwaukee, Jan. [illegible]-Feb. 2.

National Meter Committee, N. E. L. A.—Springfield, Ill., Feb. 15.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies

Relative Weight of Observation and of Scientific Measurement in Assessing Damages from Overflow.—Holcomb vs. Alpena Power Company was a suit arising because of the overflowing of part of plaintiff's farm on account of a dam maintained by the power company. The plaintiff's original suit for an injunction forbidding the maintenance of the dam had been denied, but damages had been awarded to him, and against these the power company appealed to the Supreme Court of Michigan. This court found the award excessive, reducing it from $6,555 to $3,820. In estimating the relative weight of conflicting testimony the court said: "The law is well settled in this state, as well as elsewhere, that tests from observation and experience are competent evidence against scientific measurements and theories and often more satisfactory when the two are brought into conflict." (184 N. W. 587.)*

The Fourteenth Amendment Applied to the Public Service Railway Company of New Jersey.—In Public Service Railway Company vs. Board of Public Utility Commissioners of New Jersey an application was made to the United States Circuit Court of Appeals against decisions of the commission on the ground that these decisions involved confiscation. The court in granting a temporary injunction against the commission's order of July 14 made it contingent upon a certain rate of fare not being exceeded during the pendency of the injunction. The grounds for overruling the commission's decision were that the board had underestimated or wholly excluded from its valuation certain of the company's properties, that the rates fixed by the board provided no return for the service of the properties excluded, and that the rates fixed were to that extent confiscatory and therefore in conflict with the Fourteenth Amendment of the Constitution.

Purchasing Company Not Bound by an Original Contract Subsequently Modified.—In City of Albany vs. Georgia-Alabama Power Company the city sought to have the company enjoined from cutting off the energy furnished the city under contract, the city alleging that the company wrongfully demanded immediate payment of a bill greatly in excess of the amount justly owed it by the city. The company predicated its claim upon an alleged contract subsequent to the original one between the city and the Albany Power & Manufacturing Company, which the defendant company had succeeded. In affirming judgment for the defendant the Supreme Court of Georgia held that the purchasing corporation was not bound to fulfill the terms of the original contract and was not estopped from asserting that if it was bound by any contract it was the one under which it had operated from the time of its purchase of the property of the first corporation up to the time that the controversy had its origin. (108 S. E. 528.)

Company's Control of Appliances Not an Inference from Rules Printed on Back of Contract.—On a rehearing of McTerran vs. Merchants' Heat & Light Company (see Electrical World, Aug. 27, page 438), the Appellate Court of Indiana, which had found the defendant company not liable because of an electrical injury causing death, the court holding that the company did not own or control and therefore was not responsible for the defective apparatus to which the injury was due, refused to amend its former decision. Counsel urged that certain statements printed on the back of the sheet of paper on the face of which the contract was written constituted evidence from which the jurors might have concluded the company did control the apparatus in question, the contract being made "subject to the rules and regulations printed on the back" and something being said in these rules and regulations about appliances "installed in the premises by the company at its expense." The Appellate Court found no evidence whatever to bear out counsel's supposition, it having been conceded that the company did nothing more than connect its wire to the customer's switchboard. (132 N. E. 267.)

Pennsylvania Supreme Court on Police Power.—In reversing an order of the Public Service Commission of Pennsylvania for a reduction of tolls charged by a Bethlehem bridge-owning coporation to a street railway (New-Street Bridge Company vs. Commission), the Pennsylvania Supreme Court made these observations on police power: "It seems the growing tendency is to broaden the scope of the police power; it is now out of the question to hazard a definition of it, or even to decide that action such as indicated may not be declared a lawful exercise of this power. Judges in other days said it was for the benefit of the common weal, in furtherance of morality, health, safety, general prosperity and the like; but it is growing to be regarded by some more as the handmaid of socialism, without reference to any of the great fundamental principles on which organized society rests. The justification for the exercise of police power over these companies and their contracts was that their business occupied a peculiar position on the highways of the commonwealth, interwoven with the public life and of a nature essentially monopolistic in character, compelling the public to be their customer whether it would or not. They operated under charters and laws with certain governmental powers not given to ordinary companies. Indispensably creatures of the state, they dealt with the public directly and the public had to deal with them. As to the extent of regulation, this court has consistently held that neither the commission nor the Legislature could enter the field of public service activity unless it was for the benefit of the public generally, and then only after a fair return was made to the company, or, in other words, in the application of the police power confiscation could not take place." (114 At. 378.)

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities

Contract for Sale of Bonds Is Modified.—The practice of some California utilities of entering into a contract for the sale of bonds, subject to the approval of the Railroad Commission, encountered a snag when the commission modified the terms of an issue of $1,000,000 of 7 per cent bonds sought by the Southern California Gas Company. The utility on Sept. 26 had made a contract to sell this issue at 93½ per cent of its face value, plus accrued interest, and filed its application with the commission on Oct. 10. The matter was heard and submitted on Oct. 28. In the meantime, the commission pointed out, the bond market had improved, and the commission's order directed the company to sell the bonds at not less than 95 per cent net and accrued interest, without the payment of any commission or brokerage. The commission announced that it will be governed by market conditions as they exist at the time it passes on an issue of securities, and not by the market conditions as they existed at the time any contract to sell bonds was made.

Regulation of Off-Peak Service.—Canceling proposed limited-hour rate schedules of the Commonwealth Edison Company and substituting others as a result of complaint against the company's charges by a number of industrial companies, the Illinois Commerce Commission laid down the following principles as governing ones in the cases at issue: (1) The Illinois Commerce Commission has full authority over all public utility rates regardless of the fact that they may have been the subject of private agreement; (2) the failure of an electric company rendering service at reduced rates during off-peak hours to enforce restrictions on service is not a waiver of the right to enforce such restrictions; (3) an electric company should not be allowed to insert in a rate schedule for off-peak service a provision that when a consumer exceeds the allowable demand at the time of the peak hours he shall be billed for unrestricted service from the date of the contract or from the effective date of the schedule; (4) it is proper to include in an electric rate schedule for off-peak service a provision for placing a limited-hour consumer on the regular rate from the beginning of any month in which his demand first exceeds that permitted in the limited-hour rate contract; (5) it is proper to include in a rate schedule for off-peak electric service a provision that in case a consumer who has been changed from the limited-hour rate to the regular rate, after exceeding the allowable maximum demand, shall again elect to substitute the limited-hour rate and then shall again exceed the allowable minimum, he shall be billed retroactively under the regular rates to the beginning of the peak period then existing.

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*The left hand numbers refer to the volume and the right hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel—Responsibilities and Association Appointments of Men Engaged in Professional, Executive, Operating and Commercial Branches of the Industry

Charles E. Gurney has been appointed chairman of the Maine Public Utilities Commission, succeeding B. F. Cleaves, who resigned recently to become secretary of the Associated Industries of Maine. Mr. Gurney's nomination was unanimously confirmed by the Governor's Council Oct. 29, and he has entered upon his duties, with headquarters at Augusta. The new chairman was born at Portland, Me., forty-six years ago, and since his graduation from Colby College, in 1898, he has been engaged in legal practice. In 1917 he was a member of the Maine House of Representatives, and he was elected from Cumberland County to the State Senate for the sessions of 1919 and 1921. Upon the assumption of the governorship by Percival P. Baxter, following the death of the late Governor Parkhurst, Mr. Gurney was elected president of the Maine Senate, and he filled that office until his appointment as head of the Maine commission. To a representative of the ELECTRICAL WORLD Chairman Gurney said that it is his belief that the most valuable asset of a public utility is the confidence, good will and support of its patrons; that there is no deadline with public utilities on the one side and people on the other, and that honest and impartial regulatory policies must be mindful of the fact that along with their application should go a recognition of the fact that the money of the citizens is invested in these utilities.

C. E. GURNEY

Henry K. McIntyre, formerly associate professor of electrical engineering at the North Carolina State College of Agriculture and Engineering, West Raleigh, N. C., has been made full professor of electrical applications. George C. Cox, formerly instructor, has been made assistant professor of electrical engineering. William Hand Brown, Jr., remains professor in charge of the department.

R. Joel Andrus, until recently operating engineer of the Central Power Company at Grand Island, Neb., has been transferred to the engineering department of the Middle West Utilities Company in Chicago. Mr. Andrus is a graduate of the electrical engineering department of the University of Minnesota, 1907. He was with the Washington Water Power Company from 1907 to 1909 and district manager for the Pacific Power & Light Company in the Pasco-Kennewick district in Washington from 1909 to 1912. From 1912 to 1916 he was vice-president and general manager of the Northwest Electric & Waterworks Company at Seattle. He was the general manager of the Indiana Water & Power Company at Bloomfield, Ind., in 1916 and 1917 and has been with the Insull properties in Nebraska from that time to the present.

E. M. Walker, who was elected president of the Indiana Electric Light Association at the recent French Lick Springs convention, is president of the Terre Haute & Western Railway, which operates in Illinois as well as Indiana. For a number of years he was connected with the combined electric light and gas business and later had the duty of managing a gas, electric and street-railway business. Up to 1912 he was with the utility properties at Muscatine, Iowa. From 1912 to 1917 he was in charge of the electric light and street railway properties at Dubuque, Iowa, resigning in 1917 to go to Terre Haute, Ind., as the general manager of the company. He was president of the Iowa Electric Light Association for the year 1916-1917 and for the past year president of the Illinois Electric Railways Association. Mr. Walker is a native of England, having come to this country in 1887. He was graduated from Williams College in 1897.

E. M. WALKER

Arthur S. Blair has been appointed assistant superintendent of the general service department of the Edison Electric Illuminating Company of Boston. Mr. Blair entered the company's service in 1896 and was employed for a time in the generating department. He resigned in 1897, but re-entered the organization in 1903 as a test man in the laboratory, later becoming chief clerk and ultimately head of the office division, which post he occupied at the time of his latest appointment.

Charles K. Nichols, who has been appointed chairman of the Power Sales Bureau, Commercial National Section, N. E. L. A., is general power agent of the New York Edison Company. After leaving Pratt Institute in Brooklyn Mr. Nichols took up special work in industrial and works engineering in the Brooklyn Polytechnic Institute and then spent three years in practical work in New England textile mills. In 1902 he entered the service of the New York Edison Company and after filling several positions in the commercial department was placed in charge of the then newly organized power bureau. Since then he has handled all of the commercial power work for the company. Mr. Nichols has served as member of the industrial power committee of the A. I. E. E. and has long been identified with the activities of the N. E. L. A. both in the national body and in the New York Companies' Section. In the New York section he has been a member of the executive committee for several years. He was one of the original members of the Power Sales Bureau of the Commercial National Section, serving for two years as its vice-chairman.

C. K. NICHOLS

Prof. Alexander J. Wurtz, who has been in charge of the department of electrical engineering of the Carnegie Institute of Technology since the opening of the institute in 1905, has been named research professor in the new research division of the institute and will give the major portion of his time to this field of work, though he will still give one or two courses in the electrical engineering department. William R. Work, associate professor, who has also been in the department about fifteen years, has been promoted to professor and acting head of the department of electrical engineering, thus taking over the administrative work formerly handled by Professor Wurtz.

Harold B. Fisk, who was recently appointed manager of the Walsh Plate & Structural Works, Ltd., at Drummondville, Quebec, was born in England in 1885. He was educated at a grammar school and Kings College, London. After serving as a pupil with Baily, Grundy & Barrett, a firm of mechanical and electrical engineers, at Cambridge, England, he went to Canada in 1907, entering the service of the Shawinigan Water & Power Company as operator in the Montreal terminal station and being soon transferred to the head office of the company in Montreal. Mr. Fisk has also seen service with the British Canadian Power Company, now the Northern Ontario Power Company, Ltd., at Cobalt, being assistant to the general superintendent and afterward superintendent of the Matabitchouan River power development. He has been connected with the Toronto Power Company at London, Ont. and the Kaministiquia Power Company at Fort William, Ont. The period from 1916 to his present appointment he spent with the Southern Canada Power Company as superintendent of the Drummondville division. Mr. Fisk became a member of the A. I. E. E. in August, 1919.

H. B. FISK

Guy Barker, formerly in the engineering department of the Pacific Gas & Electric Company, is now associated with the H. W. Johns-Manville Company as electrical specialist, with headquarters in San Francisco.

Emory M. Coffin, formerly sales manager of the Pierce Fuse Corporation, Buffalo, and B. F. Perry, formerly district manager of the same company, have announced their resignation in order to form the Coffin-Perry Company, with headquarters at Columbus, Ohio. The new company will represent well-known electrical manufacturers in West Virginia, western Pennsylvania, Ohio and Kentucky.

N. I. Allen, for the past ten years connected with the Western Electric Company, Inc., has resigned as sales manager of the Providence (R. I.) branch and has become sales manager of W. A. Huse & Son, consulting electrical engineers and contractors, 128 Empire Street, Providence. The lighting and household-appliance departments of the organization will be placed under the personal supervision of Mr Allen.

T. M. Orchard has been appointed production manager of the Hygrade Lamp Company, Salem, Mass., succeeding A. B. Stetson, who severed his connection with the company Nov. 1 to enter another line of business. Mr. Orchard is a graduate of Bucknell University and of the Massachusetts Institute of Technology, and has been on the staff of the Hygrade company about a year. Mr. Stetson entered the company's service in 1916 after a successful career with the General Electric and Westinghouse companies .

D. K. Chadbourne has been appointed manager of the New York office of the Westinghouse Electric International Company. Mr. Chadbourne went to the Westinghouse company from the George Cutter Company in 1920, before the latter was affiliated with the Westinghouse organization, having served successively as Western district manager and Eastern district manager of the George Cutter Company for eight years, beginning in 1912. Before becoming connected with the Cutter interests he spent six years with the Allis-Chalmers Company. Mr. Chadbourne was graduated from Purdue University in 1906.

Frank M. Germane, known throughout the automotive and allied industries through his years of association with manufacturers' distribution of ball bearings, has resigned as director and sales manager of the Marlin-Rockwell group. Mr. Germane joined the old Standard Roller Bearing Company in 1903 as Western sales manager in Chicago, covering all the manufacturing plants from Buffalo west. Two years later he went to the Philadelphia factory as sales manager and became successively general manager and vice-president, when the company was absorbed by the Marlin-Rockwell interests.

Charles P. Cushway has been appointed manager of the cable and specialties department of the Belden Manufacturing Company. Mr. Cushway joined this company in 1918 and since then has served as junior and senior engineer and as assistant chief engineer. Previous to this he had been with the Commonwealth Edison Company in its meter-testing department. Mr. Cushway received his education at the Crane Technical High School and in the electrical engineering course at the Armour Institute of Technology.

C. P. CUSHWAY

Obituary

Leon H. Scherck, general sales manager of the Central Hudson Gas & Electric Company, Poughkeepsie, N. Y., died suddenly on Nov. 16, of angina pectoris. Mr. Scherck was born at New Orleans in 1876. He was graduated from Tulane University of New Orleans. Soon after graduation he was associated with Isadore Newman & Sons, bankers of New Orleans, and later with Ford, Bacon & Davis, engineers of New York City. In 1909 he became general sales manager of the Central Hudson Gas & Electric Company, which position he held at the time of his death. Mr. Scherck was nationally known as an authority on matters dealing with public utility sales. He was also largely interested in local affairs and was president of the Poughkeepsie Chamber of Commerce during the year 1917.

L. H. SCHERCK

Prof. Charles R. Cross, for forty-three years actively connected with the Massachusetts Institute of Technology and because of whose foresight and zeal the institute offered the first degree given in an electrical engineering course in the United States, died Nov. 16 at his home in Brookline, Mass. Professor Cross was born at Troy, N. Y., in 1848. He was graduated from the Massachusetts Institute of Technology in 1870 and in 1871 became an assistant in physics. After seven years' service he was appointed professor of physics, and in [illegible] he became director of the Rogers Laboratory, which post he held until a few years ago, when he retired with the title of professor emeritus. The inclusion of electrical studies in the physics courses and their later extension into an electrical engineering curriculum at the institute was largely due to Professor Cross's recognition of the increasing importance of electrical applications in civilized life. He was an authority on sound and played an important part in telephonic development. As a teacher he was noted for his pioneer vision, thoroughness of work and devotion to the highest standards of student training. In the days when the institute itself was largely an experiment Professor Cross's self-sacrificing service was no small factor in its success.

Trade and Market Conditions

Business Reviews, Together with Market Letters
from Important Trade Centers, on the Supply, Demand and Prevailing Prices of
Electrical Apparatus and Supplies

Electrical Sheet Firm in Unsteady Steel Market

PIPE and tubular goods seem to be the most favored of iron and steel products at the present time, and they are barely holding their own. Steel sheets are sagging consistently, though it was only a little over a month ago that a number of independent sheet makers notified their customers of a five-dollar-per-ton increase in sheet prices which brought quotations to 3.25 cents on black, 2.75 cents on blue annealed and 4.25 cents on galvanized on Oct. 15. These quotations endured for some time, but in the last two weeks weakness has developed, and sheets may now be obtained from several sources for 2.75, 2.25 and 3.75 cents for black, blue annealed and galvanized respectively.

Production of sheets is still fairly high, some mills running as high as 80 to 85 per cent of capacity, though the general average for steel products is only around 50 per cent. The output of electrical sheet still remains low, however, and producers have their stocks well ahead of demand. Buying is considerably better than a month ago. Then even inquiries were somewhat scarce. Transformer manufacturers are coming into the market more boldly, and one producer is said to have obtained several good orders for electrical sheet from this source. Motor manufacturers apparently are out of the electrical sheet market, though it is felt that the movement of popular-size motors will encourage them to come into the market for raw materials soon. The prices of electrical sheet have not been affected either by the two increases on ordinary sheets put into effect Sept. 15 and Oct. 15 respectively or by the weakness of the present market.

October Electrical Exports Show Moderate Increase Over September

ELECTRICAL exports for October, 1921, are valued at $4,970,332, showing an increase over the preceding month this year of $91,449, or less than 2 per cent. However, as compared with October, 1920, there was a loss of $5,007,883, or approximately 100 per cent. This decrease would be startling if it were not for the fact that many of the items listed have decreased in money value from 25 to 30 per cent during the twelve months that have elapsed. That exports have shown even a slight upward turn, however, is taken for a sign of encouragement, and there is hope that the bottom of the curve, which has been going down since March of this year, has been reached. September was the lowest month this year, and the previous lowest month, August, is still ahead of October in value of exports.

The value of exports for the year to date is still considerably ahead of that for the first ten months of 1920, and it may be taken for granted that the volume is far ahead. The total value up to Nov. 1, 1921, is $86,143,034, while that for the corresponding period in the previous year is only $78,318,655. However, it is doubtful whether the end of the year will see this ratio still good, as at the present rate last year will eclipse this by several million dollars. Under the present conditions in the export field the fact that the current year's total will come so close to that of 1920 may be taken hopefully.

Only seven articles show decreases for this ten-month period, including batteries, carbons, interior wiring supplies, arc lamps, metal-filament lamps, magnetos and rheostats and controllers. The most important decrease was on batteries, amounting to $1,898,980, or approximately 56 per cent of total exports of this item for 1921 to date. Excluding the miscellaneous classification, eleven totals show increases, some of the more important being dynamos and generators, insulated wire and cable, motors, telephones and transformers. Transformers continue to hold the lead in percentage of increase, being almost exactly 100 per cent ahead of last year, with a total of $7,444,257.

A comparison of October and September of this year shows that the past month exceeded September totals in only eight items, including interior wiring supplies, arc lamps, carbon lamps, metal-filament lamps, magnetos and spark plugs, rheostats and controllers, switches and accessories, and transformers. As in the previous month, transformers made the best gain, one of approximately 35 per cent. Insulated wire and cable, with a total of $177,536, showed the largest drop, being 30 per cent behind September.

			Nine Months Ended October	
	Oct., 1920	Oct., 1921	1920	1921
Batteries	$483,109	$211,758	$5,368,371	$3,469,391
Carbons	137,760	26,526	1,223,591	373,832
Dynamos and generators	970,840	779,338	5,625,877	6,784,154
Fans	55,212	15,444	986,202	1,198,509
Heating and cooking apparatus	182,715	74,302	1,443,578	1,493,747
Insulating wire and cable	575,041	177,536	5,873,334	7,799,532
Interior wiring supplies	282,999	86,822	2,617,167	1,644,985
Arc lamps	1,548	1,250	3,312	1,879
Carbon-filament lamps	16,871	3,980	87,826	119,376
Metal-filament lamps	354,536	104,889	3,111,320	2,920,052
Magnetos, spark plugs, etc.	317,891	140,068	2,982,755	1,269,801
Meters and measuring instruments	254,876	161,462	2,123,176	2,509,383
Motors	1,255,539	525,142	10,154,662	13,997,773
Rheostats and controllers	64,251	77,735	1,225,855	964,363
Switches	425,615	176,154	3,473,439	3,846,199
Telegraph apparatus	24,751	42,769	506,185	928,942
Telephones	282,488	163,397	2,877,427	4,235,552
Transformers	785,300	464,281	3,765,486	7,444,257
All others	3,516,873	1,737,479	24,853,509	25,106,503
Total	$9,988,215	$4,970,332	$78,318,655	$86,143,034

In only two items did the month surpass October, 1920. They are telegraph apparatus and rheostats and controllers. All other items showed a decrease. Motor exports have fallen off most, being valued at only $525,142, as against $1,255,539 in October, 1920.

Figures in the accompanying table have been received from the Bureau of Foreign and Domestic Commerce, Washington, D. C.

Pole Producers Awaiting Freight Reduction

ANY drop that may come in pole prices before the end of the coming season in the woods, according to a large producer, is entirely contingent upon the movement of freight rates. The present stock of poles was brought out of the woods when labor costs were at their peak, and it will be well into spring before a new supply cut under better labor conditions will be available. What lower freight rates in the meantime would mean to buyers can be seen by comparing delivered prices in various cities of the East. A 40-ft., 8-in. Western red-cedar pole is delivered f.o.b. New York for $19.50, in Buffalo for $18.50, in Pittsburgh for $18.10 and in Toledo for $17.55. When the freight rates from the mill to two points as close together as New York and Toledo show a differential of $1.60, it is not difficult to see what a reduction of from 20 to 25 per cent would mean in the cost delivered of several carloads of poles. Prices are now about 200 per cent in advance of the 1915 prices, 90 per cent of the increase, the producers claim, being accounted for by freight rates and the other 10 per cent by higher labor costs and overhead. At the present time there has been some reduction in rates in the territory west of the Mississippi River, and producers are looking forward to similar action in the Eastern classification territory.

In spite of the fact that some potential buyers are holding off on account of the possibility of lower prices, October is reported to have been one of the best months for pole producers in the last year. There has been some new construction work in the East with quite a bit of maintenance and replacement activity in the South and Middle West. Supply is the best for some time, being sufficient to fill almost any demand. One large producer reports over 2,000,000 poles in stock in various yards throughout the country. There is no difficulty in obtaining cars for shipment, one producer even having gone so far as to permit his privately owned cars to be put on sidings.

Freight and Interest Cut Will React on Electrical Industry

TWO important steps toward readjustment of business conditions have just been taken in the reduction of the Federal Reserve rediscount rate to 4½ or 5½ per cent, depending on the locality, and the cut of 10 per cent in freight rates on agricultural products. In the opinion of several large electrical manufacturers and jobbers interviewed by a representative of the ELECTRICAL WORLD, these reductions should react favorably for them within the near future.

At the present time the farmers in many parts of the country have been unwilling to liquidate their loans with the cash they have received for their season's crops, but the reduction of interest rates will induce them to do so in order to take advantage of the lower rate on new loans. This action will free considerably more money, and the opportunity will then be ripe to push the sale of farm light and power plants, 32-volt accessories, farm-line equipment, appliances, etc. Moreover, a general liquidation will result from this, extending back through the dealer to the jobber and to the manufacturer. Not much of this has been observed as yet on account of the comparatively short time the new rate has been in effect.

Lower freight rates on agricultural products, coming now at the season when crops are moving well, are hoped to have the same effect—that of freeing more money in the farm district, with the same happy consequences.

Christmas-Tree Lighting-Set Business Expected to Be Good

ADVICES received from both manufacturing and distributing sources in the past week indicate that for the next two months business in miniature lamps, including Christmas-tree lighting sets, is expected to be good. It is true that a good many jobbers and some dealers had a carryover from last year, but this was not unwieldy, and in addition a new type of outfit has been put on the market and there have been good orders for this as it has proved popular with the public.

In the East jobbers already have or have on order from one-half to two-thirds of the stocks they put in last year, but as there was very little carryover these orders may be regarded as cautious feelers. As yet dealers in that section are not expressing any active demand, but things are expected to open up more fully about the first of December as retailers seem reluctant at present to order from jobbers unless they are being prodded by the public. Three leading jobbers in New York expect to dispose of from 750 to 1,000 sets each this year. These figures are from 25 to 30 per cent below last year and are conservative estimates of business which is almost sure. The eight-light set, which is proving a popular type, is listed at $4.75 with 40 per cent off in lots of one to twenty-five and 45 per cent off in lots of twenty-five to fifty.

In New England small-lot buying is under way from jobbers. So far, the report continues, there is little tendency to stock up, but orders very probably will expand as the holidays draw nearer. The same eight-light set is selling at $3 net in Boston, there being included attachments for adding lamps without wiring back to the base plug or receptacle.

In the Middle West both jobbers and dealers seem to be moving cautiously, with neither carrying very heavy stocks. Jobbers estimate that this year's business will be within 15 or 20 per cent of last year's, or even closer. The carryover from last year was not excessively heavy, and as a result manufacturers expect to do a good business there.

Pacific Coast reports are optimistic, inasmuch as dealers there have ordered their full quota for the season in spite of the fact that the carryover from last year was fairly heavy. Here again the popularity of the eight-light set overshadowed the question of the carryover. Jobbers there are expecting delivery of their orders within the next couple of weeks.

The market on other miniature lamps is picking up also. The booking of a leading manufacturer has increased 40 per cent in the last three months on automobile lamps and other miniatures. Whether this is due to more confidence on the part of jobbers and dealers or to an actual increase in use it is difficult to say. This same manufacturer reports the possibility of a shortage of Christmas-tree lighting sets if demand is equal to that of last year, as some makers cut down their production considerably earlier in the fall. Business in flashlight bulbs is picking up also, this being a seasonal phenomenon. Manufacturers state that, strangely enough, the demand curve for miniature lamps is fairly steady all the year round and has been for the last two years, whereas before that there was a heavy demand in October, November and December of each year and a light demand the remainder of the year.

Foreign competition in the miniature lamp business seems to be on a par with last year, about 8,000,000 lamps being imported up to Oct. 1.

Metal Market Situation

THE domestic copper market during the past week has been featured by purchases by the brass makers and the rolling mills, as was the case the week before. Wire makers placed a few orders, but their needs are reported to be well covered. There is a distinct improvement in copper, and not for some time have the producers been more optimistic about the outlook. One most noticeable development has been the disposition on the part of consumers to provide against future requirements, and considerable business has been reported covering deliveries over the first half of next year.

Some of the largest sellers are consistent in their unwillingness to quote beyond January, but it is much rumored that sales have been made extending shipment as far ahead as June. The effect of this buying has been to strengthen the hands of the sellers, and the market has been advancing steadily an eighth of a cent at a time. Spot prices on electrolytic have been fixed at 13¼c. by the refineries.

NEW YORK METAL MARKET PRICES

	Nov. 14, 1921	Nov. 21, 1921
Copper	£ s d	£ s d
London, standard spot	67 0 0	67 0 0
	Cents per Pound	Cents per Pound
Prime Lake	13.25	13.37½—13.50
Electrolytic	13.12½	13.25
Casting	12.37½	12.50—13.62½
Wire base	14.75	14.75—15.00
Lead, Am. S. & R. Co. price	4.70	4.70
Antimony	4.70	4.55
Nickel, ingot	41.00	41.00
Sheet zinc, f.o.b. smelter	9.00	9.00
Zinc, spot	5.20—5.25	5.15
Tin, Straits	28.75	29.75
Aluminum, 98 to 99 per cent	24.50	29.50

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	10.50 —10.87½	10.50 —11.00
Brass, heavy	5.00 — 5.25	5.00 — 5.25
Brass, light	4.75 — 5.00	4.75 — 5.00
Lead, heavy	3.75 — 4.12½	3.75 — 4.12½
Zinc, old scrap	2.50 — 2.75	2.50 — 2.75

THE WEEK
IN TRADE

Prices When Quoted Are Those Prevailing at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

JOBBERS in all sections of the country report a steady movement of supplies, though not much improvement over October is noted by any center but New York. Several large New York jobbers have stated that if the present volume of sales continues the current month will be unusually satisfactory. Much of this business is in wiring supplies. In New England business is running along smoothly and retail trade is improving noticeably owing to better general business conditions there. As a contrast to this, retail sales in Atlanta and the Southeast have slumped, though jobbers are finding satisfactory business.

A few price cuts have come through during the week. Chicago notes a 10 per cent cut on high-tension equipment, New York a 5 per cent lower discount on outlet boxes, and the Pacific Northwest a slight reduction on switch and conduit boxes, knobs, tubes, cleats and pole-line hardware.

Construction seems to be keeping up unusually well for the time of year and wiring materials are going well. In the Pacific Northwest wiring work is so plentiful that there is a shortage of electricians.

NEW YORK

Activity in the electrical trade has held up well this week, and the demand for wiring materials is increasing gradually. Jobbers report that at the present rate of increase November sales will exceed those of October despite the fact that there were three extra holidays in this month. Prices remain virtually the same as last quoted, with the exception of outlet boxes, which have been advanced about 12½ and 14 per cent for galvanized and black boxes respectively. On a few items some price competition has appeared; however, this has been caused by the desire to move large stocks and is by no means general.

Little change has been noted in the demand for heating appliances and household devices. Manufacturers are again warning the trade against last-minute orders for holiday delivery. It is expected that this business will develop rapidly after Dec. 1.

Conduit.—Prices have stiffened slightly this week on the strength of the generally better tone to business and increasing demand. Jobbers' prices this week ranged as follows: For ½-in. black pipe in 2,500-ft. lots, $48.29 to $50.83; ¾-in., $62.06 to $65.32, and 1-in., $88.51 to $93.16 per 1,000 ft. Galvanized pipe in the same sizes was quoted at $53.19 to $55.93, $68.61 to $72.22 and $98.91 to $103.36. Stocks are good in the above sizes.

Rubber-Covered Wire.—Conditions in the wire market remain about as last reported. Demand is moderate and orders are for small quantities. In 5,000-ft. lots No. 14 rubber-covered is quoted at $6.50 to $6.60 per 1,000 ft. It is understood that jobbers with large stocks have shaded these prices slightly on orders for larger quantities.

Flexible Armored Conductor.—The active demand for this material continues, and while jobbers' stocks are low and the available supply from manufacturers is limited, prices remain unchanged. No. 14, two-wire, single-strip, is quoted at $44.50 to $46 per 1,000 ft. in lots of that quantity. Double-strip is quoted at $46.50 to $48 per 1,000 ft.

Loom.—Prices on this material remain about as last quoted, although manufacturers claim that because of the cost of cotton present prices are unprofitable. Both the 7/32-in. and the ¼-in. sizes were quoted at $18 per 1,000 ft. in that quantity.

Lamp Cord.—Demand is only moderate and stocks generally are good. No. 18, cotton, twisted, sells for $12.90 per 1,000 ft. and parallel in the same size sells for $15.60 per 1,000 ft.

Outlet Boxes.—An advance of about 14 per cent on black boxes and 12½ per cent on galvanized boxes became effective the first of this week, when the maximum discount was decreased 5 points. Formerly the maximum discount on black boxes was 65 per cent and on galvanized boxes 60 per cent. This has been reduced to 60 per cent and 55 per cent respectively.

Schedule Material.—Like other items of wiring supplies, this material is moving satisfactorily. Jobbers' stocks are good. In standard package lots key sockets were quoted at $18.15 per 100 and full sockets at $33 per 100.

CHICAGO

Although the electrical business has been steady in nearly all lines, the outstanding feature of the week was a 10 per cent reduction on high-tension equipment by a local manufacturer. The steady flow of electrical goods is encouraging to jobbers and dealers, but the majority of them feel that a slow but firm revival of business would be more beneficial to the industry than if a selling boom were started with the possible precipitation of a "second depression." Jobbers and dealers are alert for future business, and they are also in the field for new supplies since their stocks are often on limited bases.

The organization of more than 150 civic and business men for the purpose of supporting the Landis award is continuing to gain strength; and since a majority of business men are backing this movement, some strong action may be expected to develop.

Wire.—Movement on No. 14 rubber-covered wire has been steady during the week, although it still sells for $6.50 to $6.60 per 1,000 ft. in 5,000-ft. lots. Weatherproof has not changed in price or demand and is selling for 16½ cents a pound in 1,000-lb. lots. Bare wire base remains at 16½ cents, and jobbers report some fair sales.

Conduit.—Action on conduit has been on the increase, but ½-in. black pipe still sells for $46.60 to $48.50 per 1,000 ft. in 5,000-ft. lots. Jobbers' stocks are sufficient to meet the present calls, and many are adding to their supplies only when necessary.

Flexible Armored Conductor.—This material has moved steadily during the week, showing that suburban residential building is continuing. The No. 14 two-wire double-strip price ranges between $47 and $50 per 1,000 ft. in 5,000-ft. lots. A number of jobbers have stocks on hand to supply a large amount of trade, but in general the majority of jobbers are working on small stocks.

High-Tension Equipment.—One manufacturer announces a reduction of about 10 per cent on practically all his line of equipment. Sales on heavy busbar supports seem to indicate that central-station companies are giving some thought to future extensions and also to replacement of present inadequate apparatus. Another manufacturer reports a sale of complete high-tension equipment, including the steel structure, for two 6,000-kva. substations for Pennsylvania coal mines. Still another company tells of a large order for indoor substation apparatus for a central station in the Pacific Coast region.

Poles.—Movement on poles has declined slightly from the activity previous to the railroad strike threat. A 30-ft., 7-in. top Western red cedar pole sells at Chicago for $7.50, a slight reduction in price from the previous quotation. Stocks are still large.

Heating Appliances.—This line continues to be the center of interest in the retail trade. Ironers and heating pads are reported as the leaders, while hollow ware, grills and toasters are not far behind. Open-air heaters are selling well with the continuance of cold weather.

Farm-Lighting Plants.—Fair sales on small to medium-size outfits have been reported.

BOSTON

Business ran on an even keel last week, the principal demand being for wiring material. No shortages were reported, and jobbers bought mainly for current needs. Prices underwent minor readjustments in the schedule material line. Building and engineering contracts for the week ended Nov. 15 totaled $2,743,000 for New England. Retail trade is improving, and the latest statement of the Federal Reserve Bank of Boston reports that sales of the eight largest department stores of Boston in October were the greatest for any month this year and 5.8 per cent ahead of October, 1920. Retail trade outside Boston has begun to increase, with favorable comparisons against last year's business. A slight turn for the better is evident in the metal-working factories of New England, and the textile industries continue their excellent volume of output. Prospects of better labor conditions in the shoe industry were features of the week-end news.

Wire.—Widely scattered wiring jobs are causing fair sales, though orders are of moderate size for the most part. Rubber-covered No. 14 sells at $6.25 per 1,000 ft. in 5,000-ft. lots to $6 in 25,000-ft. consignments. Weatherproof wire is showing little activity, the base being 15½ cents. Scarcely any bare wire seems to be moving at present except occasionally for extensions of central-station bulk service supply.

Radiators.—Unseasonably warm weather has retarded sales. Stocks are in good shape for immediate requirements should a cold spell emphasize the value of this equipment. Prices are steady, and considerable competition between makes of different grades is in prospect.

Lamps.—Continued active demand is reported, with current needs being comfortably served. Prices are steady, but revisions in the miniature schedules are expected soon.

Meters.—Trade is more vigorous than for some time. Modifications in wiring requirements due to the new code in connection with carrying conduit to the service box are causing some additional meter sales, it is reported. Interest in combination meter and safety switch installations is more evident. Meter stocks are not being strained by present demand, so far as has been learned.

Loom.—The demand is relatively dull. In 5,000-ft. lots 7/32-in. loom sells for $16.50 per 1,000 ft. and ¼-in. loom for $19. Stocks are plentiful.

Sockets.—Light sales are reported, with no difficulty in getting orders filled promptly. Prices are steady, case-lot quotations on pulls being 31½ cents net, keys 18 cents, and keyless 16½ cents. Brass manufacturers are a little busier, and a gradual improvement in demand appears to be under way in the switch and socket-making plants.

Appliances.—A lull in this class of trade appears to be on. Slow recovery in the unemployment situation is affecting purchasing power, but in retail circles better business should be experienced in a week or two at the outside. It appears probable that jobbers will be called upon this year to supply current demands well into the Christmas season, owing to the amount of small-order buying which has characterized the fall trade.

ATLANTA

Reports from retailers indicate that somewhat of a slump in the amount of business done this week from that of several weeks preceding is in evidence, owing possibly to inclement weather. The electrical jobbing business, however, seems to be holding the pace of prior weeks. No increase has been registered for the past fortnight, orders having settled to a fairly uniform volume. Jobbers report that their orders on manufacturers will be very light from now until the first of January, purchases being made only on the hand-to-mouth basis. Plans for a systematic agricultural marketing program are beginning to crystallize, and in a large number of the small cities throughout the State grain warehouses have been established. If the Farm Bureau's plans materialize, it will provide for a more systematic marketing throughout the State and less fluctuation in business conditions in rural districts. The general improvement in conditions is reflected by statistics which show that sales for August, 1921, in the Sixth Federal Reserve District approximate 180 per cent of those for August, 1917, the third largest percentage of all of the reserve districts.

Outlet Boxes.—In the face of a rather slow movement in this line an advance in price of 5 per cent is announced this week. Stocks are in excellent shape.

Meters.—A slight increase in the volume of sales is to be noted, the 5-amp. and 10-amp., two-wire type constituting approximately 90 per cent of the business. Jobbers' stocks are fair to good in all sizes.

Condulets.—A steady demand is reported in all sizes, with no recent change in price. Stocks are ample.

Portable Lamps.—Local retailers' stocks will be complete within the next ten days. This specialty is already moving quite satisfactorily, and local firms anticipate a volume almost up to that of last year.

Toys.—Jobbers' stocks are in good shape, despite the fact that they have placed few orders on manufacturers owing to heavy carry-overs. Retailers are just beginning to send in orders for their holiday requirements.

Insulators.—Porcelain and glass telephone insulators rated for 2,300 volts fail to keep pace with pole-line material, the demand not being quite up to expectations. Stocks are good, with no recent price change.

Lamps.—As was to be expected, this line is moving excellently, particularly in the 60-watt and 75-watt tungsten and 75, 100 and 150-watt type C. The series street lamps are very slow. Stocks are in good shape.

Porcelain.—The movement in this line is confined to "Nail-it" knobs, cleats and 3-in. tubes, none of which, however, is selling as well as has been the case for the past two weeks. Jobbers' stocks are good to heavy.

Oil Switches.—Industrial activity has created a fairly good demand for the 550-volt and 2,300-volt oil switches of the automatic type. In the more popular sizes stocks are in good condition, while factory shipments are prompt on the larger sizes.

High-Tension Arresters.—In voltages up to 38,000 there is a fair demand. Manufacturers are making very prompt and satisfactory shipments. No recent changes in price are to be noted.

ST. LOUIS

Jobbers generally report improved business. Appliance sales have naturally been a feature owing to holiday-goods buying, but improvement was also noted in wiring supplies, both industrial and residential. The volume of appliance orders being placed by the dealers is keeping jobbers' stocks at a low point, there being an actual shortage of some items. Jobbers are buying cautiously, however, as good factory deliveries can be had. The demand so far has been almost entirely for heating appliances. One jobber is of the opinion that the holiday trade this year will be as good as it has ever been in the past.

A strong effort is being made by all those interested to get building costs on such a basis as will stimulate construction work. Assurances have been given by prospective builders that they will start construction by April 1, 1922, on work totaling $14,200,000, if labor will accept a 20 per cent reduction in wages and if material prices are cut about 12 per cent. Of the amount pledged, arrangements have been made to finance all but about $2,000,000. A leading banking house has offered to reduce the regular commission for making loans from 3 to 2½ per cent. If some agreement between all those interested is reached, the entire electrical industry here will be materially benefited.

Wire.—Some improvement was noted in the movement of the larger sizes of rubber-covered last week, resulting from the improving condition of the industrials. Stocks of the larger sizes are somewhat heavy, but No. 14 rubber-covered supplies are short. The latter wire is selling from $6.40 to $6.50 per 1,000 ft. in 10,000-ft. lots. The base on bare and weatherproof remains around 16 cents per pound.

Knobs and Tubes.—Stocks are low, and one jobber's stock is completely exhausted. The demand has been increasing because of better residential work and because contractors and dealers are carrying heavier stocks. "Nail-it" knobs are priced at $17.50 per 1,000, 2½-in. tubes at $5.25 per 1,000, and 3-in. tubes at $5.75 per 1,000, all prices being for barrel lots.

Switches.—Reasonably good business is reported, with a tendency to increase because of continued residential work. Stocks are in good condition. The 5-amp. single-throw non-indicating snap switch sells for $20.20 per 100, and the same switch of the indicating type sells for $23.20 per 100. The single-throw push-button switch is priced at $21 per 100; the three-way push-button switch at $30 per 100, and the single-gang plate at $8.40 per 100.

Conduit.—Short stocks of ½-in. black conduit continue, and stocks of ½-in. galvanized have been somewhat reduced. However, stocks of the larger sizes remain heavy. The call for residential work continues good. Half-inch black is priced at $47.25 and ½-in. galvanized at $53.15, both per 1,000 ft. and in bundle lots.

Tape.—The following prices have been established by a leading jobber on friction tape: Less than 5 lb., 45 cents per pound; 5 lb. to 50 lb., 37 cents per pound; 50 lb. and more, 34 cents per pound. Prices on rubber tape are about the same. Stocks here are somewhat low, and movement the past few weeks has been on an attractive scale.

Waffle Irons.—An unexpected development of the holiday purchasing is the strong demand for this item, and the stocks of a number of jobbers are entirely gone, though early replacement from the factory will be made. The substantial reduction in prices made since last year is the principal contributing factor.

SAN FRANCISCO

No great amount of new large construction is reported, most of the permits being for flats, bungalows and smaller apartments. However, many of the larger office buildings have reached a stage where they are ready for their electrical equipment, so that a steady call for roughing-in material and wiring devices is reported. On the other hand, there is a decided drop in the sale of appliances, especially of the larger kind. The rules of the industrial show covering California-made products, which opened in San Francisco on Nov. 19, have been amended to permit some local dealers to display electrical devices largely sold, although not manufactured locally. It was felt that this business required some stimulation which the fair could give.

Farm Lighting Plants.—The current year has not been an altogether disappointing one, despite lower sales than those of last year, because the same condition is true of many other lines that are far better known and advertised. In fact, the sales even as they are guarantee that farm plants are now definitely established as indispensable farm adjuncts and assure a good season for 1922. The average outfit sells locally for about $500.

Lamps.—The lamp season is approaching its peak with no sign of any shortage or delayed orders. A slightly increased call for white tungstens is reported. The Oakland lamp works are being enlarged so that not only Edison and National lamps but also Westinghouse lamps will be assembled and stored.

Christmas-Tree Outfits.—Almost every dealer has ordered his quota for this season, the orders being surprisingly large in view of the fact that a considerable number of outfits were carried over from last season. This greater demand is probably caused by the new type of outfit sold in multiples of eight. Jobbers' stocks are still enroute from factory.

Washing Machines.—The demand is now lower than it has been all year. This sudden slump is surprising, for general conditions are no worse than they have been and the financial wounds of the builders' strike are almost healed. Tumbling prices and the expectation of future decreases have probably produced this condition.

PORTLAND—SEATTLE

General business seems to have slackened a little compared with preceding weeks. The outstanding feature of the return to normal is the unusually heavy shipments from the ports of Portland and Seattle. These consist principally of lumber, apples and grain. Electrical jobbers report satisfactory conditions, but business is not characterized by any sensationally large contracts as in boom times. A steady, healthy demand exists, however, and the coming holiday trade is expected to stimulate things for the next month. Jobbers of Portland report activity in appliances, line material and in wire of the smaller sizes, indicating a continuous activity in residence building. Slight price reductions in switch boxes, conduit boxes, knobs, tubes, cleats and pole-line hardware were announced last week. Contractor-dealers report unusually good business, particularly in the contracting line. There are in fact so many wiring jobs on hand that there is a scarcity of journeymen electricians.

Rubber-Covered Wire.—The market has been strengthening steadily during recent weeks, and quotations are somewhat higher. No. 12 sells at $9.20 per 1,000 ft. in 5,000-ft. lots, while No. 14 is quoted at $7. The demand for moderate-sized lots is very good. Local stocks are good.

Pole-Line Hardware.—A normal demand to take care of replacements and minor extensions is noted in this material. Some large orders for New York are in prospect. Following a weak market, price reductions averaging from 15 to 20 per cent in the various items have been made.

Household Appliances.—Among the larger items of household appliances, ranges and washers continue as the best sellers. These are rapidly becoming recognized as economical and convenient, if not actual necessities. Of electric ranges this is increasingly true, since increases in gas rates, coupled with a reduction in heating value, have made the use of gas in this section expensive and relatively undesirable. These facts, together with considerable price reductions from the peak values, have resulted in a very satisfactory movement in this line.

SALT LAKE CITY—DENVER

A general strike in the coal-mining regions of Colorado has been called and is already seriously affecting production. The military force has been called out by the Governor to preserve order in one of the chief mining counties, with prospects of the emergency measure extending to other affected areas. Conflicting reports as to the seriousness of the strike are rife, but it seems fairly certain at this writing that the unions have already accomplished a 50 per cent reduction in the state's coal output. No prospect for immediate settlement is yet in sight. The unions are protesting against a proposed 30 per cent reduction in the wage scale.

A noticeable increase in the number of unemployed in the Intermountain territory is reported by official statisticians. The reason for this condition is the falling off in demand for farm labor at the end of the harvesting season. It is expected, however, that thousands of jobless men will find work on projected highway construction that will soon be under way as a result of the federal aid law. Several million dollars is now available for road building, and the Intermountain States are hastening the launching of extensive construction.

The copper metal market has improved substantially during the past three months. Against a monthly output of 40,000,000 lb. the deliveries by the refineries in August were 104,000,000 lb. and in September 109,000,000 lb., while October is believed to have been fully up to the previous month. At this rate of consumption it is fair to forecast augmented production before many months have passed. The merging of several big steel, coal and iron corporations for the purpose of the development of the steel resources of Utah promises a significant expansion of business and industry which will largely affect the Intermountain country.

A big building boom is said to be waiting on a reduction in the cost of materials, especially cement, a reduction in freight rates and an adjustment of interest rates.

Manufacturers' Activities

Devoted to the Business Side of Manufacturing, Distribution and Sales, News from Jobbers and Foreign Fields and a Record of New Devices and Trade Literature

Sales of Farm-Lighting Sets Improving

Sales of farm-lighting sets the country over show a real improvement over last year, declared E. B. Dunigan, New England manager of the Delco Light Company, to a representative of the Electrical World a few days ago. Out of twenty-eight sales districts all but four show an increase in business, including pumping equipment, and the whole country from Jan. 1 to Oct. 31 showed a gain of about $25,000 compared with the same period of 1920. While this gain is not a striking one, it indicates a thoroughly satisfying change in the trend of business and taken in connection with recent price changes presages well for the future demand for this class of equipment. Purchases of lighting sets by farmers of moderate means and by summer cottagers have been active this year.

New Cable & Cord Company

The McConnell Cable & Specialties Company, 426 South Clinton Street, Chicago, has been organized by P. G. McConnell, formerly a department manager of the Belden Manufacturing Company, Chicago. Mr. McConnell resigned Oct. 31 in order to enter the electrical cable field for himself and will specialize in special cords and connectors and automobile electrical accessories.

Westinghouse Service Department Changes

The Salt Lake City service department of the Westinghouse Electric & Manufacturing Company has been made a branch of the Denver office under the direction of A. F. Maccallum, district service manager, Denver. M. R. Davis, formerly district service manager at Salt Lake City, will remain there and devote his time to sales service work and to securing repair business for both shops. There have been changes also in the Seattle office, according to the announcement of the company, B. B. Burkett having been appointed district service manager to succeed N. P. Wilson. Mr. Wilson has been transferred to sales service activities on switchboards and similar apparatus in the Seattle territory.

Milwaukee Company to Make Electric Alarm Posts

The Fire & Police Alarm Post Company, Milwaukee, recently incorporated with a capital stock of $25,000, will develop the manufacture of patented cast-iron and steel posts for fire and police alarm telegraph systems, automatic traffic-handling devices and similar equipment designed by Hugo A. Kleinsteuber, assistant superintendent of the Milwaukee fire and police telegraph alarm division. The general office of the company is at 120 Miller Building, while the factory, newly acquired, is at Thirty-ninth Avenue and Mitchell Street. The officers of the company are: President, P. J. Hayes; vice-president, Leopold Wieland; secretary, C. L. Harder; treasurer, G. F. Carroll. The posts will be marketed through agents in various cities. The Milwaukee municipal government already has purchased 250 of the posts.

Electro Refractories Corporation to Rebuild

The Electro Refractories Corporation, Ellicott Square, Buffalo, contemplates rebuilding its factory, which was recently destroyed by fire, causing a loss estimated at $200,000. The contract for the new plant, which is to cost approximately $100,000, has been let to Harding & Crea, Buffalo, and includes a factory, 50 ft x 300 ft., and a machine shop, 30 ft. x 75 ft., on Town Line Road, between Buffalo and Lackawanna. Construction will be started at once, according to L. U. Milward, manager of sales, and the company expects to be back in production by Dec. 15.

Tindall & White Acquire Perfection Company

Tindall & White, Inc., 329 East Twenty-second Street, New York City, have taken over all the rights and interests of the Perfection Sales Company, formerly at the same address. The company will continue the manufacture of the Perfection shade, and all-metal lighting bowl. The personnel of the old company will remain under Tindall & White. The officers of the company are: President and general manager, W. L. Tindall; treasurer, R. W. Tindall, and secretary, C. A. White.

Electric Vehicle Men Hold First of Monthly Luncheons

The first of a series of luncheons to be given by and for men interested in the electric vehicle business of New York was given on Nov. 17. According to the announcement sent out by Charles R. Skinner, Jr., of the New York Edison Company, the luncheon was entirely for the purpose of getting the New York electric vehicle men together and promoting the feeling of good-fellowship and co-operation which already exists. This first luncheon was very well attended, there being over sixty-five men present, representative of the electric vehicle, the storage battery and the accessory industries. Those in charge of the luncheon felt that this was a very good attendance for the first meeting, and plans were at once made to hold the second luncheon on Dec. 15. A feature of the first meeting was the absence of any set speeches. An announcement was made, however, of an electric vehicle meeting to be held on Dec. 2. Further details may be found on page 1088 of this issue.

Apex Company Aids Dealers in Financing Sales

It is the belief of the Apex Electrical Distributing Company, Cleveland, Ohio, that dealers in its appliances find it impracticable to finance all their time sales, and as experience shows that selling on the installment plan triples and even quadruples the electrical appliance business, the company has put into effect a plan whereby all their dealers may finance their time sales through a central financing company. A detailed explanation of the financing plan has been issued by the company in booklet form and a second booklet tells the dealer how to go about collecting his accounts and keeping a record of them.

The collection system, according to R. J. Strittmatter, sales manager, is considered one of the most important parts of the plan. It is readily apparent, he states, that to the smaller dealers the mere offering of a financing plan is not sufficient, because the small dealer usually does not have a good bookkeeping system and is very apt to fail to collect his accounts properly. For this reason the Apex company supplies all the necessary forms such as ledger sheets, follow-up system, collection pads, complete series of collection system and everything else that goes with the following up of a sale of this kind.

Robbins & Myers Add to Philadelphia Space

The Robbins & Myers Company, whose headquarters are at Springfield, Ohio, has leased a one-story building at 229-231 North Twenty-third Street, Philadelphia, for use as a new warehouse and distribution point. The building has a floor space of 6,000 sq.ft. The Philadelphia offices of the company are at 1418 Walnut Street.

American Firm Grants British Sales Rights

The Metropolitan Vickers Electrical Company, Ltd., with principal offices in Manchester, England, has just completed arrangements with the Railway and Industrial Engineering Company of Greensburg, Pa., whereby the latter company grants to the Metropolitan Vickers Electrical Company, Ltd., the exclusive rights to manufacture and sell apparatus of the R. & I. E. design in the entire British Empire, with the exception of the British North and South American possessions.

G. E. Increases Small Motor Production at Fort Wayne

As a result of increased orders the small-motor department of the General Electric Company at Fort Wayne, Ind., has been placed back on full time, with a complete force of men working. A few men are being called back from furlough, and all are working five days and a half a week in place of the four days that they had been working formerly. The increase in hours and force will last at least for six weeks, as orders will guarantee operation for that length of time, it is understood. Whether similar increases will be made on other departments in the next few days was not predicted by officials. It is possible, however, that these will be made in the near future. The meter department is also back on full time, and it is also stated that the Decatur works are back on a normal basis of operation. Fractional-horsepower motors are also made at Decatur.

Milwaukee Company Again Makes Storage Batteries

The Globe Electric Company, Milwaukee, has re-entered the automobile storage-battery field after having discontinued this line for some years. In the interim the company manufactured belted and direct-connected farm light and power plants and also Faure storage batteries for this class of equipment. A large one-story factory has recently been erected by the company. The officers are: President, John I. Beggs; vice-president, J. H. Gugler; secretary and general manager, J. D. Wanvig, Jr.; treasurer, C. O. Wanvig.

Laundryette October Sales Best in Last Year

October sales of the Laundryette Manufacturing Company, Cleveland, washing-machine manufacturers, came within a few per cent of those for October, 1920, the best month the company has ever had, according to the Nov. 3 issue of the company's house organ. The one thing that prevented the overtopping of the highest previous month, it was declared, was the fact that production at the factory, though increased 30 per cent, was unable to cope with the demand. Orders placed since Sept. 15 have been delayed on account of this. This encouraging pick-up in sales, the company states, is due in large part to the great increase in public demonstrations and also to a vigorous advertising campaign, carried on in publications and directly by mail.

West Virginia Armature Company Acquires American Armature

The West Virginia Armature Company, Bluefield, W. Va., has taken over the property of the American Armature & Engineering Company at Mullens, W. Va. The business will be operated more or less as a branch of the West Virginia company and is particularly well equipped for general-repair and power-house work. The principal business of the main plant at Bluefield will continue to be armature winding. Armature coils and brass bearings are manufactured there, and a fair stock, according to the announcement of the company, will be maintained at Mullens. W. A. Bishop is president of the company, James W. Bailey secretary-treasurer, and A. L. Smith vice-president.

Rush Job on New Hell Gate Station by Chatham

An example of how quickly an electric wiring job can be done when it becomes necessary is being given by the Chatham Electrical Engineering Company, Inc., of New York, at the new Hell Gate power house of the United Electric Light & Power Company in the same city. This plant when completed will be one of the largest steam-driven generating plants in the world, having an initial capacity of 140,000 kw. and an ultimate rating of approximately 280,000 kw. Thomas E. Murray, Inc., New York, are designing and constructing engineers for the entire plant.

Actual work on the purely electrical construction, pulling of cables and wiring, erecting of switchboards and the installation of the necessary electrical equipment was started on Sept. 1, and this part of the work was expected to require about a year for completion. However, demands for additional power were so pressing that it became a necessity to complete the electrical installation in the shortest period of time possible, thereby accomplishing in approximately four months what was considered a year's work. Already one of the units is in service. The existing unusual business conditions made possible the selection of carefully picked technical men for every branch of the staff and personnel, and the actual results being obtained demonstrate what can be done to meet emergency conditions. The first high-tension test, made on Wednesday, Nov. 3, proved that neither the factor of safety nor the quality of the work had been lowered by the enforced speeding up of the work.

Approximately 52 per cent of the work was completed on Nov. 1, and the contract is expected to be finished by Dec. 31, making a record for an installation of this size.

A GATHERING OF CHATHAM COMPANY EMPLOYEES WHO SPEEDED ELECTRICAL JOB ON HELL GATE STEAM PLANT

Large Japanese Order Placed with Westinghouse

An order for substation material amounting to $76,000 has been placed with the Westinghouse Electric & Manufacturing Company by Japanese railway interests, indicating better business conditions in that country. This order covers the complete equipment for two substations and includes eight rotary converters, twelve transformers, two complete switchgear equipments and station lighting transformers.

Other large orders for railway material recently have been placed in this country by the Seto Electric Railway Company, the Bisai Electric Railway Company, the Nagasaki Electric Railway Company, the Tokyo municipality and other large Japanese railway operating companies and municipalities.

The Northern Electric Company is now at 224 North Seldon Street, Chicago, having moved from 542 St. Clair Street on Aug. 15. Manufacturing facilities of the company are increased about 300 per cent, and excellent business on heating appliances for the months of September and October is reported.

The Klymax Manufacturing Company, 115 North Desplaines Stret, Chicago, bought out the Home Utilities Company of the same address on Oct. 1. This company is developing and improving the "Klymax" washing machine, which the Home Utilities Company produced.

Payne Dean Limited, 103 Park Avenue, New York City, manufacturer of the Dean control for electrical operation of water, gas and high-pressure steam valves, has established offices in Pittsburgh and Chicago. C. J. Burrage, formerly of the engineering department of the Cutler-Hammer Manufacturing Company, Milwaukee, is in charge of the Pittsburgh office, which is in the Bessemer Building. The Chicago office, which is in the Lumber Exchange Building, 11 South LaSalle Street, is in charge of A. H. Kohlbusch, formerly superintendent of construction for the Public Service Electric Company.

The Union Electric Supply Company, Providence, R. I., has been appointed jobber for the Rhode Island district in the distribution of motors manufactured by the S. A. Woods Machine Company, South Boston, Mass.

J. B. Howard, 398 Newbury Street, Boston, has been appointed representative agent for the Walter Motor Truck Company, New York City, manufacturer of electric road trucks.

The Sunny Line Appliances, Inc., Detroit, has appointed the Sausaman-Bradley Company, 441 Monadnock Block, Chicago, as distributer for the "Sunnysuds" electric washing machine in the state of Illinois and in northern Indiana.

The Tiffany Electric Company, Inc., 165 Broadway, New York City, manufacturer of electrical machinery and parts, has under construction a two-story machine shop, 40 ft. x 150 ft., on Howell Street, Jersey City, N. J. It is expected to have the building ready for occupancy by Dec. 15.

The Trico Fuse Manufacturing Company, Milwaukee, announces that it has established a new branch office at 15 William Street, New York City.

Foreign Trade Notes

ELECTRIFICATION OF STATE RAILWAYS IN ITALY.—Reports forwarded by Assistant Commercial Attaché [illegible] Rome indicate that the Director-General of the State Railways [illegible] the government have the reparations account settled in part by requiring the Germans to hand over the material which could be used in electrifying the government railways. The office of the Auditor-General is said to oppose this means of settlement and to consider it preferable to have the adjustment of reparations made on a strictly money basis. Plans, according to the report, have been completed for the electrification of the Bologna-Verona-Brenner, the Pisa-Leghorn and the Venezia-Giulia lines, as well as for a shortened route between Rome and Naples. Studies are being made for the possible electrification of the Naples-Reggio, Calabria and Paola-Cosenza lines. The Director of Railways is negotiating with the Ministry of the Treasury to obtain necessary funds to carry out this extensive program. According to a report received from Commercial Attaché H. C. MacLean of Rome, the *Official Gazette* of Oct. 1 published law decree No. 1,298, whereby the State Railway Administration is authorized to expend the sum of 160,000,000 lire (about $6,400,000 at present exchange) for the purchase of 120 electric locomotives.

STORAGE BATTERIES MANUFACTURED IN ARGENTINA.—Trade Commissioner George S. Brady, Buenos Aires, reports that there is a factory in Argentina (claiming to be the only one of its kind in South America) that manufactures storage batteries for automobiles and for lighting and for wireless sets. The plant employs from thirty-five to sixty hands and is producing at present 40,000 lead-battery plates monthly, of which 25,000 are for automobiles. The maximum capacity of the plant is 100,000 plates per month, besides which it makes lighting and switchboard installations. The lead used in making the plates and all of the lead oxide used come from the United States. Glass jars and hard-rubber containers are manufactured locally. Prices are considerably below those of the imported American article, and the management states that it is prepared to make further reductions to meet foreign competition. The company advertises that it installs complete farm lighting and power sets and has a force of electricians for this purpose. The factory has been in existence for nearly four years, but has only recently begun to push its products actively.

PROPOSED HYDRO-ELECTRIC DEVELOPMENT IN THE HIGHLANDS OF SCOTLAND.—The development of hydro-electric power in the Highlands, according to the *Electrician*, is under consideration in Scotland. Some of the schemes are municipal projects and others are being promoted by private companies. The Moray County Council has been invited by the Banff County Council to co-operate in a joint scheme for providing electricity from the Spey River and its tributaries. A communication has also been submitted by the Town Council of Inverness, which is promoting a hydro-electric project for the northern area. A committee has been appointed to report on both schemes.

PROPOSED HYDRO-ELECTRIC DEVELOPMENT IN SICILY.—According to *Electrical Industries* the Technical Commission for Unemployment has approved the urgent execution of works in connection with the utilization of the river Simeto in Sicily for the production of electric power. The Consiglio Superiore delle Acque has authorized a concession for this purpose and has approved the scheme submitted by Signor Omodeo, engineer. It has also authorized a provisional commencement of the work as soon as the agreement is signed without waiting for the settlement of details. The project provides for the formation of an artificial lake at Vale di Aderno, capable of storing 100,000,000 cu.m. of water. The total cost, inclusive of works in connection with bringing land into cultivation, is estimated at 60,000,000 lire. It is estimated that 14,000 hp. can be developed, while 35,000 hectares of land will be irrigated and cultivated.

NEW ELECTRIC PLANT IN COAL DISTRICT OF CZECHOSLOVAKIA.—The Ministry of Public Works, according to *Electrical Industries*, is planning to establish at the Hedwig pits in the coal district of Most (Bruew) a large electric generating station, which will furnish electricity to Prague and central Bohemia. The cost of the proposed plant is estimated at 150,-[illegible] kronen.

PROPOSED ELECTRIC RAILWAY IN SPAIN.—Preliminary plans for the construction of an electric railway between Corunna and Santiago and Caraballo, Spain, according to Consul Busser at Corunna, are now in the hands of the engineers for submission to local capitalists. A company with sufficient capital has been organized to finance the actual construction work as soon as the electric railway between Corunna and Sada, already laid to Pasaje, is completed. The banking house of Sobrinos de Jose Pastor, Corunna, is interested in the project. The distance from Corunna is about 40 English miles. Five tunnels will have to be built for the line.

HYDRO-ELECTRIC POWER IN CONNECTION WITH ZINC INDUSTRY IN FRANCE.—As a means of stimulating production considerable attention is being given in France to the availability of water power. An illustration of what might be accomplished by a larger use of this power is furnished by the status of the zinc industry, in which production has decreased over 80 per cent since 1913. This is largely due to the fact that practically all French zinc factories, most of which are situated in the Pas de Calais, use coal as a means of production, and at present the high cost of coal is a discouraging factor. In connection with the larger use of water power, an estimate received by the Bankers' Trust Company from its French information service indicates that if the electrolytic process were used the production of zinc could be increased to 120,000 tons of metal yearly, necessitating 300,000 tons of ore, half of which would be imported from French colonies and the other half extracted from the native mines.

PROPOSED ELECTRICALLY OPERATED FERRY AT HOBART.—The parliamentary public works committee, according to *Electrical Industries*, has recommended the government to build an electrically operated ferry between Hobart and Bellerive. The cost is estimated at about £33,000.

ELECTRICAL DEVELOPMENT IN WESTERN SLOVAKIA.—With the financial co-operation of the Czechoslovak government the Western Slovak Electrification Company, according to *Electrical Industries*, has been organized with a capital stock of 8,000,000 kronen, which is to be increased to 16,000,000 kronen in the course of the next three years. The first undertaking of the new company is the electrification of the Bratislava (Pressburg) district.

PRECEDENT SET IN ANTI-DUMPING LAW.—The first specific ruling that a commodity was being dumped in the United States in contravention of the anti-dumping statute has been made by the Secretary of the Treasury at Washington, the material involved being goatskin parchment, according to the American Pulp and Paper Association. The memorandum says in part: "After due investigation I find that the paper-making industry in the United States is being or is likely to be injured by reason of the importation into the United States of goatskin parchment paper, first and second quality, and that such merchandise was sold and is likely to be sold in the United States at less than its fair value." The decision is not only the first relative to paper importations, but is said to be the first of its kind under the anti-dumping act of 1921 relative to any importations. It is expected that electrical apparatus and equipment will be treated in the same manner.

GERMAN ELECTRICAL GOODS IN SPAIN.—During the first seven months of the present year, according to *Electrical Industries*, the Germans sent to Spain among other goods over 2,000 tons of electrical installation material out of a total importation of 4,900 tons and over half the telegraph and telephone equipment imported.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

The representative of a mercantile firm in Australia (No. 306) is in the United States and desires to be placed in touch with manufacturers and exporters for the sale of electrical goods, etc.

A merchant in Norway (No. [illegible]) desires to secure the representation of firms for the sale of electrically driven portable tools, engine-room fittings and mountings, etc.

New Apparatus and Publications

ELECTRIC WASHER AND WRINGER.—The Hendrickson Machine Company, 1310 East Fourteenth Street, Cleveland, has brought out an electric washing machine and wringer, equipped with an electric [illegible]

HEATING AND VENTILATING UNIT.—The Bayley Manufacturing Company, Milwaukee, has brought out a new model of a complete, self-contained heating and ventilating plant, known as the "Bayley Thermo Unit."

FAUCET WATER HEATER. — The Aetna Electric Appliance Company, Boston, Mass., has placed on the market a "Hotvent" automatic type faucet heater, which may be connected with the ordinary household outlet.

ELECTRIC STOVE. — A light-weight "Duplex" kitchenette electric stove has been brought out by the Redtop Electric Company, Inc., 8 West Nineteenth Street, New York City.

LOADING RHEOSTATS. — The Ward Leonard Electric Company, Mount Vernon, N. Y., is distributing a small booklet describing its loading rheostats.

OHMMETER.—Charles Cory & Son, Inc., 183-7 Varick Street, New York City, have issued a catalog bulletin No. 101-29-A, covering the "Cory-Record" ohmmeter.

POWER EQUIPMENT.—"Allis-Chalmers Power Equipment for Textile Mills" is the title of bulletin No. 139, issued by the Allis-Chalmers Company, Milwaukee, in which it describes and illustrates its line of power machinery and also a complete line of electrical apparatus.

LAMP STANDARD.—The Denver Electrical Laboratories, West Thirty-second Avenue and Shoshone Street, Denver, Col., has placed on the market two new models of its lamp-selling standard, "Cel-A-Lite," models B and C, for counter display.

PORTABLE LAMPS.—The Faries Manufacturing Company, Decatur, Ill., has recently placed on the market a new line of portable electric lamps and adjustable floor portable lamps.

SOCKET PLUG.—The Ajax Electric Specialty Company, 1011 Market Street, St. Louis, has recently placed on the market an improved type of plural socket plug, known as "Ajax" No. 33.

VACUUM BRUSH. — A vacuum brush (motor-driven) for cleaning upholstered furniture has been developed by the O. K. Machine Company, 2131 Fairfield Avenue, Fort Wayne, Ind.

MOTOR STARTING SWITCH.—A motor starting switch ("Mason"), equipped with under-voltage release, has been developed by the Trumbull-Vanderpoel Electric Manufacturing Company, Bantam, Conn.

SAFETY SWITCH.—S. Schmukler & Son, Second and Bainbridge Streets, Philadelphia, have recently placed on the market an externally operated switch.

AUTOMATIC PROJECTOR LAMP.—The Sun-Light Arc Corporation, 1600 Broadway, New York City, has recently placed on the market an automatic projector lamp, "Sperry-Sunlight," of special flaming-arc type. The lamp is manufactured by the Sperry Gyroscope Company, Manhattan Bridge Plaza, Brooklyn, N. Y.

VIOLET RAY MACHINE.—A violet-ray machine ("type J"), with sparkless cords and non-turning electrodes, has recently been placed on the market by the Rogers Electric Laboratories Company, 2015 East Sixty-fifth Street, Cleveland.

TRADE DISCOUNT SHEET.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, is distributing trade discount sheet 1-A, effective Nov. 10, superseding former trade discount sheet 1-A.

ARC WELDING LEAD.—A [illegible] has been developed by the General Electric Company, Schenectady, N. Y., for use in conjunction with its automatic arc-welding lead.

ILLUMINATION VALUES.—"Illumination Values and Their Measurements" is the title of bulletin E-101, issued by the Westinghouse Lamp Company, 165 Broadway, New York City, which contains table of present standards of desirable illumination for various classes of service, etc., illustrations of illuminating measuring [illegible] equipment, etc.

SOAP FOR ELECTRIC WASHING MACHINES.—"How to Use 'Oakite' in Your Washing Machine—It Cleans" is the title of a booklet distributed by the Oakley Chemical Company, 22 Thames Street, New York City, covering the use of "Oakite" in electric washing machines.

TRADE DISCOUNT SHEETS. — The Westinghouse Electric & Manufacturing Company, Mansfield Works, Mansfield, Ohio, is distributing new trade discount sheets as follows: Sheets 9-A, 13-A and 9-B, effective Oct. 25; sheet 1-B, parts 1 and 3, effective Oct. 24.

New Companies

THE STANDARD RAILWAY FUSE CORPORATION, New York, N. Y., has been organized by E. D. Purcell, G. E. McClure and P. H. Miller. The company is capitalized at $50,000 and proposes to manufacture electrical equipment. Newmark & Miller, 154 Nassau Street, represent the company.

THE CENTRAL ELECTRIC COMPANY, Huntington, W. Va., has been chartered with a capital stock of $15,000 to manufacture electrical supplies. The incorporators are Thompson B. Pierce and F. L. Hussey, Ashland, Ky., and R. T. Mosby, Christianburg, Va.

THE ELECTRIC UNITS CORPORATION, 816 First National Bank Building, Chicago, Ill., has been incorporated by Samuel Labow, F. J. Maas and Robert H. Stall, to manufacture electrical appliances.

PORTABLE DRILLS.—The Stow Manufacturing Company, Inc., Binghamton, N. Y., has issued a circular covering the "Stow" portable electric drills.

RADIO APPARATUS AND SUPPLIES.—The Navy Department, Washington, D. C., has issued catalog No. 601, describing the radio supplies and apparatus offered for sale by the department.

ELECTRIC OVENS.—The Oven Equipment & Manufacturing Company, New Haven, Conn., is distributing leaflet No. 108, describing its type "T" conveyor bakers' oven, and leaflet No. 109, covering the "Crawford" sectional continuous oven.

SNAP SWITCHES. — Harvey Hubbell, Inc., Bridgeport, Conn., is distributing bulletin No. 17-6, describing its surface-type toggle snap switches.

DIESEL ENGINE. — The Worthington Pump & Machinery Corporation, 115 Broadway, New York City, has issued two four-page leaflets describing the "Worthington" Diesel engine, two-cycle, solid injection.

THE BEIDNER ELECTRICAL SUPPLY COMPANY, New York, N. Y., has been incorporated with a capital stock of $10,000 to manufacture and deal in electrical equipment. The incorporators are R. Cymberg, M. and H. Edelman. The company is represented by Reisfeld & Comberg, 90 Nassau Street.

THE CRESCENT CITY ELECTRIC COMPANY, Evansville, Ind., has been organized by R. P. Oblinger, H. E. Rasmussen, J. D. Meek and C. E. Roberts. The company is capitalized at $150,000 and proposes to manufacture electrical machinery.

THE DEER ISLE LIGHT & POWER COMPANY, Deer Isle, Me., has been organized with a capital stock of $5,000. The company proposes to operate an electric light and power system and also a gas and water system. The directors of the company are F. M. Haskell, president; Harry W. Haskell, treasurer, and Winslow C. Haskell, clerk, all of Deer Isle.

THE WANDEFLEET ELECTRICAL APPLIANCE CORPORATION, New York, N. Y., has been incorporated with a capital stock of $100,000 to manufacture electrical machinery. Max Hirschfeld, [illegible] Avenue, New York City, is interested in the company.

THE WINGO (KY.) LIGHT COMPANY has been incorporated with a capital stock of [illegible] by J. H. Robertson, W. F. Wood and J. E. Barber, all of Wingo.

THE LONDON (KY.) ELECTRIC COMPANY has been organized with a capital stock of [illegible] by W. H. Marshall, [illegible] Marshall of Lindley and E. S. Myers of Springfield.

THE BAGDAD (KY.) ELECTRIC COMPANY has been incorporated with a capital stock of [illegible] by [illegible] Harrison and M. E. Harrison, all of Bagdad.

THE DISTRIBUTORS ELECTRIC COMPANY, Canisteo, N. Y., has been organized to operate and maintain a high-tension transmission line between Canisteo and Hornell. The company is capitalized at $20,000. Among the incorporators are J. H. Anderson, T. Churchill Cobb, Leverett J. Simpson and I. M. Rosenberg.

THE PHILLIPSTOWN (N. Y.) ELECTRIC CORPORATION has been incorporated by H. C. Derahan, W. M. Benjamin and W. C. Osborn. The company is capitalized at $50,000 and proposes to operate a local electric light and power system. Osborn, Fleming & Whittlesey, 170 Broadway, New York City, represent the company.

THE CHAMPION ELECTRIC MANUFACTURING COMPANY has filed articles of incorporation under the laws of the State of Delaware, with a capital stock of $4,600,000, to manufacture and deal in electrical appliances. The incorporators are M. L. Rogers, L. R. Wilson and M. M. Nichols, all of Wilmington.

THE RADIO SPECIALTY COMPANY, New York, N. Y., has been organized by H. Kantro, H. Gernsback and D. M. Salzman to manufacture wireless instruments, equipment, etc. G. A. Hoffman, 100 Broadway, represents the company.

THE DAVIS-CARLE ELECTRIC COMPANY, INC., Wheeling, W. Va., has been incorporated with a capital stock of $9,000 by Ray L. Davis, J. H. Carle, H. Poffenbarger and E. B. Maurer, all of Wheeling, and J. E. Rehm, Brookside, Ohio.

THE AQUA ELECTRIC HEATER COMPANY OF CANADA, LTD., St. Hyacinthe, Que., has been incorporated by Louis Agustin, Cornelio A. Morin and Wilfred Girouard. The company is capitalized at $500,000 and proposes to manufacture electrical appliances, heaters, machinery, etc.

THE EVANSVILLE (IND.) ELECTRIC SERVICE, INC., has been chartered with a capital stock of $10,000 to manufacture electrical equipment. The incorporators are Charles Legeman, Sr., Clyde E. Zapp and Charles E. Kiefer, Evansville.

Record of Electrical Patents

Notes on United States Patents

(Issued Oct. 18, 1921)

1,393,751. TRAY FOR ELECTRIC HEATING APPLIANCES; Charles H. B. Chapin, Englewood, N. J. App. filed Feb. 4, 1921. For receiving and supplying current to one or more heating appliances.

1,393,794. SWITCH BOX; Carl H. Kuhlman, Toledo, Ohio. App. filed Jan. 29, 1920. Wall type.

(Issued Oct. 25, 1921)

1,394,667. ELECTRIC LAMP AND HEATER; Elbert A. Corbin, Jr., Swarthmore, Pa. App. filed May 25, 1921. Combined electric heater and lamp.

1,394,699. SELF-WINDING CLOCK; Alfred L. Sohm, Chicago, Ill. App. filed March 31, 1919.

1,394,723. TOLL-TELEPHONE SWITCHING APPARATUS; Herbert M. Friendly and Archibald E. Burns, Portland, Ore. App. filed June 7, 1915. For remotely connecting and disconnecting.

1,394,763. PORTABLE DRIVING MECHANISM FOR TALKING MACHINES AND THE LIKE; Walter Scott, Lakewood, Ohio. App. filed Feb. 19, 1921. Detachable motor and switch.

1,394,768. INSTRUMENT FOR USE IN LEARNING TELEGRAPHY; James E. Smith and Clarence W. Burger, Washington, D. C. App. filed May 21, 1920.

1,394,810. ELECTROTHERMAL GARMENT; Joel E. Craddick, Denver, Col. App. filed April 3, 1919. Heated garment.

1,394,815. ELECTROMAGNETIC RECTIFIER AND [illegible]; Richard A. Eberle, Dubuque, Iowa. App. filed March 23, 1914. Vibrating rectifier.

1,394,818. RAIL BOND; Harold H. [illegible], Newark, N. J. App. filed May 28, 1918. "Tunnel" type.

1,394,838. REGISTRY SYSTEM AND REGISTER THEREFOR; C. C. Johnson, Mount Vernon, N. Y. App. filed June 12, 1919. Watchmen's registry system.

1,394,840. REGISTRY APPARATUS; Clarence C. Johnson, Metuchen, N. J. App. filed Jan, 23, 1920. Watchmen's registry systems.

1,394,847. ELECTRIC WATER HEATER; Charles Kratt, Nottingham, England. App. filed Jan. 4, 1921. Rapidly delivers small quantities of boiling water.

1,394,856. ELECTRIC TOASTER; Irwin J. Mendels, Chicago, Ill. App. filed Jan. 31, 1920. Means for assembly.

1,394,875. ARC LAMP; Maurice J. Wohl, Brooklyn, N. Y. App. filed Jan. 14, 1918. Mechanism to control several arcs.

1,394,876. ARC LAMP; Maurice J. Wohl and Harry Hertzberg, New York, N. Y. App. filed June 14, 1918. Used in motion-picture photography.

1,394,891. ELECTRIC HEATING APPARATUS; Henry Geisenhoner, Schenectady, N. Y. App. filed June 21, 1920. Rivet heater.

1,394,899. WATER-COOLED ELECTRIC APPARATUS; Allan B. Hendricks, Jr., Pittsfield, Mass. App. filed Feb. 24, 1920. Transformers, etc.

1,394,901. ELECTRICITY TRANSFORMER AND TRANSFORMING AND CONVERTING APPARATUS; Henry M. Hobart, Schenectady, N. Y. App. filed Sept. 4, 1917. Rotary converter.

1,394,910. REACTOR IN TANKS; Friend H. Kierstead, Pittsfield, Mass. App. filed Feb. 3, 1920. Particularly adapted for large-sized units.

1,394,922. MOTOR-CONTROL SYSTEM; Robert H. McLain, Schenectady, N. Y. App. filed May 14, 1921. Motor may be stopped, started and generally controlled.

1,394,937. RESISTANCE UNIT; Ludwig Reichold, Pittsfield, Mass. App. filed March 28, 1919. Resistance conductor inclosed in metallic sheath.

1,394,942. BUSHING FOR OUTLET BOXES; Peter E. C. Sater, Cleveland, Ohio. App. filed Aug. 16, 1920. For ½-in. pipe in ½-in. or ¾-in. hole.

1,394,949. RESISTANCE MATERIAL; Ralph W. Stearns, Schenectady, N. Y. App. filed Feb. 19, 1920. Plastic resistance material having a so-called negative ampere-volt characteristic.

1,394,954. METAL-MELTING POT; Tycho Van Aller, Schenectady, N. Y. App. filed Dec. 4, 1919. Metal is automatically maintained at a constant temperature.

1,394,965. ELECTRIC MARKING DEVICE; Clifford A. Bourne, Portland, Ore. App. filed Jan. 5, 1921. To mark upon metal tools.

1,394,971. PROTECTIVE DEVICE; Elmer E. F. Creighton and Frederick R. Shavor, Schenectady, N. Y. App. filed Jan. 10, 1918. Lightning arrester.

1,394,972. ELECTRIC REGULATION; John L. Creveling, Auburn, N. Y. App. filed Oct. 24, 1914. To regulate voltage and current.

1,395,002. ELECTRIC HEATING-ELEMENT CONTROLLING DEVICE; Paul M. Mueller, Erie, Pa. App. filed March 24, 1920. To prevent overheating.

1,395,003. ELECTRIC HEATING-ELEMENT CONTROLLING DEVICE; Paul M. Mueller, Erie, Pa. App. filed March 24, 1920. To prevent overheating.

1,395,007. TELEGRAPH SYSTEM; Arthur W. Post, Westbury, N. Y. App. filed March 20, 1920. Signaling between Morse line subscriber and the attendant at relay office.

1,395,046. AUTOMATIC CIRCUIT-CONTROLLING APPARATUS; Laurence M. Klauber, San Diego, Cal. App. filed March 1, 1920. To eliminate dangers in series electric light circuits.

1,395,065. METHOD OF ADMINISTERING THERAPEUTIC LIGHT TREATMENT; Roy X. Tuttle, Battle Creek, Mich. App. filed Feb. 14, 1921. Alternate heating and cooling.

1,395,066. CONTROLLING MECHANISM; Charles R. Underhill, New Haven, Conn. App. filed Jan. 13, 1917. For governing operated devices.

1,395,108. MULTIPLE CONNECTOR; John W. Haywood, New York, N. Y. App. filed Feb. 27, 1919. Portable multiple-receptacle block.

1,395,117. MEDICAL APPARATUS; Bess E. Johnston, Chicago, Ill. App. filed March 22, 1920. Applying heat, light rays and water.

1,395,1[illegible]. RADIUM HYDRO-EMANOMETER; George Kunkle, Grand Junction, Col. App. filed March 12, 1917. For rendering water radio-active.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

CAMBRIDGE, MASS. — The Cambridge Electric Light Company has plans under way for the construction of a one-story power house, 80 ft. x 180 ft. French & Hubbard, 210 South Street, Boston, are engineers.

SAYLESVILLE, R. I.—The Sayles Finishing Plants, Inc., is considering rebuilding the power house at its textile mills, recently destroyed by fire.

Middle Atlantic States

BINGHAMTON, N. Y.—The Binghamton Light, Heat & Power Company, it is reported, is investigating the possibilities of extending a transmission line to Apalachin, Tioga Center, Smithboro, Barton, Nichols, and Newark Valley. The company has work well under way on the Whitney Point-Marathan line, a distance of 27 miles. S. W. Murray is manager.

CAYUGA, N. Y.—The Empire Gas & Electric Company, Geneva, has been authorized by the Public Service Commission to construct and equip an electric light and power plant in Cayuga.

ALLOWAY, N. J. — Plans are under way for the installation of an electric light and power system in Alloway. A transmission will be erected from Quinton.

EDGEWATER, N. J.—The Daniels Linseed Oil Company, 20 Ninth Avenue, Minneapolis, Minn., is planning the construction of a 1,000-kw. power plant in connection with its new plant at Edgewater, N. J. Contract for the erection of a number of buildings, including main building, 150 ft. x 250 ft., has been awarded to the Tilt-Hargan Company, 90 West Broadway, New York City. Samuel Mairs is secretary.

HEGINS, PA. — The Hegins Light & Power Company, recently organized, is considering the installation of a light and power system in Hegins.

PHILADELPHIA, PA. — Arrangements have been made by the Department of Transit, City Hall, for the installation of a new underground conduit system on Front Street, for the Frankford Elevated railway lines, to cost about $44,900. W. S. Twining is director.

PHILADELPHIA, PA.—Bids, it is understood, are being received by the city for the construction of several substations. For further information address the Electricity Commission.

PITTSBURGH, PA.—The West Penn Power Company has applied to the Public Service Commission for authority to extend its system in Jefferson, Clarion, Venango, Elk and Lawrence Counties, covering townships adjacent to present operations.

SCRANTON, PA.—Plans have been prepared by the board of directors of Maryland College for the construction of a one-story power house, 40 ft. x 104 ft. John J. Hawley, Traders' Bank Building, is architect.

WEST CHESTER, PA.—The property of the Montgomery & Chester Electric Railway Company has been purchased by Thomas E. O'Connell, president of the Phoenixville, Valley Forge & Strafford Electric Railway. Connections will be made between Spring Valley and other points and Valley Forge, via Phoenixville. A new power house will be built at Williams Corner to supply the entire consolidated line.

MILLSBORO, DEL.—Arrangements have been made by the Council for the installation of an electric lighting system in Millsboro.

BALTIMORE, MD.—Plans are being prepared by the fire department for the construction of a building for an electrically operated fire-alarm system at Lexington Street, to cost about $75,000. Bids, it is understood, will be asked soon.

ELKINS, W. VA.—The Elkins Power Company is planning the installation of additional equipment, including a 750-kw. turbo-generator with condenser equipment. The company recently filed notice of an increase in its capital stock from $50,000 to $100,000. C. C. Bosworth is manager and engineer.

GLEN LYN, W. VA.—The Appalachian Power Company, Bluefield, has plans under way for extensions to its plant at Glen Lyn, to provide for an increase in output from 20,000 kw. to 40,000 kw. New generating machinery, boilers and other equipment will be installed. Viele, Blackwell & Buck, 40 Wall Street, New York City, are consulting engineers.

KEARNEYSVILLE, W. VA.—The Northern Virginia Power Company, Winchester, Va., is considering extending its transmission lines to Middleway, near Kearneysville, W. Va.

MABEN, W. VA.—The Raleigh Wyoming Coal Company is considering the construction of a one-story power plant, 70 ft. x 80 ft., at its local properties. The Rust Engineering Company, 1901 Fifth Avenue, Pittsburgh, Pa., is engineer.

MARTINSVILLE, VA.—Plans have been prepared by the American Furniture Company for the construction of a new power house. Lockwood, Greene & Company, Charlotte, N. C., are architects.

WASHINGTON, D. C.—Bids will be received at the office of the Chief Signal Officer, U. S. Army, Washington, D. C., until Dec. 3, for furnishing 150 miles of cable, types WC 44 and WC 45. (Circular PR 8269-1CP.)

WASHINGTON, D. C.—The Bureau of Supplies and Accounts, Navy Department, Washington, D. C., will receive bids for furnishing the following: Until Dec. 13, Eastern and Western Yards, Schedule 9076—two testing panels; Mare Island, Schedule 9087—2,825 ft. lighting and power wire and 13,500 ft. lamp cord.

North Central States

GRAND RAPIDS, MICH.—Plans are under consideration by the Kent Storage Company, Front Street, N.W., for the construction of a power plant and cold storage plant. G. H. Hess is chief engineer.

LANSING, MICH.—The construction of a power house on the site of a projected State reform school, Lansing, to cost about $2,000,000, has been authorized by the Michigan State Administrative Board. Preliminary work, it is understood, is under way.

LUDINGTON, MICH. — The Stearns Lighting & Power Company is planning the erection of a new power unit, remodeling the unit now in use, and the installation of new equipment.

OTSEGO, MICH.—Bids, it is understood, will soon be received by the Mac Sim Bar Paper Company for the construction of a one-story electric power plant, 85 ft. x 140 ft., to cost, with machinery, about $300,000. Billingham & Cobb, Press Building, Kalamazoo, are architects and engineers.

SANDUSKY, MICH.—Arrangements are being made by the Council, it is reported, for the construction of a municipal electric light and power plant, to cost about $45,000. L. C. Reid is city engineer.

TECUMSEH, MICH.—The plant of the Dundee Electric Company has been purchased by Pliny Gratz and R. J. McCoy. The new owners are considering plans for the extension of transmission lines to Tecumseh for light and power purposes. Equipment, including a waterwheel, will be installed for generating electricity at the Quaker mill.

DAYTON, OHIO.—Plans are under consideration for improvements to the fire and police signal system, including the installation of new cables and boxes and the construction of a building to house switchboards. The cost is estimated at $200,000. F. E. Eichelberger is city manager.

FREMONT, OHIO. — The Ohio Power Company contemplates the construction of four transformer stations in Fremont, in addition to the two on which work is now under way.

DENVER, IND. — Arrangements have been made by the town committee for the installation of an electric lighting system. Electrical energy will be furnished by the Winona Interurban Railway Company with line connection at Chile, Ind.

HUNTINGTON, IND.—The Bippus Utilities Company, Huntington, has been organized by J. F. Bippus, owner of the Huntington Light & Fuel Company; J. A. and P. M. Browne, North Manchester, and others. The new company has taken over the electric plant at North Manchester and will control the transmission lines from this city to North Manchester, also furnish electricity in [illegible] and Bippus, as well as to residents along the lines.

NEW BOSTON, ILL.—The Illinois Northern Utilities Company, Dixon, is planning the erection of a high-tension transmission line to supply electricity in New Boston and vicinity.

SOLDIERS' GROVE, WIS.—Bids, it is reported, are being received by E. E. Dillon, consulting engineer, Washington Building, Madison, in behalf of the Atley Peterson estate, for equipment, including water wheel, generator, switchboard, etc., for the proposed hydro-electric power plant and dam, to cost $50,000. Clarence C. Peterson is general manager.

FT. MADISON, IOWA.—The City Council has organized a contract with the Fort Madison Electric Company for furnishing electricity for the proposed ornamental lighting system to be installed in the business section of the city.

BROOKINGS, S. D.—Plans have been completed by the State Board of Regents. Plans for the construction of a new power house at the State College of Agriculture and Mechanical Arts, Brookings. H. F. Berg, Pierre, is state engineer. T. W. Dwight is president of the board.

Southern States

CHARLOTTE, N. C.—Plans are under consideration by the Southern Power Company, Charlotte, for the construction of two hydro-electric plants on the Catawaba River, one to be located at Great Falls, where the company already has a plant, and the other at Mountain Island. The former will have a maximum capacity of 60,000 hp. and the latter 80,000 hp. Bids, it is reported, will be received by the Southern Power Company until Dec. 1 for excavation and masonry work on the proposed plants. The cost is estimated at more than $10,000,000. W. S. Lee, 511 Fifth Avenue, New York City, is vice-president and chief engineer.

ENFIELD, N. C.—Plans are being prepared for the construction of a municipal electric light and power plant in Enfield, to cost about $50,000. William C. Olsen, Kinston, is consulting engineer.

FORT SMITH, ARK.—Bids, it is reported, are being received by the Fort Smith Light & Power Company for new machinery to be installed at its power plant. It is proposed to increase the output by 7,000 hp. D. C. Green is manager.

MEXIA, TEX.—Preliminary surveys are being made by representatives of eastern capitalists for an interurban line from Waco to Mexia and Palestine. A site, it is understood, has been selected for a power plant

Pacific and Mountain States

MARYSVILLE, CAL.—The Pacific Gas & Electric Company, Marysville, it is understood, is planning a survey with a view to furnishing electricity for lighting in Wheatland, Dobbins and Lomo Rica. E. C Johnson is manager.

SAN JACINTO, CAL.—Arrangements are being made by the Lake Hemet Water Company, Hemet, for the construction of a hydro-electric power plant in the San Jacinto section, to cost about $100,000. W. S. Post, Central Building Los Angeles, is consulting engineer.

GREAT FALLS, MONT.—The Montana Power Company is planning the construction of a hydro-electric power plant and dam on the Missouri River, below Mystic Falls, to cost about $1,000,000. J. R. Hobbins is local manager.

Canada

BRODHAGEN, ONT.—The erection of a transmission line from Brodhagen to Dublin, to cost about $30,000, is under consideration. J. Jordan, Dublin, is interested.

LONDON, ONT.—The Utilities Commissioners contemplate the installation of an ornamental street-lighting system in London, to cost about $60,000. Inquiries, it is understood, are being made for prices on lamps, standards and general equipment. E. V. Buchanan, Hydro Building, is engineer.

STRATFORD TOWNSHIP, ONT — The Township Council is considering entering into an agreement with the Hydro-Electric Commission of Ontario for the erection of rural transmission lines.

DUNKIRK, SASK.—The [illegible] Company, [illegible], has awarded general contract for the construction of a sulphate plant at Stink Lake, near Dunkirk, Sask., to S. Pritchard, 1120 Fourth Avenue, N.W., Moose Jaw, Sask. The plans provide for a power plant to be equipped with steam engines, boilers and generators, to cost about $100,000.

Electrical World

New York, Saturday, December 3, 1921

To Level the Peaks of Boom and the Valleys of Depression

DOWN through the years this country has watched the steady operation of a business cycle that has brought us alternate peak periods of boom and valleys of depression. The peak points of the booms are areas of speculation, overexpansion, extravagance in living, relaxation in effort, wasteful expenditure in industry and commerce, with consequent destruction of capital. The valleys are marked with business stagnation, unemployment and suffering. Both of these extremes are vicious and hurtful. We know it. Then why should we drift on longer without making an attempt to govern this economic ebb and flow?

The production processes of business may be broadly set into two classes—(1) additions to national plant and equipment, such as houses, stores, factories, railroads and tools, and (2) consumable goods. We have always gone ahead with both at the same time. In boom periods we have put these classes of production into competition. In bad years we have allowed them both to languish.

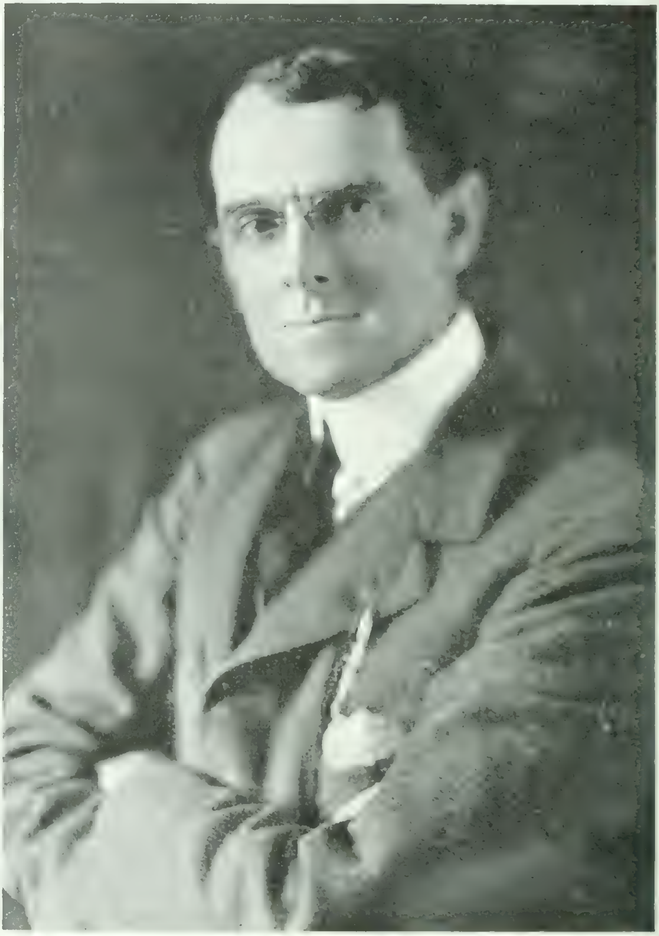
Now, the demand for consumable goods cannot be directly controlled. But it should be possible to control the period in which the expansion of the national plant and equipment takes place. Federal, state and municipal authorities and public utilities throughout the land could to some degree set aside reserves in time of prosperity for the deliberate purpose of financing public works, construction and plant expansion during times of depression. If this were done, it would decrease the depth of depressions and at the same time diminish the height of booms. It is calculated that such a construction reserve of 10 per cent would almost level out the curve of business. And our plant and equipment would be built in times of lower cost.

Unemployment likewise can and must be met in the same way. We must have a labor load dispatcher and prevent the demands for labor for construction and other controllable work from competing with harvest times and the unchangeable seasonal occupations. A way must be found to distribute our labor to a more even load of work and to distribute our work with a regard to economic needs. The subject is one of most profound national importance. If it is possible to do this thing, we must not wait for it longer. California has already taken the first step by providing for the control of public works to this end.

The ELECTRICAL WORLD believes that business men of every industry should make immediate demand for a national statistical service that will determine accurately the production of stocks, the consumption of commodities, the volume of construction and the actual unemployment at all times. Such a service in itself would contribute mightily toward this big reform which the world of business needs.

John Boswell Whitehead

A teacher, engineer and scientist whose original investigations of the properties of air at high voltages have been important additions to the fundamentals of power transmission at high potentials.



IN A LETTER which Sir William Thomson (Lord Kelvin), the famous English mathematical genius and scientist, wrote to Silvanus P. Thompson he began with this remark: "You have splendidly verified the validity of my applying to you for information not to be found in encyclopedias or ordinary textbooks on a very interesting and important scientific subject." In this country such sources of scientific information are in the main two—the research laboratories, which are often difficult of access, owing to the commercial value of their findings, and the private laboratories of the scientists in our universities. When new physical and scientific information comes from the latter source, hampered in most instances by impoverished facilities, there is invariably revealed a genius devoted to the highest ideals of scientific investigation. Not infrequently, because of their modesty, are these geniuses discovered among us by their contemporaries in foreign lands.

Such is in part the case of Dr. J. B. Whitehead, to whom the Institut Electrotechnique Montefiore of Liege, Belgium, has recently awarded the triennial prize of 5,000 francs, known as the Foundation George Montefiore, for the best orginal work on scientific advancement or progress in technical applications of electricity. This prize is awarded on the recommendation of a jury formed of ten electrical engineers, of whom five are Belgians and five are from other countries. The paper which won this recognition was entitled "The Corona Voltmeter and the Electric Strength of Air," presented by Dr. Whitehead and T. Isshiki before the American Institute of Electrical Engineers more than a year and a half ago.

Dr. Whitehead was born in Norfolk, Va., Aug. 18, 1872. He was graduated from Johns Hopkins University, with the degrees of E. E. in 1893, A. B. in 1898 and Ph.D. in 1902. During the period of 1893 to 1896 he was associated with the Westinghouse Electric & Manufacturing Company on transformer design, and from 1896 to 1897 he was a member of the operating staff of the Niagara Falls Power Company. He resigned that position to join the faculty of Johns Hopkins University, advancing to be professor of electrical engineering in 1910 and dean of the School of Engineering in 1919. During this period he has been associated with the Bureau of Standards on special research and was research assistant at the Carnegie Institute, Washington from [illegible] to [illegible]. Dr. Whitehead has also carried on a consulting engineering practice, acting in this capacity for the Maryland Electric Railways. His principal effort, however, has been the study of different phases of experimental research with special endeavor directed to investigation of the electric properties of air. Ten or twelve papers giving details of his investigations have been published. His studies along these lines have resulted in the invention of the corona voltmeter, for which he has fundamental patents.

In the affairs of the American Institute of Electrical Engineers Dr. Whitehead has always taken an active interest. He has served as a member of a number of committees and for two years was chairman of the electrophysics committee. He inaugurated the movement which led to the foundation of the Baltimore Section of the Institute and was its chairman for the first nineteen years. During the war Dr. Whitehead was commissioned major in the Corps of Engineers and detailed to the Naval Consulting Board, working on a development of an electromagnetic submarine detector. An account of this was published in the *Journal* of the A. I. E. E. for March and April, 1920.

Dr. Whitehead has an unusual ability to foresee needed research and to incorporate in the investigations which he directs those [illegible] considerations which are too often ignored by [illegible] researchers. His devotion to research and the clearness with which he conceives the problems involved make his viewpoint much sought at meetings of both engineers and scientists.

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A Makeshift Revenue Bill

"THE mountain labored and brought forth a mouse." Little satisfaction can be found in the revenue bill passed by Congress last week. Admittedly a makeshift, the best that can be said of it is that it is a trifle better than the one it superseded. The two measures differ, however, about as much as alternating current does from direct current. You can do things with the one that you cannot do with the other and vice versa. But if one wants to commit suicide the general effect of either is about the same. So it is with the revenue bills. Applied long enough, either one would suffice to kill business. There is no need of looking at the reductions made in the new bill. Some have been made, but nothing worth bragging about. The law will not remain long in effect—of that we may be certain. There is already talk of its revision before the Treasury Department has made its regulations based on the statute and the courts have interpreted both. Thus business will not only be hampered by further indecision, but the country as a whole will never be able to compose itself until a more moderate and stable tax law has been enacted. Billions are required of us because we have wasted our substance in riotous expenditure for that which contributes naught to the public welfare. This extravagance must be checked. We, as a people, are anxious and willing to maintain the finest government on the face of the earth and gladly pay taxes for that purpose, but waste and inefficiency we must away with, and the surest way to check them is to limit the available funds. This check cannot be applied any too soon, and we shall never be satisfied until we obtain a reasonable and scientific tax law and a Congress not itching to add unnecessarily to the functions of government or even anxious to assume meritorious functions at too fast a pace.

A Policy that Robs the Till

ONE day early this year the sales manager of a certain central-station company walked into the office of the president, with a sober face, and said: "I find that some one has stolen $12,000 out of the cash drawer." The president sat back aghast and asked him how. The answer was that that amount had been lost in 1920 by not charging a proper profit on merchandise sold and on repair jobs done for customers. The money had been lost. Not one thief, but many good customers, had been allowed to help themselves unconsciously out of the company's cash drawer. And this occurs in many cities.

After all, there is no policy involved save one, the policy of good business. For electrical appliances are worthy and popular enough to be salable at a proper price that pays a profit. And business that does not pay its way and a profit is not good business. All the arguments in the world cannot prevail against that simple fact. Why, therefore, should the central-station company go on robbing its till with its own hand by selling goods on a losing basis?

The market for electrical appliances today is only opening in the bud. It will increase and develop to proportions now beyond imagination. The central-station shop, if policy is right, will sell in growing volume. It can and should be the leading, guiding store in every city, working actively and progressively in a harmonious helpful co-operation with an increasing number of dealers' stores. For electrical appliances are destined to become standard household equipment and, as such, staple merchandise that everybody sells. But the first step must be to make each electric store—central-station or otherwise—a store that pays. Under any other policy that store is headed toward the rear. The electrical appliance is going ahead, and he helps most who makes his store prosperous and strong to serve.

A Plain Case of Hallucination

WE HAVE several times recently drawn attention to the disposition on the part of the ignorant and careless to lay at the door of electricity every fire that occurs anywhere within a few blocks of an electric circuit and is not obviously due to some other cause. Recently a daily paper that ought to know better published an extraordinary communication ascribing the Hoboken (N. J.) pier fire to the malign influence of current which indulged in a flying leap from the lighting circuits to the water. The author of this weird theory maintains that transformer oil is a conductor of 2,300-volt current, wherefore the source of the conflagration becomes plainly evident. In fact, the story seems to be the product of one of the most elaborate sets of "wheels" yet possessed by any pseudo-scientist.

The moral which we desire to draw from this tale is simply the depths to which human foolishness can go and the truly abysmal credulity of a considerable part of the daily press. A few papers are singularly free from display of gross ignorance on technical matters, evidently having some one around the office who keeps an eye out for just such wild theories as the one under comment. It more generally happens, however, that any sort of drivel couched in technical terms "gets by" the editorial staffs of daily papers, and consequently gross misinformation often reaches the public.

Newspapers may be pardoned for ignorance of abstruse scientific matters, but not for the display of it when in every city a telephone call in the right direction is all that is necessary to ascertain the truth. We have in mind a daily paper which, receiving a somewhat sensational technical announcement in the press dispatches, routed its scientific mentor out of bed by telephone and cleared the matter up then and there. It is an example worthy to be followed, especially when, as in the Hoboken instance, the technical question concerned involved gross misstatements of fact and baseless accusations of the most sweeping character.

Help the Consulting Engineer

SOME central-station companies and many of their consumers cannot afford to maintain engineering organizations competent to handle all their engineering problems, because many of those problems are special in character and present themselves only at long intervals. Even those companies and consumers that maintain large engineering organizations find themselves frequently confronted with problems demanding specialized skill and must resort to outside organizations for advice. Such advice and guidance can be provided only by engineers whose work extends over a large territory and embraces a large volume of diversified practice. The most serious criticism that has been made of the services rendered by such engineers is that they have usually been content to complete their work, get their pay and forget the trouble that may develop in the course of regular operation. This criticism has been unfair to many conscientious consulting engineers, but it is true that there has been too much of the casual in the relations between consulting engineers and their clients.

If an engineer is to do effective work and learn the most from his mistakes, he must feel that he is not only responsible for the original design and installation but also for the weaknesses that may develop after the work is turned over to the operator. The engineering organizations maintained by the larger operating companies have had an advantage over the consulting engineers in many instances because their men have not only been responsible for the design and installation of the plant but have had to live with it in its operation and be responsible for the removal of any difficulties that have developed. To bring about something like this condition for the consulting engineers will be a benefit to both the engineer and his client. The electrical industry is a long way from the point where every operating company can maintain its own engineering organization on a broad enough scale to handle all its problems. It is essential, therefore, that the functions of the consulting engineer should be recognized on a broad basis and such relations established with him as will result in mutual profit to him and his client from the experiences gained in operation.

Providing for 220,000-Volt Operation Without Radical Departures in Design

DETAILS of the Big Creek No. 8 station of the Southern California Edison Company, which has been built for 220,000-volt operation, indicate that the step from 150,000 volts to this higher voltage has been made without material changes in construction. Before plans were actually put on paper it was thought that the advance in voltage might be marked by radical changes in design and layout. This has not been found necessary. None the less the new station is of unusual interest for the very reason that it is so much like stations of lower voltage. Placing the high-tension equipment indoors has made the likeness particularly marked.

Plants of the new station published on another page of this issue show that a steel-frame building having a content of approximately 575,000 cu.ft. was built to house the transformers, high-tension switches and high-tension buses. If the apparatus had been placed outdoors, then cost would have been reduced to that necessary to support the apparatus, but the additional expenditure involved in housing it was considered justifiable because of the greater ease of inspection and maintenance thus afforded.

The station layout is very simple. There are no low-tension buses, and the connections between the generator, the low-tension switch and the transformers are direct and substantial. The elimination of low-tension buses is a progressive step and achieves a substantial reduction in the number of possible causes for trouble. In order still further to reduce the possibilities of low-tension troubles, the supply of energy for station lights and auxiliary motors is taken, not from the 110,000-volt output of the generator, but from an entirely separate 6,600-volt generator driven by an independent impulse wheel.

The entrances of the 220,000-volt lines and the layout of the high-tension wiring have been simplified to the extreme. The lines are brought straight into the building through large openings in the walls on two floors and connect directly to the high-tension buses. No 220,000-volt lightning arresters are installed. Only two high-tension oil switches are to be used, and of these only one has yet been installed.

A Clearing House for Technical Information

IN THE ambitious program of the National Electric Light Association for the reorganization of its technical committees on a broader scale there is created a practical machine for widespread co-operation in engineering matters through the activities of the national geographic committees that have been organized to co-operate with one another in gathering data and information. The state association committees are also being brought into the activities, as it is being discovered that they are an essential link in the chain necessary to bring the individual companies into close touch with the entire central-station industry of the country. The major problems of the industry should be reflected in all their different phases, since through the touch gained by the co-operation of the committees, both state and geographic, any valuable work done by individuals in one company will be accessible to any one engaged in similar work in another company. Possibilities for greater standardization, more complete education of personnel and ability to get valuable information quickly should be some of the immediate results.

The expenditure of considerable effort and of some money will, however, be necessary to develop the full benefits of the program. Engineers who have been in close touch with the work are convinced that much good has already been done. It is essential that company executives realize the value of the work if all companies, small and large, are to profit by it. One of the big benefits, in addition to the work done and the information gleaned by the men in attendance, is the contact with the industry and the resulting realization that what seem to be individual problems are, after all, common problems and have perhaps been solved by those who have had to face them before. This leads to a study of what others have done and acts as a real preventive of serious mistakes that may have been made many times before.

The work needs only the moral and financial support of executives through the ordinary channels of the association, but support that will make it possible for their men to attend not only the committee meetings of the division and state committees, but the National Technical Section group meetings arranged for various parts of the country. However good the organization idea may be, it can be of value only as long as an unbroken line of personal contact with the committees, from the local to the national, is maintained. Any break in this personal contact will be a direct loss to the individual and the company he represents and also a means of lowering the efficiency of the organization. The scheme involves the keeping of a membership in the national committees that is drawn to a large degree from the division committees handling the same subjects. In turn the division committees should contain members representing every state committee on the same subject and every company in the division having an interest in it. It is the most ambitious plan that has been worked out by the association for co-ordinating the engineering work of the central-station industry, and the plan deserves wholehearted support.

Interest in Static Condensers Warrants Development

CONSIDERABLE attention is being given, especially by some of the large electric utilities, to the use of condensers as a remedy for bad power factor. We do not refer to the synchronous condenser, which is of course often used on long feeders or transmission lines, but to the straight static condenser applied locally to bring up the power factor of induction motors. Where heavy machinery is in question the synchronous motor does a good job and can be made greatly to relieve the power factor. In very small machines the call for current is relatively insignificant, and nobody worries much provided that the power factor is kept within tolerable limits. One is hardly tempted, however, to use a synchronous motor under 100 hp., and right here is where the static condenser comes into play down to sizes which are customarily wound for rather modest voltage.

The static condenser, as our older readers will remember, was in use by William Stanley and his associates some thirty years ago for the very purpose for which it is now being reintroduced. The Stanley motor of that day had a magnetic circuit decidedly unfavorable from the standpoint of power factor, and the addition of the condenser not only remedied the difficulty but actually did bring the machine to substantially unity power factor over a wide range of load. There are plenty of extant tests showing the effectiveness of the procedure. Now the condenser is coming back, but whether it is coming into its own is another question. Only a few days ago W. C. L. Eglin, chief engineer of the Philadelphia Electric Company, described the experiments of his company with static condensers which it imported at moderate expense in the absence of any standard equipment obtainable here. Other large companies have quietly been trying the same kind of experiments.

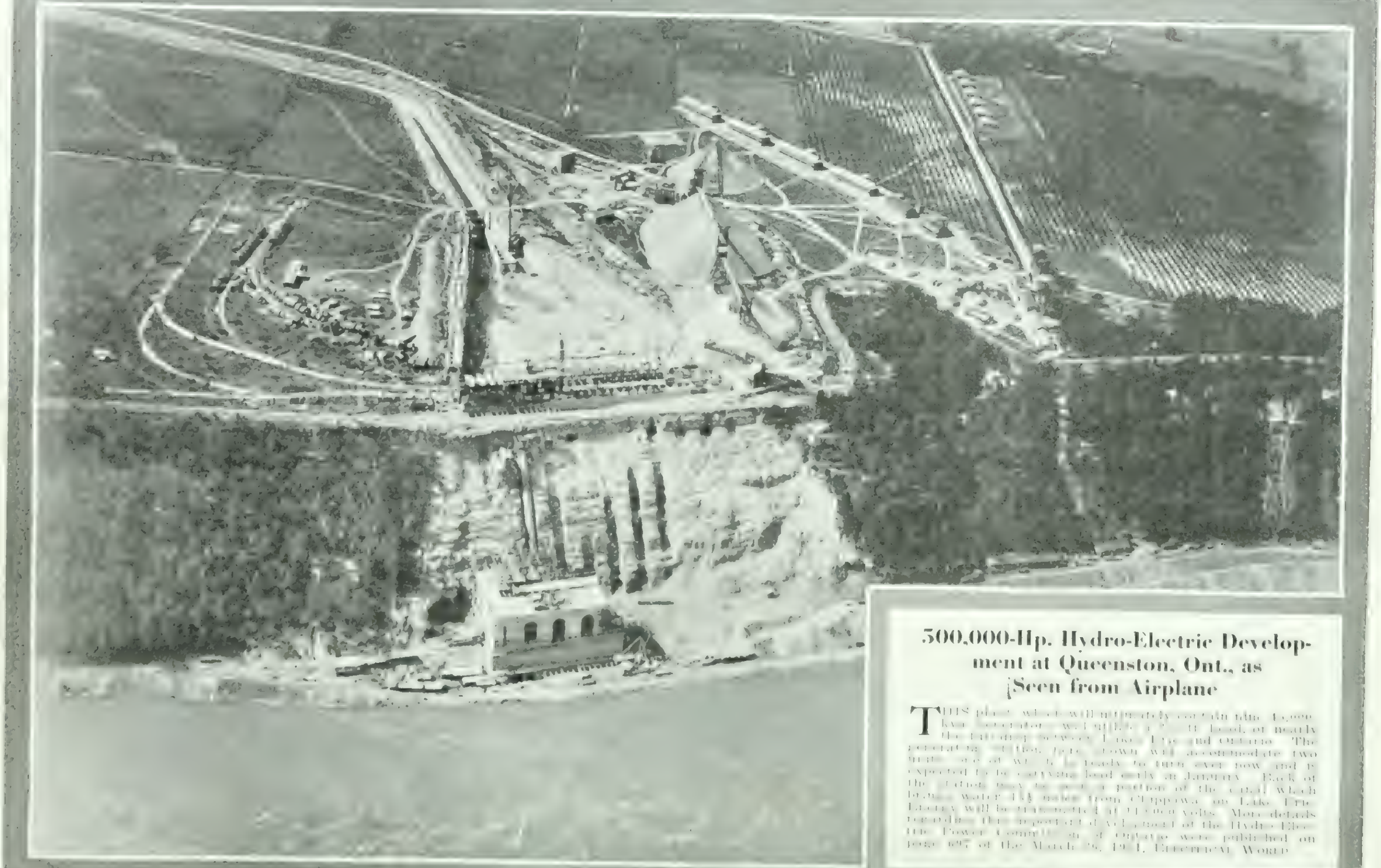
Power factor is certainly of sufficient importance to justify a serious attack along any line which promises success, and the static condenser furnishes such a line. Apparently we in this country are in this particular behind the game to a degree that is altogether regrettable. If our American manufacturers are ready to take up the matter and furnish a standard and reliable product, let them step forth. They will receive a cordial welcome from a great many badgered central-station operators.

The Natural Limitations of Municipal Power Developments

MUNICIPAL lighting and municipal power supply have long formed a bone of economic contention. Broadly there are many reasons why municipalities should not go into power enterprises. Chief among these is just plain graft, the strong probability that politics will get into the operation of a plant and make it a costly and an unsatisfactory investment for everybody except the grafters. One cannot go quite so far as the Psalmist and proclaim, "There is none righteous, no, not one," among city governments, because we know of some that have shown, at least in other things than municipal electric plants, a very high degree of honesty and common sense; but such a happy condition is unfamiliar in far too many communities.

As electric enterprises grow to larger dimensions another phase of municipal ownership rises to great importance. A city which merely runs its own plant from sources of power within its own boundaries has a simple problem in hand. If it goes into a power transmission scheme on such a scale that all the power will be promptly absorbed within the municipality, the difficulties are comparatively small. As extension goes on, however, a question must arise as to the rightfulness of a municipality investing its funds extraterritorially for developing power from a source which in equity belongs to other communities as well. Roughly, the question is this: Is a city justified legally or morally in issuing bonds to promote a transmission system passing three or four other municipalities which need power from the same source, when no provision for supplying these communities is made? On the other hand, if it does supply them, is it not going far beyond its municipal rights? Similar questions arise on a greater scale when interstate relations are concerned.

A private corporation can distribute and should distribute power wherever its lines can reach. It is not hampered in the issuance of securities for work in one or many states. A municipality, however, has certain charter limitations upon its power of borrowing money and with respect to the purposes for which loans may be obtained. It is for this reason ordinarily in a rather bad situation with respect to engaging in enterprises outside its own territorial limits. Difficulties enough, for instance, may arise in the case of a municipal water system, owing to the damage inflicted on other communities, and it has sometimes been necessary to strain a good many points of the law to carry out such an enterprise. If it should become common for cities to undertake power supply, these questions as to the extraterritorial rights of a municipal organization are bound to come to the front, and we are inclined to think that the courts of last resort will proceed slowly in allowing one municipality for its own gain to strike hard at the prosperity of another.



500,000-Hp. Hydro-Electric Development at Queenston, Ont., as Seen from Airplane

THIS plant, which will ultimately contain nine 45,000-kva. generators, will utilize a 305-ft. head, or nearly the full drop between Lakes Erie and Ontario. The generating station, here shown, will accommodate two units, one of which is ready to turn over now and is expected to be carrying load early in January. Back of the station may be seen a portion of the canal which brings water 13 miles from Chippawa, on Lake Erie. Energy will be transmitted at 110,000 volts. More details regarding this important development of the Hydro-Electric Power Commission of Ontario were published on page 697 of the March 26, 1921, ELECTRICAL WORLD.

The Natural Foundation Laws of Service[*]

A Graphic Presentation of the Reasons for and the Reward of Service Brought Down to the Terms of a Useful, Simple, Human Thought

By LOYAL S. WRIGHT

WE ARE living in the realm of law, not luck. All life is a sequence of law. I hold an object in my hand and suddenly release it. Unless impediments prevent, it will go straight to its attraction—Mother Earth. This is perfectly natural and never varies, never changes. If I step out of my window, sixteen stories above the street, I do not break any law, but the law proceeds to break me. And we use words loosely when we say we break the law, because we don't. It would make no difference if the President of the United States stepped out of my window. The law would likewise break him on the pavement below, because man did not make this law and man cannot break it.

The laws that underlie the principle of service are just as perfect and just as real as the law of attraction, and that men do not recognize this to be true does not alter the facts. Men have been attempting in the past through organizations and individually to break some of these natural laws, and the result has always been the breaking of themselves.

The serving of the public is a subject that has been discussed before many gas and electric conventions by many individuals. Bulletins have been written treating of the effects rather than of the causes, and the reason for the "upside-downness" and the "inside-outness" of business conditions is the simple fact that institutions serving the public have had their eye upon and set their ambitions on effects rather than causes and have failed to take care of the means that naturally lead to the end.

It is perfectly natural for objects to gravitate to the earth. It is no more natural, however, than for the public to gravitate to the concern that renders service. Like attracts like, and this truth is so simple and yet so important that institutions overlook the real issue.

PUBLIC PAYS THE BILLS

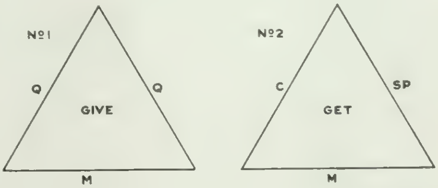
Employers have been trying to see how much they can get and how little they can give. Employees, likewise, have been trying to see how much they can get and how little they can give. The result has been a composite getting without the composite giving, and the public, being human and paying the bills, has felt this condition very keenly, which has resulted in the forming of prejudiced judgments and has torn away some of the concrete of confidence on which the public service corporations must at all times stand.

In other words, the books in the mathematics of life are out of balance. Some such spirit as this might be illustrated in the case of a fellow who appealed to the head of an institution for a job. His first question to the employer was: "How much will you pay me?" The employer replied that he would pay him all that he was worth. The man's answer was: "Nothing doing! I am getting more than that now."

This "principle of service" does not stop with the public service corporations. It is a universal principle—one that applies to the animal world, the vegetable world, the mineral world and even to the banker, and the violation of this principle has and always will mean heavy penalties. Let me illustrate in a simple way the mathematics of life as I see them, by making use of these two triangles:

Triangle No. 1 has for its right side right quantity of work, right quantity of giving. One naturally expects when he pays for service that the right quantity will be delivered, and a safe rule for all individuals connected with business in order to be sure that this side of the triangle is of the right dimension is to do a little more than is absolutely necessary. The left side of the triangle represents right quality of work or service rendered. The base of the triangle represents the mode or manner in which the work is delivered.

To apply this idea in a practical way: A bookkeeper may do all the work that is required of him and even more. He may work long hours, and faithfully, but if the quality of his work is not satisfactory, he is of no particular value to the institution. Again, he may do his work without making any errors, but if he doesn't do enough work, again his value is materially lessened and he cannot render service. Another bookkeeper may be a hard worker, his quantity of work may be right and his quality of work may be right, he makes no mistakes and is thorough in the work he does, but his manner of rendering that service, his mental attitude toward those with whom he works, his habits and so forth, his mode of conduct, may be off. In that event the two other sides of the triangle are killed. In order, therefore, for any individual engaged in human activity to render service he must have right quantity, right quality and right mode of conduct.



EQUILATERAL TRIANGLES OF SERVICE AND COMPENSATION

I know of a farmer who owns a dairy of high-grade cows, all registered, and while showing a friend of mine through his barn one day the friend observed on the stanchions of different cows letters—Q, Q, M. On some stanchions there was just one, on others there would be two Q's, and so forth. So he asked what they meant, and the farmer explained it in this manner. Pointing to cow No. 1, he said: "Here is a cow that gives a lot of milk. Her quantity is most excellent, but her milk is bluer than a whetstone. She tests less than 3 per cent and her quality is off. Therefore, she is going to get it in the neck." To another cow he pointed and said: "Here is a cow that gives the richest milk of all the cows in the barn, but she doesn't give enough milk to pay for the feed she is eating. Her quantity is off, and she," he added, "is going to the slaughter house." They came to a third cow, and my friend asked him about that cow, and he said: "Here is a cow that gives a large quantity of milk and gives very rick milk, but her manner of delivery is rotten, and she is going the same way as the others." And then the dairyman took the friend to still another cow, and approaching her very gently he said: "Here is a cow that is Q, Q, M. She gives enough milk, her milk tests a very high percentage, and her manner is fine." And he added: "I wouldn't take a thousand dollars for her." That cow had a blanket on and was receiving special care from attendants and enjoying life, simply because she was rendering service.

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[*] An address delivered before the Empire State Gas and Electric Association at Lake Placid, N. Y., Oct. 7, 1921.

I might go further and show how the same principle applies to the minerals, to vegetation, and so forth. But I think all will recognize that this is a universal principle that cannot safely be violated. So in the center of this first triangle "Q Q M" we put the word "Give."

Triangle No. 2 has for its right side the letters "SP," which mean self-preservation. This is a natural feeling for all individuals, because one of the first thoughts that come to us even in childhood is to preserve and take care of ourselves. The left side of this triangle we will name "C," which stands here for contentment. The base of the triangle we will call "M," which means money.

It may be that all three of these states are essential in order to be successful. One must be contented and must preserve himself. And I have never met very many individuals who were "broke" financially and were exceptionally happy. Therefore money is essential for happiness, and it is perfectly right and proper that we should strive to accumulate money. In the center of this triangle we will place the word "Get."

The Good Book says that the first shall be last and the last shall be first, and it is quite evident that in the attempt to serve the public many institutions and employees have been studying and practicing the teachings of the Good Book, and in the mathematics of life they have put Triangle No. 2 before Triangle No. 1. This is why I say that the books are out of balance. This is why I say that we are violating the great natural foundation law of service when we try to serve the public with the triangles in the wrong place.

Reward for Service

If at any gathering of men representing institutions engaged in commerce I should cause to be passed among the different attendants a slip of paper with this question on it, "Why are you in business?" the chances are that the majority of the replies would be, "To make money," "To make profit," and no doubt this would be a perfectly honest answer. But, as a matter of fact, these men are not in business to make money; they are in business to render service, and money is simply the natural effect, that is, reward for service rendered.

Everybody knows that if he builds a little fire he gets a little heat. If he builds a bigger fire he gets a bigger heat. It is likewise true that if he renders a little service he gets a little reward and if he renders a greater service he gets a greater reward.

Action and reaction are equal, and when gas and electric companies, or other public service companies, come to a realization of this great fundamental truth, the "upside-downness" and the "inside-outness" of things are going to be adjusted. You have got to give in order to get, and the best way that I know to absolutely destroy Triangle No. 2—which is the thing that you desire—is to allow selfishness or the spirit of getting predominate in your life and business.

In order to serve well, the individual or the collective group of individuals must first possess deeply the desire to serve. There is no weak sentimentality about this principle of service. It is a sound economic principle that does not change and cannot be violated without impunity. To the earnest man during these stressful times the only question would be, "How can this be accomplished? How can I so teach myself and also my employees this principle of service that the public may first feel its effect and confidence established in their minds and that our reward may automatically come back to us?" The answer is not easy by any means, and yet this can and should be accomplished.

First Step Is Salesmanship

Millions of dollars have been poured through the gutter of inefficient training. Plans that were valuable have never been carried through because of the lack of co-operation from officials, from heads of departments or from employees. The first step that must be taken is to recognize that it is a question of salesmanship. There are three sales to be made. The first sale is from the employer to the employees in order that the employee may have complete confidence in the institution and may become boosters instead of knockers—may at all times, from the office head down to the line men, speak well of the management. The second sale is the sale by the employees back to the institution in order that the institution, represented by the executives and managers, may have this same confidence in the employees. And the third sale necessary is the composite institution, that is, from president to porter, back to the public. When these three sales are accomplished, you have what I like to call a constructive organization, a solid line-up which becomes practically impregnable. Even then some disloyalty creeps into the institution, but it is very quickly discovered and eliminated because of the general composite condition.

Disloyalty and pessimism cause a great deal of trouble, not only to the individual who is so afflicted, but to the institution in general and to the public. It is true that some individuals are naturally pessimists. On the other hand, it is also true that the majority of human beings are very susceptible to development and may be taught the principle of service and will co-operate in building a real organization when they are properly instructed. It is the duty of every employer to co-operate on some fair basis with the employees, so that they may either hear some competent teacher on this subject or may have pamphlets or material that would teach them in a simple way the mathematics of life. And it should be remembered that this great natural foundation law of service, this law of get and give, is not alone an intellectual accomplishment or a physical accomplishment. It involves the deep-seated heart stuff which is so often lacking in the organization. You can buy heads and you can buy hands, but you cannot buy hearts. But head stuff and hand stuff without heart stuff will never build a constructive organization and an enduring institution.

First 220,000-Volt Station Completed

Construction Records Broken by the Completion of the Big Creek No. 8 Station of the Southern California Edison Company in Three Months—Simplicity of Station Layout a Feature

THE FIRST hydro-electric station to be built for 220,000-volt operation has been completed by the Southern California Edison Company. The station, known as Big Creek No. 8, has one 22,500-kw. vertical reaction turbine in service at the present time and plans are laid for the development of 135,000-kw. The lines are operating at 150,000 volts pending the construction of additional stations in the Big Creek project, at which time the lines will be raised to 220,000 volts. In addition to the high voltage the station is remarkable for the speed with which it was constructed. Excavation of the powerhouse site was started on March 1, 1921; the first concrete was poured on May 10; the station building was completed and all machinery installed with the exception of the high-tension switches on Aug. 1, and the unit was first turned over on Aug. 7.

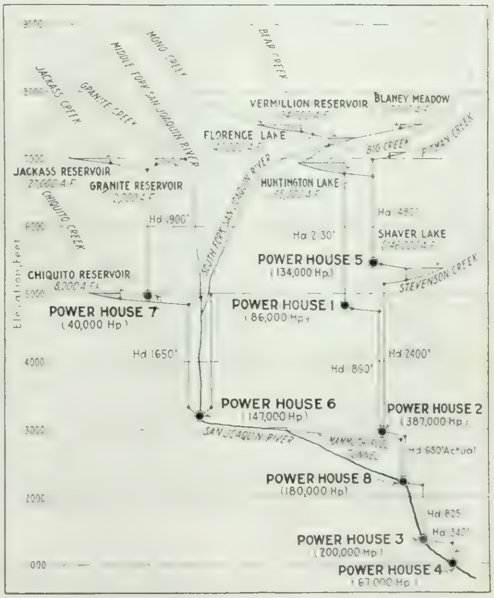
Big Creek No. 8 is the third unit of the Big Creek development of the Southern California Edison Company. A general survey of this development was given in the ELECTRICAL WORLD for Sept. 11, 1920, page 513. Stations No. 1 and No. 2 have been in operation for eight years, transmitting their output at 150,000 volts to Los Angeles, a distance of 240 miles (386 km.) over a two-circuit transmission line. No. 8 station is located at the junction of Big Creek and the San Joaquin River and is about 40 miles (64 km.) northeast of Fresno, Cal. It receives its water at the tailrace of Big Creek No. 2, from which point it is diverted by a low concrete dam through a tunnel approximately 2 miles (3.2 km.) long. The original plans were to carry the tunnel to a point where a head of about 1,500 ft. (450 m.) could be obtained, but these plans were modified owing to the urgency of providing additional power at an early date. Consequently the No. 8 station was designed to utilize 680 ft. (207 m.) of the available head, as this could be quickly done without affecting the total output of the ultimate development.

The selection of 220,000 volts for the transmission voltage was not because of the output of this station alone, but because of the ultimate output of the entire project. The present developed capacity of stations Nos. 1, 2 and 8 is 102,500 kw. The ultimate development of 929,000 kw. is detailed in the accompanying table.

The economical capacity of the two transmission lines to Los Angeles is about 60,000 kw. each at 150,000 volts, so it is evident this limit will be reached soon at the rate additional power is being developed. As the economical capacity of the lines operated at 220,000 volts will be more than double that at 150,000 volts, a great saving in right-of-way and line investment will be effected by the use of the higher voltage. The exact date upon which the line voltage will be increased has not been determined, but it will probably be within eighteen months.

At the outlet of the tunnel a steel surge tank 35 ft. (10.6 m.) in diameter and 90 ft. (27.4 m.) high has been constructed. In addition to taking care of possible surges in the penstock due to the operation of the wicket gates of the turbine, the tank will place the tunnel under pressure. A maximum surge of 70 ft. (21.3 m.) pressure is calculated for the penstock.

The penstock is connected to the surge tank with an 8-ft. (2.43-m.) coffin-sluice gate placed inside the tank, below which there is a 36-in. (0.9-m.) air-vent pipe extending to the top of the surge chamber. Provisions are made in the surge tank for the connection of two additional penstocks to supply water to units which will be added in the station later.

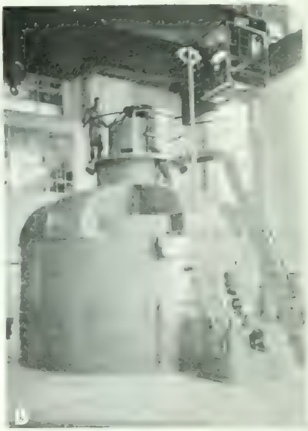


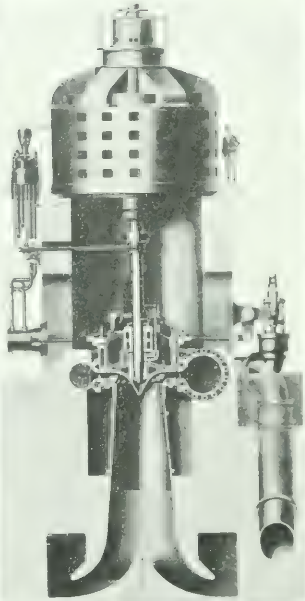
ULTIMATE DEVELOPMENT OF SAN JOAQUIN RIVER

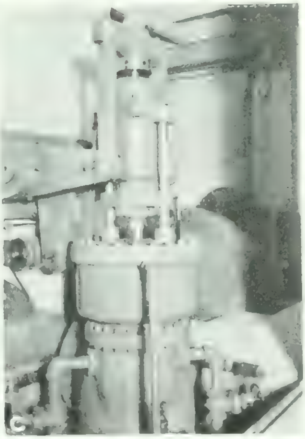
Station No	Rating, Kw	Head, Ft.
1	64,000	2,130
2	290,000	1,860–2,400
3	150,000	825
4	50,000	340
5	100,000	1,480
6	110,000	1,650
7	30,000	1,900
8	135,000	680
Total	929,000	10,865–11,005

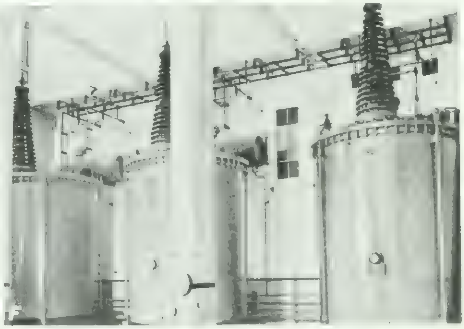
The upper 700 ft. (213 m.) of the penstock is 8 ft. (2.43 m.) inside diameter, riveted steel pipe. The remaining 2,000 ft. (600 m.) is of welded steel pipe with bumped joints. This type of joint was selected as with it the frictional losses are reduced to a minimum and the pipe is easy of assembly. Five concrete anchors are provided for the penstock, one at each of the angles in the pipe. Midway between anchors expansion joints are placed, principally because the pipe is uncovered. Each of the approximately 19-ft.

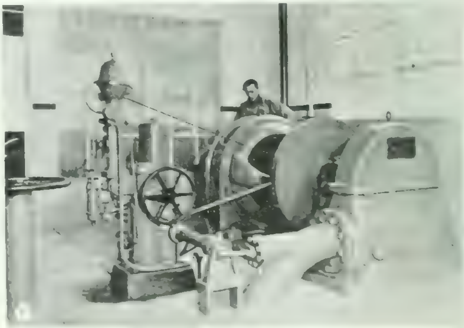
Some Interesting Hydraulic and Electrical Parts of Big Creek No. 8 Station











A—Waterwheel governor that permits ready change-over from automatic to manual control.

B—22,500-kw., 11,000-volt generator.

C—Release-valve control.

D—Cross-section of a prime mover showing governor on left, release valve on right, waterwheel rotor and draft-head regainer.

E—First section of main switchboard.

F—220,000-volt transformers are in bay adjacent to generator room. The transformers and the 220,000-volt oil switches constitute particularly interesting parts of this installation.

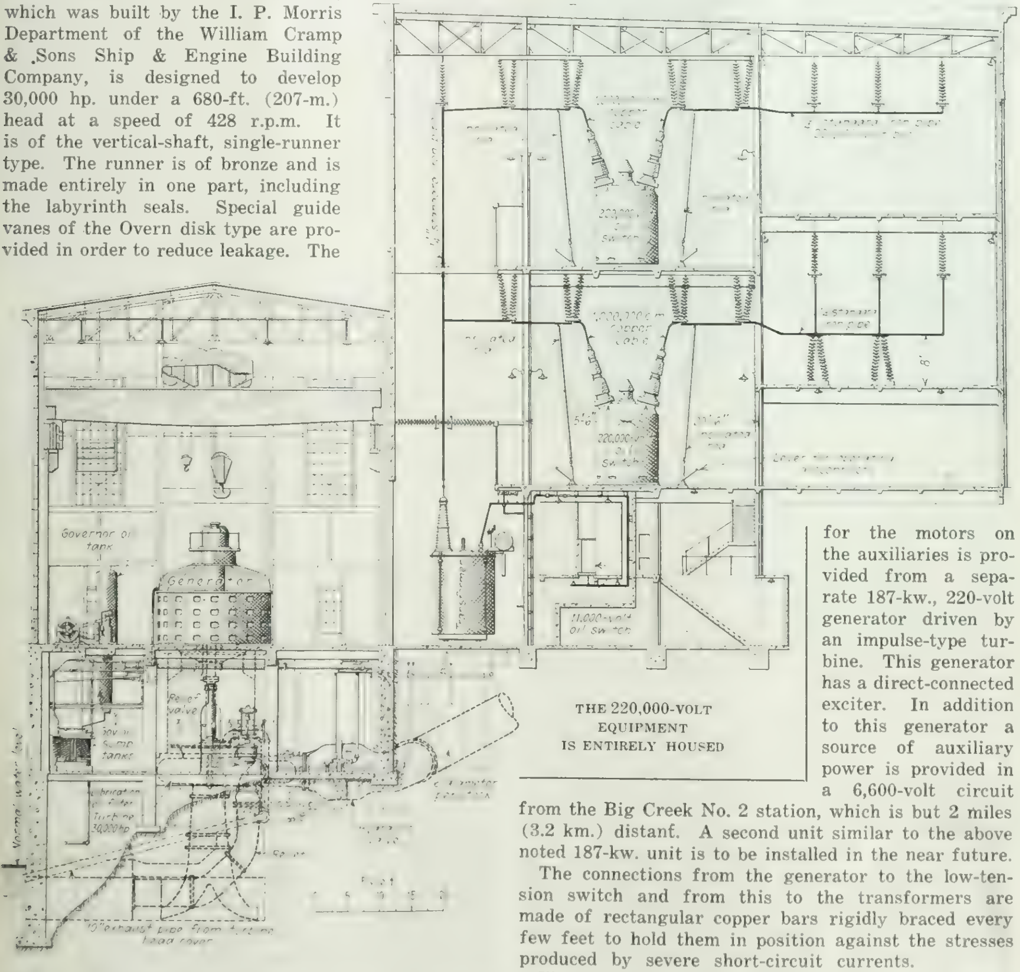
G—Station power generating set driven by impulse-type waterwheel.

(5.8 m.) sections of the welded portion rests upon a concrete saddle.

At the lower end the penstock is 6 ft. (4.8 m.) in diameter and connects to a Johnson valve having an intake diameter of 6 ft. and a discharge diameter of 4 ft. 6 in. (1.4 m.). This valve is connected to the turbine casing through a cast-steel pipe containing a Y-connection for a relief valve. The relief-valve disk is mechanically connected through a piston rod, heavy link, lever and reach rod to the operating ring of the turbine gates. The turbine, which was built by the I. P. Morris Department of the William Cramp & Sons Ship & Engine Building Company, is designed to develop 30,000 hp. under a 680-ft. (207-m.) head at a speed of 428 r.p.m. It is of the vertical-shaft, single-runner type. The runner is of bronze and is made entirely in one part, including the labyrinth seals. Special guide vanes of the Overn disk type are provided in order to reduce leakage. The draft tube is of the Moody spreading type. The intermediate section of the tube immediately below the runners is made removable in order that the runner may be replaced from below.

The governor is of the I. P. Morris double floating-lever type furnished with an automatic device known as the Taylor control system. By the use of this system a movement of one hand lever permits a change-over from governor to hand control and thus avoids all danger of a runaway or difficulties due to loss of control of the unit during the change.

The generator was manufactured by the General Electric Company and generates at 11,000 volts. A direct-connected exciter is provided on the upper end of the generator shaft. Between the generator and transformer is connected an oil switch which is to be used primarily for synchronizing, particularly when the later units are installed. A bypass connection is provided around the switch so that it may be worked upon without taking the generator out of service. There is no low-tension bus.



THE 220,000-VOLT EQUIPMENT IS ENTIRELY HOUSED

Auxiliary electric power for the station lights and for the motors on the auxiliaries is provided from a separate 187-kw., 220-volt generator driven by an impulse-type turbine. This generator has a direct-connected exciter. In addition to this generator a source of auxiliary power is provided in a 6,600-volt circuit from the Big Creek No. 2 station, which is but 2 miles (3.2 km.) distant. A second unit similar to the above noted 187-kw. unit is to be installed in the near future.

The connections from the generator to the low-tension switch and from this to the transformers are made of rectangular copper bars rigidly braced every few feet to hold them in position against the stresses produced by severe short-circuit currents.

The transformers, which are of General Electric manufacture, are rated at 8,233 kva., 220,000 volts, and involve several new features of construction. The fact that they are to be connected without resistance to a permanently grounded system made possible the attachment of the line terminal to the middle of the coil stack and the attachment of the neutral to the top and bottom of the coil stack. With this arrangement ample creepage distance to ground is obtained along the supporting and insulating cylinders within the dimensions of the coil stack. If the usual construction had been employed with the line end at the top or bottom of the

BIG CREEK NO. 8 STATION IS AT JUNCTION OF BIG CREEK AND SAN JOAQUIN RIVER (BIG CREEK IN LEFT FOREGROUND)

stack, these supporting cylinders would have projected at least 16 in. beyond the coil stack, thus increasing the height of the core about 32 in.

The position of the line terminal attachment necessitates two multiple circuits on each of the two core legs so that enough turns had to be provided for double the rated voltage. Instead of connecting adjacent coils on the same core leg in series, adjacent coils on opposite legs are connected in series, that is, the coils are cross-connected.

The low-voltage winding consists of a helical coil of eight strands wound in multiple, each turn of the coil being separated from the adjacent turn by a generous oil duct. Such construction insures free oil contact with the winding and possesses exceptionally good mechanical characteristics. The spacing between turns corresponds to the spacing between coils in the high-voltage winding, permits the cooling of the heavy conductor in the same manner that the cooling of the high-voltage coils is effected, and prevents local spots of high temperature. This insurance is not jeopardized by the pressboard supporting structure as this is so located that it does not require any heat transmission through it. The circular coil structures on both high-tension and low-tension windings afford excellent mechanical resistance against radial forces, while the steel supporting structure at each end of the coil stacks resists longitudinal forces.

To obtain the necessary radiating surface and substantially circular outline the core was made in five steps. Asbestos-covered heat-resisting core bolts, staggered in location, and core sections separated by sheet asbestos make any high internal temperatures which may accidentally occur perfectly safe. This construction had been previously extensively used and tested in service, the only new features involved being a slight increase in the dimensions over those of the largest similar core structure previously used.

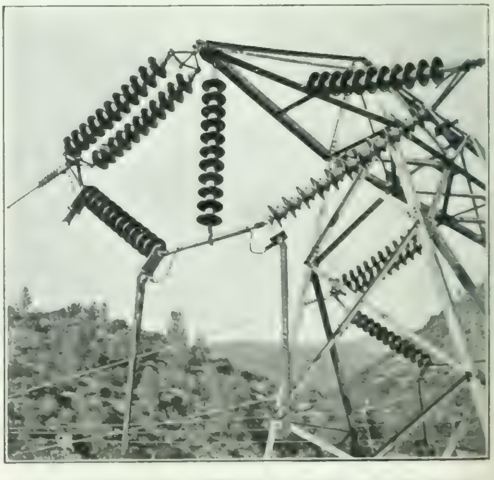
The completely oil-filled tank, of conservator type, which is employed in this make of transformer has been used before and has demonstrated its value and efficiency in protecting or guarding the oil against deterioration.

The high-tension leads (only one being required to each transformer tank) had previously been developed for other requirements. They are of the oil-filled type, which are now available for any voltage above 60,000. The bushings for this transformer were tested at 565,000 volts for one minute. They have a dry arc-over value of 650,000 volts and a wet arc-over value of 485,000 volts.

From the high-tension bushings of the transformers leads are taken to the two 220,000-volt oil switches, which are mounted on separate floors one directly above the other. From the oil switches connection is made to the high-tension buses. These can hardly be termed buses in the usual sense of the word as they are actually a part of the transmission lines. As shown in the wiring diagram, the high-tension wiring is extremely simple, there being no oil switches in the lines themselves. Units to be added later will have oil switches connecting their transformers to the buses in a manner similar to the first units.

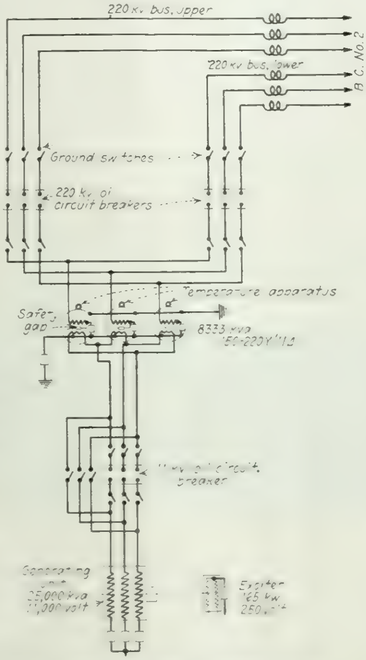
The high-tension buses are supported by pillars of unit-type disk insulators arranged in the shape of a tripod. Investigations are being continued as to the proper number of units for use at the ultimate voltage of 220,000. It is expected that some form of shield ring will be placed at the line end of the insulator strings in order to distribute the stress over the line units, but the exact form of these rings has not as yet been determined upon.

The 220,000-volt oil circuit breakers, which were also furnished by the General Electric Company, are housed in huge cylindrical tanks, one to each phase, and have the largest bushings ever supplied for commercial switches. At their lower ends are explosion chambers which inclose the stationary contacts. The



TWO DISCONNECTING SWITCHES IN SERIES IN EACH PHASE OF 220,000-VOLT LINE movable contacts for each phase consist of two electrically connected copper plungers, one clamped at each end of a horizontal wooden cross-bar, which in turn is attached to a vertical wooden operating rod guided at two places. This breaker, complete with mechanism and oil, weighs 202,000 lb.

The station building is of steel-frame construction and has reinforced-concrete walls. It consists of two principal portions, one part housing the generator and control equipment and the second housing the switches and bus structure. The latter were placed indoors to protect them from the weather so that any necessary repairs might be carried on most conveniently. One end of the building is sided with galvanized iron in order to provide for future extensions. At the other end of the building the switchboard, offices, pump rooms and supply rooms have been placed. A standard-gage track also enters this end of the building on which future equipment will be brought into the building. A 150-ton (136-metric-ton) crane is installed in the generator room. As the station is at only 2,250 ft. (675 m.) elevation and is built in a box canyon where high summer temperatures are experienced, a humidifier is provided for the generator. Air is taken through this into the turbine floor and exhausted upward through the generator.



SWITCHING AND CONNECTIONS ARE EXTREMELY SIMPLE

On the turbine floor and the one below are vertical pumps for lubricating oil and transformer cooling water and sump water. These are connected to vertical motors placed on the generator floor in order that they may be under the direct observation of the operators. Two motor-driven rotary pumps supply oil to the governor and one impulse waterwheel is provided as an auxiliary to the two motor-driven pumps and may be connected to either of them through a hand-operated clutch.

The material and apparatus for the power house were carried by railroad to a point above the station at an elevation of approximately 5,000 ft. (1,500 m.), whence it was lowered to the station over an inclined cable railway about two miles (3.2 km.) long. The construction was under the direction of E. R. Davis, manager of construction Southern California Edison Company.

System Voltage Raised Without Suspending Service

Old System, Which Was 2,300-Volt, Three-Wire, Changed to 4,000-Volt, Four-Wire, Without Damage or Inconvenience

By Austin Burt
Manager Citizens' Gas & Electric Company, Waterloo, Iowa

CHANGING from 2,300-volt, three-phase, to 4,000-volt, four-wire, three-phase distribution involves some nice planning if service is not to be seriously interrupted. This task was accomplished at Waterloo, Iowa, without a single instance of personal injury or property damage, and not a single customer was in any way inconvenienced in his service.

The old central station, like Topsy, "just grew" from 433 kw. in engine-driven capacity to 4,600 kw. in turbine-driven capacity, and the original 2,300-volt, three-wire, three-phase distribution system developed with it to supply the demands of a population that increased in seventeen years from 12,000 to 34,000. During this period the number of factories increased from twenty to 150 and the connected motor load from 25 hp. to 6,300 hp.

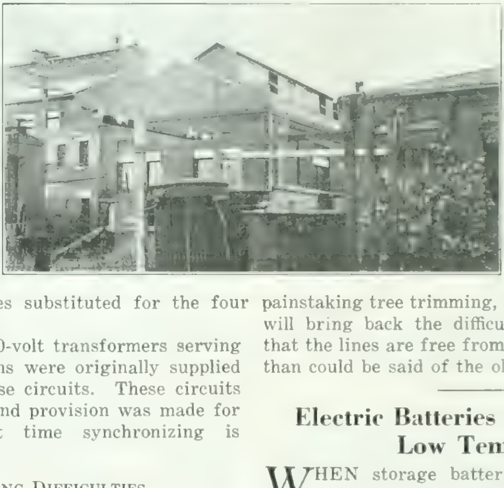
New Station Necessary

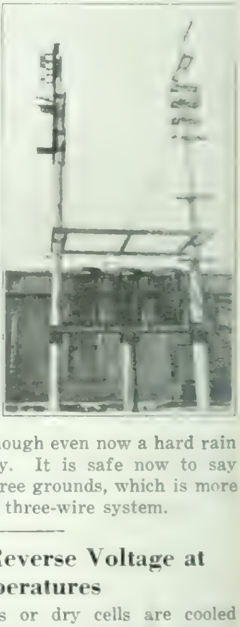
A new and more favorable station location was selected and all-new equipment installed. This gave the opportunity to provide 4,000-volt generators and revamp the inadequate distribution system for 4,000-volt, four-wire operation. The two main problems concerned the lighting and power feeders, minor problems arising with the special installations of a few consumers. There were four 2,300-volt single-phase lighting feeders equipped with Westinghouse induction regulators. In making the change two new four-wire feeders equipped with automatic induction regulators between each phase wire and neutral were run to centers of distribution. The four old circuits were cut to make six. The necessary new wire was run to the distribution center, and the cuts and taps were made to put the single-phase circuits between the new feeder phase wires and the neutral at a time when service would not be interfered with.

The power circuits, consisting of four 2,300-volt feeders of No. 1/0 copper, were all badly overloaded. The fourth wire was unnecessary as the power transformer banks could be operated with a floating neutral. The delta banks were changed to star connection, and the open-delta banks had one transformer added and the primary connections changed. In these larger problems it will be observed that it was not necessary to supply new equipment except for the tying in of the old circuits to the new station. Although the new station was put in operation on March 1, the old plant was kept running until the change-over of the distribution system was completed on the following July 4, thus keeping the amount of cutover work at any one time to the minimum and avoiding the use of special equipment to keep circuits on which the cut-over was not complete in service.

At one important location the consumer wanted the equivalent of protection found in a delta connection when one of the three transformers burns out. To provide this a near-by neutral wire was extended to his transformer bank so that an open-star connection could be used in an emergency. Several installations of 2,300-volt motors and motor-generator sets, the latter all office elevator equipments, were handled by installing at the old station two step-down and step-up transformers, rated at 4,000/230 volts and 230/2,300 volts respectively, to maintain 2,300-volt, three-phase service until the necessary rewinding of motors could be completed or replacements made.

The underground system, devised by the writer and in operation about nine years, supplying the business district, consists of four 2,300-volt, single-phase-three-phase, three-wire combination lighting and power feeders with automatic regulators in the lighting phase. The system could not be operated with a star connection and was changed to 4,000 volts and maintained at three-wire delta with new transformers of double capacity and 4,000-volt primaries substituted for the four 2,300-volt transformers.





TRANSITION FROM 2,300 VOLTS TO 4,000 VOLTS MARKED BY CHANGED LINES AND TRANSFORMER CONNECTIONS

Left—New six-pin pole line with old poles not yet removed. Center—Step-down (4,000/230-volt) and step-up (230/2,300-volt) transformers used in making transition. Right—One of the transformer banks which was changed from delta to star connection for 4,000-volt operation.

Two banks of 2,300/33,000-volt transformers serving twenty-eight cities and towns were originally supplied by two 2,300-volt, three-phase circuits. These circuits were changed to four-wire and provision was made for grounding the neutral at time synchronizing is necessary.

Neutral Grounding Difficulties

The arrangement in the station provides for the grounding of each generator through an oil switch, but in operation after the generators are synchronized only one is grounded to avoid flow of the third harmonic current. Attempts to ground the neutral of the lighting circuits near the transformer locations led to serious interference with the 60-cycle ringing circuits of the telephones so this method of grounding had to be discontinued. The neutrals of all overhead lighting circuits are grounded at the station, however. Some difficulty was encountered from the breaking down of transformer bushings by lightning. Single-gap arresters made by shorting all the gaps of old multi-gap arresters were cut in at various points between the neutral and ground, especially at hilly locations, and the trouble disappeared. The lighting-circuit neutral grounds at the station give rise to a total harmonic current varying from 5 amp. to 45 amp. Power feeders are not grounded. The neutrals of the high-tension transformer bank circuits are grounded only when the transformer banks are being synchronized. When connected, the harmonic currents vary from 40 amp. to 70 amp. All secondaries below 440 volts are grounded.

The old multi-gap arresters at the station were replaced by electrolytic arresters, while the old pole-type 2,300-volt arresters were replaced with compression-chamber arresters. Three 2,300-volt single-circuit series incandescent "tubs" on the street lighting were connected to one phase and the neutral wire and operated as before.

Operating Difficulties Few

The operating difficulties have been few, the most serious being that caused by tree grounds. With the grounded neutral system the slightest contact will cause the relay to operate or burn a wire off. The trouble has been reduced to a minimum by the most vigilant and painstaking tree trimming, though even now a hard rain will bring back the difficulty. It is safe now to say that the lines are free from tree grounds, which is more than could be said of the old three-wire system.

Electric Batteries Reverse Voltage at Low Temperatures

When storage batteries or dry cells are cooled down to minus 170 deg. C., the temperature of liquid air, these producers of electricity may reverse their voltage. This is the scientifically startling phenomenon that has been discovered at the Bureau of Standards, Department of Commerce, by G. W. Vinal and F. W. Altrup, who were making tests to determine the reliability of batteries at arctic temperatures. So far as is known, this is the first time this phenomenon has been observed.

Down to 80 deg. below zero, the voltage remained at the normal value. At about minus 100 deg. C. the voltage dropped down to nothing and then, at a slightly lower temperature, strangely registered a minus reading as high as 10 volts. The voltage fluctuated violently, ranging from positive 10 volts to negative 10 volts. These reversals happened whenever the frozen electrolyte of the cell "ticked."

No hope is held out by the Bureau of Standards that storage batteries can be recharged by the simple method of cooling them to the low temperatures used in the tests. The currents at these low temperatures are vanishing small, and practically they hardly exist.

Experience with Powdered Coal in Arizona

Advantages of This Fuel and the Solution of Some Problems Encountered—Costs Less than Fuel Oil per B.t.u. in This Case—Detailed Costs of Pulverizing Given

By J. B. JOHNSON
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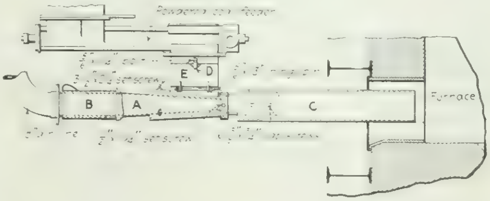
VERY economical generation of steam has been accomplished with powdered coal in the Verde district near Jerome, Arizona. The equipment necessary to obtain the best results and the costs of generation have been carefully studied. Details of the processes and of the plants installed are given in this article, which also contains costs of preparing powdered fuel.

The largest item of expense when installing powdered coal equipment is the cost of the plant for preparing the coal. A plant for this purpose usually consists of the following divisions, named in the order in which the coal passes through them: (1) Storage; (2) coarse crushing; (3) drying; (4) disintegrating; (5) pulverizing, and (6) collecting and conveying to furnaces.

Run-of-mine coal must be crushed before drying so as to break up the lumps to sufficient fineness to liberate the contained moisture during the drying process. The crushing in this stage should make a product not over 1¼ in. (3.18 cm.) nominal size. If the product is too fine, there results a great loss in the dryers due to the escape of "fines" in the dryer uptakes. On the other hand, if the product is too coarse, the moisture will not be sufficiently expelled. The moisture content after drying should not exceed 2 per cent for best results. At the plant of the United Verde Copper Company the moisture runs sometimes as high as 5 per cent without any detrimental results.

After drying the coal is pulverized. As most pulverizers work better on a ¼-in. (6.4-mm.) feed than a coarser feed, it is usually economical to introduce another crushing stage before pulverizing. This reduction is done in disintegrators to about a ¼-in. size. Coal of this size is then fed into the pulverizers, which make a product 80 per cent of which will pass through 200 mesh and 90 per cent through 100 mesh. The separation of the finished coaldust from the pulverizer mills in most modern plants is effected by an upward current of air induced by a powerful exhauster installed above the mill. This method is employed at United Verde. The separation of the dust from the air is later effected by dust collectors of the tangential cyclone type, one primary and a smaller auxiliary being required for each mill. Such separation at this point presents one of the difficult problems in the preparation. When the plant of the United Verde first began operations a muslin tube filter and dust collector was installed, connected by means of a header duct to the vents of all the auxiliary collectors. A vacuum was maintained in this header by means of an exhaust fan beyond the filters. The results obtained in keeping the plant free from dust and preventing dust losses from the main vent were highly satisfactory, but an objection lay in the fact that a header duct was necessary to connect up all the auxiliary collector outlets, thus communicating any fire in the system to this header and to the dust filter. After several fires had burned out the muslin filter tubes this apparatus was disconnected and individual filters were placed over each auxiliary collector. These filters consisted of stacks with baffles and water sprays, the dust caught being washed into a pipe line carrying it back into the main coal-storage plant. This system prevented the communication of fires as it did away with the common header, but allowed considerable dust to escape into the atmosphere.

The ideal result to be obtained is a complete separation of air and dust, but it is more economical to return the greater part of the air to the pulverizer mills, the remainder going to the atmosphere, the dust loss then being confined only to that portion which remains suspended in the air and escapes to the atmosphere. In the Raymond pulverizer mills used at the United Verde about 80 to 85 per cent of the total air handled by the exhauster remains in this closed circuit, returning to the mills in the air downtakes.



POWDERED-FUEL BURNER USED AT CLARKDALE PLANT

Previous to reaching the dryers all lump and slack coal is conveyed on belt conveyors. Out of the storage bunkers the coal is reclaimed by means of a clamshell bucket and gantry crane. The bunkers adjacent to this crane are equipped with bottom gates opening into an underground tunnel in which a belt conveyor runs. A traveling feeder supplies the belt from any gate under which it can be spotted. This belt delivers to the coarse coal crusher, and another similar belt conveyor delivers to the dryer bins from the crusher. The coal from the dryers to the pulverizer mills and the coaldust from the mill collectors to the furnace bins are handled in 14-in. (35.5-cm.) screw conveyors.

The dryer furnaces use powdered coal for fuel, and in conveying the coaldust to these furnaces an air transport system has been in use. Air at 40 lb. (2.8 kg.) pressure shoots the coaldust through a 4-in. (10-cm.) pipe about 150 ft. (45 m.) long. The coaldust is weighed and dropped into a tank into which the air is turned. Dust collectors at the other end of the line collect the dust, releasing the air through a vent in the top. This air transport has given good service. Even bolts and nuts accidentally dropped into the coaldust have been transported through the pipe line with the dust without injury to the apparatus. The coal fed through this system has averaged 3 tons per day, but the system is good for at least ten times that much.

In conveying coaldust to the furnaces the screw conveyor has been relied upon as the economy of the air transport is doubtful under conditions of heavy tonnages.

As shown in the accompanying table, the cost of pulverizing one ton is $0.98, not including fixed charges. The plant charges also are given in this table.

The coaldust is fed to the furnace burners by means of a small 4-in. double-flight screw feeder with flights at 4⅝-in. (11.6-cm.) pitch. The speed of the screw can be varied from 15 to 100 r.p.m., feeding between 0.22 ton and 1.46 tons per hour. The rate of feed that is most economical varies with air pressure. If the air velocity falls below a certain critical point, the coaldust will drop from suspension and obstruct the flow of the mixture into the furnace. For this reason the air duct must be small enough to insure a velocity of at least 110 ft. (33 m.) per second. This can usually be maintained by a pressure of 2 oz. per square inch (8 grams per sq.cm.) inside the burner duct. The question of the proper initial air pressure to use is still unsettled. The problem involved is only one of economy, however, as installations using 90-lb. (6.3-kg.) high-pressure air have been successful. Of course, only a portion of the air necessary for complete oxidation of the fuel is supplied by blowers under high pressure. The coal burners as usually designed are air injectors drawing induced air into the burner tubes along with the coaldust fed into it by the feeders. The air supplied by blowers varies from 20 per cent to 50 per cent of the total. As a general principle it may be stated that the higher the blower pressure the less blower air required. Experience has taught, however, that the highest air economy lies within the range of the low-pressure blowers from 6 oz. to 20 oz. pressure per square inch (26 grams to 88 grams per sq.cm.), and not in the range of the high-pressure compressors. This is due largely to the fact that the type of air injectors most suitable for blowing coaldust are not efficient injectors with high-pressure initial air.

COST OF PREPARING POWDERED COAL FOR FUEL

The capacity of the storage bunkers is approximately 13,000 tons of lump coal. The normal capacity of the pulverizing plant is 750 tons per day, with twenty-four hour operation. At this rate of operation, however, the pulverizing plant proper is the only portion that needs to run three eight-hour shifts, the dryers running only two eight-hour shifts. The first costs of the plant, which are shown below, are figured on the above basis of operation. The operating costs, however, as given in the table, are figured from actual operating conditions; that is, an average of 130 tons per day. This condition obtained during the three-month period ended July 1, 1920, which was the period investigated.

OPERATING COSTS

Operation	Operating Cost per Ton
Unloading, storing and reclaiming lump coal	$0.07
Conveying and primary crushing	0.05
Drying and disintegrating	0.30
Pulverizing	0.56
Total	$0.98
Power cost (21 kw.-hr. per ton at 1.5 cents per kilowatt-hour)	$0.32

FIXED CHARGES

	Fixed Charges per Ton at 750 Tons per Day	Fixed Charges per Ton at 130 Tons per Day
Unloading, storing and reclaiming	$0.08	$0.45
Conveying and primary crushing	.01	.06
Drying and disintegrating	.09	.57
Pulverizing	.14	.80
Fixed charges, total	$0.32	$1.88

FIRST COST OF PLANT

	Per Ton Storage Capacity
Storage and reclaiming plant	$13.00
	Per Ton Daily Capacity
Primary crushing plant	32.00
Drying and disintegrating plant	286.00
Pulverizing plant	403.00

The powdered-coal burners developed at Clarkdale are shown in the accompanying sketch. Blower air is delivered through an 8-in. (20.3-cm.) duct to each burner. Coaldust is fed from the 4-in. (10-cm.) screw overhead through the vertical chute *E* on to the first air nozzle *A*. The first stage of induced air is drawn in around this nozzle and regulated by means of sleeve *B*, which slides back and forth over the pipe. The second stage is induced into the burner pipe *C* after the coaldust has been fed into the air current. The burner pipe contains a fair mixture of powdered fuel and air which is introduced into the furnace through cast-iron burner ports. This mixture acts as a fluid and is under a pressure varying from 3 oz. to 6 oz. per square inch (13 grams to 26 grams per sq.cm.) and contains approximately 85 per cent of the total air necessary for complete combustion. The remainder of the required air is drawn into the furnace through the furnace walls, burner ports, etc.

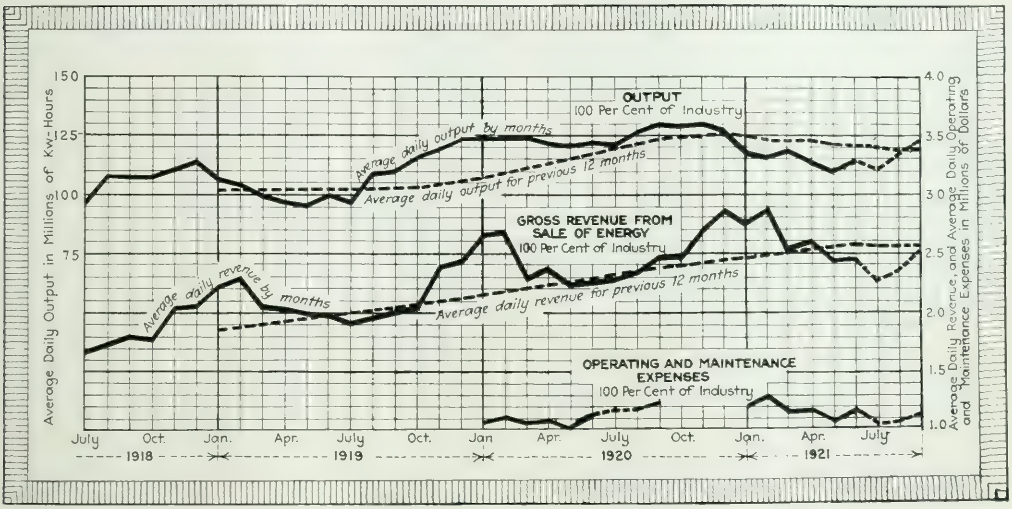
Powdered-coal burners for steam-boiler application must differ in design very materially from those in use on various types of heating furnaces. Many of the failures of powdered-coal application to boilers can be attributed to ignorance of this fact. The principal point of difference in these designs lies in the fact that boiler burners must be capable of quick and efficient regulation within the limits of a wide range. Boiler furnaces must be specially designed for burning powdered coal to accommodate the removal of slag and ashes. It must be kept in mind that powdered coal contains as much ash as the lump coal from which it was prepared. In a properly designed furnace ashes and slag drain into the ash pit continuously as fast as deposited.

There is no more danger in handling and transporting powdered coal than in handling and transporting gasoline if the same precautions be observed in both cases. Powdered coal will oxidize very rapidly when exposed to the atmosphere owing to the enormous surface exposed by the dust particles; therefore, if allowed to accumulate anywhere inside a building or pulverizer mill and lie for two or three days, the least amount of heat applied will cause it to ignite and burn. Some trouble was caused at the Clarkdale plant from the burning of coaldust inside the pulverizer mills during the early days of the plant operation. This was due to coaldust lodging in one or two places inside the mill after it was shut down. Upon starting up after a day or more idleness this dust would ignite in the current of air drawn through by the exhauster, and it was necessary to flood the mill in order to put the fire out. This trouble has, however, been largely overcome by the ordinary precautions of cleaning out all pockets of accumulated coaldust when the mill is shut down. At Clarkdale as much as 10,000 tons of lump and stack have been stored in the storage bunkers, which are built water tight on the ground, and it has been found necessary to flood the coal almost daily in order to prevent spontaneous fires. The bunker construction and design render this operation very simple, and therefore no trouble from this source has ever been experienced, although the New Mexico coal which is used here is very susceptible to spontaneous fires.

Comparisons of powdered coal with fuel oil must not only take into account the efficiency on a heat basis but also the expense of preparing the fuel and the fixed charges on the plant. After taking these into account in the United Verde plant, it was found that powdered coal was markedly more economical than oil fuel. The evaporation based on tests at the plant of the United Verde Extension was 6½ lb. of water net per pound of coal. The average coal cost, f.o.b. smelter, Clarkdale, Ariz., in 1920 was $6.10 per ton.

The coal that is used in this district varies in heating value from 10,500 to 11,800 B.t.u. per pound high value, while the California fuel oil which is used here averages 18,000 B.t.u. per pound. To arrive at the total fuel cost it is necessary to add the costs of unloading, storing, and, in the case of oil, pumping, heating and atomizing, and in the case of coal, crushing, drying, pulverizing, conveying and blowing into furnaces.

Energy Output Continues to Increase



CENTRAL-STATION OUTPUT AND GROSS REVENUE INCREASE DURING SEPTEMBER

REPORTS received by the ELECTRICAL WORLD for the month of September from central generating and distributing companies representing 78 per cent of the installed rating of the country indicate that the average daily electrical energy requirements during that month were the largest since December, 1920. A slight general increase in industrial power use and, of course, the advancing lighting requirements, added to the consumption of new customers, explain the increase in average daily output of 4,846,000 kw.-hr. over that reported for August.

From an economic viewpoint the September returns are most encouraging to the electric light and power industry, especially when the industry is compared with other primary industries of the country. The electric light and power industry, while selling 4.3 per cent less electrical energy in September this year than in September, 1920, reported gross revenue from sale of energy 2.1 per cent in excess of that received for September last year. In addition, the operating and maintenance expenses during September were 6.4 per cent below those of September, 1920. From this it is apparent that there has been a considerable increase in the high priced energy consumption, indicating a growing number of domestic customers. When comparing one month with the corresponding month in the year previous sight must not be lost of the added consumption by new customers connected during all the intervening months. While the extent of this growth is not definitely known, the ELECTRICAL WORLD is making a survey the results of which should be available about the first of the year.

The output of electrical energy during September reflected industrial activity about on a par or slightly above that of August, with the exception of the Atlantic States, where an undoubted upward swing in industrial activities is discernible. A seasonal increase in energy consumption for lighting purposes, however, was reported by every section.

Slightly increased operations were reported by the textile mills in New England during September, and virtually all the paper mills were opened during the month after a prolonged strike. The other primary industries of this section were operating at about the same capacity as during August. These slight increases in industrial requirements, augmented by an increased lighting load, and new lighting and industrial customers, resulted in an average daily electrical output of 850,000 kw.-hr. in excess of that reported for August.

In the Middle Atlantic States the first sign of general industrial improvement was reported in August, and a very gradual increase in industrial operation continued in September. The coal mines in the western part of the section increased production, and textile mills and clothing factories continued slowly to approach normal.

TABLE I—CENTRAL-STATION RETURNS BY SECTIONS OVER A TWELVE-MONTH PERIOD

Month	Percentage of Installed Ratings Represented	New England States 1920 Thousands	New England States 1919 Thousands	New England States Per Cent Increase	Percentage of Installed Ratings Represented	Atlantic States 1920 Thousands	Atlantic States 1919 Thousands	Atlantic States Per Cent Increase	Percentage of Installed Ratings Represented	North Central States 1920 Thousands	North Central States 1919 Thousands	North Central States Per Cent Increase	Percentage of Installed Ratings Represented	South Central States 1920 Thousands	South Central States 1919 Thousands	South Central States Per Cent Increase	Percentage of Installed Ratings Represented	Pacific and Mountain States 1920 Thousands	Pacific and Mountain States 1919 Thousands	Pacific and Mountain States Per Cent Increase
KW HR OUTPUT																				
Oct.	82	196,310	191,132	2.7	66	964,739	841,694	14.5	74	896,241	817,757	9.5	56	157,267	126,769	24.1	79	[illegible]	522,136	11.7
Nov.	82	193,231	183,624	5.4	66	953,436	825,011	15.5	74	895,229	861,352	10.5	56	144,889	125,438	15.0	79	554,920	507,977	9.2
Dec.	82	210,494	227,403	7.4	66	969,909	917,945	5.7	74	903,628	852,264	5.9	56	140,485	133,419	5.3	79	568,038	517,715	9.6
		1921	1920			1921	1920			1921	1920			1921	1920			1921	1920	
Jan.	81	200,269	247,800	-19.2	77	1,003,223	1,043,650	-3.9	73	860,643	956,078	-10.0	62	144,936	145,336	0.3	81	556,561	[illegible]	1.1
Feb.	81	178,694	216,890	-17.6	77	902,030	970,539	-7.0	73	789,539	882,873	-10.6	63	131,654	132,537	-0.7	81	451,754	508,961	-11.2
Mar.	81	205,348	230,309	-10.8	79	1,029,120	1,119,428	-8.1	73	894,500	941,893	-5.0	63	139,381	136,017	2.4	81	538,260	516,434	4.2
April	81	196,680	227,008	-13.3	79	963,659	1,052,716	-8.4	73	828,457	894,028	7.3	63	132,075	135,421	2.5	88	555,048	526,644	5.4
May	82	191,141	219,298	-12.8	79	934,973	989,408	5.5	73	819,506	899,657	-8.9	63	136,573	138,416	1.3	89	586,264	642,495	8.7
June	82	192,007	219,476	-12.5	79	940,443	1,003,727	-6.3	73	806,270	880,934	-8.5	63	136,011	129,120	5.3	89	611,128	639,637	-4.5
July	81	187,622	218,995	-14.3	79	934,822	1,026,390	8.9	73	804,009	884,572	9.1	64	140,795	141,450	-0.6	89	639,768	678,725	-5.7
Aug.	81	205,351	224,324	-8.5	79	993,427	1,040,158	-4.5	73	848,509	920,353	-7.8	64	147,967	154,353	-4.1	89	644,696	[illegible]	-6.1
Sept.	81	216,783	223,270	-2.9	79	1,008,301	1,052,557	-4.2	73	852,406	895,571	-4.8	64	149,017	149,415	-0.3	89	634,101	670,138	-5.4
REVENUE		1920	1919			1920	1919			1920	1919			1920	1919			1920	1919	
Oct.	82	$5,675	$4,623	22.7	65	$19,201	$15,722	22.0	57	$14,458	$11,667	23.9	54	$3,504	$2,551	37.3	79	$8,532	$6,492	31.5
Nov.	82	5,898	5,017	17.5	65	20,938	17,119	22.2	57	15,158	12,561	20.8	54	3,853	2,910	32.4	79	8,775	7,104	23.5
Dec.	82	6,548	5,744	14.0	65	22,332	19,149	16.7	57	16,004	13,142	21.8	54	3,722	3,113	19.8	79	9,091	7,432	22.3
		1921	1920			1921	1920			1921	1920			1921	1920			1921	1920	
Jan.	81	6,379	6,170	3.5	74	22,180	19,225	15.3	59	16,818	14,436	17.3	62	4,155	3,484	19.3	81	9,323	7,546	23.6
Feb.	81	5,925	5,728	3.4	74	21,492	18,327	17.4	59	15,971	14,070	13.6	62	3,915	3,329	17.6	81	8,237	7,179	14.7
Mar.	81	5,784	5,566	3.8	76	21,822	18,934	15.3	59	15,853	14,103	12.4	63	3,747	3,246	15.5	81	8,307	7,222	15.0
April	81	5,665	5,554	2.0	76	21,504	18,609	15.8	60	15,506	13,822	12.2	63	3,744	3,312	13.2	88	8,817	7,767	13.6
May	82	5,362	5,342	0.4	76	20,795	17,613	18.0	60	14,866	13,558	9.8	63	3,516	3,179	10.7	89	9,362	8,240	13.7
June	82	5,285	5,397	2.4	76	20,058	17,438	15.0	60	14,485	13,519	7.1	63	3,536	3,152	12.2	89	9,021	8,439	6.9
July	81	5,180	5,121	1.1	76	18,798	17,155	9.2	60	14,158	14,689	3.6	63	3,509	3,145	11.3	89	9,101	8,733	4.3
Aug.	81	5,297	5,483	-3.3	76	19,168	17,789	7.9	60	14,543	14,586	-0.2	63	3,612	3,536	2.2	89	9,507	[illegible]	2.2
Sept.	81	5,661	5,857	-3.3	76	20,113	18,708	7.4	60	15,147	15,593	2.9	63	3,850	3,565	8.1	89	9,638	9,558	0.8
OPERATING EXPENSES:		1921	1920			1921	1920			1921	1920			1921	1920			1921	1920	
Jan.	34	$1,098	$1,288	-14.7	48	$6,373	$5,411	17.8	28	$3,941	$3,451	14.2	37	$1,015	$905	12.2	54	$2,135	$2,030	5.2
Feb.	35	1,069	1,242	-13.9	53	6,799	5,937	14.5	29	3,958	3,445	14.8	44	1,217	1,053	15.5	55	2,042	[illegible]	[illegible]
Mar.	45	1,576	1,651	-4.5	59	7,969	7,241	10.0	35	4,570	4,228	8.2	51	1,776	1,514	17.2	79	2,866	2,614	9.7
April	45	1,418	1,479	4.1	59	7,590	7,168	5.9	36	4,347	4,112	5.7	51	1,567	1,403	11.6	79	2,893	2,479	16.8
May	48	1,548	1,577	1.8	56	6,921	6,660	4.0	37	4,274	4,292	-0.4	52	1,563	1,486	5.2	81	2,969	2,713	9.5
June	46	1,737	1,862	-6.7	56	6,916	6,878	-0.5	39	4,843	5,152	-5.9	60	1,835	1,678	9.4	83	3,565	3,519	1.3
July	47	1,712	2,077	-17.6	53	6,772	7,111	-4.8	39	4,940	5,800	-14.8	62	1,870	2,039	-8.2	83	3,339	3,937	-15.1
Aug.	48	1,861	2,088	-10.8	53	6,402	6,611	-3.1	39	5,028	5,793	-13.2	62	1,892	2,003	5.5	88	3,648	3,884	6.0
Sept.	49	1,994	2,191	-8.9	54	6,366	6,774	-6.0	40	5,405	5,589	-3.2	63	1,921	2,057	6.6	88	3,498	3,992	-12.3

Although improvement was generally noted in the steel and iron industries, it had not progressed to the point of calling for large quantities of additional electrical energy.

In the South Atlantic States reports from all sources and covering almost all industries in this section showed decided improvement and a distinct increase in industrial activities. The drought in this section continued during the month, resulting in largely reduced production of energy by hydro-electric plants and the continued operation of all available steam auxiliary plants.

Taking the Atlantic Section as a whole, the increase in industrial requirements, in conjunction with the increased consumption of electrical energy for lighting

TABLE II—AGGREGATE OPERATING RATIO OF COMPANIES REPORTING DATA MONTHLY TO THE "ELECTRICAL WORLD"

Type of Generating Plant and Month	New England States				Atlantic States				North Central States				South Central States				Mountain and Pacific States			
			Average for Year				Average for Year				Average for Year				Average for Year				Average for Year	
	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920
Steam Plants																				
January	54.0	60.8	54.0	60.8	53.5	50.9	53.5	50.9	61.2	61.8	61.2	61.8	53.1	53.7	53.1	53.7	69.0	60.5	69.0	60.5
February	54.3	59.5	54.2	60.3	52.3	53.0	52.7	52.1	63.0	57.9	62.1	59.8	59.1	51.2	56.2	52.3	60.2	60.5	64.3	60.3
March	64.0	70.0	56.7	62.5	54.5	56.7	53.3	53.7	58.4	59.7	60.8	59.8	53.3	50.9	55.0	51.9	68.4	62.5	65.9	61.2
April	59.4	63.5	57.3	62.7	50.9	54.3	52.8	53.8	54.8	61.2	59.3	60.2	54.1	52.8	54.7	52.1	53.7	53.7	61.8	58.6
May	63.2	69.1	58.3	63.8	56.2	58.6	53.4	54.5	54.7	63.3	58.5	60.8	53.3	56.0	54.4	53.0	55.0	57.0	59.9	58.3
June	60.1	71.2	58.7	64.9	55.8	59.5	53.8	55.3	56.6	68.3	58.3	61.8	55.3	60.0	54.6	53.8	53.4	56.2	58.6	57.8
July	60.7	77.3	59.0	66.7	57.2	62.7	54.1	56.1	56.9	70.6	58.1	63.0	55.1	62.4	54.7	55.3	53.3	59.3	57.8	58.0
August	67.3	72.3	60.1	67.3	55.8	61.3	54.2	56.6	56.0	70.0	57.8	63.9	53.8	57.3	54.3	55.7	51.8	59.8	57.0	58.3
September	57.7	71.2	59.8	68.1	52.7	59.4	54.1	56.8	56.9	60.3	57.8	63.6	52.9	60.3	54.2	56.1	46.2	55.7	55.8	57.9
Hydro Plants																				
January	26.5	35.2	26.5	35.2	21.2	21.2	21.2	21.2	25.0	20.8	25.0	20.8	26.4	20.1	26.4	20.1	27.5	27.3	27.5	27.3
February	30.1	46.5	26.8	35.6	20.1	20.6	20.7	20.9	24.1	20.6	24.6	20.6	28.6	21.4	27.4	20.5	23.9	27.2	[illegible]	27.6
March	29.9	30.0	26.9	35.3	21.0	20.6	20.8	20.8	23.0	20.6	23.5	20.6	30.4	23.2	28.4	21.3	24.9	19.0	25.8	25.6
April	24.6	34.7	26.5	35.2	18.2	18.8	20.2	20.3	24.8	20.8	24.2	20.7	22.4	25.0	26.8	21.2	27.3	19.2	26.9	24.2
May	26.5	25.6	26.5	34.3	15.5	17.4	19.2	19.7	21.5	20.1	22.5	20.5	27.9	21.2	27.1	21.2	29.8	22.9	26.6	24.0
June	29.2	21.5	26.6	33.8	17.6	18.8	19.0	19.6	21.1	19.5	22.8	20.2	27.3	18.3	27.1	20.7	30.3	27.4	27.6	24.2
July	29.2	29.6	26.6	33.9	15.9	21.1	18.6	19.8	19.4	19.7	22.3	20.2	27.3	18.3	27.7	20.7	24.2	19.0	26.3	23.7
August	31.4	36.5	26.8	33.9	16.7	20.9	18.3	19.8	20.7	21.6	22.0	20.4	33.7	23.1	28.5	21.0	25.1	24.3	26.2	23.6
September	31.4	32.2	26.8	33.4	16.6	19.9	18.1	19.9	20.8	21.1	21.9	45.7	27.6	20.2	28.4	20.9	23.4	22.8	25.9	23.6
Combined Systems of Steam and Hydro Plants																				
January	45.3	53.5	45.3	53.5	43.5	45.8	43.5	45.8	39.5	38.6	39.5	38.6	38.6	46.6	38.6	46.6	35.2	45.5	35.2	45.5
February	44.3	60.0	44.7	58.8	41.8	41.9	42.6	43.8	42.4	49.8	41.0	48.2	41.7	39.6	40.5	[illegible]	39.6	43.8	37.4	44.7
March	49.7	53.8	47.3	56.0	39.7	47.3	42.0	45.3	41.5	46.0	41.8	47.3	38.6	39.2	40.2	41.2	36.4	39.7	36.9	43.0
April	46.6	48.5	47.1	53.5	42.9	43.9	41.9	44.8	45.0	48.3	42.7	47.5	43.6	48.6	40.7	42.8	37.0	36.8	37.0	41.0
May	49.2	48.5	47.6	52.3	39.8	44.2	41.4	44.7	47.0	52.8	43.7	48.8	40.7	39.6	40.6	42.2	35.0	38.3	36.4	40.5
June	58.5	56.5	49.6	53.2	42.3	45.8	41.6	44.9	50.1	62.2	45.0	51.6	45.1	44.8	41.3	42.7	38.8	44.3	37.0	41.1
July	56.1	63.2	50.5	54.7	42.6	51.3	41.7	45.8	51.6	64.4	46.0	53.0	53.6	45.3	41.4	42.8	35.4	43.1	36.8	41.5
August	60.6	62.7	51.9	55.8	46.5	49.0	42.3	46.2	51.2	64.5	46.6	55.5	45.3	50.0	41.9	43.8	36.8	43.5	36.7	41.8
September	62.9	[illegible]	53.4	57.3	47.4	50.6	42.9	46.7	51.2	62.6	46.9	56.3	45.0	47.3	42.2	44.2	38.3	47.7	36.9	42.5

purposes and new domestic and industrial customers, resulted in an average daily central-station output of 42,500,000 kw.-hr.. which is about 2,000,000 kw.-hr. in excess of that reported during August.

The iron and steel industry, textiles and leather and shoe factories in the North Central States reported slightly increased activities during September, and the wheat belt continued to report capacity operations in the mills of that section. These slight but significant increases in energy requirements plus the seasonal increase in lighting requirements and new customers were sufficient to raise the average daily energy output of the North Central States by about 1,400,000 kw.-hr.

In the aggregate, industrial conditions in the South Central States during September were on a par with those of August. The increased lighting load and new customers plus a slightly increased energy demand by the lumber industry probably account for the small increase in the central-station output above that reported for August.

TABLE III—CENTRAL-STATION RETURNS FOR TWELVE MONTHS

	Percentage of Installed Ratings Represented	Kw.-Hr. Output (Companies Reporting)			Percentage of Installed Ratings Represented	Revenue from the Sale of Energy (Companies Reporting)		
		1920 Thousands	1919 Thousands	Per Cent Increase		1920 Thousands	1919 Thousands	Per Cent Increase
Oct.	71	2,797,625	2,499,488	11.9	66	$51,370	$41,055	25.1
Nov.	71	2,741,705	2,503,402	9.6	66	54,620	44,711	22.0
Dec.	71	2,792,554	2,648,746	5.4	66	57,697	48,580	18.6
		1921	1920			1921	1920	
Jan.	76	2,765,632	2,943,349	−6.0	70	58,855	50,861	15.8
Feb.	76	2,453,671	2,711,800	−9.4	70	55,540	48,633	14.3
Mar.	77	2,806,609	2,989,581	−6.1	72	55,513	49,071	13.3
April	78	2,675,949	2,895,067	−7.0	72	55,326	49,064	12.8
May	78	2,668,457	2,889,174	−7.6	72	53,901	47,932	12.6
June	78	2,686,479	2,872,900	−6.4	72	52,385	47,977	9.3
July	78*	2,706,016	2,949,132	−8.2	72*	50,747	49,195	3.4
Aug.	78†	2,839,950	3,025,104	−6.1	72†	52,127	50,703	2.9
Sept.	78‡	2,860,608	2,990,951	−4.3	72‡	54,409	53,281	2.1

	Percentage of Installed Ratings Represented	Operating and Maintenance Expenses (Companies reporting)			OPERATING RATIO					
					Steam Plants		Hydro Plants		Combined Systems of Steam and Hydro	
		1921 Thousands of Dollars	1920 Thousands of Dollars	Per Cent Increase	1921	1920	1921	1920	1921	1920
Jan.	40	14,562	13,085	11.3	56.1	55.3	26.8	27.0	38.1	45.6
Feb.	43	15,085	13,640	10.5	55.6	54.5	22.9	26.0	44.1	47.3
Mar.	53	18,757	17,248	8.7	56.1	57.7	23.4	19.6	40.2	44.8
April	53	17,815	16,641	7.1	53.0	56.5	23.9	19.8	41.4	43.3
May	53	17,274	16,727	3.1	55.4	56.8	24.2	22.9	40.6	44.8
June	54	18,836	19,089	−1.3	56.2	62.5	20.4	21.6	45.0	50.9
July	54	18,633	20,964	−11.1	56.8	65.9	20.6	20.2	43.0	52.6
Aug.	55	18,832	20,380	−7.6	56.2	63.8	22.3	22.2	44.5	52.3
Sept.	55	19,184	20,503	−6.4	54.1	60.3	20.8	22.1	47.3	54.7

*Includes estimates for 27 companies, representing 3.6 per cent of the total installed rating of all central stations.

†Includes estimates for 38 companies, representing 6.5 per cent of the total installed rating of all central stations.

‡Includes estimates for 76 companies, representing 17.1 per cent of the total installed rating of all central stations.

Manufacturing plants in the Mountain States called for about the same amount of electrical energy during September as during August, but metal mining fell to a lower ebb than at any previous time during the year. In the Pacific Northwest industry appeared at a standstill, and similar conditions prevailed in California. The central-station irrigation load decreased with the advancing season. As a result of these adverse conditions and notwithstanding a substantial increase in lighting requirements and new customers, the Mountain-Pacific section as a whole reported only a small increase in output over August. The gross revenue was $75,600,000, and the total operating expenses were $34,900,000. These figures indicate an increase of $1,600,000 in gross revenue and a decrease of $2,400,000 in operating expenses compared with September, 1920.

Letters from Our Readers

This is a readers' forum. Comments on questions before the electrical industry presenting economic, financial, engineering or commercial aspects and new or supplementary viewpoints on published articles are cordially invited

Some Aspects of the Superpower Project

To the Editors of the ELECTRICAL WORLD:

The report emanating from the United States Geological Survey and made by a group of distinguished engineers headed by W. S. Murray which deals with the so-called superpower project brings before the public a tremendously interesting collection of data regarding the things which might be done to gain a better co-ordinated power supply. Personally I have preached networks and big transmission work for a good many years, and it is gratifying to see some of the larger projects gradually taking form. In connection with this report, without in the least wishing to offer adverse criticism, I want to call attention to some features which might advantageously be stressed in the interest of a wider project and a further view of the possibilities of the present situation.

No time was ever more uncertain as a basis of forecast than the present year, coming at the end of a desperate period of world inflation, when all nations have joined hands in a financial debauch. It would take nothing short of an officially accredited prophet to say what the demand for electrical energy will be ten years from now. Extrapolation is always a hazardous procedure, particularly when the part of the curve from and beyond which fancy must take its flight is notoriously abnormal in the values shown. Certainly I hope that thirty-odd billion kilowatt-hours for the output of the electrical utilities in 1930 is conservative, but curves have a nasty way of becoming asymptotic, and I fear it is going to be somewhat difficult to persuade the financial world to bet something around a billion dollars on the course this particular curve is going to take.

Broadly, the whole question of this superpower system, with its great possibilities for good, is not one of engineering but of sheer finance. None of us who have been brought up in the power transmission game would hesitate at the voltages suggested, the distances which must be covered or the kind of distribution to be undertaken. The question of who is to pay the bills, however, looms large. Possibly the beginning may come by two or three large utilities making a start purely for their own benefit. Eventually others might join and the project grow to something like full dimensions.

Such part of the hypothetical load as may come from the electrification of railways looks particularly dubious from the financial standpoint. There may be some roads which could, practically, get away with an equipment bond issue of $30,000 per mile, which is the sum suggested, despite their underlying securities; but I doubt whether these roads are numerous or whether they cover more than a small fraction of the 19,000 miles of trackage set out in this report.

Finance rather than engineering difficulties will determine the feasibility of the whole affair, but the thing to which I desire to call attention, as an old power transmission engineer, is the need of looking forward to still larger things and of having the broadest aspects of the whole affair thoroughly investigated before anything involving great expense shall be undertaken.

The hydraulic resources ought to be very completely cataloged and considered before the grand strategy of the affair is determined. For what is most needed is to cut down the coal consumption, good, bad and indifferent, at once, before the evil hour comes in which the cost of coal will bear hard not only on the manufacturer but on the very existence of the population of manufacturing districts. Unless definite endeavor is made to check the waste of fuel the next generation is going to see a very grave situation. Not that the coal supply will run out, for if one were to figure down to the last deep-sunken vein, the time that must elapse before its exhaustion would run into several centuries; but we have had sufficient evidence of the effect on price of even a minor shortage of coal to show beyond any question that a comparatively small additional difficulty of mining or transportation will mean increase of price sufficient to bear hard on any center of population lying north of latitude 30 deg. or thereabouts.

We are the only nation in the world which uses anthracite for domestic heating purposes to any considerable extent, and anthracite is already going the way of the cannel coal which our grandfathers burned in their grates. To an onlooker it seems therefore that the first line of attack on the whole superpower situation should be via the hydraulic resources, from the Long Sault to the Potomac. The former is credited with nearly 1,500,000 hp. developable at entirely feasible cost, the latter with 200,000 hp., somewhat expensive, but near its market. There is another 1,500,000 hp. on the St. Lawrence, besides all that might be developed at Niagara by a proper international agreement, and sooner or later an international agreement must come. North of the St. Lawrence lies again a region of great hydraulic possibilities, not out of reach of our Eastern manufacturing districts and which our Canadian neighbors might profitably exploit. It may be that these big developments will have to be undertaken under an international agreement at government expense, but they are fundamental to stopping the inroads on our coal supply.

LOUIS BELL,
Boston, Mass. Consulting Engineer.

Kelvin's Law and the Determination of Economical Type of Transmission Line

To the Editors of the ELECTRICAL WORLD:

Having read with interest the excellent article in the ELECTRICAL WORLD of Sept. 24 describing the new transmission line of the San Joaquin Light & Power Corporation, I venture to offer a little friendly criticism on a feature that may deserve some comment.

Kelvin's law is based on the assumption that the fixed charges on the conductor are proportional to the sectional area (A) and are therefore equal to K_1A and that the cost of the energy loss is inversely proportional to the sectional area and therefore equal to K_2A, K_1 and K_2 being constants. We then have the total cost over any period of time (usually taken as one year):

$$C = K_1A + (K_2/A).$$

Taking the first derivative and equating to zero gives:

$$dC/dA = K_1 - (K_2/A^2) = 0.$$

This is a minimum value of C, since the second derivative is seen to be positive. Transposing and multiplying by A gives $K_1A = K_2/A$, which is the condition for minimum total cost during any period of time.

Therefore the assumption that a certain design is the most economical because the total of the fixed charges, including various classes of plant, is equal to the cost of the energy loss, is not a correct one. It is quite possible in such a case that some other design for which the annual charges on the conductor and its supports are less or greater than the cost of the losses may have a smaller annual cost, including the losses, than the one selected. A strict statement of Kelvin's law is that if all expense proportional to the sectional area (or weight) of the conductor be added to the resistance losses, the sum is a minimum when the two components are equal to each other. If the annual charges include any expense not proportioned to conductor weight, such as poles or line expense, or if the loss cost includes items such as corona, other than the K_2/A loss, Kelvin's law evidently does not apply and may lead to the selection of an uneconomical line.

For the above reasons the only reliable method is to compute for a given amount of power transmitted the actual cost of transmission, including all plant charges and the cost of all losses, for various sizes of conductor. If these values are plotted with transmission cost as abscissas and conductor size as ordinates, the most economical conductor and type of line will be shown by the point of tangency of the curve with a vertical line, or, in other words, by its nearest approach to the Y axis.

Seattle, Wash. E. S. THAYER.

To the Editors of the ELECTRICAL WORLD:

I have read the letter of E. S. Thayer regarding the article in the ELECTRICAL WORLD of Sept. 24, 1921, describing the 110-kv. transmission line of the San Joaquin Light & Power Corporation. Criticism is raised concerning the method of determining the most economical type of line, and the last paragraph of the letter sums up a proposed method for such determination. This method is exactly the one used in the case of the line described in the article, though possibly it has been stated somewhat differently. In the second column of page 614 of the article I stated my views in regard to the items to be included in finding the annual cost of a line built under the conditions of this one. The curves of annual charges shown at the beginning of the article include 15 per cent on all plant costs, and if to them be added the values shown as the costs of losses at the various loads, the total annual costs of transmission are obtained. In other words, the total installed cost of one mile of line was taken in the case of each size of conductor. The method used was similar to the one shown on page 51 of Still's "Electric Power Transmission," second edition. However, as already noted above and in the article in the ELECTRICAL WORLD, annual charges are on total cost of line instead of on the conductor alone as in Professor Still's method.

An inspection of the curves will show that the lowest annual cost occurs at the point of crossing of the curves, except at some of the very low loads. Kelvin's law really was not applied in its strict sense and probably should not have been mentioned, except to say that it should not be used without the modifications noted both by Mr. Thayer and the article of Sept. 24.

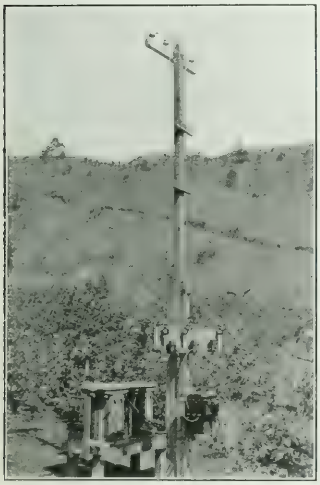
San Joaquin Light & Power Corp., L. J. MOORE,
Fresno, Cal. Executive Engineer.

Industrial and Station Practice

Installation, Operation and Maintenance of
Generating and Distribution Equipment and Economical Utilization of Electrical Energy
in Mills and Factories, Including Testing and Repair Methods

Welding a Penstock in the Field

TO REPAIR a 20-in. penstock in the field by welding it was found necessary by the writer to use part of the transmission system to supply the required voltage for the arc-welding outfit. This penstock, connected with a 700-kw. hydro-electric plant, after about twelve years of service began to develop thin sections and holes. A portable electric arc-welding machine used about the mill and mine being available, it was decided to repair the entire penstock by welding on sections where necessary. The welding outfit consists of a motor-generator set mounted on a truck, the motor designed for operation on three-phase and 110 volts. The nearest three-phase, 110-volt service being at the mill more than 2 miles from the penstock, some other source had to be found.



TEMPORARY TRANSFORMER STATION FOR CONNECTING WELDING MACHINE TO 2,200-VOLT LINE

As the transmission line running near the penstock operates at 6,600 volts, the advisability of purchasing a bank of small 6,600/110-volt transformers was at first considered. However, two 15-kva. 2,200/110-volt transformers were found available, and the following changes and connections successfully solved the difficulty.

Power is transmitted as generated, at 6,600 volts, from two hydro-electric plants to the mill and mine, where the transformer substations are. At the mill the bulk of the power is utilized at 2,200 volts, six 125-kva. transformers serving this load. Duplicate lines run from switch house No. 1, where the two plants are tied together, to the mill. These are for the purpose of insuring continuity of service to the mill in case of line trouble. One of these lines was used to carry the 2,200 volts back to switch house No. 1, and from this point the 2,200 volts was carried back on the 6,600-volt line to the point near power house No. 1 adjacent to the penstock.

As much of the mill and mine load as could be carried by power plant No. 2 was delivered over the line from the plant through switch house No. 1 to the mill and from there through switch house No. 2 to the mine. The disconnecting switches of the lines between power plant No. 1 and switch house No. 1 and between switch houses No. 1 and No. 2 were opened and jumpers connected across these lines at switch house No. 1. A temporary line to bring the 2,200 volts from the mill to these lines at switch house No. 2, a distance of about 1,000 ft., completed the necessary circuit and brought the 2,200 volts to a point near the penstock.

A temporary outdoor substation, as shown in the accompanying illustration, was then installed at the penstock and connection made to the nearest tower in the transmission line, the two 15-kva. transformers being operated in open delta.

FREDERICK KRUG,
Electrical Engineer.

New York & Honduras Rosario Mining Company,
San Juancito, Honduras, C. A.

Battery Wagon Saves One Man in Lamp Maintenance

A 750-LB. tower wagon equipped with forty-eight battery cells has proved to be an economical feature of the equipment of the Hartford (Conn.) Electric Light Company's distribution department. It is furnished with a rigid tower and platform for the use of the trimmer, the platform being about 11 ft. above the roadway, and is capable of making 12 miles per hour on the level. From 3.5 kw.-hr. to 4 kw.-hr. per day is consumed by this wagon, which ordinarily covers about 11 miles each twenty-four hours. The outfit went into service in July. 1914, and this particular type was adopted to eliminate sending out two men to replace burned-out lamps, which would be necessary if the

ONLY ONE MAN IS REQUIRED WITH THIS ELECTRIC MAINTENANCE TRUCK ordinary type of business wagon were used in connection with a stepladder.

The ornamental lighting system at Hartford consists of 592 gas-filled incandescent lamps, of which 228 are single and 182 are double units. C. M. Yale, superintendent of distribution, states that the company considers the electric wagon for this type of work superior to the horse-drawn wagon or to a small gasoline runabout, owing to the ease with which it can be operated and to the frequent stops necessary. The cost of the equipment, which includes tool and supply boxes installed in the wagon body, was $1,030, and the total repair cost from 1914 to 1921 was $2,202, including extras not due to its service. It ran 22,918 miles and the actual maintenance cost was about $1,200.

W. M. THAYER.

Manager Vehicle Sales and Battery Department.
Hartford Electric Light Company,
Hartford, Conn.

Large Field Rheostat Rebuilt to Eliminate Troubles

CONSIDERABLE trouble was repeatedly occurring on three generator-field rheostats at the Holtwood station until recently, when the rheostats were remodeled by the station's maintenance organization. The original construction of the field rheostats proved to be faulty for the following reasons:

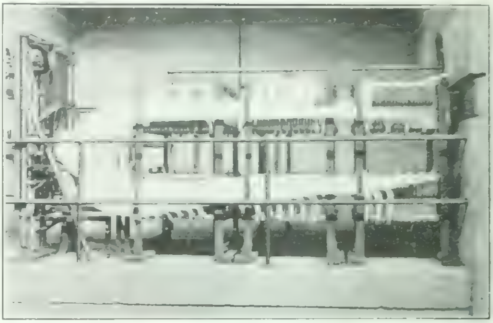
1. From one to four $\frac{1}{32}$-in. copper washers were used between the contact surfaces of the grids with the idea of lowering the resistance at these points. The surface of many of these washers was not absolutely true and the copper oxidized when heated. This trouble was cumulative, the connections sometimes becoming red hot.

2. The cables comprising the connections between the grids and the dial were carried in a form in the center and over the top of the rheostat, thus being subjected to the heat from the grids, especially where the wires were threaded between the groups and over the top of the grids to the terminals. The cable originally used for the grid connections is that known as "underwriter's wire" with slow-burning insulation. The heat from the grids caused this insulation to deteriorate and break away from the cable, resulting in oxidation of the wire and short circuits.

3. The type of terminal used was that in which the cable is secured by setscrews. As these screws clamp but a limited number of the strands, a good connection is not possible. An effort was made to avoid this trouble by soldering the strands together, but the solder was melted out by the heat from the grids and a loose connection resulted. On several different occasions cables have burned off entirely at these terminals.

As it was impossible to keep the generators out of service while the rheostats were being rebuilt, it was necessary to make up some form of resistance which could be used during this period. This was successfully accomplished by the proper grouping of a number of standard resistance boxes, each having a capacity of 30 amp. to 40 amp. This rheostat was divided into six sections controlled by quick-break knife switches. As the current to be handled ranged from 250 amp. to 500 amp., this was a problem in itself.

The rebuilding was done as follows: (1) The twelve groups of grids comprising the rheostat were removed from the frame and each set of grids was taken apart. (2) The contact surfaces of each grid were cleaned and trued up by means of a counterbore and surfaces checked for parallelism with a micrometer. (3) The mica insulating sleeves on the clamping bolts were removed and replaced with new ones. (4) The grids were reassembled in their original order, but no metal spacing washers were used except to balance the terminals. These washers were turned in a lathe from cast-iron stock and extend ½ in. beyond the boss of the grid to increase the radiating surface. (5) A clamp type of terminal was substituted for the setscrew type and no solder was used in the ends of the cable. (6) In mounting the groups in the framework they were turned 90 deg. from their original position, thus bringing one-half the total number of terminals to each side of the rheostat and permitting all wiring to be carried on the outside away from the heat as the illustration shows. (7) The cable used in rewiring these rheostats is No. 3/0 B. & S. gage, stranded, with asbestos-braid insulation. This cable had given excellent service in the rheostats for other generators in the plant.


LEADS ON THIS RHEOSTAT WERE REMOVED FROM TOP AND ARE NOW LOCATED AT SIDE, AS SHOWN, TO PREVENT OVERHEATING

The elimination of the troublesome copper washers decreased the spacing between the grids to a slight extent, and this probably accounts for the fact that the grid temperatures run somewhat higher in the rheostat as rebuilt in comparison with those obtained before the overhauling was done. The maximum grid temperature observed before rebuilding was 210 deg. C., while the maximum temperature noted since this work was completed was 270 deg. C. (current density 480 amp. per square inch). A considerable reduction in the temperature of the grid connections in favor of the new design was obtained, as the maximum temperature observed in the original construction was 144 deg. C. against 131 deg. C. in the new arrangement.

FRANK I. MORGAN.

Pennsylvania Water & Power Company,
Holtwood, Pa.

Maple Cleats Prove Useful in Heavy Construction

PORCELAIN cleats such as are ordinarily used for insulating and supporting low-voltage cables very often are broken, and for this reason it was decided to use hard wood to support the heavy cables installed in a substation recently built in San Francisco. A large amount of 2,000,000-circ.mil cable was used in this station in wiring up two 500-volt rotary converters. Strips of treated maple were bored out to conform to the size of the cable so that when two of the strips were placed together they formed a series of connected cleats. These strips were sawed off to the length required and, according to J. E. Woodbridge, engineer of Ford, Bacon & Davis, a considerable saving was thereby effected in the cost of the construction.

FIELD EDITOR ELECTRICAL WORLD.
San Francisco, Cal.

Maintaining an Electric Hoist

A TRAVELING electric hoist in a foundry or erecting department is an effective time saver, but it must be kept in first-class order. In the first place, it should have no structural defects; for instance, one supporting I-beam must not be narrower than another, as this might cause the motor and cable drum suddenly to lurch to one side every few minutes—that is, where the beam is single. No bolts connecting rail ends or holding cross-bars supporting the conductor insulators should be so long as to strike the machine every time it passes. Bolts actually holding the insulators ought to have double nuts as they get enough jar and vibration to loosen single nuts, which may cause the insulator to sag out of place.

Where the feed wires connect to the conductor rails they should be bolted through copper lugs absolutely tight and held so with lock washers. If the machine carries broad shoes making contact against flat iron conductor rails, their springs are liable to weaken or be gummed with grease after a while, and perhaps only two out of three shoes then carry current, a condition which will not permit a three-phase motor to operate. Then, again, if the live rails are cut out of level in places, the shoes may fail to make contact just there, and perhaps the machine may be stopped at such a place and refuse to start again. In one foundry the trouble with the shoes not making a good positive contact at all times was overcome by riveting to the surface of each shoe a flat strip of copper ⅛ in. thick, 2 in. wide and 5 in. long. This not only increased the tension but had a slight coppering effect on the iron rails.

Sometimes, when everything seems in good order and yet the crane will not move, trouble may be found in the rheostat, owing to one or two of the copper fingers not touching the segments. If the motors are direct-current or slip-ring, any short brushes or weak springs should be renewed. The motor bearings should be oiled each week regularly, and the dust and dirt should be blown out every few weeks. Coating the winding with an insulating varnish once in a while will tend to keep out the moisture to which a motor is subject in a foundry or when running out of doors. The main switch and fuses must be close by, so that if anything goes wrong with the crane no time will be lost cutting off the current. It is well to have one or two ruby lamps connected across the switch in plain view at all times to show that the current is on, especially on 440 volts.

If the crane refuses to move after a seemingly careful search reveals no defect, start at the top of the fuse block and test the line with a suitable lamp. If current is found here, then test through the fuses, then through the main switch, especially at the binding posts, and then up at the live rails where the line connects. By this time a dead line may be found, showing that there is a disconnection somewhere. If the line is complete up to the rails, then go along the rails and use the test lamp freely, especially at each end. If no break can be found, the trouble may be in the rheostat, which should be opened and the lamp applied. The open circuit may be found in a broken armature lead or a brush which does not touch the commutator, although it may seem to. The brush may need cleaning or replacement.

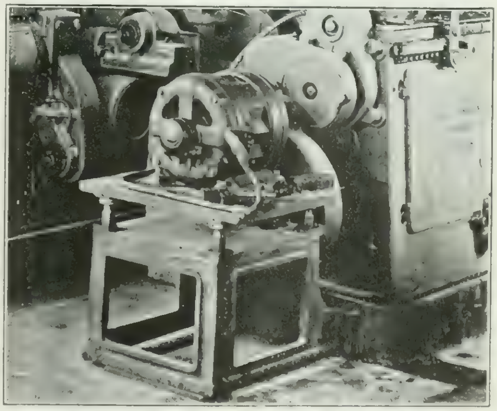
When repairing a crane, if there is any occasion to remove any leads, be careful not to reverse them, as the machine may operate backward without any warning. When making repairs it is well to place a card on the switch even though the fuses are removed, for some one could easily replace them, not knowing why they were taken out. If, for any reason, the limit switch does not stop the motor when the tackle block goes too high, the contacts should be looked after, as the undue strain may either break the lifting cable or blow out the fuses. If the crane is operated from the floor by a long rod, this rod should be well insulated either by placing a rubber hose over it or by covering it with insulating tape and varnishing it.

H. S. RICH.
East Berlin, Conn.

Adjustable Motor Mounting Permits Accurate Line-Up of Gears

IN ORDER to obtain a precise line-up of gears an adjustable motor mounting is applied at the East Springfield (Mass.) factory of the Westinghouse Electric & Manufacturing Company. In the application of these motors a ⅞-in. x 16½-in. x 20½-in. metal platform is provided, as shown in the accompanying illustration. The motor platform rests upon four flat heads, each carried at the top of a screw and movable up or down by the simple expedient of inserting a metal rod or key in a hole in the head of the spindle. The spindles rest upon a hollow base as shown.

This mounting is on a group of Potter & Johnson 5-A automatic machines of the turret lathe type, each individually driven by a 3-hp., 440-volt, three-phase motor running at 1,160 revolutions per minute. These machines are placed back to back to save space and are symmetrically fed by electric service leads carried in rigid conduit branching from overhead runs.



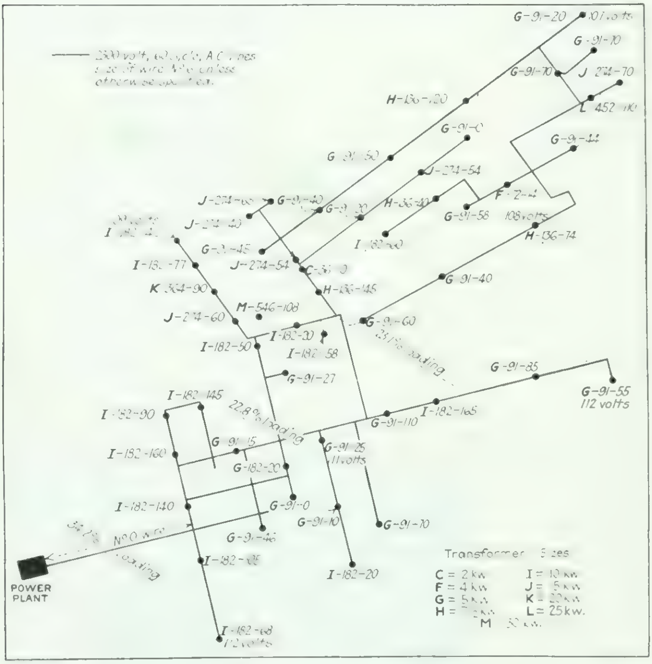
MOTOR HEIGHT MAY BE ADJUSTED ACCURATELY BY MEANS OF FLAT-HEAD SCREWS UNDER PLATFORM

Westinghouse Electric & Mfg. Co.
East Springfield, Mass.

R. P. KING,
Works Engineer.

Analyzing Distribution System to Prepare for Expansion

DISTRIBUTION circuits should not be laid out solely for present conditions but should be planned with the future in mind. To do this it is necessary to study the density of population in the various parts of a city to ascertain whether future expansion will be in the same direction as that of the past. Such a study has been found particularly beneficial at El Paso, Tex., where it has been necessary to make many short line extensions, oftentimes without the opportunity for careful study with future requirements in view. For that reason it was decided to make a thorough analysis of the distribution problem.



LINE DIAGRAM FOUND USEFUL IN STUDYING A DISTRIBUTION SYSTEM

The distribution system consists of overhead and underground wiring conveying single-phase and two-phase, 2,300-volt energy to almost every point in El Paso and across the Rio Grande in Juarez, Mexico. The population served in the city of El Paso alone is in the neighborhood of 100,000 and the territory covered within the city limits is 11¼ square miles. The density of population therefore is not so great as in the majority of cities of this size. The steam generating plant is situated in the southwest corner of the city, although one of the largest consumers is established in the northeast corner of the city. Other consumers of large blocks of power are situated at considerable distance from one another. These conditions have naturally required the use of a three-phase, 13,000-volt transmission system.

Each lighting circuit is studied separately by means of a skeleton one-line diagram with correct copper and transformer sizes inserted, but without uniform scale. During the winter months peak loads on all transformers are obtained by the use of instantaneous ammeter readings at peak hours. The voltage conditions are also ascertained similarly by instantaneous readings. The accompanying diagram gives a typical layout showing transformers with rating in kva. and amperes, sizes of wire, the accumulative loads on each wire at junction points and, where the sizes of wire change, voltage for sections and actual loading of transformers in amperes. Unbalancing of transformers has been made the subject of special study. With this information it has been possible to determine the most strategic section for wire reinforcement, and in some cases to determine where exchanges in different sizes of wire were advantageous. It is the intention to keep about twenty maximum-demand meters in constant operation throughout the system, placing one meter on the supply side of each transformer for three or four nights and then changing it to another location. If it is possible to cut in such a meter on the line feeding a number of transformers at the same time the individual transformer demands are taken, the diversity of each part of the system can readily be obtained. By this method it will be possible to get a constant check on peak-load conditions. By checking the sum of the loads on a circuit with the power-plant readings it has been found that in lighting circuits it is reasonable to believe that the maximum demand of practically all transformers occur at the same time.

The line losses were determined rather closely after obtaining the loading and voltage conditions, and from such determination it was possible to decide whether a circuit should be fed from the main steam generating plant or from a substation fed from the 13,200-volt transmission line. Out of the study which has been made it has developed that the present railway and lighting substation, situated approximately 6 miles (9.6 km.) from the power plant, is the center of distribution for a large portion of the residential section of the city. In addition, it was found advisable to locate two more lighting circuits and two or three street lighting transformers at this substation.

In obtaining the data upon lighting lines it was possible to pick out many transformers which could be replaced by either larger or smaller ones according to the existing conditions. This tended to improve service or to reduce the transformer investment per kilowatt connected load. The study also brought out the fact that occasionally in a bank of four transformers one would not be working at all. For some reason the fuses would blow and the investment of this apparatus would be hanging on the lines idle with the remaining transformers overtaxed. On the face of it this condition might seem absurd, but even on a carefully maintained system such things will happen. The subject of proper transformer banking is receiving special consideration.

Line maintenance correctly scheduled is the only way properly to insure a system against poor service. Excessive investment conditions such as have been outlined will come to the surface through a carefully prepared line maintenance schedule without unnecessary loss of time, and in addition the property will be maintained in better condition than with a system of "hit-and-miss" maintenance.

In addition to obtaining data on voltage conditions, maximum transformer capacity, installed capacity, size of wire, etc., a curve showing the monthly maximum-demand recorded on power-station meters is of utmost importance. At a glance it is possible to note any sudden increase or decrease in the load which is put upon each circuit, and any such changes can be made a subject of immediate study in case a condition arises that calls for an increase in capacity to benefit service or a decrease of capacity to benefit the investment. As the line study progressed other things were constantly brought to attention.

Two-phase, 2,300-volt power circuits are to be approached in a slightly different manner inasmuch as maximum transformer loadings do not occur at the same time throughout the city. The loads on these transformers should be taken by graphic meters and the instantaneous voltage taken at the time of maximum loading of each transformer. In the case of power circuits it will probably be true that owing to diversity in the motor loads the sum of the transformer maximum demands will not govern the size of the wire in the branches.

From results which have already been obtained in this direction, it is manifest that the two-phase, 2,300-volt power lines extend such a distance from the generating plant that a substation a few miles from the generating plant and supplied with our 13,200-volt transmission service would save a considerable amount annually by the reduction of line losses.

It is generally true in companies of this size and smaller that the strict electrical engineering of distribution is made a minor part of the work. In fact, nobody is detailed primarily for the purpose of saving money in distribution. Usually the expense of obtaining business and establishing service is considerable, and the line study described has indicated that the net revenue would be increased in a great many cases if some of the money allocated to solicitation were spent on increasing the distribution efficiency.

El Paso Electric Railway, P. M. HATCH,
El Paso, Tex. General Supt. of Light and Power.

Fiber Rollers on Armature-Winding Stand Do Not Cut Motor Shafts

FIBER rollers have been found very satisfactory for an armature-winding stand of the separate-support type used in a Pennsylvania shop. Originally the stand was equipped with cold-rolled steel rollers 1 in. thick by 2½ in. in diameter, upon which the armature rested. These worked satisfactorily on lighter armatures, but when use was made of the stand to support an armature weighing 600 lb. the rollers scored the shaft quite badly. This occurred despite the fact that the shaft was 0.40 per cent carbon steel.

The steel rollers were replaced with rollers made of black fiber, ¾ in. thick, sheet stock being used for the purpose. Some doubts were entertained at first as to how the fiber would stand up in service, but the results obtained are all that could be desired. There is, of course, no possibility of scoring the shaft and the fiber shows no tendency to mushroom or crack, even under the heavy armatures mentioned. J. M. WALSH.

Honesdale, Pa.

Blowing Post Holes with Dynamite Saves Expense

THE use of dynamite in digging post holes has proved economical and satisfactory according to the experience of the Canton (Ill.) Gas & Electric Company. The principal saving accomplished by the method resulted from the fact that line crews placing poles could be considerably smaller. Depending upon whether the digging was in soft soil or was very difficult, it took from five to ten men to dig as many holes by hand as were dug by two men using dynamite.

It was found on starting the use of this method that two men only were needed to dig the holes, that number being able to keep ahead of the pole-setting crew without much trouble. One man dug the first spading while the other drilled a 2-in. hole 4½ ft. deep. The post holes were to be 5 ft. deep, and the drill holes were stopped 6 in. from this desired depth because the explosion had sufficient downward force to depress the earth approximately 6 in. Under average digging conditions it was found that two men could blast and clean out about twenty-five holes per day, while it required at least five men to finish that many per day by hand.

Prices of both labor and material have changed since this method was used by the Canton Gas & Electric Company, but its experience shows that a saving of about 45 per cent can be accomplished. A 1-lb. stick of dynamite is used for each hole. When the foregoing comparison was made (June, 1921) the quotation on dynamite was about 26¾ cents per pound. Twenty-five sticks a day on an average will be used, the total cost of material being $6.70. With men kept on the job, as is necessary in building a transmission line of any length, board and lodging averaged $2.50 per day per man. Linemen's pay in most parts of the country was about 85 cents per hour, on the basis of an eight-hour day. Thus the total cost per day per twenty-five holes blasted with dynamite ran slightly over $25. This amounts to approximately $1 a hole. According to the figures supplied by the Canton company, five men would be required to do the same work by hand, making the same number of holes cost $46.50, or $1.85 per hole. These figures are necessarily approximate and would vary in other sections of the country, but they show that a saving may be accomplished by the use of dynamite.

The main difficulty with this practice is the lack of earth from the hole for use in tamping in the pole, as the charge blows a clean hole and compresses the earth, it being necessary only to clean out the neck of the hole, using post-hole digger or spade. In rural sections the necessary earth is easily obtainable, but in city work the difficulty is not so easily overcome. Another drawback to the use of dynamite in cities is the restriction laid upon the use of any explosive, and although ordinances vary in different cities, the cost of license and the care necessary for using dynamite often increase the cost per hole above that of the hand method.

This information was secured from E. H. Negley, secretary-manager Canton Gas & Electric Company.

Chicago, Ill. FIELD EDITOR ELECTRICAL WORLD.

Management and Policy

Embracing Central Station Commercial Organization and Management, Customer and Trade Relationships, Public and Financial Policies, Advertising, Selling and Service Methods

Let Us Make It Easier for Employees to Use Electrical Appliances

A Practical Solution Offered by
George W. Hurn, Manager Haverhill
Electric Company, Haverhill, Mass.

As a central-station policy, the use of electrical appliances by officers and employees of lesser rank should be encouraged by practical arrangements for putting such equipment into their hands. If the men who are selling these different appliances do not know from actual experience what the devices can do and what the cost of operating them is, how can we expect to convince our customers? An interesting investigation was made recently by the merchandising division of the Commercial Section, New England Division, N. E. L. A., as to the extent to which employees and officials of central-station companies are using appliances. Forty-five companies submitted data, and these embraced 218 officials and 6,492 other employees, or a total of 6,710. Seventeen well-tried appliances were listed. From a study of these data it appears that more than half of these utility people, or 3,769, still do not use electric flatirons, 5,049 do not use toasters, 6,058 have no electric percolator, 5,593 have no electric fan, 5,934 use no electric washer, 5,055 have no vacuum cleaner, 6,461 do not use the electric range, and so on. In other words, only about 20 per cent used any of these seventeen appliances except the flatiron.

G. W. HURN

We are very much undersold within the industry. Interest in ourselves as "prospects" is developing, and throughout the companies affiliated with Charles H. Tenney & Company there is coming about a healthy rivalry to increase the use of electrical conveniences in the homes of officers and employees alike. We do not want percentages like those brought out in the New England Division, N. E. L. A., at the recent New London convention to be repeated another year in this part of the country.

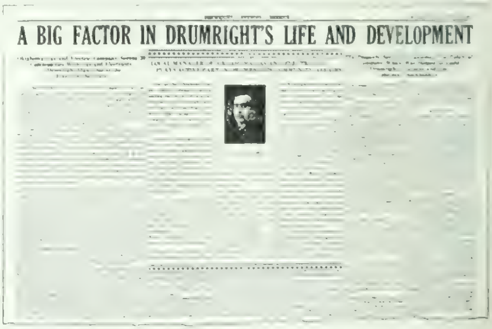
If the utility manager is a good user of electric appliances, much is gained in carrying the work forward. In response to a recent inquiry by the Electrical World, I may say that in my own home I have in use at present an electric range, a vacuum cleaner, a washing machine, a flatiron, a toaster and a coffee percolator. I am also testing out a refrigerating outfit which is proving very satisfactory, and the figures obtained from tests of devices through separate meters in the home of a utility manager are very helpful and convincing. Personal experience, backed by figures from one's own installation, carries weight in local sales work. I do not mean to imply that I have all the appliances that I would like or should utilize, but as an illustration I think I have more in use than many other men in this line of business.

Instances are not rare where a sale can be made by referring the "prospect" to the manager's or other employee's own household for unbiased testimony on the value of this or that equipment.

Our company at Haverhill sells appliances to employees at cost, and they are allowed to pay for them in weekly installments. The period covered may be a year, or in some cases even two years, depending on the device purchased. The sale is made on the understanding that the device is for the employee's own use. In this way we are making a more vigorous effort to increase the use of appliances within the central-station family, and I believe that lasting good to the industry will follow the adoption and maintenance of liberal and progressive policies along this line.

Newspaper Tells of Utility's Importance to City's Affairs

Evidence of public appreciation of the importance of a utility's service to a community is shown in the accompanying reproduction from the Drumright *Evening Derrick* of a half-page story about the Oklahoma Gas & Electric Company. The local newspaper has told here in an interesting manner the scope of the company's service and how it plays a leading part in the life and development of the city. The company's policies with regard to service and its customer and employee ownership plans are outlined, and an intimate personal touch is given in a brief account of Manager Walter B. Miser's experience in the public utility field.


A BIG FACTOR IN DRUMRIGHT'S LIFE AND DEVELOPMENT

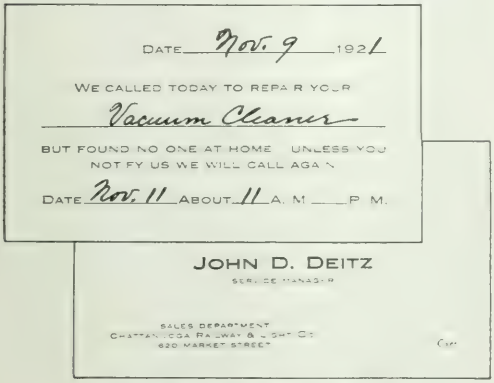
A STORY OF A UTILITY'S PART IN COMMUNITY DEVELOPMENT

Other central-station companies have found that similar articles published in the local daily papers have gone a long way in giving the public a clearer understanding of utility aims and problems.

A Call-Back Card Used by the Troubleman

BY USING the card shown here the Chattanooga (Tenn.) Railway & Light Company has injected a new touch of thoughtfulness into its repair service. When a repairman calls at a customer's house to take care of a trouble order or to make repairs and finds no one at home he fills out the reverse side of the card, indicating when he will return, and leaves it in the door. The customer therefore not only knows that he has called but when to expect his return without having to telephone the company's office, and it is seldom that the repairman does not find some one in when he calls back.

"This card, in addition to facilitating the work of the repair department, is greatly appreciated by the company's customers," says L. J. Wilhoite, lighting sales manager of the company. "It makes them realize that we are on the job regardless of whether or not they stay at home."



DATE Nov. 9 1921

WE CALLED TODAY TO REPAIR YOUR

Vacuum Cleaner

BUT FOUND NO ONE AT HOME UNLESS YOU NOTIFY US WE WILL CALL AGAIN

DATE Nov. 11 ABOUT 11 A. M. ___ P. M.

JOHN D. DEITZ
SERVICE MANAGER

SALES DEPARTMENT
CHATTANOOGA RAILWAY & LIGHT CO
620 MARKET STREET

CARD USED BY COMPANY'S REPAIRMAN

Pioneering of Electrical Appliances a Divided Responsibility

By LEWIS A. LEWIS

Sales Manager Washington Water Power Company, Spokane, Wash.

UP TO this time the central-station companies of the country have been the pioneers of practically every electrical device that is on the market and have paid the price of such development. It is a question whether the utilities, rigidly regulated as they are, can afford to spend the money that they have spent in the past for the pioneering of the future. I do believe, however, that such appliances as refrigerating machines and electric ranges and water heaters must be exploited by the central-station company, and they will in time with the co-operation of the manufacturer be remunerative. The companies should be relieved of this expense in connection with such appliances as dishwashers and ironing machines, whose gross revenue is of little consequence and does little more than to popularize electricity.

The Washington Water Power Company has done as much as any central-station company in the United States in the development of the electric range and water heater. We do not regret it as we are now beginning to receive earnings from this type of load. I believe we were the first company to give an order for a carload of electric irons, and we spent a great deal of money in publicity, popularizing this device, and there is no question that we have been benefited by this action. The same has been true of the vacuum cleaner and washing machine, but in the case of these appliances we have had in mind the merchandise profit, and our expenditure for development was only in proportion to good merchandising practice.

As soon as a household refrigerating plant is perfected and can be sold at a popular price I think it would be the policy of most progressive central-station companies to get behind a campaign to popularize that machine. It will be a real revenue producer, while, on the other hand, the development of the dishwasher is of minor importance to the average company. For my part, I think that the development of the dishwasher must be put strictly up to the manufacturer, or it must be sold to the dealer at such a price that he can profit by its exploitation. The ironing machine is in somewhat the same class—electrically heated the maximum demand causes a customer expense which is not justified by the revenue, and when gas-heated the revenue is less than that now received from the ordinary hand iron. We have sold many electrically heated ironing machines, but, as with the vacuum cleaner and washing machine, sales have been on a strict merchandising margin.

What Other Companies Are Doing

Minnesota.—During October the securities department of the Southwestern division of the Northern States Power Company sold 362 shares of the company's preferred stock to 104 shareholders. Thirty-two sales were made to employees of the division during the month, which with the present stockholders gives this division a 100 per cent list of employee-shareholders.

Easton, Pa.—A successful electrical show was conducted recently under the auspices of the Easton Electrical Education Association, whose members are made up of the employees of the Pennsylvania Edison Company, electrical contractors, dealers and electrical men employed in the various manufacturing concerns in and about Easton. The show had the thorough support of the newspapers, merchants, school board and colleges in Easton and Bethlehem. Eight thousand people attended the show during the three evenings and one afternoon that it was open.

Cleveland, Ohio.—The third "home electric" of the Cleveland Electrical League was recently opened for four weeks in East Cleveland. Thousands of girls attending domestic science classes, members of women's clubs and teachers in the schools and colleges were especially invited to inspect the house. As the first and second homes drew visitors principally from Cleveland Heights, Lakewood and the west side of the city, the third home electric gave many people their first opportunity to see an electrically modern dwelling.

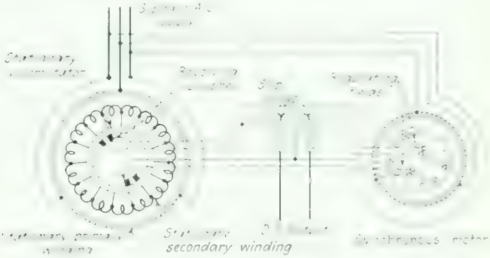
Boston, Mass.—The employees' loyalty committee of the Edison Electric Illuminating Company has issued an attractive booklet for popular distribution. It explains the "how" and "where" of electrical generation and distribution on the company's system and gives the non-technical reader an interesting illustrated account of the company's latest developments and facilities.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
of the World

Motors, Generators and Transformers

Converter with Stationary Windings and Core.—S. Shiio.—An alternating-current-direct-current converter using the principle of a polyphase induction motor with its revolving field is described in this paper. To obtain direct current, alternating current is applied to the stationary stator and the brush gear is rotated at synchronism about the commutator attached to what would be the rotor, which in this case is also stationary. The position of the brushes is automatically adjusted in such a way as to give maximum potential difference between the positive and negative brushes. The only revolving parts of the machine are the direct-current brushes, the two direct-current slip rings and the synchronous motor which drives them and which is small compared with the main windings and core of the machine. The windings which carry the main current are stationary.—*Journal of the Institute of Electrical Engineers of Japan*, No. 395.



MAIN WINDINGS OF THIS CONVERTER ARE STATIONARY WHILE BRUSHES REVOLVE

Laminated and Transposed Conductors for Large Generators.—F. Punga and H. Rosa.—Many methods of transposing the component wires in built-up conductors of large turbo-generators which have been patented in recent years are described in this article. They are all combinations of single and multiple flatwise and edgewise bending and offsetting of copper strips. The fact that very high additional losses occur in large solid copper rods in deep slots, owing to uneven flux distribution within the slot, has made it necessary to adopt some subdivided conductor the individual strands of which are insulated from each other and so twisted or transposed that each of them takes up consecutively several different positions within the slot. To insure the least loss the individual strands must be twisted fully 360 deg. within each slot. The insulation of the strands has to be perfect both electrically and mechanically, because the rods are pressed into the slots with considerable force. No dependable results can be achieved with round wires. Not only is their insulation difficult and unreliable, but the finished rods lack stiffness. Very good results were obtained by subdividing the total required copper cross-section into a relatively small number of rectangular strips insulated from each other by mica foil and subsequently pressed and baked to the desired shape. This gives a finished rod, virtually as solid as a one-piece conductor.—*Elektrotechnik und Maschinenbau*, Oct. 2 and 9, 1921.

Recent Water-Turbine Developments.—W. H. White.—Machines and settings are, this paper asserts, now sufficiently perfected to handle any conditions imposed by superpower schemes. The value of low velocity in spiral casings of draft tubes, siphon settings, fall increasers, etc., is discussed.—*Canadian Engineer*, Oct. 13, 1921.

Traction

Report of Committee on Electrolysis.—The 1921 report of the American Committee on Electrolysis is a collection of the known facts on electrolysis and its mitigation. Design, construction and operation of railways and underground structures, electrolysis surveys, European practices and research are all covered. In a 204-page discussion the committee makes this recommendation: "Prior to the consideration of measures of electrolysis mitigation, the following features should be given due attention: (1) Measures tending both to railway economy and the reduction of stray current: (a) The return system, including track bonding, should be put in proper condition; (b) the number of substations should be made a maximum consistent with railway economy. (2) Measures employed solely for electrolysis prevention. Where necessary to effect a still further reduction in electrolysis below that provided by the most economic railway system, one or more of the following measures should be taken: (a) Applicable to railways—additional substations, insulated feeders, a modified system of power distribution, such as a three-wire system; (b) applicable to affected structures—insulating joints in pipes and cables, insulated coverings for pipes; (c) interconnection of affected structures and railway return circuits—electrical drainage of cable sheaths, electrical drainage of pipes." In the summary of good practice some comment favorable or unfavorable is based upon most of the methods of electrolysis mitigation which have been attempted. It is interesting to remember that this report is a unanimous one. Other chapters in the book treat "Electrolysis Surveys," "European Practice" and "Electrolysis Research." Under the first of these headings there is an excellent portrayal of the whole question of electrolysis surveys, their purpose, scope, possibilities and interpretation, as well as the instruments available for making them.—(Report is obtainable from the American Institute of Electrical Engineers.)

Railway Situation in Berlin.—Large reductions in operating expense made necessary by the present conditions have been effected by the consolidation of various street and suburban lines in Greater Berlin and by improving traffic conditions. — *Electric Railway Journal*, Nov. 5, 1921.

Applications of Electric Arc Welding.—According to this rather complete paper, successful welding calls for three prime requisites, proper equipment, proper materials and a certain inborn skill. A list is given showing a very large number of applications of electric welding in railroad work.—*Railway Electrical Engineer*, October, 1921.

Arc-Welded Rail Joints.—Experiences in the city of Detroit with the electrical welding of rail joints. Tests were made showing temperature rises on rails welded in several manners.—*Welding Engineer*, October, 1921.

Choice of Locomotives for Mine Service.—H. H. JOHNSTON.—This paper asserts that locomotives with dynamic-braking controllers deliver current on descending grades and must have additional motor capacity. The effect of low-voltage and series-and-parallel control versus series-parallel control is discussed. Solid side frames, it is stated, increase motor temperature.—*Coal Age*, Nov. 13, 1921.

Generation, Transmission and Distribution

Burning Powdered Coal and Blast-Furnace Gas at River Rouge—THOMAS WILSON—This article gives details of the arrangement and construction of the boilers and their control, the pulverized-coal equipment and the layout of the gas piping and burners, performance guarantees and the operating force required.—*Power*, Nov. 1, 1921.

Photographic Representation of the Electric Field.—B. ELL.—The photographs accompanying this article will catch the eye of every reader, but, unfortunately, the author does not explain sufficiently how the results were obtained. Using a static machine, distinctly different pictures are obtained with a positive and with a negative charge. It is possible that what the author calls the electric field is merely the corona distribution around and near the conductors.—*Elektrotechnische Zeitschrift*, Oct. 20, 1921.

Relation of Run-Off to Rainfall.—An attempt to formulate with some reasonable certainty a comparison between the amount of rainfall and the run-off in different kinds of soil and other conditions.—London *Engineering*, Oct. 7, 1921.

Developments in Power-Station Design.—A study of generation of electricity by waste from blast furnaces, coke ovens, etc. The plants described supply local generating systems with the maximum amount of energy possible with the waste heat available. All regulation is done at the main power stations of the system.—London *Engineer*, Oct. 7, 14 and 21, 1921.

English Generating Station at Blackburn.—A description of a station containing two 6,600-volt turbo-alternators of 10,000 kw. rating each which has been erected at a cost of £850,000. The coal and ash-handling plants, boilers, turbo-alternators, cooling towers, switchgear, transformers, etc., are covered.—London *Engineer*, Oct. 21, 1921.

Study of Chain-Type Insulators for Highest Voltages.—A. FONTVILLE.—It is at present still very doubtful with what safety factor a chain of disk type insulators really operates. In spite of the fact that there are today a number of transmission lines operating at more than 100,000 volts, there is insufficient information about the most favorable construction and the best dimensions of the insulator chains for these extreme tensions. One of the most puzzling problems has been to measure accurately the voltage distribution along the different units of such chains. That this distribution is by no means uniform was soon recognized, and several methods were devised to measure the voltage drop along the disks. The author describes in this paper four different measuring methods and shows that the results obtained by these entirely different methods are sufficiently similar to permit of a good check and a fair average value. The paper deals first with methods to measure the small capacity of the disk. For this the use either of a ballistic galvanometer with a standard condenser or of an electrometer is suggested. The bridge method of Gott is less suitable. It is emphasized that the dielectric losses of these chain insulators increase rapidly with increasing frequency, to which fact is due the overheating during high-frequency overvoltage surges on the line. The four methods to determine the voltage distribution along the insulator chain are: (1) Use of a 100,000-volt Kelwin electrometer, either direct or by the compensating method, the latter being preferable. (2) Use of a small testing spark gap of sewing-needle points. (3) Use of a potentiometer according to Peek or De la Gorce. The uniform distribution of the voltage along a zigzag bent tube filled with water and equipped with equidistant voltage taps, as used by Peek, is doubted by the author on account of the not negligible capacity of self-induction of such a tube. The author uses a vertically stretched-out string wetted from above with water from a funnel. The voltage distribution along this wet string is almost proportional. (4) Use of an auxiliary transformer to produce a certain phase displacement, permitting the graphical determination of the voltage distribution. Comparing the results obtained from these four methods, a variation of only about 1 per cent is found. As has been proved by Thomas, Imslay and Peek, the insulators do not stand up well against overvoltages and sudden surges. The author claims, however, that it is wrong to attribute a breakdown of a chain to the aging of porcelain. Such chains are used only for about four or five years, and it would be safe to assume that if aging of the porcelain has any influence upon the dielectric strength, it certainly would have manifested itself on other porcelains used on voltages of more than 50,000 for periods exceeding in duration fifteen years.—*Revue Générale de l'Electricité*, Oct. 29, 1921.

Miscellaneous

Nationalization of Electrical Power Plants in Japan.—S. TADA.—The problem of nationalization is treated not from the popular viewpoints of economy and industry but from the standpoint of social policy. It is the author's conviction that society should control the power plants for the benefit of its members. He advocates that the generated power be distributed to the people on a profit-sharing basis at a reasonable rate, and that the management be in the hands of a special committee invested with absolute power. The author believes that the present tendency toward amalgamation of power companies will give new power to capitalism and is a hindrance to nationalization.—*Journal of Institute of Electrical Engineers of Japan*, September, 1921.

Monelmetal Welding — MICHAEL DZAMBA.—General principles that must be observed in the welding of this difficult metal and special instructions for rods and sheets.—*Welding Engineer*, October, 1921.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

To Ask Regulation of Radio Interference

IN ALL probability the Department of Commerce will request a strengthening of the law governing the control of radio operation. The need for an addition to the existing law became apparent when the Supreme Court of the District of Columbia authorized a writ of mandamus requiring the Secretary of Commerce to issue a license to the Intercity Radio Company of New York.

It was stated at the Department of Commerce that the Intercity company, which operates its plant almost continuously, is interfering in a very material way with the operation of other radio systems. Just what legal steps will be taken by the department will not be determined, it was said, until the return to Washington of its solicitor.

Thirty-Million New York Edison 6½ per Cent Issue Oversold at Premium

A THIRTY-MILLION-DOLLAR issue of series A, 6½ per cent, twenty-year first-lien and refunding mortgage bonds of the New York Edison Company was placed on the market Monday and was greatly oversubscribed in just a few minutes at a 4½ point premium. So far as is known, this is the largest single issue of electric light and power company bonds ever offered at one time. The yield at the subscription price was 6.10 per cent.

In connection with this financing the company acquires all of the bonds and more than 99 per cent of the capital stock of the United Electric Light & Power Company, formerly owned by the Consolidated Gas Company of New York. For many years the two companies have operated virtually as a unit, and this action makes possible the creation of a single first and refunding mortgage.

Since 1903 the New York Edison Company has issued no bonds. During the past fifteen years the two companies have spent more than $85,000,000 for permanent extensions and additions, largely financed by the issue of stock and temporary obligations. The proceeds from the present issue will reimburse the companies in part for these expenditures. The New York Edison Company has $86,741,300 of stock outstanding, all owned by the Consolidated Gas Company, and, including the present issue, $68,071,000 of bonds. The properties of the two companies represent an investment of more than $220,000,000.

The gross earnings of the two companies for the twelve months ended Sept. 30 amounted to $50,694,825.71; operating expenses, maintenance and replacements, taxes, etc., to $36,052,095.68, leaving net earnings of $14,642,730.03.

The combined properties have a total rating of 820,000 hp., including the 200,000 hp. in the new Hell Gate station of the United company just coming into operation.

Question of Public or Private Development Involved

THE Federal Power Commission probably will consider at its next meeting the "high dam" project between St. Paul and Minneapolis. It is very apparent that the Northern States Power Company could utilize power thus derived to greatest advantage, but the matter is complicated by a very determined protest from Senator Nelson of Minnesota, who wants to see this development handled by a municipal corporation formed ten years ago under a special act of the Minnesota Legislature. This corporation is composed of the city of St. Paul, the city of Minneapolis and the University of Minnesota. In addition, the city of St. Paul is endeavoring to secure sole control of the water power.

Senator Nelson's main objection seems to be based on the allegation that the Northern States Power Company is a monopoly and that to give it jurisdiction over this additional power would add to the monopoly. The Federal Power Commission, however, is charged with the duty of considering the efficient utilization of the power. There will be considerable secondary power developed at the high dam, and there seems to be little question that the public utility company is the only applicant in a position to insure maximum utilization of the power available.

The municipal corporation has been in existence since 1911 and has done nothing toward developing the project. Some regard the application of the city of St. Paul as in fact an application of Henry Ford, because it is understood that he is to have first call on the power if the city of St. Paul be given the necessary permission to develop the project.

Inductive Interference Discussed by Independent Telephone Men

INDUCTIVE interference was discussed before the recent convention of the United States Independent Telephone Association at Chicago. S. P. Grace of the American Telephone & Telegraph Company discussed the subject from the standpoint of the telephone companies, telling of the difficulties with which the telephone engineers have struggled in the effort to develop methods of preventing interference with their service from inductive influences from many sources, including power circuits. Asserting that under the conditions of high voltage, close proximity of power lines to telephone lines and the long parallels that have grown so rapidly in the past few years it is difficult to reach a solution of the inductive-interference problem within the telephone system itself, Mr. Grace explained that the telephone interests were pushing the question with the power interests because they had reached the point where to solve the problem they must have the help and co-operation of the latter.

Mr. Grace indicated in his discussion that there are some causes of trouble that will probably be counteracted only by adequate separation of the power and telephone lines, if substantial impairment of the telephone service is to be avoided. He made a plea for the utmost efforts at settlement of the issues on a co-operative basis, legal means to be only the last resort. He also asked the telephone companies to try to establish the most cordial relations with neighboring power companies and to study the problems of these companies.

W. J. Canada, for the National Electric Light Association, pointed out the necessity of developing means by which the service of both utilities can be given to the public by the use of the same highways, since separation in many instances is impossible unless the public along the highway in question forgoes one service or the other. The efforts being made by the N. E. L. A. to form state committees to forward the co-operative work between the American Telephone & Telegraph Company and its subsidiary companies and the various power interests were brought to the attention of the convention by Mr. Canada, and both he and Mr. Grace emphasized the work of the joint committee of the telephone and power interests that is endeavoring to work out a solution of the problem in such a way that future controversy will be avoided.

Planning to Rebuild Tallassee Dam that Went Out in 1919

TENTATIVE plans for rebuilding the Tallassee dam of the Montgomery Light & Water Power Company, which went down in 1919 during the heavy rains, are being considered. These plans call for a 20,000-hp. project, which is more than three times the capacity of the original plant. The high prices in the past, as well as the condition of the market for money, have made it impossible to go ahead up to date. The property, which is now in the hands of a receiver, is one of the Cities Service Company's subsidiaries.

Kentucky Operator Sees Increasing Public Confidence in Private Operation

CHARACTERIZING the situation as "clearing and not quite so warm," Donald McDonald, before the meeting of the Kentucky Association of Public Utilities on Nov. 22 at Louisville, said that the confidence of the people in the private operation of utilities is increasing. He sees a widespread disposition to give public utilities fair play.

In summing up Mr. McDonald gave this advice to the utility men: "Maintain your service, treat your customers respectfully, relax your rules if it is necessary in order to meet special cases, and raise your capital, as far as possible, among the people you serve."

Martin J. Insull urged the public utility men to take advantage of every opportunity to place the facts regarding their business before the public. The part the public utilities are playing in the "back to the farm" movement by furnishing electric, telephone and railway service to improve living conditions on the farms was brought out in his address. Good service was emphasized as the basis of good public relation.

M. H. Aylesworth, executive manager of the N. E. L. A., urged the utility men to have faith in their own business and to get out and tell their story to the public and cease complaining. While he admitted the value of holding-company management, Mr. Aylesworth at the same time took a strong stand against foreign management.

The officers elected for the coming year are: President, L. B. Herrington, Louisville; first vice-president, John Stoll, Lexington; second vice-president, W. H. Barton, Newport; treasurer, P. S. Pogue, Louisville; secretary, E. F. Kelly, Louisville.

New Louisiana Public Utility Laws

UNDER Section 27, Article 3, of the new Constitution of Louisiana, the following acts of the extraordinary session of the Legislature will become operative Dec. 9, 1921: No. 63, making it unlawful to use fraudulent means in securing electric current and gas through meters; No. 80, authorizing municipalities to mortgage their utilities; No. 93, investing rate-making power in the New Orleans Commission Council; No. 94, authorizing the Commission Council to grant indeterminate permits to utility corporations.

President Nichols of Massachusetts "Tech" Resigns

DR. ERNEST FOX NICHOLS, who was inaugurated president of the Massachusetts Institute of Technology last June, succeeding the late Dr. Richard C. Maclaurin, has resigned on account of ill health. Immediately after being inducted into office Dr. Nichols was overtaken by a severe illness which precludes his assumption of the arduous duties of his new post, though in due course he expects to be able to return to the field of physical science research. A leave of abscence to Jan. 4, 1922, has been granted him by the executive committee of the institute corporation, at which time his resignation will be regretfully accepted. Dr. Elihu Thomson, chief consulting engineer General Electric Company, Lynn, Mass., will again assume the chair of acting president, and the direction of the institute's affairs until a new president is inaugurated will be carried on by a faculty administrative committee consisting of Prof. Henry P. Talbot, head of the department of chemistry and acting dean; Prof. Edward F. Miller, head of the department of mechanical engineering and chairman of the faculty, and Prof. Edwin B. Wilson, head of the department of physics. A biographical sketch of President Nichols was published in the ELECTRICAL WORLD on page 849, April 9, 1921.

First Sections of "Electrical Salesman's Handbook" Now Ready

ANNOUNCEMENT is made by the "Electrical Salesman's Handbook" committee of the Commercial National Section of the N. E. L. A. that the first two units of the new handbook are ready. These sections are those entitled "Industrial Lighting" and "Lamp Equipment for Commercial and Industrial Lighting." They are punched to fit the old handbook covers and may be had from the committee at 50 cents each. As soon as practicable the remaining sections of the handbook will be revised and issued in the new form.

Executive Board of American Engineering Council Adopts New Plan

A NEW plan of regional activity for the Federated American Engineering Societies has been adopted by the executive board of the American Engineering Council and is now being put into effect. It is expected to become effective by Jan. 1. By the new method, which provides for an increase of districts from six to eight, districts are arranged on the basis of unity of local interest rather than on parity in numerical membership. The districts will be as follows:

District No. 1.—New England and New York: Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut and New York.

District No. 2.—Great Lakes: Michigan, Wisconsin and Minnesota.

District No. 3.—Ohio Valley: Ohio, Indiana, Illinois and Kentucky.

District No. 4.—Middle Atlantic States: Pennsylvania, New Jersey, Delaware, Maryland, Virginia, West Virginia and District of Columbia.

District No. 5.—South Atlantic and Gulf States: North and South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana and Tennessee.

District No. 6.—North Mississippi and Missouri Valley; Iowa, Missouri, Kansas, Nebraska, North and South Dakota, Wyoming, Utah and Colorado.

District No. 7.—South Mississippi Valley and Gulf: Oklahoma, Arkansas, Texas, New Mexico and Arizona.

District No. 8.—Pacific Coast: Washington, Oregon, Montana, Idaho, California and Nevada.

Kern River Company Forfeits Right-of-Way Under Supreme Court Decree

A DECISION of the United States Supreme Court handed down Nov. 21 in a suit against the United States by the Kern River Company, which appealed from a verdict of the Circuit Court of Appeals, entails the forfeiture by the Kern River Company of a right-of-way for a canal several miles in length through a California forest reserve and also enjoins the appellant from further occupying or using the land unless within some reasonable time, to be fixed by the district court in which suit by the United States against the company was first brought, the company applies for and obtains a right or license under an act of Feb. 15, 1901, or some other applicable statute.

The litigation began when a suit in equity was brought by the United States to obtain (a) a cancellation of the Secretary of the Interior's approval of two maps on the ground that it was obtained fraudulently by falsely representing that the right-of-way was sought with irrigation as the main purpose and the development of electric power as a subsidiary purpose, when in truth the latter was the sole purpose, or (b) a judicial declaration and enforcement of a forfeiture of the right-of-way on the ground that, although granted on condition that it be used mainly for irrigation, it in fact has been used solely for developing electric power and its use for irrigation is precluded by a binding and continuing agreement on the part of the grantee.

The trial court concluded that the charge of fraud in procuring the Secretary's approval was not sustained, and the bill was accordingly dismissed. On appeal by the United States, the Circuit Court of Appeals concluded that the charge of fraud was adequately proved, and the decree of dismissal was reversed with directions that a decree be entered canceling the Secretary's approval and also enjoining the further maintenance of the canal unless within a reasonable time the claimants applied for and obtained a lawful permit or license, which it was conceded could be done under the act alluded to above.

The Supreme Court has now maintained the decision of the Court of Appeals, with slight modifications.

Administration Not Inclined to Hurry Tariff Bill

IN THE course of an address before the Fifth Avenue Association in New York on Nov. 15 Will H. Hays, the Postmaster-General, made significant references to the tariff situation. His utterance, in some quarters at least, is interpreted to mean that there will be no effort to hurry the enactment of the tariff bill. An extract from Mr. Hays' speech is as follows:

> Before 1914 we were a debtor nation—the largest in the world. Today we are precisely the opposite. We are the largest creditor nation in the world. Just what is the effect of the enormous importance of this change in our economic and commercial position in relation to the rest of the world I do not pretend to know. I merely point out that no thorough or open-minded or candid consideration of the tariff question can be complete without including consideration of this new factor. Regardless of what an investigation of this point might reveal—omitting this factor altogether—it is a fact that to thoughtful men there must be approval of a certain hesitation and disposition to be cautious and a determination to be sure-footed in the consideration of the whole subject of the tariff. Conditions throughout the world are so chaotic that it is difficult to foretell exactly what is needed. The very basic conditions on which a tariff is built—the cost of manufacturing in various European countries with relation to our own cost of manufacture and the value of the currency of the various European countries with relation to the value of our own currency—are at the present moment as fluctuating as quicksand. To build a dependable tariff on such a foundation is difficult, of course. It has been thought by many that we could overcome these handicaps by a device which is called American valuation and which would provide that all customs duties shall be estimated upon the value of goods at the time when they arrive in the United States and in terms of American money. The Congress in a proper eagerness for information has made an appropriation of $100,000 to investigate the device and otherwise determine what might be done to help us toward writing a permanent tariff. This was proper, but a much better arrangement, and one which is very definitely in the mind of the administration for accomplishment, is to make the Tariff Commission a really useful and functioning institution which will constantly study the situation and with sufficient authority, which ought to be given it, be able to meet any and all conditions that obtain or emergencies that may arise. The work of the special investigation has been going on, and with the adjustment of our international relations by the accomplishment of the steps which the President has in mind we may except relief from some of the conditions of fluctuation and instability so that proper permanent tariff making will be possible.

Seattle Municipal Plant Bonds at Less than Six per Cent

A SYNDICATE is offering a new issue of $3,205,000 Seattle (Wash.) municipal light and power 6 per cent gold bonds dated Nov. 1, 1921, and due Nov. 1, 1927 to 1941, to yield according to maturity about 5.65 per cent to 5.75 per cent. The bonds are exempt from all federal income taxes and all taxation in the State of Washington. The issue is to make additions to the existing system and for the Skagit River plant construction.

Important N. E. L. A. Executive Committee Meeting Dec. 14

THE midyear meeting of the National Executive Committee of the National Electric Light Association is to be held in New York on Dec. 14. Representatives are expected to be present from all of the divisions. A number of very important matters are to be taken up at that time, including a decision on the date and place of the next annual convention.

Finance to Be Sole Theme of O. E. L. A.'s New Business Committee

FINANCIAL problems of central-station companies are to be the only subject of the meeting of the new-business co-operations committee of the Ohio Electric Light Association to be held at Dayton on Wednesday, Dec. 7. At the morning session J. R. Edwards, vice-president Fifth-Third National Bank, Cincinnati, will read a paper on "Public Utility Financing"; W. W. Freeman, president Union Gas & Electric Company, Cincinnati, will make an address on "Relation of Utility Rates to Price of Other Commodities," and a general discussion will be opened by C. H. Howell, vice-president and general manager Ohio Service Company, Coshocton. In the afternoon there will be two papers followed by a round-table discussion. The subjects of the papers are "Methods of Central-Station Financing—the State Commission" and "The Organization and Work of the Central Station Securities Department," the first to be presented by Grover C. Maxwell, Cleveland, former secretary of the Ohio Public Utilities Commission, and the second by C. E. Yacoll, Youngstown, manager securities department, Pennsylvania-Ohio Electric Company.

Steinmetz Tells Why Electrical Industry Will Grow

THE indisputable reason for the future growth of the electrical industry as well as its past development is that a large and reliable supply of energy is an absolute necessity to our present civilization, said Dr. Charles P. Steinmetz in an address before the New York Electrical Society on Nov. 25. Electricity, he maintained, is the best and in most cases the only reliable and economical form of energy. While transportation is the first essential to modern life in that it brings together materials from all parts of the world, energy is next in importance because it must be available to turn the materials into articles for human use. Moreover, transportation itself is now largely dependent on electrical energy. "Just as the railroads seventy-five years ago organized the transportation of materials, so the transmission of energy to turn our wheels and fetch and carry," said Dr. Steinmetz, "is being supplied by the electrical industry. Great factories which make electricity and supply it as other factories supply hats or stoves have come into being. Electrical energy is the only kind that can be easily. economically and simply conducted to the centers where it is needed, whether in small quantities for the vacuum cleaner or the house lamps or in huge masses for great mills and factories. In long-distance transmission the voltage has crept up from 150 volts to 10,000, 30,000, 60,000 and finally 220,000 volts, and, experimentally, we have gone to a voltage of 1,100,000.

"When the first power plants were established in Niagara the question was asked whether electricity could not be sent to New York City. But no one asks that question any more. The reason is that the distance is so great that the electric power finds a market long before the limit of transmission has been reached. There is no economic excuse for transmission over long distances. Instead, a network of interconnected generating and conducting systems is springing up. It has already ignored the boundaries of states, and the laws of different states are already in conflict, so that federal supervision will certainly be needed.

"On our great railroad trunk lines the anachronism of the steam locomotive still exists. But even the layman knows that only the unfortunate financial situation of our railroads makes more extensive electric propulsion impossible. The enormous consumption of coal by the railway must be stopped.

Hartford Company Plans Reduction in Domestic Rates Jan. 1

A VOLUNTARY reduction in the 10 cents per kilowatt-hour rate now charged domestic consumers has been voted by the directors of the Hartford (Conn.) Electric Light Company, to take effect on all bills rendered after Jan. 1 next. The exact amount of the decrease remains to be figured out, but the guiding principle to be pursued is indicated in this utterance of Vice-president Samuel Ferguson, who announces the satisfaction of the management that it is at least possible to lower charges: "In the present case, as in the case of past increases, it has been the consistent policy of the company to do as great a volume of business as possible on as small a margin above cost as possible."

The resolutions passed by the directors made the following stipulations in regard to the revision:

Such revision to effect a reduction in amounts to be paid by domestic users as a class, based upon the business of the past twelve months, of approximately $100,000.

Such revision to be arranged to distribute this reduction as nearly as practicable to domestic customers in proportion to the use made by each customer of the facilities required to furnish service, and without distinction between large and small customers.

And in addition: Be it resolved, that, in order to accommodate those desiring to make a more liberal use of our service, the executive officers are requested to endeavor to provide a means whereby an average customer may obtain not less than 30 per cent more energy without increasing his present bills more than 10 per cent.

Proposal to Develop Colorado River Power for Railroad Electrification

TWO applications for preliminary permits were received by the Federal Power Commission during the week ended Nov. 26. Guy P. Mohler of Needles, Ariz., requests a permit covering a location on the Colorado River in Mohave County, Ariz., and Clark County, Nev. He wishes to erect a series of dams beginning at Pyramid Peak at the lower end of Pyramid Canyon and extending upstream to the proposed projects of the city of Los Angeles and of E. L. Beyard in Boulder Canyon. The available power is estimated to be 316,800 hp., and it is proposed to build a plant of 400,000 hp. installed. The power is for railroad electrification.

Benjamin H. Hardaway of Columbus, Ga., requests a preliminary permit to cover a 1,400 hp. project on Pea River near its mouth for public utility uses.

To Call Meeting to Co-ordinate National Association Effort

BELIEVING that individual organizations and companies making up the electrical industry are being taxed too heavily both in money and time to carry on the activities of the different national associations, the directors of the Society for Electrical Development at its recent meeting considered the advisability of working out some plan whereby co-ordination of the activities of national association might be accomplished to the end that duplication of effort would be avoided. A committee was appointed by Vice-president J. E. Montague, in the absence of President W. W. Freeman, to prepare a call to be sent to every national association requesting that representatives be nominated to meet and discuss the matter. During the discussion the relation between the society and local electrical leagues came up. The directors were of the opinion that it was advisable first to undertake to co-ordinate national effort and afterward national and local efforts.

A further revision in dues was decided upon at the meeting. Authorization was given for the organization of a home economics department.

The office of secretary-treasurer was divided, and Theodore E. Burger was elected secretary, R. F. Paige continuing as treasurer.

New England Utilities Suffer Million-Dollar Storm Damage

ELECTRIC utilities in New England were visited by the worst sleet storm in their history beginning Sunday of this week, and preliminary estimates of damage to overhead lines and loss of revenue exceed a million dollars. Wire service of all kinds from 66,000-volt transmission lines to telephone and telegraph circuits was crippled to an unprecedented degree; thousands of poles and tens of thousands of spans fell under the accumulating weight of ice and tree branches, and under the most favorable conditions weeks will be required to restore even approximately normal service.

The most severe effects of the storm were felt through Massachusetts from Pittsfield to the suburban district west and north of Boston. Maine, New Hampshire and Vermont escaped with minor damage. Connecticut sustained line trouble near New Haven and on the transmission line of the Connecticut Power Company. Rhode Island got off fairly well until Tuesday, when a shift of the storm caused much telephone damage in the Providence-Pawtucket district and considerable service line trouble, with some street-lighting failures, on the Narragansett system in Providence.

Thirty-four cities and towns within a radius of 30 miles of Boston and supplied by the Edison Electric Illuminating Company were almost entirely in darkness Monday night. Twenty-six other places were seriously affected, and in many towns the service was ordered cut off by city officials on account of the danger of crossed wires. Nearly all the Boston Edison substations were alive up to Tuesday night, and in Boston proper very little interruption of service was reported. Suburban hospitals were being supplied with storage-battery and spot-lamp equipments for operating room service, transported through the co-operation of the company. The total losses of this company may reach $100,000.

The New England Power Company was hard hit on its 66,000-volt transmission system, about a dozen A-frame steel towers and some square towers going down in the vicinity of Worcester. Distributing lines of this company fared badly. Its loss on the entire system may reach $200,000. The Worcester Electric Light Company maintained its downtown and underground service satisfactorily, but in outlying residential sections both street and house lighting was severely shattered. Power service was well maintained. The total loss at Worcester will probably not exceed $30,000. Springfield is reported seriously damaged and cut off from telephone communication. The Tenney companies north of Boston sustained heavy line trouble, including the loss of towers on the Salem-Malden-Revere interconnection. Lowell, Lawrence and Haverhill were also in difficulties. The New England Telephone & Telegraph Company sustained damages estimated at $500,000. 3,000 poles being down Tuesday.

Merrill Recommends Acceptance of N. E. L. A. Depreciation Proposals

WORD was received by the ELECTRICAL WORLD from its Washington correspondent on Thursday that O. C. Merrill, executive secretary of the Federal Power Commission, recommends the acceptance of the proposed changes in the water-power regulations with respect to depreciation suggested by the National Electric Light Association. A meeting was held on this subject in Washington on Nov. 21, at which time the N. E. L. A., through a committee, outlined its proposals. A full report will be found on pages 1091 and 1092 of the ELECTRICAL WORLD for Nov. 26.

The statement made this week by Mr. Merrill follows:

The committee originally proposed that the existing regulation with respect to depreciation reserves be practically discarded and that an entirely new regulation be submitted in its place. The proposed new regulation would have had the effect of leaving the commission not only without any authority to determine the principles upon which depreciation reserves should be established, but also without any control over the application of such principles except through proceedings in the courts The original proposals have been materially modified so that the committee's final proposals consist in the insertion of two new sections, Nos. 6 and 7, which modify the remainder of the regulation only in its application to state-regulated public utilities. Certain verbal changes are made in other sections largely for the purpose of securing conformity with the new sections and with the amendments proposed to Regulations 12 and 20.

Objection was originally made to the method proposed for accruing depreciation on the grounds, first, that the method was incorrect, and second, that, if correct, it could be carried out by licensees only to the extent permitted by state regulatory bodies. There apparently is considerable difference of opinion among the members of the committee themselves over the proper method of determining depreciation. The method set forth in the regulation is the one followed by many utilities voluntarily and the one required by many of the state commissions as well as by the Interstate Commerce Commission. In its final proposals the committee leaves the principle of determining depreciation intact in the regulation and confines itself to recommendations concerning the application of the principle to licensees that are public utilities subject to state regulation.

If the regulation is altered as proposed, licensees under state regulation will submit to the commission a classification of project property and a statement of the rates and amounts of depreciation which are proposed to be set up on account of such project, such rates and amounts to be those prescribed or authorized by the public utility commission of the state in which the licensee is operating. These rates and amounts will be reviewed by the commission, and if the commission finds that the reserves proposed are not adequate for the purposes of the act, it will issue an order requiring the creation and maintenance of reserves which are adequate. If the licensee does not set aside the reserves as ordered, it will be necessary for the commission to enforce the order by proceedings in the courts under the provisions of Section 26 of the act. If the licensee is not under state regulation, the general rule of the regulation will apply.

It is recognized that there would be possibilities of conflict with state authorities if the commission should in all cases in the first instance require depreciation reserves to be set up by any specific method. The maintenance of reserves by licensees who are under state regulation is partly dependent upon their authority to do so under such regulation and partly upon their ability to do so under the rates allowed by the state authorities. Failure to set up reserves adequate to take care of accruing losses in service value of operating property in order that rates may be lower or dividends higher secures such results at the expense of depletion of capital assets and at the risk of future financial difficulties. It is, therefore, believed that the method proposed in the regulation is sound in principle and should be enforced in practice in every case except where, under the specific circumstances, it would, for the time being, be manifestly unreasonable to do so.

Unless it be assumed that the acceptance of a license under the regulation now in force would constitute an agreement on the part of the licensee to account for depreciation on the plan set forth in the regulation, the amendment proposed may accomplish the same results as the present regulation, but in a less direct way. The present regulation prescribes a general rule which licensees would be required to follow unless relieved in specific cases by action of the commission. Under the amendment proposed, licensees, if not required by state authority to set up reserves under the rules contained in the regulation, would be under no obligation to do so, regardless of the amount of their earnings or the condition of their reserves, unless and until specifically ordered by the commission; that is, the proposed amendment transfers the responsibility in each individual case from the licensee to the commission.

The amendment will involve more work on the part of the commission than would have been required by the original regulation. It will be necessary to determine in the case of every state-regulated licensee whether the reserves established are adequate for the purposes of the act, since such licensees would be without legal obligation to establish such reserves unless specifically ordered to do so by the commission. Furthermore, it will undoubtedly be necessary in some instances to enforce the orders of the commission though the courts and to settle the question of the reasonableness of the rule of depreciation by court proceedings rather than by a contracted agreement with the licensee expressed in the license itself.

Notwithstanding the certainty of increased work for the commission and the possibility of protracted litigation in some cases if the amendment is approved, it is probable that these objections are outweighed by the difficulties which would be involved in fixing an inflexible rule applicable in all cases, or by the uncertainties which would be involved by leaving the matter indeterminate. It is, therefore, recommended that the proposed changes be approved.

First Demonstration of Carrier Current to Railroad Men

THE first public demonstration of the application of carrier current to moving trains was made before railroad men at Schenectady on Wednesday. Representatives of the Pennsylvania and New York Central railroads who are members of the radio committee of the American Railway Association were holding a meeting at Schenectady, and the General Electric Company took the opportunity to show how far it had advanced in its experiments on carrier current.

The demonstration was made from a moving car on the Schenectady street-railway system. Those on the car were able to talk with a substation 3 miles away.

The General Electric Company has been experimenting with the use of carrier current for railroad purposes for a long time. For several months it has been conducting a test on the electrified Chicago, Milwaukee & St. Paul.

Utility Security Yields Still Lower

DURING the month of November the amount of stocks and bonds offered investors by electric light and power companies was $54,900,000, the highest monthly total of the year with the exception of May, when a new record was set with a flotation of $55,375,475. As is shown in the table the number of single issues offered was small, but the record issue of $30,000,000 offered by the New York Edison Company accounts for the increase in volume. The most prominent characteristic of the month's flotation is the exceedingly low rate of return yielded the investor, 6.33 as compared with 7.33 for the month of October and 7.6 for the month of September. Long-term issues again predominate.

The past month brought a decided upturn to the public utility security market, especially in bonds and preferred stock of electric light and power companies. The public demand for this type of security has been very large and is not yet entirely satisfied. Bond merchants state that their shelves are bare of good issues.

Name of Company	Amount of Issue	Term	Class of Security	Purpose of Issue	Rate of Interest	Per Cent Yield	Offered At
United Light & Railways Co., Mich.	$2,000,000	10-yr. 7 [illegible]	First and refunding mortgage gold bonds of 1912	To retire an issue of notes falling due	5	7.45	82
Connecticut Light & Power Co.	4,000,000		Cumulative preferred stock	To provide funds for construction and additions and betterments to plants	8	8.[illegible]	[illegible]
Utah Power & Light Co.	2,[illegible]00,000	22-yr	First lien and general mortgage gold bonds, series of [illegible] 1944		6	[illegible]	94
Kingsport [illegible]	[illegible]	[illegible]	First mortgage gold bonds, series B		7	7.30	
[illegible] Power Co.	5,500,000	30-yr.	First mortgage lien and refunding gold bonds	Provide funds for redemption of secured notes falling due. Reimburse company in part for expenditures made and to be made	6	6.20	97
Pacific Gas & Electric Co., San Francisco	10,000,000	20-yr	First and refunding mortgage gold bonds, series B	Improvements and to reimburse treasury ...	6	6.[illegible]	98
New York Edison Co.	30,000,000	20-yr	First lien and refunding mortgage gold bonds, series A		6½	6.10	104½
Electric Bond & Share Co.	$1,250,000		Cumulative preferred stock		6	5.75	89
Total	$54,900,000						

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Louisville Electric Home Sold for $15,025.—The electric home at Louisville, Ky., which during its use for exhibition purposes by the Electrical Club of that city was visited by 23,000 persons, was sold at auction for $15,025, the price including all electric fixtures but no appliances.

Manchester (N. H.) Company Discontinues Surcharge.—The Manchester (N. H.) Traction, Light & Power Company has announced that on Feb. 1 it will drop the surcharge of 25 cents on all electric meters in the Manchester and Nashua district that was imposed in war time. The charges for energy will remain the same.

Jersey City Opens "Great White Way."—A civic celebration of the opening of a "great white way" along the southern part of the Hudson County Boulevard was recently held in Jersey City, N. J. The installation comprises eighty-nine 600-watt lamps. Energy for lighting will be furnished by the Public Service Electric Company at a rate approximating 3.65 cents a kilowatt-hour.

Bradford, Pa., Defeats Project for City-Owned Lighting Plant.—The taxpayers of Bradford, Pa., after an intensive educational campaign for and against city ownership of the local lighting plant, recently defeated the proposition by a vote of 1,700 to 117, or about fifteen to one. The specific question voted on was whether or not to bond the city for $112,000 to pay for construction of a new plant.

Lower Lighting Rate for Birmingham Probable.—It is expected that Birmingham, Ala., will have a cheaper electric light rate commencing early in January, 1922. Under the franchise of the Birmingham Railway, Light & Power Company, which furnishes the electric lighting for the city, the rate is to be reduced 0.5 cent a killowatt-hour when the number of electric meters installed shall have reached 22,500. According to J. S. Pevear, president of the company, this number will be reached before Jan. 1.

Municipal Lighting Plant Question Comes Up Again in Milwaukee.—Mayor Hoan of Milwaukee is actively working for a municipal plant to supply energy not only for the street-lighting service but also for commercial purposes. He has addressed a communication to the City Council which is expected to reopen the ten-year fight for the establishment of a municipal plant. In 1910 the voters approved a bond issue for the construction of a plant to supply energy for the street-lighting system, and the Mayor believes that the city is legally free to float this issue, construct a plant and sell the surplus energy.

Oregon Town Votes Against Municipal Plant.—Public opposition to experimenting with a municipal light and power system was manifested in the outcome of a special election held in Roseburg, Ore., last month for the purpose of voting on the issuance of bonds for establishing such a system. Although the city still has the authority to issue $500,000 in bonds and proceed with a new plant by virtue of the result of an election several years ago, it is very doubtful that it will make this move in the face of the recent adverse vote, especially as this amount would probably not be sufficient to build a power plant and the necessary distribution system. The private utility now supplying the city is said to be willing to make any necessary extensions and improvements and the citizens apparently find its service adequate and reliable.

Municipal Councilors Say Utilities Are Paying All the Taxes Their Business Will Bear.—An unusual report to be made by municipal councilors was rendered recently to the City Council of Butte, Mont., by its ways and means committee. This committee asserted that the local power, telephone and water companies were paying all the taxes and license fees that their industries would bear and that the need of raising additional sums for the administration of the city did not justify imposing still higher taxation on them. The report was accompanied by a statement of taxes paid by these companies, showing the low rate of return they were earning on investment.

Smithsonian Institution Does Not Indorse Plan to "Consolidate Government Science."—Through the publication in the *Congressional Record* of a plan by Arthur McDonald of Washington to consolidate government science in the Smithsonian Institution, wide circulation has been given to a scheme which is not taken seriously in Washington and does not have the indorsement of the Smithsonian Institution. Dr. Charles D. Walcott, secretary of the Smithsonian Institution, says that the plan was drawn up and circulated without his knowledge, and the Congressman who inserted the proposal in the *Record* state that he did so as an accommodation to Mr. McDonald and is opposed to the scheme himself. As a result of the publication of this plan the various scientific bureaus and the Smithsonian Institution have received a flood of comment.

Indiana Utilities Ask Leave to Offer Securities on Better Terms for Purchasers.—Two Indiana public utilities have petitioned the Public Service Commission to permit more favorable terms for purchasers of securities already authorized by the commission. The Interstate Public Service Company, a gas, electric and interurban utility, has requested permission to sell $130,000 of its first and refunding bonds at 75 per cent of par. The commission some time ago authorized the company to sell the securities at 80 per cent of par, but the company avers that it cannot now market the bonds unless it gives a greater discount. The Indiana Power Company of Vincennes has requested leave to increase from 7 to 8 per cent the dividend rate on $1,303,000 of unsold preferred stock. The commission originally authorized the company to issue $1,590,000 of 7 per cent stock, but the company asserts that it cannot now dispose of the remainder unless it pays a higher dividend.

Projected Transmission at 200,000 Volts in Scandinavia.—The project of exporting electrical energy from Norway to Denmark through Sweden continues to receive official consideration in those countries, and an engineering commission not long since visited a number of Norwegian power stations to ascertain their value in carrying out the scheme. Some experts, according to *Engineering*, consider it probable that Norway will deliver power either from power stations on the River Glommen or from Nore and that she will herself undertake the transmission of this power as far as the Swedish border, from which point the further transmission would be undertaken by Sweden. It is proposed to employ a tension of 20,000 volts, which would far exceed any voltage now used in Europe.

Peat and Water Power in Ireland.—At a recent "All-Ireland" industrial conference held in Dublin a speaker estimated the available electrical energy of the country from water power at at least five times that now developed by imported coal. An official fuel research board, this speaker also said, had reported that the peat deposits would satisfy the power requirements of the island for more than 250 years, so that the outlook was very good. The chief electrical engineer of the Dublin Corporation said that the chief trouble with water power in Ireland arose from the variable flow in the rivers. The Dublin authorities were anxious to develop the Liffey, and that river and the Bann would be the first to be exploited. The Shannon and the Erne would produce more power, but there was not a great enough population to make its development profitable.

A New Type of Windmill Motor.—According to a Duluth (Minn.) contemporary, an inventor of that city, Albert H. Heyroth, has attacked from a new angle the problem of generating electricity with the windmill as a prime mover. "He placed around a standard 8-ft. fan a laminated iron periphery having 108 teeth at equal intervals. This periphery was made rigid to the fan. With the movement of the fan it was made to pass under what might be termed the armature coils of a stator. This stator, which is supported above the fan by a post set in the turntable and which consists of two sets of coils, is covered with a copper housing and sealed. With increasing and diminishing of the magnetic flux through these coils by the passage of the teeth, an alternating current is set up. This is rectified in a vacuum tube and charges the battery and supplies the excitation to the field coils of the stator, which are excited by a current from the batteries until the plant begins charging." Mr. Heyroth designs his apparatus for a suburban home or a farm with small electrical requirements. According to the newspaper, the first plant he erected supplied all the energy required by the home to which it belonged for a period of more than four months. The operation of the plant for three hours a day was found sufficient to replace all the energy which had been taken from the batteries during the previous twenty-four hours. Charging began with wind at five miles an hour. Sixteen cells provided this home, which is equipped with all the electrical appliances, with enough energy for ninety hours with no operation of the plant.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies

Powers of Florida Commission.—Quashing an alternative writ of mandamus sought by the Railroad Commissioners (State ex rel. Burr) against the Jacksonville Terminal Company to compel the company to comply with certain orders of the commission concerning the checking of baggage, the Supreme Court of Florida has declared that authority not granted by a corporate charter or by the law cannot be conferred by an order of the commission. (89 So. 641.)*

Value of Franchise Determined by Earning Capacity.—In a suit brought against the Louisiana Board of State Affairs by the Baton Rouge Electric Company to reduce the assessment of the company's franchise from $452,530, as fixed by the board, to $67,375, the Louisiana Supreme Court held that the board was not justified in adding to the earning value of the franchise an additional assessment for the privilege of occupying the streets or for carrying on the business of the corporation, since the value of the franchise is to be determined by earning capacity. The court held further that a public utility corporation the franchise of which is assessed according to the net earnings rule is entitled to have deducted from its annual earnings the estimated annual cost of replacements or renewals of its tangible property used in the business. (89 So. 244.)

Pennsylvania Courts Bow to Supreme Court of United States.—The case of Ben Avon Borough vs. Ohio Valley Water Company, which began before the Pennsylvania Public Service Commission nearly five years ago, has finally come to a conclusion. In this case a decision was originally rendered by the commission greatly decreasing the valuation placed upon the plant by the water company and necessitating, if sustained, reductions in the schedule of rates. The Pennsylvania Superior Court overruled the commission as to five of the items of valuation, the net result of which action would have been to sustain the rates. On appeal the Pennsylvania Supreme Court reversed the judgment of the Superior Court and approved the findings and order of the commission. The judgment was in turn appealed to the United States Supreme Court, which reversed the Pennsylvania Supreme Court (see ELECTRICAL WORLD, Dec. 11, 1920, page 186) upon the ground that the state must provide a fair opportunity for submitting the issue of confiscation by fixing too low a rate to a judicial tribunal for determination upon its own independent judgment as to both law and facts; otherwise, the court of last resort held, the order would be void because in conflict with the Fourteenth Amendment. The Superior Court then proceeded to reconsider the case and again decreed that the order of the commission be reversed and the complaints dismissed. The cause was once more appealed to the Pennsylvania Supreme Court, which now affirms the judgment of the Superior Court and dismisses the appeals. In Beaver Valley Water Company vs. Public Service Commission, the Superior Court had affirmed a similar commission finding out of deference to the ruling of the Pennsylvania Supreme Court in the Ben Avon case. The Superior Court has now, on resubmittal, reversed itself, ordering the commission to dismiss the complaints, and has been sustained by the State Supreme Court. (114 At. 369, 373.)

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities

Reasonableness a Factor in Permissible Operating Expenses.—The mere fact that a utility has spent a certain sum of money for operation does not, the Indiana Public Service Commission observed in denying increased rates to a gas company, necessarily mean that that amount must be allowed as an operating expense, if it appears that the expenditure is improper or that it is too large. Moreover, the commission has to remember that excessive rates are likely to result in a falling off of consumption and a consequent failure of financial benefit to the utility.

Fair Value, Not Purchase Price, the Criterion. — A North Dakota village having raised the point that the utility serving it had been allowed a valuation on its plant larger than the price it had paid for it, the Board of Railroad Commissioners of that state replied: "If the public is charged only rates based on the fair value of this property as determined by this board after considering all the facts, then the public has no complaint. If the utility has paid more for the property than it is worth, that is the utility's fault, and it cannot recoup itself out of the public. If, however, economic conditions and the law have been such as to give the utility the benefit of the bargain, that does not go to the public. The public is concerned only with the fair value."

Ten-Year Average of Prices Used in Figuring Valuation of Electric Utility.—The Indiana Public Service Commission has placed a valuation of $4,346,653 on the Indiana Railways & Light Company of Kokomo for rate-making purposes. The valuation is one of considerable importance since rates authorized by the commission will hinge on the value of the property of the company. A ten-year average of prices from 1911 to 1920 was used by the commission in figuring the value of the property. Non-utility property owned by the company, valued at $172,585, was not included in the valuation. The company operates interurban lines, street-railway lines, electric utilities and heating utilities in a number of Indiana cities, including Kokomo, Frankfort and Marion.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

Ohio Electric Light Association.—A meeting of the new-business co-operations committee of this association is scheduled for Dayton on Wednesday, Dec. 7, and one of the transmission and distribution committee for the same city on the following day.

Institute Section Meetings.—Section meetings of the A. I. E. E. for this month are scheduled as follows: Dec. 6, Toronto, "Distribution Records and Overhead Distribution"; Dec. 8, Baltimore, "Design and Construction of the Westport Generating Station," by A. S. Loizeaux, and "Operating Problems in the Westport Generating Station," by A. L. Penniman; Dec. 14, New York (joint session with A. S. M. E.), "Central-Station Operation."

N. E. L. A. National Section Meetings.—January meetings of the National Electric Light Association sections are scheduled as follows: New Orleans, Commercial National Section—Jan. 18, 10 a.m., Lighting Sales Bureau and Power Sales Bureau; Jan. 18, 2 p.m., Electric Vehicle Bureau and Merchandise Sales Bureau; Jan. 19, 10 a.m., Advertising and Publicity Service Bureau and education committee; Jan. 19, 2 p.m., committee on commercial service and relations with customers, committee on "Electrical Salesman's Handbook" and committee on electrically equipped furniture; Jan. 20, 10 a.m., executive committee. New York City, Technical National Sectional (all meetings at 10 a.m.)—Jan. 23-24, inductive interference committee, meter committee and underground systems committee, main groups; Jan. 25-26, electrical apparatus committee, overhead systems committee and hydraulic power committee, main groups; Jan. 26-27, prime movers committee and safety rules committee, main group.

Coming Meetings of Electrical and Other Technical Societies

A. I. E. E. Section Meetings—Baltimore, Dec. 8; New York, Dec. 14.

A. I. and S. E. E.—Cleveland Section, Dec. 12; Chicago Section, Dec. 16; Pittsburgh Section, Dec. 19; Philadelphia Section, Dec. 20.

American Society of Mechanical Engineers—New York, Dec. 5-9.

American Society of Refrigerating Engineers—New York, Dec. 5-7.

American Institute of Chemical Engineers—Baltimore, Dec. 6-9.

American Physical Society—Toronto, Dec. 27-30.

American Association for the Advancement of Science—Toronto, Dec. 27-31.

American Engineering Council—Washington, Jan. 5-6.

Western Association of Electrical Inspectors—Chicago, Jan. 17-19.

American Society of Civil Engineers—New York, Jan. 18-19.

Lighting Fixture Dealers' Society of America—Milwaukee, Jan. 30-Feb. 2.

National Meter Committee, N. E. L. A.—Springfield, [illegible]

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*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel—Responsibilities and Association Appointments of Men Engaged in Professional, Executive, Cperating and Commercial Branches of the Industry

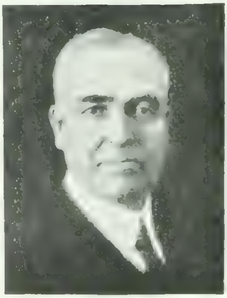
E. N. Willis, who has recently been appointed secretary of the Southwestern Electrical and Gas Association, vice H. S. Cooper, resigned, comes to his new position after ten years of close touch with the public utilities throughout the Southwest from both a commercial and an operating standpoint. Mr. Willis was born in St. Lawrence County, New York, in 1880. He was graduated in electrical engineering from Lawrence Scientific School, Harvard University, in 1903. He was connected with the General Electric Company in Schenectady, in the testing department and as construction engineer, from 1903 to 1911, when he went to Dallas to join the General Electric Company of Texas, later the Southwest General Electric Company, as assistant to the sales manager. In 1919 he became manager of the Houston office for Smith & Whitney, power-plant engineers. Mr. Willis is well acquainted with public utility problems and men throughout Texas and the Southwest and is well qualified for his new work with the Southwestern association.

E. N. WILLIS

Dr. Ernest Fox Nichols, who upon the advice of physicians recently resigned the presidency of the Massachusetts Institute of Technology, is to return to Cleveland to resume the directorship of the Laboratory of Pure Science maintained by the National Lamp Works of General Electric Company, Nela Park. This position he left previous to his inauguration as the president of the institute on June 8, last. Because of ill health Dr. Nichols never actively assumed his office. In his work at Nela Park Dr. Nichols' time will be more nearly at his personal disposal. Dr. Nichols is widely known in the educational and scientific world. He has done much scientific research work concerning light, and his calculation of the pressure of light upon the earth is accepted universally. A short time before leaving Cleveland he perfected apparatus for measuring the heat of the stars. From 1909 to 1916 Dr. Nichols was president of Dartmouth College. He has also held professorships at Colgate, Yale and Columbia universities and has studied at Kansas Agricultural College, Cornell University, the University of Berlin and Cambridge University.

Harry C. Abell, formerly vice-president and engineer of the American Light & Traction Company and a member of the firm of Emerson McMillin & Company, has been elected a vice-president of the Electric Bond & Share Company. Mr. Abell has taken an active interest in the activities of the N.E.L.A. for a number of years and is at present treasurer.

Albert W. Childs, superintendent of sales of the Southern California Edison Company, has just been elected chairman of the advisory committee of the California Electrical Co-operative Campaign, with L. H. Newbert as vice-chairman. Mr. Newbert, who is manager of the East Bay Division of the Pacific Gas & Electric Company, had been chairman of the committee since its inception in 1918. Mr. Childs was born in Milwaukee, Wis., in 1870, whence he moved to Los Angeles in 1886 and received his early business training in real estate and fire insurance. He entered the employ of the Southern California Edison Company in March, 1902, serving successively as cashier, district manager in four of the most important districts, assistant general agent and superintendent of sales. He was promoted to the last position in 1913. Mr. Childs has long been active in electrical affairs on the Pacific Coast. He has served on numerous committees of the National Electric Light Association, including the chairmanship of the Pacific Coast Division commercial committee. He has been a member of the Co-operative Campaign committee since October, 1918, and is thus well qualified to carry on the constructive work of this committee.



A. W. CHILDS

H. C. Hasbrouck, for many years associated with the old Public Service Commission of New York, Second District, as head of the accounting and statistical department, has resigned from the new commission to become associated with H. C. Hopson in New York on matters of finance, accounts, taxes and public utility rates. Mr. Hasbrouck is a native of Troy, N. Y., and received his early education in the public schools of that city. After his graduation from Cornell University, where he specialized in economics, history and political and social science, he served for a time as assistant to the registrar of that institution. In July, 1908, he received an appointment as junior statistician with the then recently organized Public Service Commission for the Second District and had remained with that body and its successor in various capacities ever since. In 1913 charge of the commission's division of statistics and accounts was given to him, and he continued to perform the duties of that position until the reorganization of the public service commissions in July last. When the two commissions were consolidated Mr. Hasbrouck became deputy chief accountant of the commission, in immediate charge of the accounting and statistical work of the Albany office, through which most matters relating to finances and accounts of the up-state companies have been handled. Since July 1 he has, therefore, had supervision over most of the work previously done by the division of capitalization and the division of statistics and accounts of the up-state commission.

H. C. HASBROUCK

Mr. Hasbrouck is known to public utility interests outside of New York State by reason of his membership for several years on the committee of statistics and accounts of public utilities of the National Association of Railway and Utilities Commissioners. He was chairman of the special committee of three which prepared the original draft of the uniform systems of accounts for electrical and gas companies which the 1920 committee presented to the national association at its annual convention last year with the recommendation that they be made the basis for uniform accounting in all states.

W. L. Tindall, formerly secretary and general manager of Tindall & White, Inc., lighting bowl manufacturers, New York, has been made president and general manager of the company.

R. J. Wensley, engineer of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, has left for an extended trip through England to study electrical conditions.

C. L. Steber has been appointed the Chicago representative of a St. Louis fuse manufacturer, the Bussman Manufacturing Company. Mr. Steber succeeds J. S. Jacobson, who will devote his entire efforts to his own products.

M. I. Scott, for some time in charge of crane-motor production with the General Electric Company at Fort Wayne, Ind., has been transferred to the Erie (Pa.) works of the company. Crane-motor production in the future will be carried on there. W. H. Kellermeyer is taking Mr. Scott's place at Fort Wayne.

Oswald Dale, formerly vice-president of the Irvington Varnish & Insulator Company, who recently returned from Europe, has been appointed general manager of the Pittsburgh Insulating Company, Pittsburgh. Mr. Dale while in Europe made a study of the English and French insulating material markets.

C. A. Cotton, well known in the New England electrical field as a motor sales representative with headquarters at Boston, has established offices in that city in his own name. He will represent the Northwestern Manufacturing Company of Minneapolis, builder of direct-current and alternating-current motors, and the Sunlight Electrical Manufacturing Company of Warren, Ohio, manufacturer of fractional-horsepower split-phase motors in the New England territory with headquarters at 100 Pearl Street, Boston.

E. J. Mora, until recently engineer and manager of the electrical department of the Pacific Commercial Company, Manila, P. I., the agent of the General Electric Company, has entered into partnership in that city with A. G. Hillberg, C. E., under the firm name of Hillberg & Mora, electrical engineers and contractors. Mr. Mora for a time was connected with the Johns-Manville Company and the West Pennsylvania Railway Company as electrical engineer. Mr. Hillberg was associate editor of the *Engineering Record* for a number of years. He has devoted considerable time to the study of hydro-electric development.

Fred B. Uhrig, for the past forty years an employee of the Western Electric Company and widely known in electrical circles, has retired from active service. Mr. Uhrig was employed by the Western Electric Company as an office boy in Chicago in 1881. By 1883 he had become editor and service man and in 1895 credit man of the Chicago office. When the Denver branch was opened, in January, 1903, Mr. Uhrig was chosen as its manager. The following year he went to Kansas City as manager of the distributing branch there, and with the exception of a short period in 1909 in St. Louis, he has ever since been manager at Kansas City and Western district manager. He has contributed much to the development of his company's business in the Southwest between the Mississippi and the Rockies.

W. T. Cotter, for the past ten years manager of the Davenport (Iowa) branch of the Crane Company, has been appointed manager of the Omaha (Neb.) branch. The appointment takes effect on Jan. 1. His successor at Davenport has not yet been appointed.

E. E. Aldous has been appointed the representative of the American Steel & Wire Company for the Duluth, St. Paul and Minneapolis territory. Mr. Aldous has been in the service of the company for twenty years. He will have his headquarters in St. Paul.

F. T. Coup, until recently in charge of the Milwaukee office of the Wagner Electric Manufacturing Company, St. Louis, has been appointed district manager in charge of the Cincinnati office of the company. Mr. Coup is well known in the trade, having been connected with the Wagner company for many years.

S. N. Clarkson, consulting engineer of St. Louis and former associate Western editor of the ELECTRICAL WORLD, has been selected as permanent secretary of the Power Club, with headquarters at 506 Laclede Gas Building, St. Louis, Mo. Up to the present time the duties of secretary have been performed by one of the members. Of late years C. H. Roth, of Roth Brothers & Company, has given a very large amount of time and effort to this work. Now the activities of the organization have grown to the point where they require more of the secretary's time than it is felt any one member should be asked to give. Mr. Clarkson brings to the Electric Power Club a wide commercial and engineering experience in the manufacturing, central-station and industrial branches of the electrical industry in addition to a broad conception of the entire industry and a wide acquaintance gained in the two years he was a member of the editorial staff of the ELECTRICAL WORLD. Mr. Clarkson was educated in Australia and came to this country seventeen years ago. He has been connected with the Westinghouse Electric & Manufacturing Company, the Union Electric Light & Power Company of St. Louis and the Milwaukee Electric Railway & Light Company. A detailed account of his activities in the electrical industry appeared in the ELECTRICAL WORLD for March 12 last, on page 622.

S. N. CLARKSON

Benjamin P. George, who has just been re-elected president of the Electrical Credit Association, Central Division, has been the recipient of many honors at the hands of the credit men of the electrical industry. In 1919 he was elected president of the national body. For five years previous to that he had served the Central Division of the body as its representative on the board of the national association. At the 1920 meeting of the Central Division he was made president, the post to which he has been re-elected. Born in Concord, N. H., in 1862, Mr. George was graduated from Dartmouth College in the class of 1884, and ever since that time virtually all of his activities have been along credit or financial lines. He was interested in credit matters for about fifteen years before he became closely connected with the electrical industry as credit manager for the Beardslee Chandelier & Manufacturing Company in 1908. Mr. George is still responsible for the credit policy of that company, although in 1917 the additional responsibility of being its treasurer was given to him.

B. B. GEORGE

Obituary

James Healey, special sales engineer of the Mutual Electric & Machine Company, Detroit, Mich., died on Nov. 15, from pneumonia, at the age of sixty years. Mr. Healey was prominent in the electrical field, particularly in the vicinity of Detroit and Chicago. He was formerly associated with the American Telegraph & Telephone Company and had traveled extensively all over the world.

Timothy J. Lynch, for about thirty years superintendent of the Danvers (Mass.) municipal electric lighting department, died recently at Salem, Mass., as the result of a street-railway accident. He was about sixty-four years of age. The Danvers plant was one of the first municipal installations in the country. About two years ago it was converted into a substation from which energy is distributed by the department after purchase from the Eastern Massachusetts Electric Company, operating the Salem-Malden interconnection.

Trade and Market Conditions

Business Reviews, Together with Market Letters from Important Trade Centers, on the Supply, Demand and Prevailing Prices of Electrical Apparatus and Supplies

Better Feeling Continues in Motor Market

ALTHOUGH the road to full recovery still appears long in the motor market, there is an improved tone to both inquiries and orders where persistent sales effort has been shown, as recently noted in these columns. Unless something foreseen occurs, the opinion of well-informed circles is that a gradual strengthening of demand will persist during the winter and that by next fall extremely active conditions will be realized compared with present sales. During the past few months good progress has been made in filling orders from factory and distributers' stocks, and yet this has not been done to an extent that has curtailed factory production beyond the clearly evident necessities of the market. Factory production has been called upon to an extent little appreciated to fill such orders as have been received, and while the publication of ratios is not authorized, it may be said that on many orders more than two-thirds of the units required have been lately fabricated in the manufacturing plants.

Labor conditions tend to improve as liquidation proceeds; raw materials are plentiful, and production plants are being tuned to the most efficient pitch allowable in relation to the scale of present business, at least in the more progressive concerns. Best of all, the underlying gains in general business, while not spectacular, are imparting more encouragement to industry, and the latent market for motorization is far from developed. With many other constructive activities it bids fair to expand if the hoped-for agreement to limit arms is adopted by the Washington conference.

Insulated-Wire Raw Materials Reaching Higher Price Levels

SEVERAL of the raw materials used in the manufacture of insulated wire have reacted from their previous low price levels and have started to climb once more. In some quarters the rise in price of rubber is thought to have been a trifle too rapid, but a recession to the extremely low prices of sixty days ago is held to be unlikely.

Within the last sixty days rubber has shown decided strength, and the present prices are approximately the same as those prevailing around the first of the year. The question of further advances depends entirely upon demand, and there is little reason to conclude that demand can increase very largely for several months, so that prices may be expected to remain stationary for the time being. There are good stocks of insulated wire, and even if this were not so the total percentage of rubber production consumed by the wire industry is not large. On the other hand, large manufacturers of automobile tires have announced radical reductions, and there is a feeling that this might stimulate enough demand for rubber to keep prices at today's levels. The proposal of the rubber growers to stimulate the market by limiting production according to advices has met with failure through lack of co-operation, but many are holding for higher prices. Up-river, fine, was quoted at 24 cents on Nov. 23, first, latex crepe, at 18¾ cents, and ribbed smoked sheets at 18¾ cents per pound, an increase since Nov. 1.

While the cotton market has been irregular, prices are still well up. The weakness was derived in great part from English influence, and this has somewhat worn off. Large spinners' takings for the past week have been high, and the fact that they have taken not only 1,700,000 bales more since Aug. 1 than last year, but also 900,000 bales more than during the active period of 1919, has had a decided influence on sentiment. Cotton-yarn prices closed for October somewhat off from maximum, but there is little likelihood of their declining any considerable amount, enough at any rate to bring them down to the low levels of four or five months ago. As long as the raw-cotton market continues to win back to normal a strong cotton yarn market is naturally to be expected. So far higher cotton has not entered greatly into governing the price of insulated wire and insulating material, but this is due mainly to small demand for the products themselves.

Copper, the most important of the raw materials in this product, has been strong since the beginning of September, with only an occasional slump. There are a number of authorities who predict 15-cent copper by spring, and this forecast seems to be justified by the willingness of buyers to cover their needs for the next six months.

Signs of Improvement in Export Credit Situation

THE foreign exchange situation has ceased to be the bugaboo of six months ago, according to statements made by L. R. Browne, credit manager of the International Western Electric Company, in a talk last week before the National Association of credit men at their monthly "foreign credit round table." With the exception of the Far East, Mr. Browne remarked, where the depreciation of silver has been an impediment, and a few countries in South America, the buyers are showing more faith in the future.

"Mexico in particular has staged a buying 'comeback,'" he said; "our neighbor to the south is in the field for almost every type of supply. The same promising conditions are noticeable in Colombia and Peru. While the demand as yet is a modest one compared with the pre-slump period, history will prove that it is the very stuff of which all great buying movements are made. Some of the South American countries have used the cotton boom to relieve their financial troubles. They also deem it expedient to swallow the difference in exchange rates now existent, under the impression that by the time deliveries are completed on their new orders the money market will have displayed a still better tendency in their favor. Another hopeful sign is the movement among merchants of Mexico, Cuba, Venezuela and Colombia gradually to settle up overdue accounts. Exporters are finding many of their foreign clients ready to accept the exchange losses and balance up their books. Cuba is particularly active in this respect."

An increase in trade with the Far East may be expected soon, according to Mr. Browne, as silver bullion has appreciated more than 12 cents an ounce.

Prices on Western Red-Cedar Poles Drop

A GENERAL decrease in the delivered price of western red-cedar poles has been put into effect by a number of the largest producers. A 40-ft. pole, 8-in. top, may now be bought in New York in carload lots at $16.15. The former price was $19.10, so that the drop on this size is about 15 per cent. Quotations on other sizes f.o.b. New York are as follows: 40-ft., 7-in., $14.35; 35-ft., 8-in., $14.10; 35-ft., 7-in., $11.85; 35-ft., 6-in., $9.55; 30-ft., 7-in., $8.55; 30-ft., 6-in., $6.80; 25-ft., 7-in., $6.80; 25-ft., 6-in., $5.05. The decrease all down the line averages about 15 per cent.

This move of the producers came somewhat unexpectedly even to those closely connected with the industry. Producers had declared that there was little basis for a reduction until freight rates were cut, and for that reason few looked for a drop until after the first of the year. However, there are large stocks on hand, and it is thought that the move was made in order to get these stocks out of the way by inducing a buying movement. So far, it was stated by one large producer, the drop has not had a great deal of effect on demand. There is a fair amount of new construction in most parts of the country, together with the usual amount of repair and maintenance work. Manufacturers of high-tension apparatus report good sales in rural territory, and this indicates that farm lines are going ahead. Much of this business centers in the Middle West.

Wire Shows Inclination to Follow Copper Market

DURING the past week both weatherproof and bare wire have become firmer in many parts of the country jobbers quoting ½ cent a pound higher than last week's base prices. In other centers prices are somewhat spotty, with some jobbers high and others low. Discounting the size of stocks, an increase in wire prices has been looked forward to since the activity of the copper market started in September. Whether this rise in wire is a flurry or not, authorities take it to signify approaching recovery of the market.

Boston reports an advance by jobbers of ½ cent on weatherproof, which is now at 16 cents per pound. Storm damage in that section is expected to increase demand there, though at the beginning of the week the properties damaged were making repairs chiefly out of stock. In Atlanta there has been an equal advance on both bare and weatherproof. The orders there are reasonably good on Nos. 4 to 8 inclusive, and stocks are large. St. Louis jobbers are quoting 15 and 15½ cents per pound on bare and weatherproof respectively. Demand is dull, with stocks heavy. Chicago and New York jobbers are at variance on prices, though the majority seem to be sticking to the old figure.

So far rubber-covered has not followed the lead of bare and weatherproof. Prices vary a great deal, though jobbers' quotations even in the same city varying as much as 60 cents per 1,000 ft. of rubber-covered No. 14. The trend of the copper market, however, is forcing all copper products higher, and to this rather than demand may be laid wire increases.

Continued Improvement Shown in Collections and Credits

IT IS reported by a large electrical jobber that the average basis of collections for the whole country has been reduced about five to six days. On the first of November collections were averaging almost exactly sixty days, while at the present time they are between fifty-four and fifty-five days. Much of this improvement is ascribed to a general reduction in interest rates, with the resultant easier money market, and to generally improved basic conditions.

At the present moment the Northwest is perhaps the worst spot. In North and South Dakota there have been many bank failures, and this, coupled with low prices of farm products, has brought the average of collections higher there than in any other part of the country.

In the Southeast conditions run about the same as last month with flashes of further improvement showing here and there. Collections range from fifty to sixty days, with the average close to fifty.

The general improvement in the southern and central sections has materially bettered credit and collection conditions for jobbers in the Middle West and Southwest. Current obligations are being met within thirty to sixty days, but there remain a quantity of long-term obligations which have been standing for as much as a year. The latter, however, are being steadily liquidated. In the more northern states collections are on an average of forty-five days, all obligations considered. However, these results are not being obtained without considerable work on the part of credit managers. Credit conditions generally are on a much sounder basis and more liberal purchases are being permitted.

The Intermountain district shows some improvement. However, taxes there are felt to be very high, and this is retarding collections. There seems to be plenty of money for investment, however, and this is an encouraging fact. Credits are being well scrutinized.

Pacific Coast collections are a shade better, although during the past month a number of firms have been forced to reorganize. New credits there are being very jealously watched and very few are reported.

Collections in New England are slightly better than last month, and while considerable variation exists between different jobbers' conditions, a more optimistic feeling is evident. Current payments are being made in about sixty days, though here and there outstanding accounts are running a little longer. The three months' period seems to have yielded to better business, and a maximum of seventy-five days represents about the most unfavorable condition. In some cases the tendency to obtain cash discounts for prompt payment is more evident. On the whole, the outlook is good.

New York collections are running about sixty days. Conditions are practically the same as last month, except that the outlook is brighter.

Metal Market Situation

THE copper market is running along steadily with a good amount of business and numerous inquiries. Many of the large producers have already sold the amount of copper set aside for 1921 and have withdrawn from the market as far as deliveries over the balance of the year are concerned. The only month they are quoting is January, at 13¾ cents per pound, as against 13⅝ cents a week ago.

Domestic demand continues good, while foreign buying has been somewhat weak during the last few days. However, taking last week as a whole, European and Japanese buying has been good, with Germany buying about two-thirds that taken by Europe. French buying has been fairly good and Italy has been taking electrolytic and blister in moderate amounts. Domestic brass mills are finding December business holding up well.

Lead is featured by a firmer market abroad, London cables being 7s. 6d. higher for spot at £25 17s. 6d. The domestic situation is quiet, though this is largely seasonal and indications point to a strong revival of demand in the spring.

It became known earlier in the week that the Aluminum Company of America had reduced its quotation on 98-99 per cent ingots from 24.50c. to $19.00c. per lb. with corresponding reductions on other grades. These reductions went into effect on Nov. 15 but were not announced until Nov. 28.

NEW YORK METAL MARKET PRICES

	Nov. 21, 1921	Nov. 28, 1921
Copper	£ s. d.	£ s. d.
London, standard spot	66 7 6	67 7 6
	Cents per Pound	Cents per Pound
Prime Lake	13.37½ – 13.50	13.50
Electrolytic	13.25	13.50
Casting	12.50 – 12.62½	12.87½
Wire base	14.75 – 15.00	14.75 – 15.00
Lead, Am. S. & R. Co. price	4.70	4.70
Antimony	4.55	4.55
Nickel, ingot	41.00	41.00
Sheet zinc, f.o.b. smelter	9.00	9.00
Zinc, spot	5.15	5.15
Tin, Straits	29.75	30.00
Aluminum, 98 to 99 per cent	24.50	19.00

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	10.50 – 11.00	10.50 – 11.00
Brass, heavy	5.00 – 5.25	5.00 – 5.25
Brass, light	4.75 – 5.00	4.75 – 5.00
Lead, heavy	3.75 – 4.12½	3.75 – 4.12½
Zinc, old scrap	2.50 – 2.75	2.50 – 2.75

THE WEEK
IN TRADE

Prices When Quoted Are Those Prevailing at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

Business in strictly electrical circles during the past week has been on an even keel, just as it has been through the whole month of November. However, for all its lack of high spots, the month will exceed October in sales, according to large New York jobbers. Other cities have had virtually the same sort of business. From now on orders may be expected to drop off a little as inventory time approaches. Reports from various sections indicate that holiday business expectations are subsiding a trifle. Still, there is the chance that this season may surprise the pessimists just as did last season.

General industrial conditions are improving. St. Louis reports several steel mills on full schedule, while the same thing is noticed in Atlanta. Textile conditions in New England are good. Electrical supplies are moving well, although a widely diversified demand is shown by different sections of the country. Radio receiving sets are selling heavily in Chicago on account of the broadcasting of grand opera there. In Massachusetts and in the Pacific Northwest overhead line supplies are in demand on account of storm damage.

There is considerable agitation in the Intermountain region over the reduction of through freight rates from the East to the Pacific Coast without a corresponding decrease in the rates to intermediate points in the district. Jobbers there fear this situation will seriously affect business.

NEW YORK

Electrical business seems to have held its own during the month of November, and while actual figures are not yet available, most jobbers feel confident that October sales have been exceeded. The demand for wiring material continues on an even keel with individual orders slightly increasing in the quantity per order. Prices remain virtually the same as last week, with perhaps a little stiffening in wire prices, although this is offset by large stocks carried by some jobbers.

Heating appliances and other household devices are moving better and holiday orders are more plentiful. The trade, however, has been inclined to go slow on ordering large stocks, preferring, it seems, to take chances on a shortage rather than be overstocked.

Conduit.—Prices remain at about the same levels as last week. The smaller sizes are moving fairly well, and jobbers state that buying is in a little larger quantities. Jobbers quotations this week were as follows: For ½-in. black pipe in 2,500-ft. lots, $48.90; ¾-in., $62.70, and 1-in., $89.32 per 1,000 ft. Galvanized pipe in the same sizes was quoted at $53.97, $69.58 and $99.47 per 1,000 ft. Jobbers stocks are good in nearly all sizes.

Rubber-Covered Wire.—Although there have been considerable increases in the costs of raw material, jobbers' prices remain virtually where they were last week. In 5,000-ft. lots, No. 14 rubber-covered is quoted at $6.50 to $6.77 per 1,000 ft. Demand is fair and some jobbers have large stocks on hand.

Flexible Armored Conductor.—This material continues to move very well. Jobbers have been able to replenish stocks during the past week, and immediate delivery can now be made on moderate-size orders. No. 14, two-wire, single-strip, is quoted at $44.50 to $46 per 1,000 ft. in lots of that quantity. Double-strip is quoted at $46.50 to $48 per 1,000 ft.

Lamp Cord.—No change in price was noted this week and demand is moderate. No. 18, cotton, twisted, sells for $12.90 per 1,000 ft. and parallel in the same size for $15.60 per 1,000 ft. stocks generally are good.

Tape.—This material is moving in proportion to the demand for other wiring supplies. Both friction and rubber tape were quoted at 36 cents per pound in 100-lb. lots.

Heating Appliances.—Household devices are showing more activity than at any time heretofore. Hollow ware, grills and toasters are moving fairly well on account of holiday orders.

Loom.—The demand is dull and stocks are small. In 1,000-ft. lots both the 7/32-in. and the ¼-in. sizes were quoted at $18 per 1,000 ft.

CHICAGO

Electrical trade has not changed materially this week. Wiring materials are still moving well and the majority of jobbers have not raised their prices because they prefer to wait until their present stocks are sold. Lamp sales, particularly in the smaller sizes, are reported going strong. Sales on radio receiving sets are increasing because a new station in Chicago is broadcasting grand opera. Schedule material is progressing steadily and prices are stable. While a few jobbers are not very optimistic as to trade for the remainder of the year, the majority of them feel that business will be good to those who go out and get it.

Flexible Armored Conductor.—Activity on this material is reported good, but the price on No. 14 two-wire double-strip still varies from $46 to $48 per 1,000 ft. in 5,000-ft. lots. Stocks are ample.

Conduit.—Movement on black conduit has been steady with the ½-in. black pipe selling between $46.50 and $48 per 1,000 ft. in 5,000-ft. lots. Jobbers report their stocks sufficient for present trade.

High-Tension Equipment.—An increased number of inquiries on 13,200-volt farm-line equipment was reported this week by one manufacturer. Since the usual inquiry asks about 6,600-volt equipment, these inquiries seem to indicate that longer lines are contemplated. An order of 100 ejector cut-outs was sent to Detroit by another company.

Pliers.—Demand has been fair and stocks are ample. The 6-in. side-cutting Klein plier sells for $2.80 and the 8-in. for $3.75.

Schedule Material.—Jobbers report fairly good movement on this material. The key socket sells for $18.15, the keyless for $16.50, both in box lots of 100. Pull-chain sockets are selling at $33 per 100. Snap switches are quoted at $18.50 in lots of 100.

Fuses.—Demand for fuse plugs is holding steady and stocks are fair to good. In lots of 1,000 or more they sell for $28 per 1,000. The non-renewable cartridges, 3-amp. to 30-amp., sell for $9.60 per 100 in standard packages.

Lamps.—Dealers state that the small-size lamps, from 25 watts to 75 watts, are moving well. Gas-filled lamps are also becoming popular. Some sales on 200-watt lamps for industrial purposes are reported.

Fixtures.—Dealers state that while there is a good movement on small fixtures for residences, the best activity is on industrial or office fixtures.

Radio Equipment.—The impetus created by broadcasting grand opera has increased the sale of this equipment. Jobbers report good sales on complete receiving sets ranging from $25 to $40.

Wire.—Although the copper market has strengthened slightly, many jobbers have not increased their prices on either weatherproof rubber-covered or bare wire. Sales on rubber-covered No. 14 at $6.60 per 1,000 ft., in 5,000-ft. lots, are progressing well. Weatherproof wire is moving fairly at 16½ cents a pound in 1,000-lb. lots. The bare wire base is still at 16½ cents.

BOSTON

Trade continues in fair volume without there having been much brisk buying in the past week. Despite the holiday interruptions the trend of sales is toward more active ordering. Small-order business still dominates the market. Appliance sales are beginning to respond to the holiday appeal, but stocks are thus far ample. Prices remained fairly steady last week except under very sharp competition. Weatherproof wire is a little stiffer on current quotations. Building operations outside Boston are proceeding toward better conditions, but within the city proper new projects are slow to materialize. Central-station outputs are improving, some companies showing decided gains over last year, ranging from 3 to 15 per cent. Jobbers' stocks are being kept relatively low, but no shortages of material were reported Monday. General business in New England is spotty, with continued healthy sales of textile products, fairly good leather sales and slightly improving metal-product movements. Collections are somewhat better than last month. A heavy consumption of overhead-line material began Monday among eastern New England utilities, which were hard hit by a sleet storm starting Sunday, preliminary estimates of the losses exceeding half a million dollars.

Motors.—Gradual improvement in motor demand is apparent. Current orders are being met partly from stock and in part from factory production. Prices show little change, and small units are in chief demand.

Lamps.—Better movement in both portables and fixtures is reported. Stocks are in fine shape for a good holiday trade. An exceptionally satisfactory sale of lamps has been a feature of this fall's business, considering other branches of the trade.

Loom.—Steady sales without spectacular-sized orders are noted. The 7/32-in. size moves around $16.50 per 1,000 ft. in 5,000-ft. lots and the ¼-in. size around $19. The feeling that prices are unsatisfactorily low continues to be manifested in jobbing circles.

Flexible Armored Conductor.—Building construction continues to absorb fair quantities of this material. Stocks are easily meeting requirements. No. 14 single-strip was selling Monday at $48 to $50 per 1,000 ft. in 5,000-ft. lots and at $49 to $51 where double-strip is specified.

Lamp Cord.—Easy conditions prevail as to supply. A moderate demand is under way, with No. 18 cotton-covered cord selling at $14.50 per 1,000 ft. in 1,000-ft. lots, prices being open on 5,000-ft. shipments.

Rigid Conduit.—Relatively quiet demand characterizes this week's trade. On ¾-in. black pipe, in less than 5,000-ft. lots, $67.91 is asked, and on galvanized pipe, in the same size and quantity, $73.36 per 1,000 ft.

Appliances.—Hollow ware for socket and table use is moving better, and in some quarters washing machines show quicker sales. The lighter class of heating devices is being sought for the holiday trade. Further improvement is expected daily.

Wire.—Rubber-covered wire is moving well at $6.25 per 1,000 ft. in 5,000-ft. lots. Weatherproof base has advanced ½ cent per pound to 16 cents. Storm damage is expected to increase the demand for the latter soon on various eastern Massachusetts properties, but on Monday of this week repairs were being made chiefly out of central-station stocks.

ATLANTA

The bond issue of $8,850,000 recently voted by the city of Atlanta has just been validated by the Supreme Court, and the Bond Commission announces that approximately $3,500,000 will be expended during the year of 1922. Of the total issue, $4,000,000 is for schools, $2,850,000 for waterworks, $750,000 for the construction of the Spring Street viaduct, and the remainder devoted to sewers. The construction of schools, additions to pumping equipment and construction of the Spring Street viaduct will be the first activities to get under way, with a consequent lessening of the unemployed in the city. The electrical jobbing business is somewhat sluggish as a result of the Thanksgiving holiday coming on top of the approaching inventory season. Most jobbers are making their purchases for immediate demands only, while the contractors are placing orders in smaller sizes than is the rule throughout the year. Owing to the continued warm weather, holiday purchases have not become generally in evidence.

Industrial conditions in the state at large continue to display a firmer tone, recent reports of the textile mills showing that 88 per cent of the mills are running full or overtime, 10 per cent one-half time and that 2 per cent are idle. Most of the mills in operation state they have orders on hand sufficient to take the output of the next sixty days.

Exhaust Fans.—The movement of this specialty has been somewhat disappointing throughout the year, and there is little pick-up in sight. Therefore local stocks have been allowed to become somewhat spotty, though factory shipments are good.

Portable Drills.—A continued steady, but not heavy, demand is to be noted in this line, the automobile trade causing a slight stimulation in sales. No recent change in price has been reported.

Christmas Tree Outfits.—Contrary to the usual schedule, little or no activity is evidenced in this line. Jobbers report a very small volume of orders from retailers, this being due to overstocking by retailers last fall.

Farm-Lighting Outfits.—This business continues to brighten, jobbers reporting increased sales and interest, particularly in Mississippi and Georgia. Sales in Alabama and Florida, however, are rather slow. Local stocks are in good shape.

Rigid Conduit.—A continued steady movement in this line is reported, though the volume still remains somewhat small. All sizes are on hand in sufficient quantities, with the exception that some jobbers report shortages in 3½-in. and 4-in. black and galvanized. No recent change in price is reported.

Safety Switches.—The sales in this line continue to increase because of the adoption of ordinances in the smaller towns requiring the installation of safety devices. The 30-amp. two-wire switch is still the most popular. Some of the jobbers report that recent heavy demands have reduced their stocks to a spotty condition.

Dry Batteries.—Sales in this line are on the increase, the demand being from the territory generally. Stocks are in good shape with quotations on barrel lots at 31 cents each.

Flashlights.—The fall season has caused a slight increase in the movement of this line, while the sale of batteries and lamps continue to hold up satisfactorily. Jobbers report ample stocks.

Wire.—A price advance of 50 cents per 100 lb. in both weatherproof and bare wire is reported today, with reasonably good orders being received for sizes No. 6 to No. 8 inclusive. Rubber-covered, with the exception of No. 12 and No. 14, is somewhat slow. Both varieties are on hand in ample quantities.

ST. LOUIS

The holiday of last week interfered with buying from jobbers, and the week's volume of trade was consequently under the recent averages. Virtually all of the initial requirements of holiday goods have been ordered, but there remain straggling orders for small amounts. There is a possibility of further orders if the public buys as anticipated, for dealers have bought very conservatively.

The industries show little improvement in their demand for electrical goods, but they are operating on a better basis, and a call for electrical goods should normally follow. Several of the steel mills are on full schedule, with reasonable back orders. The railroads are not buying extensively as yet, but are making healthy inquiries, presumably in preparation of their budgets for next year.

In construction work some improvement in the underlying elements is indicated. It appears that reductions in labor, material and financing costs may be effected, in which event a large volume of work will immediately follow. That promised to date. if the reductions are of sufficient magnitude, amounts to $15,270,000. While no job in the list is for less than $200,000, they are not of particular concern to the electrical industry, for they consist of schools, hospitals, bank buildings, etc. No industrial work is included, but it would surely follow in goodly amounts if the construction costs should be materially lowered.

Air Heaters.—The demand has slackened because of the comparatively mild weather. Dealers' stocks generally are in line, but those of some jobbers are heavy. All buying is extremely conservative.

Table Appliances.—The demand for waffle irons continues good and stocks are still low. Percolators and toasters have been reasonably well stocked by dealers and their demand is consequently decreasing. The public interest in all table appliances this year is very encouraging.

Washing Machines.—Indications are that continued improvement in demand may be expected. Sales are better in southern Missouri and Arkansas and are holding up well in the northern portion of this territory. Stocks as a rule are in line with present requirements.

Ranges.—The sales in this territory are exceptionally quiet, but there are some indications of improvement in Missouri and Kansas. Very little business is being done in St. Louis, though no discouragement of range installations is being made there as in other places in the territory where power facilities are limited.

Flatirons.—Sales are extremely good, in the opinion of some, better than normal for this time of year. The lower prices this year have unquestionably stimulated purchasing. There are reasonable stocks.

Dishwashers.—A buyer is occasionally found, but the decrease in prices some time ago did not create much interest. It is felt that still lower prices and considerable educational work will be required before these can be made to move in satisfactory volume.

Wire.—An increase of ½ cent per pound has been made in the base prices of bare and weatherproof, the resulting prices being 15 cents and 15½ cents respectively. Rubber-covered prices are unchanged, No. 14 selling for $6.50 per 1,000 ft. in 5,000-ft. lots and for $6.40 per 1,000 ft. in 10,000-ft. lots. The demand for all wire the past week was dull. Residential jobs are being completed, and there is only a small amount of industrial and commercial work. Stocks are about in line, with a tendency to be heavy in the larger sizes.

PORTLAND—SEATTLE

Stormy weather prevailed throughout the Northwest generally during the past week, and Portland experienced a very unusual and severe sleet storm which completely demoralized public utility service in the district covered by the storm. Street-car service was paralyzed, and the two steam lines coming down the Columbia Gorge had at one time as many as eight or ten trains bound by snow and sleet. One power company lost fourteen continuous miles of transmission line, and the telephone company had more than twenty miles of poles and wire down on its toll lead in the gorge. The storm caused an unprecedented demand for linemen and line materials of all kinds. Portland stocks of insulators and line tools were immediately depleted and other Coast cities had to be drawn upon. Some high-tension insulators are coming from the East by express. Damage to the public utilities, exclusive of the steam roads, will amount to approximately $500,000.

Business in general in both Portland and Seattle continues to improve slightly and shows some gains over the marked improvement in September and October. The employment situation shows some improvement, lumber business is good, building continues, exports are heavy, and the situation is very satisfactory on the eve of the holiday season. In the city election in Portland the 1925 tax levy carried by a large majority, and this has been the cause of announcements concerning several large buildings.

Reports from electrical jobbers indicate that the electrical business, in common with others generally, is well sustained. Portland jobbers report a large demand for weatherproof wire, particularly Nos. 2, 4 and 6, as well as for poles, cross-arms, pins, insulators, pole-line hardware, duplex telephone wire and galvanized-iron wire.

Hollow Ware.—Jobbers have accumulated heavy stocks in anticipation of the Christmas trade. The carry-over from a year ago is small. A volume of business something in excess of that of last year is predicted.

SAN FRANCISCO

Welcome rainfall has given the ground a needed soaking. This came in the nick of time according to the farmers. Business is remaining fairly steady, but a better holiday season is predicted than last year.

Lamps.—Attention is drawn to an error in last week's issue in the statement that Edison, National and Westinghouse lamps were to be assembled and stored in the Oakland Lamp Works. The inclusion of Westinghouse lamps in this statement was of course a mistake.

Fixtures.—Remarkably keen competition is reported on all new fixture jobs, down to the smallest dwellings.

Electrical Appliances.—Holiday orders have been placed by most dealers, but buying is lighter than last season, not only because of larger stocks left over but because of a general expectation of a sharp drop after the first of the year. Waffle irons are selling very well. Another specialty which has become standard with most local dealers is a 1½-lb. electric iron.

Vacuum Cleaners.—A slight increase in sales is reported by a few manufacturers, although it is felt that the action of some makers in offering a free set of tools with each machine will produce bad effects for the future. The market is still steady, averaging about $50 to $60 per machine. Most of the sales teams have been withdrawn.

Ironers.—Business is holding up fairly well, although the washer business is poorer than it has been all year.

SALT LAKE CITY—DENVER

Jobbers of the Intermountain territory are considerably agitated over the proposed reduction of freight rates from the East to the Pacific Coast, without corresponding reductions to interior points. If the Interstate Commerce Commission cannot be prevailed on to make concessions to the Mountain States, it is believed the jobbing territory commanded by Salt Lake City and Denver will be materially reduced and business in general seriously damaged. Strong and concerted protest is being made against the pending action. The concern uppermost in every mind just at present is taxes. Forecasts indicate that all records for delinquency will be broken, since the rates are high and money is scarce. It is believed, too, that this universal obligation is going to cut in on the Christmas trade as never before. However, there are healthy signs of holiday buying. Electrical merchants are stocking fairly well with such items as are usually in demand at this season.

With the advent of a spell of cooler weather business generally has shown a healthy increase. Building of cottages continues unabated, with builders' hardware and electrical equipment in good demand. Road construction is proceeding vigorously in many counties, employing hundreds of men formerly out of work. With the completion of crop harvesting the demand for agricultural labor has fallen to a low mark.

Collections show little improvement from week to week. That there is considerable money for investment is indicated in the healthy tone of the bond market. Unusual rates of interest, however, ar edemanded as a prerequisite condition.

Air Heaters.—The general trade has been disappointing. Sales featuring price concessions have secured a few orders. A fall phenomenal for high temperature is the cause of inactivity.

Vacuum Cleaners.—No item of electrical merchandise is being more consistently and steadily pushed by jobbers and dealers alike. Demonstrations and educational work generally are keeping up a lively trade. Stocks are good in most of the standard makes. There have been no recent price changes.

Manufacturers' Activities

Devoted to the Business Side of Manufacturing, Distribution and Sales, News from Jobbers and Foreign Fields and a Record of New Devices and Trade Literature

G. E. Plans Substitutes for Navy Electric Work

A statement from the Schenectady plant of the General Electric Company announces plans for increased employment to be offered part of the employees of the plant there to take the place of the prospective discontinuance of naval building. The company intends to build a substantial quantity of large apparatus for stock and will also arrange for a considerable amount of repair and maintenance work to be done during the winter months. The statement does not mention the number of men involved or the value of the work to be undertaken.

Present conditions at the Schenectady plant are considered good under prevailing conditions. There has been no recent lay-off and the announced retrenchment program has been carried out in part only. Although the plant is working on several orders, including one for the Japanese government, electrical work for the American government has claimed a good part of the production. A number of men were laid off when that work was temporarily cancelled. When the company received release on the navy work about 500 men were put back to work. Complete cessation of the work would affect about 1,000 men, but it is hoped to take care of a large percentage of this number by the stock and repair work mentioned above.

During its existence the company has received orders for $100,000,000 worth of electric drive machinery for ships, the greater percentage of this within the last five years. Naval disarmament may cut off some lucrative business for the company, but it is felt that this loss will be more than counterbalanced by increased orders from mercantile shipping interests. The company has sold in the aggregate approximately 2,000,000 hp. in electric turbines for ship drive, together with all the auxiliary apparatus.

Ohio Vacuum Cleaner Company Sales Encouraging

Some interesting figures on vacuum cleaner sales for the three months of August, September and October are given in the November issue of the *Red Band*, the house organ of the Ohio Electric Company, Cleveland. The same article also details a number of reasons for business optimisim and reads in part as follows:

"Although sales fell off slightly during October, the three-month average for August, September and October is 53 per cent greater than the low month, and the October increase is 64 per cent. Sales for August were 20 per cent greater than for July and the September total showed an increase of 82 per cent. Inquiries increased 7 per cent, to 53 per cent greater than the July record, while the three-month average was boosted to 43 per cent increase. The August increase was 29 per cent and that for September 46 per cent.

"Every barometer points to steadily bettering conditions. Every big business man is growing more optimistic, more certain that business is coming back has 'turned the corner.' Business is just coming into its new season of blossom and fruit; the frost is out of the ground, hardships virtually over. There is no doubt about that. Yet how many fail to see the hopeful signs on every hand. The farmer's buying power and willingness to buy are undoubtedly on the increase. The wheels of production are whirling faster. Freight is moving in greater volume every month.

"Governor Harding says: 'Business will not again dip as low—nor will it go as high—as it went before. The crisis has passed without most people knowing when. We need not look to heaven for a sign that conditions have improved. Actual prosperity was never as great as it seemed. Actual depression was never as low as it seemed. The present is the time for the constructive, hard-working optimist.'

"The public has great buying power. And buying power begets buying power. When one industry resumes others automatically revive, and industries are reviving."

Burroughs Machinery Corporation Acquires Burroughs Company

The Burroughs Composition Machinery Corporation, 246 North Tenth Street, Newark, N. J., has taken over the business of the Charles Burroughs Company, which for many years manufactured hydraulic and general machinery at 141-149 Commerce Street. The company was known to the electrical industry as a manufacturer of machinery for molding various types of insulators. A short while ago the Commerce Street property was disposed of to the city, and operations will be carried on in the future at the North Tenth Street plant. Charles Burroughs is president of the new organization.

Central Credit Men Discuss Reconstruction Problems at Chicago Meeting

Co-operation Between Credit and Sales Departments and More Intimate Contact with Banks Urged—Figures Show Large Increase in Claims Over Last Year

Closer co-operation between credit men and salesmen was advocated by W. E. Sargent, credit manager Cutler-Hammer Manufacturing Company, in a paper presented before the twenty-sixth annual meeting of the Electrical Credit Association at Chicago, Nov. 17 and 18. Mr. Sargent stated that if salesmen could be taught a few credit fundamentals these two departments would work in closer unison for better business. He also suggested a personal acquaintance between credit managers and business or manufacturing men.

With a set of charts George A. Hughes, president Edison Electric Appliance Company, Chicago, showed very clearly the past trend of business conditions. Since 1812 labor, wholesale and retail prices have risen for thirty years and then declined for twenty. Mr. Hughes declared that, considering the price peak of 1920 and the 1921 reductions, he felt business had turned the corner; but he advocated short-term bonds and ample but small stocks in order to take advantage of the return of the decline cycle. E. W. Shepard, general credit manager Western Electric Company, New York, in considering credits and reconstruction, advised a closer knowledge of business methods in the sales and accounting departments and also more intimate contact with the banks.

With fourteen million homes unwired in the United States, Stanley A. Dennis, associate editor of *Electrical Merchandising*, presented a realistic picture of the electrical credit men's job for 1922. He said that it was up to the credit men to find out whether a dealer was a good dealer or whether he would make a better contractor; it was a case of putting the right man in the right place. With this accomplished, the next thing to do would be the sale of electrical appliances and central-station service. However, the entire project requires an extensive educational campaign, and Mr. Dennis suggested that every credit man get behind these movements.

Other topics of interest were treated in addresses on "Value of Electrical Credit Service," by T. C. Russell, president Russell Electric Company, Chicago; "Creative Credit Management," by C. E. Vandel, Western Electric Company, Kansas City; "Hard Nuts to Crack," by A. V. Willet, Western Electric Company, Chicago; "The Viewpoint," by M. W. Scanlon, Westinghouse Electric & Manufacturing Company, East Pittsburgh, and "Sample Credit and Collection Forms," by H. H. Pribbanow, Julius Andrae & Sons Company, Milwaukee.

B. P. George was re-elected to the president's chair and to the national board. J. H. Taylor was elected to the vice-presidency and also to the executive committee. Elmer Forsell is the other new member on the executive committee.

An insight into the past year's credit conditions was afforded by the figures on claims reported and adjusted during the year as submitted to the meeting. The total number of claims reported to Nov. 1 was 104,727, involving $9,656,701, an increase of 43 per cent in number and 41 per cent in amount over last year. The total number of claims adjusted during the same period was 61,823, involving $5,441,426. This constituted an increase of 59 per cent in number and 69 per cent in amount.

Equity Receivership for Habirshaw

On the application of the Habirshaw Electric Cable Company John B. Johnston and John S. Worley have been appointed by Judge Knox in the federal court as receivers in equity of the Habirshaw Electric Cable Company, Inc., the Electric Cable Company and the Bare Wire Company. The plaintiff brought the equity recevership suit as a creditor and stockholder of the three companies. The petition stated that the defendant companies are under joint management and have debts aggregating about $5,000,000. Their assets are estimated at about $7,000,000.

Those companies, despite their assets, are said to be financially embarrassed at the present time and unable to pay pending and maturing claims. The claims of the Habirshaw Electric Cable Company amount to $430,000 for money loaned. The Habirshaw Electric Cable Company, Inc., has a capital stock of $925,000. Its plant is at Yonkers. The Electric Cable Company has a capital stock of $1,500,000 and is located at Bridgeport, Conn. The plant of the Bare Wire Company is in New York City. The company is capitalized at $500,000.

According to the papers filed the Habirshaw Electric Cable Company, Inc., owes about $1,025,000 to banks and trust companies, $1,000,000 to merchandise creditors and $680,000 to the United States government, the balance of a note for $1,247,000 accepted by the Secretary of War in 1919. Liabilities of the Electric Cable Company are debts to banks and trust companies, amounting to $525,000; merchandise, $300,000, and $334,000 on a note given to the Secretary of War in 1918. It was said that under a trust agreement there is also a joint liability of $1,997,000 in debenture bonds issued under a trust agreement with the Guaranty Trust Company. In connection with that transaction the plaintiff is understood to be liable to some extent. The Bare Wire Company is said to owe $490,644 for loans and $34,500 for merchandise.

With the filing of the papers in the receivership suit the counsel for the defendant corporations put in answers, admitting the allegations of the plaintiff.

John S. Worley, one of the receivers, stated to a representative of the Electrical World that the reorganization may be regarded as a step forward in the affairs of the company and a necessary move toward reorganization. All the defendant's plants will be kept in production as before, as business is showing improvement. The Bridgeport plant of the Electric Cable Company at the present time is running with a double shift and is close to capacity.

Corporation Formed to Promote Foreign Trade

Five non-competing companies have announced their joint interest in the Associated Machinery Corporation, a newly organized company, formed for the purpose of promoting the foreign trade of the constituent companies. They are the Blaw-Knox Company of Pittsburgh, the Novo Engine Company of Lansing, Mich., the Pawling & Harnischfeger Company of Milwaukee, the Chain Belt Company of Milwaukee and the Insley Manufacturing Company of Indianapolis. All these concerns have a growing trade in Burmah and other parts of India and in Ceylon, and by the co-ordination of sales effort they expect to enlarge it and at the same time be in a position to render more service to their customers. The officers of the new company are: Henry Harnischfeger, president; Clarence E. Bement, vice-president, and Clifford E. Messenger, secretary and treasurer. Lionel R. Vinall-Moon is the managing director in India, and Charles L. Langlotz is in charge of the New York office.

Insulating Oil-Testing Service Started

An oil-testing service has been established by the Westinghouse Electric & Manufacturing Company whereby operators can mail samples of insulating oil to the Westinghouse works for test. A thoroughly dry bottle and a safe mailing container are provided, according to the announcement, and receipt at the works is followed by careful testing and a prompt report of test result. This fills the needs of many power-plant operators who have no good method of telling whether or not their transformer oil is in perfect condition.

Considerable thought has been given to the development of this service, it is stated, with the idea of making it simple for the operator to handle and giving him a prompt report as to the condition of the oil. After drawing the sample, the operators seals, packs and mails the bottle to the engineering laboratory of the Westinghouse Company at East Pittsburgh. An instruction and order sheet and a printed return label are provided, the instructions covering the taking of the sample and its proper separation for mailing. In case that the tests show the oil not to be in first-class condition, the proper treatment is suggested.

Torrington Doubles Sales of Last October

October shipments of the Torrington electric vacuum cleaner, it is reported by the Torrington Company, exceeded the shipments of October, 1920, by more than 200 per cent. The company has extended the time limit on its special offer of a set of attachments free with each cleaner sold from Nov. 30 to Dec. 31. This nation-wide drive to popularize the attachments should result in increase in future sales.

National X-Ray Prepares Package Showcase Outfits

In order to stimulate sales on showcase lighting fixtures, the National X-Ray Reflector Company, 235 West Jackson Boulevard, Chicago, has announced its policy of furnishing "X-Ray Scoopetes" in package outfits so that jobbers and dealers can make immediate shipments direct from their stocks. Since there are two standard types and length of showcases, these package outfits are supplied for standard square wood-frame or all-glass cases in 6-ft. and 8-ft. lengths. Each package contains in addition all the necessary material, etc., to equip the case completely, except lamps. A system of cover marking shows the number of lights contained and also the wood-frame case length.

St. Louis Brass to Make Own Glassware

The St. Louis Brass Manufacturing Company has announced plans for the erection of a glass factory in St. Louis where all the glassware for its lighting fixtures will be made. All of its glassware is now being purchased. The factory will be modern in every respect and will be equipped for making white, crystal and opal glass. Construction work will not be started until building costs are lower and in any event not until next spring.

Very attractive business has obtained during 1921, according to E. F. Guth, president of the company, who states that the number of "Brascolite" and "Aglite" lighting units sold will considerably exceed that in any preceding year excepting 1920 and will amount to about 60 per cent of the number sold in that year. The present plant is operating now with virtually a full force. Business in the brass department has been extremely good, and the total volume for all departments will compare quite favorably with even the 1920 business. The demand this year from office buildings has been dull, but good trade has been found in fixtures for clubs, lodges, churches, hospitals and hotels. There is a strong demand at the present time for fixtures for new hospitals.

Midwest Steel Secures Rights on Air Filter

EXCLUSIVE manufacturing and sales rights for the North American Continent on an air filter for generators and other machinery have been secured by the Midwest Steel & Supply Company, 28 West Forty-fourth Street, New York. The original patents are owned by European interests, and there are at present more than 1,500 installations in industrial plants and central stations in Europe. The filters are furnished in interchangeable units. The Midwest company will produce them at its plant in Bradford, Pa.

L. J. Land announces the dissolution of the firm of Schwartz & Land, 207 Center Street, New York City, dealer in electrical machinery, power plant equipment, etc., and that he will continue the above business under the name of L. J. Land at the same location.

The Packard Electric Company, Warren, Ohio, announces that O. T. Hall, 1926 Edmondson Avenue, Baltimore, has been appointed as its exclusive agent in Maryland, Virginia and the District of Columbia, with right of sales to all parties but the United States government.

Square D Opens Sales Office in St. Louis.—A district sales office has been opened by the Square D Company, Detroit, manufacturers of inclosed switches, at 312 International Life Building, St. Louis. J. D. Utley has been appointed office manager, while W. S. Herman is district sales manager.

The Lamp Salvage Corporation of America, 501 West 145th Street, New York City, recently organized to manufacture electric lamps, etc., has filed notice of change in name to the Phoenix Lamp Corporation.

The Riter-Conley Company, Oliver Building, Pittsburgh, Pa., announces that it has opened an office in the Scollard Building, Dallas, Tex.

Foreign Trade Notes

WATER POWER IN PORTUGAL.—There are many schemes under consideration, according to the *Electrician*, for utilizing water power in Portugal, the largest of which is that on the Douro River, where it is estimated 350,000 hp. can be developed. Before this can be carried out arrangements will have to be made with Spain, as the river where it will be diverted into a canal flows between the two frontiers. The total horsepower available is placed at more than 600,000. One of the difficulties in all water-power schemes in Portugal is that the flow of waters in the rivers is very low in summer, owing to prolonged drought, while in winter there are apt to be floods.

PROPOSED SCHEME TO SUPPLY ELECTRICITY FOR NORTHWEST COAST OF TASMANIA.—In connection with the scheme to supply electricity to the towns on the northwest coast of Tasmania, according to the *Industrial Australian and Mining Standard*, it is proposed to secure power from the vicinity of Cradle Mountain. In order to obtain a cheap rate it would be necessary to enter into an arrangement for a stated quantity. Devonport has agreed to take 2,000 hp.; Ulverstone, it is suggested, should be able to absorb 500 hp., Burnie 1,000 hp., and Wynard 300 hp. The cost of connecting the coast with the government scheme is estimated by Mr. Butters, chief engineer of the government Hydro-Electric Department, at £250,000. He proposes to bring electricity down to Penguin and step it down for distribution at that center.

ELECTRIC RAILWAYS FOR INDIA.—The B. B. and O. I. Railway administration in India, according to *Electrical Industries*, has been authorized to equip its suburban service for electrical operation.

GROWING DEMAND FOR ELECTRICAL SUPPLIES IN SOUTH AFRICA.—According to the Commerce Reports, there is a growing activity in the electrical trade in South Africa, owing to the settlement of the building trade strike, combined with a gradual decline of wiring supplies as dealers liquidated their higher-priced stocks. Technical journals report that consignments of electrical goods continue to arrive steadily from Great Britain and more slowly from the continent, and the United States. Shipments from England, it is stated, are as a rule taking about three weeks, whereas goods from Germany arrived seven or eight weeks after the date of drawing upon the merchants. In the case of American goods five or six weeks is the more or less normal time of delivery, counting from the date of drawing upon the South African buyer.

SHORTAGE OF TELEPHONE INSTRUMENTS AND MATERIALS IN AUSTRALIA.—The capital cities of Australia, according to reports from Commissioner A. W. Ferrin to the Department of Commerce, are experiencing a severe shortage of telephones. In Sydney alone about Aug. 1 more than 4,000 instruments were lacking, and a later shipment of 1,000 relieved the situation to only a limited extent as a scarcity of other materials prevented the installation of most of the telephones. Six switchboards ordered in August, 1920, were still undelivered in August, 1921, and of the 60,000 telephones ordered at the same time only 9,000 have been received, while of the 138,000 instruments ordered since August, 1920, only about 3,000 had arrived in Australia a year later. Material valued at £1,000,000, it is stated, is outstanding.

NEW TELEGRAPH LINE IN BRAZIL.—The Brazilian Minister of Public Works, on Oct. 1, 1921, according to the *Diario Official* of that date, was allotted a credit of 80,000 milreis for the construction of a telegraph line from the Iguacu Falls, Ca[illegible], Brazil, to Porto Mendes.

THE ONWARD MANUFACTURING COMPANY, Kitchener, Ont., announces that it has established a retail branch store at 40 Notre Dame Avenue, Winnipeg, under the name of the Eureka Vacuum Cleaner Company, for the sale of the "Eureka" vacuum cleaner and the "Sunnyside" washer.

THE ALLGEMEINE ELEKTRICITAETS GESELLSCHAFT of Germany has [illegible] its dividend from 11 per cent to 7½ per cent after setting aside [illegible] marks for maintaining plant repairs. Within the next year, it is said, the board of directors proposes to issue [illegible] marks in new common stock.

RESTRICTIONS REMOVED ON IMPORTS FROM UNITED STATES INTO ITALY.—A cablegram from Commercial Attaché H. C. MacLean at Rome, Italy, to the Department of Commerce states that the removal of restrictions on the importation of American products has been made by agreement between the United States and Italy. The only products which cannot be imported without a license are certain synthetic dyes and those articles the importation of which is reserved to the government, namely, sugar, tobacco, saccharine, matches, playing cards, oats, meats, salted and frozen and in tin, and bacon.

HYDRO-ELECTRIC PLANT FOR THEREZOPOLIS, BRAZIL.—Plans are under way for the installation of an electric lighting and power system at Therezopolis, a summer resort within easy reach of Rio de Janeiro, according to Assistant Trade Commissioner W. E. Embrye. Water rights have already been obtained on a nearby estate where a large hydro-electric plant will be erected.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

A mercantile firm in France (No. 350) desires to purchase all kinds of electrical appliances for household uses, particularly carpet sweepers and brushes for polishing hardwood floors.

A firm in Canada (No. 351) desires to purchase portable electric lamps.

ELECTRIC EQUIPMENT FOR POWER PLANT AT NEWCASTLE, AUSTRALIA.—Tenders will be received by the Government Railways and Tramways Department, Philip Street, Sydney, New South Wales, Australia, until Feb. 22, 1922, according to the *Electrician*, for furnishing and erecting one 5,000-kw., 50-cycle turbo-alternator, with condenser and accessories, at the Zarra Street power house, Newcastle.

INSULATED CABLE FOR ELECTRIC SYSTEM AT BRISBANE, AUSTRALIA.—The City Electric Company, Brisbane, Australia, according to the *Electrician* will receive tenders until Feb. 10, 1922, for 6 miles of 0.15-in. paper-insulated cable, suitable for 5,500 volts, with a non-earth system.

TELEPHONE EQUIPMENT FOR CITY OF ADELAIDE, AUSTRALIA.—Tenders will be received by the Deputy Postmaster General, Adelaide, Australia, until Jan. 4, 1922, according to the *Electrician*, for telephone apparatus and material, including cords, hand sets, supervisory lamps, plugs, jacks, etc.

New Apparatus and Publications

RESTAURANT KITCHEN UNIT.—A motor-driven unit designed to take over all the mixing, beating, whipping and straining operations in the hotel or restaurant kitchen, known as "Kitchen King" has been developed by the Hall Kitchen King Company, 1130 Race Street, Philadelphia.

CREAM SEPARATORS.—Two new motor-driven cream separators of the link-blade type have recently been placed on the market by D. M. Burrell & Company, Inc., Little Falls, N. Y.

ELECTRIC WATER HEATER.—An improved model of the circulation "Sepco" automatic electric water heater has been placed on the market by the Automatic Electric Heater Company, Warren, Pa.

TIMING AND SIGNALLING INSTRUMENTS.—The Stromberg Electric Company, [illegible] West Jackson Boulevard, Chicago, is distributing bulletin No. 214 describing its "Process" timing and signalling instruments recently placed on the market.

ELECTRIC HOIST.—The Shepard Electric Crane & Hoist Company, Montour Falls, is distributing a leaflet describing its "Lift-about," a small general utility hoist.

MOTORS AND GENERATORS.—The Peerless Electric Company, Warren, Ohio, is distributing bulletin No. 37-A, covering its direct-current "Multipolar" motors and generators.

AMPERE METER.—The Sangamo Electric Company, Springfield, Ill., is distributing bulletin No. 58 (superseding bulletin No. 50) describing its locomotive type ampere-hour meter.

GENERATORS AND MOTORS.—The [illegible] Dynamo & Motor Company, Belleville, N. J., has issued bulletins Nos. 1,300, 1,500, 1,600, 1,900, describing its direct-current motors, vertical motors, back-geared motors and polyphase induction motors respectively, and No. 2,201, covering its type "CB" organ generator.

GENERATOR UNITS.—"Steam Turbine and Generator Units" is the title of bulletin No. 1,119, issued by the Allis-Chalmers Manufacturing Company, Milwaukee, covering its high-pressure condensing steam turbine and generator units for public utilities, municipal railways and lighting and all industrial activities.

WATER HEATERS.—The new sales manual recently issued by the Automatic Electric Heater Company Warren, Pa., contains numerous tables regarding the quantity of water required for home use, the proper temperature, etc.

ELECTRICAL INSTRUMENTS.—The Jewell Electrical Instrument Company, 1,640-50 Walnut Street, Chicago, is distributing a pocket memorandum book, entitled the "Jot Book," in which it describes several of its electrical instruments.

MULTIPLE ILLUMINATION.—Bulletin No. 110, issued by the Kuhlman Electric Company, Bay City, Mich., describes its different types of transformers for street-lighting purposes.

RENEWABLE FUSE.—The Cote Brothers Manufacturing Corporation, 1,546 Tribune Building, Chicago, has recently brought out a new renewable fuse. It is of the Edison type and for use on circuits of 125 volts with ratings from 3 amp. to 30 amp.

New Companies

THE BIPPUS UTILITY COMPANY, Huntington, Ind., has been organized with a capital stock of $100,000 by J. S. Bippus, Frank Martin, Harry Helm and J. A. Browne. The company proposes to operate an electric light, heat and power system.

THE BREWER AUTO ELECTRIC COMPANY, Vincennes, Ind., has been incorporated with a capital stock of $25,000 to manufacture electrical equipment. The incorporators are H. L. Brewer, George W. Purcell and E. R. Purcell.

THE AMERICAN ELECTRIC EQUIPMENT COMPANY has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $2,000,000 to manufacture electric light fixtures and other electrical equipment. The local incorporators are M. L. Rogers, L. R. Wilson and W. G. Singer. The Delaware Registration Trust Company, Wilmington, Del., represents the company.

THE SNYDER TOWNSHIP LIGHT, HEAT & POWER COMPANY, Brockwayville, Pa., has been organized with a nominal capital stock of $[illegible] to operate a local electric light and power system. M. E. Keys, Brockwayville, is treasurer.

THE TAYLOR-CAMPBELL ELECTRIC COMPANY, Ltd., London, Ont., has been incorporated by John M. Marshall, Earl L. Campbell, Albert T. Taylor and others. The company is capitalized at $250,000 and proposes to manufacture and deal in electrical machinery, equipment, dynamos, lighting plants, etc.

THE WESTERN IOWA POWER COMPANY, Peterson, Iowa, has been incorporated with a capital stock of $250,000. The officers are D. M. M[illegible], president, A. O. Anderson, vice-president, and A. W. Jones, secretary and treasurer.

THE VINCENNES (IND.) ELECTRIC RAILWAY COMPANY has been incorporated with a capital stock of $[illegible] by G. H. Armstrong, J. H. Powers, E. C. Theobold, L. Gillett and E. R. Emison.

THE CONDUIT ELECTRIC SUPPLY CORPORATION, Syracuse, N. Y., has been incorporated with a capital stock of $30,000 by A. H. Poole and J. F. Troutman, to manufacture electrical equipment. The company is represented by Jacob G. Smith, First National Bank Building, Syracuse.

THE STANDARD ARMATURE WINDING MACHINE COMPANY, New York, N. Y., has been incorporated by M. W. [illegible], P. F. [illegible] and F. B. Head, [illegible] Wall Street. The company is capitalized at $[illegible] and proposes to manufacture electrical machinery.

THE INCANDESCENT PRODUCTS, INC., Jersey City, N. J., has been incorporated by Nathan and Morris G. Fredman, 665 Newark Avenue, Jersey City. The company is capitalized at $[illegible] and proposes to manufacture electric lamps and other electrical products.

Record of Electrical Patents

Notes on United States Patents

(Issued Nov. 1, 1921)

1,395,281. Dry-Battery Cell; Harry M. Koretzky, New York, N. Y. App. filed Sept. 18, 1919. For portable flashlights.

1,395,282. Dry-Battery Cell; Harry M. Koretzky, New York, N. Y. App. filed Sept. 18, 1919. For portable flashlights.

1,395,290. Non-Arcing Commutating Switch Device; Louis Paulero, Petersburg, Va. App. filed March 14, 1919. For use with electric hammers.

1,395,294. Measuring Instrument; Raymond T. Pierce, Wilkinsburg, Pa. App. filed April 5, 1917. For indicating rate of change in speed.

1,395,304. Electrolytic Condenser; Joseph Slepian, Wilkinsburg, Pa. App. filed Dec. 30, 1919. Film-forming electrodes in suitable electrolyte.

1,395,305. Electrolytic Condenser; Joseph Slepian, Wilkinsburg, Pa. App. filed Dec. 30, 1919. Film-forming electrodes in suitable electrolyte.

1,395,306. Method and Apparatus for Calibrating Measuring-Instrument Transformers; Henry N. Stroh, Pittsburgh, Pa. App. filed Nov. 22, 1918. One portable box.

1,395,335. Electrical Measuring Instrument; Lewis W. Chubb, Pittsburgh, Pa. App. filed Aug. 10, 1916. Determining penalty to be imposed against distorted voltage waves.

1,395,344. Armature-Excited Dynamo-Electric Machine; Rudolf E. Hellmund, Swissvale, Pa. App. filed Dec. 1, 1916. Alternating-current motors of commutator type.

1,395,345. Upright Electric Toaster; Henry W. Jutton, Hamilton, Ont., Can. App. filed Oct. 2, 1920. Wire supporting frame and top rack.

1,395,347. Ventilation of Dynamo-Electric Machines; Roy A. McCarty, Wilkinsburg, Pa. App. filed Sept. 28, 1917. For machines arranged side by side.

1,395,349. System of Control; Paul L. Mardis, Wilkinsburg, Pa. App. filed Feb. 3, 1917. For railway vehicles.

1,395,378. Secret Signaling; Richard H. Wilson, Newark, N. J. App. filed Sept. 29, 1919. High-frequency carrier waves for conveying voice waves.

1,395,390. Oscillation-Generating System; Lewis M. Clement, Newark, N. J. App. filed Sept. 30, 1918. For signaling and other transmission systems.

1,395,409. Winding for Dynamo-Electric Machines; Floyd T. Hague, Pittsburgh, Pa. App. filed Sept. 15, 1916. Large capacity and high speed.

1,395,440. Brush Holder; Albert T. Lochner, Chicago, Ill. App. filed July 17, 1919. Few parts.

1,395,454. Radio Signaling System; James H. Rogers, Hyattsville, Md. App. filed Sept. 12, 1921. For use in submarine vessels.

1,395,493. Switch Lock; Edward A. Halbleib, Rochester, N. Y. App. filed May 17, 1917. For locking electric switch against unauthorized operation.

1,395,520. Alternating-Current Rectifier; Charles J. Quill, San Francisco, Cal. App. filed Aug. 21, 1917. Mechanical.

1,395,521. Alternating-Current Rectifier; Charles J. Quill, San Francisco, Cal. App. filed Jan. 31, 1917. Mechanical.

1,395,548. Cigar Lighter for Steering Wheels; Edward H. Anshelm, Cambridge, Mass. App. filed Jan. 20, 1920.

1,395,579. Resistance Switch; Charles B. Jones, Above Cynwyd, Pa. App. filed Jan. 16, 1920. For reducing illumination from light.

1,395,584. Multiple-Unit Electric Heater; William A. Kennedy, Leonia, N. J. App. filed May 26, 1920. Sends heat in all directions.

1,395,595. Telephone System; Lipa Pollnkowsky, Antwerp, Belgium. App. filed Nov. 1, 1919. Machine switching.

1,395,599. Electrical Actuating Means for Typewriter Type Bars and Other Devices; Ferdinand Satterstrom, Hastings, Minn. App. filed Jan. 31, 1920. Single pair of platinum contact point.

1,395,600. Electrical Actuating Means for Typewriter Type Bars and Other Devices; Ferdinand Satterstrom, Hastings, Minn. App. filed Oct. 29, 1920. Series of selective magnets.

1,395,635. Electric Iron; Thomas D. Finzio, Kitchawan, N. Y. App. filed April 16, 1920. Few parts.

1,395,640. Motor Attachment for Sewing Machines; Martin Hemleb, Elizabeth, N. J. App. filed July 18, 1919. Motor and controller adapted for ready application to ordinary machine.

1,395,653. Pressure-Measuring Instrument; Walther Nernst, Berlin, Germany. App. filed June 14, 1919. Measuring and recording quickly varying pressures.

1,395,683. Storage Battery; Swan J. Leveen, Rock Island, Ill. App. filed June 12, 1919. Warping of plate decreased.

1,395,685. Manufacture of Alkali Perborates; Otto Liebknecht, Frankfort-on-the-Main, Germany. App. filed Jan. 27, 1917. Electrolytic manufacture from lyes containing soda and borax.

1,395,704. Electrolytic Cell; John Gerstle Dayton, Ohio. App. filed Dec. 6, 1920. Electrodes easily removed.

1,395,710. Electric Lighting Fixture; Max Herskovitz, Chicago, Ill. App. filed Oct. 18, 1918. Quickly assembled, wired and attached.

1,395,711. Electric Lighting Fixture; Max Herskovitz, Chicago, Ill. App. filed March 3, 1919. Readily assembled, wired and attached.

1,395,779. Electric Regulator; William A. Turbayne, Niagara Falls, N. Y. App. filed Oct. 10, 1919. Large range of regulation.

1,395,788. Terminal for Wires of Electric Circuit; Stanley Anthony, Boston, Mass. App. filed Oct. 28, 1918. Terminal screw.

1,395,811. Treatment of Zinc-Bearing Ores; Herbert W. Gepp, Melbourne, Victoria, Australia. App. filed Nov. 7, 1919. Zinc sulphide concentrates.

1,895,826. Supervisory Signaling System; Richard M. Hopkins, Rutherford, N. J. App. filed March 18, 1918. For fire-sprinkler system.

1,395,827. Separating Metals by Electrolysis; Noak V. Hybinette, Christiania, Norway. App. filed Feb. 16, 1920. Smelting ore into copper-nickel anodes.

1,395,847. Adjustable Lamp Support; William Lorey, Philadelphia, Pa. App. filed May 25, 1920. Arm adapted to be adjusted universally.

1,395,854. Balancing Signaling Systems; William H. Martin, New York, N. Y. App. filed Dec. 19, 1918. Ocean-cable signaling.

1,395,864. Ear-Appliance Mounting; Herman G. Pape, New York, N. Y. App. filed Aug. 24, 1918. Anti-acoustic appliance.

1,395,873. Trolley-Wire Contactor; Richard R. Scoggan, Jeffersonville, Ind. App. filed Jan. 7, 1921. Requires no deflection of trolley wire.

1,395,918. Package of X-Ray Films; John G. Jones, Rochester, N. Y. App. filed Aug. 27, 1919. Films separately packed in light-proof packages.

1,395,931. Electric Condenser; Charles F. Smith and William H. Smith, Brooklyn, N. Y. App. filed May 17, 1920. For wireless telegraphy.

1,395,953. Telegraphic System; Enrico Frattola, Vitale E. Castelli and Romualdo Regnoni, Rome, Italy. App. filed Jan. 5, 1919. For protecting instruments.

1,395,955. Incubator; Herman Gentis, Victoria, B. C. App. filed Oct. 3, 1919. Electrically heated.

1,395,977. Telephone-Exchange System; Franklin A. Stearn, Paterson, N. J. App. filed Aug. 7, 1920. Mechanical switching.

1,395,987. Wireless Signaling Apparatus; Henry J. Round, London, England. App. filed March 24, 1921. Wave length of an aërial kept constant automatically.

(Issued Nov. 8, 1921)

1,396,030. Variable Condenser; William Dubilier, New York, N. Y. App. filed July 25, 1917. Extreme flexibility of adjustment.

1,396,046. Toy Theater; Edward S. Moore, Brooklyn, N. Y. App. filed Feb. 1, 1919. Images may be moved on the stage.

1,396,058. Process for Making Carbide; James H. Reid, Pittsburgh, Pa. App. filed Sept. 21, 1917. Electric furnace.

1,396,095. Switch Lock; George A. Cokely and Michael D. Crawford, Garrett, Pa.

1,396,101. Electric [illegible] System; Alfred Dreger, Milwaukee, Wis. App. filed Aug. 12, 1920. Dynamic braking.

1,396,104. Heater; Welborn C. Garner, Edmonton, Alberta, Can. App. filed Sept. 25, 1920. For cookers.

1,396,105. Electrical Heating Element; Welborn C. Garner, Edmonton, Alberta, Can. App. filed Sept. 2[illegible], 1920. For heating or cooking.

1,396,112. System for Protecting Electric-Current-Distributing Networks Against Temporary Interruptions; Martin Hochstadter, Berlin, Germany. App. filed Oct. 20, 1914. Faulty branch immediately and automatically severed at both terminals.

1,396,121. Electric Water Heater; Richard S. [illegible], Chicago, Ill. App. filed Aug. 22, 1917. Attached to faucet.

1,396,155. Electrical Tank Gage; Ernest C. Bartlett and Joseph E. Allison, Houston, Tex. App. filed Sept. 8, 1917. Amount of fluid shown.

1,396,172. Storage Battery; Ralph G. Fear, Oakland, Cal. App. filed Feb. 7, 1920. Means for automatically maintaining constant level of electrolyte.

1,396,178. Sound-Transmitting [illegible] Apparatus; Earl H. Foley, Seattle, Wash. App. filed Aug. 19, 1917. Sound waves recorded as a line of current-conducting material on paper strip.

1,396,222. Ozonizer; William G. Lindemann, Milwaukee, Wis. App. filed April 25, 1919. Elements readily repaired.

1,396,242. Controlling System for Storage Batteries; Clarence E. Beach, Binghamton, N. Y. App. filed Feb. 11, 1920. For combination night watch and fire alarm or burglar alarm.

1,396,309. Electrical System; Clarence R. Young, Leesburg, Ind. App. filed March 1, 1918. For isolated installations.

1,396,318. Antistatic Friction Device; August Bunger, Hoboken, N. J. App. filed July 15, 1920. For extracting static electricity from paper.

1,396,331. Electric Motor; Leslie R. McDonald, Montreal, Que., Can. App. filed June 16, 1916. Continuous rotation at low velocity.

Construction News

Projects, Plans, Bids and Contracts Contemplated or Under Way

New England States

AYER, MASS.—The Ayer Electric Light Company is considering connecting its wires with the line of the New England Power Company from Leominster to Nashua, which crosses Ayer. If the connection is made the power company would establish a substation near the remount depot, stepping the electricity down to 13,000 volts, at which it would be taken by the light company for distribution at its local plant. L. Whitcomb is manager of the Ayer company.

CAMBRIDGE, MASS.—The Cambridge Electric Light Company has petitioned the Department of Public Utilities for permission to issue $[illegible] in stock, the proceeds to be used for paying in part the floating indebtedness of the company, for the purchase of additional property, extensions to its plant, etc.

CHELSEA, MASS.—The installation of an ornamental lighting system on portions of Broadway and Washington Avenue is under consideration.

Middle Atlantic States

BROOKLYN, N. Y.—Bids will be received by [illegible], superintendent of public works, Capitol, Albany, until Dec. 20 for the installation of electric light, power and [illegible] equipment in the canal terminal warehouse at Gowanus Bay, Brooklyn. (Terminal Contract No 115.)

CANANDAIGUA, N. Y.—An agreement has been reached by the City Council and the Rochester Gas & Electric Corporation relative to the installation of an electric lighting system in the business section of Main Street. The contract provides about forty iron standards maintained by underground wires.

CLINTON, N. Y.—The Madison Power Company has been authorized by the Public Service Commission to construct an electric distrbuting system in Clinton and part of Kirkland township.

MORAVIA, N. Y.—The Moravia Electric Light, Heat & Power Company has been authorized by the Public Service Commission to make extensions to its electric lighting system in the towns of Moravia and Locke.

ATLANTIC CITY, N. J.—The Chamber of Commerce is co-operating with the Camden County Federation of Civic Associations in a movement started for the installation of an ornamental lighting system on White Horse Pike.

MONTCLAIR, N. J. — The Montclair Town Commission recently passed on first reading a new ordinance providing for improvement to the lighting system on Bloomfield Avenue, other business streets and railroad centers, and appropriating $45,000 for that purpose. James T. Hannan is director of the department of streets and public improvements.

LANSDALE, PA.—The installation of new power equipment in the municipal electric power plant is under consideration by the Borough Council.

MOSCOW, PA. — The Moscow Electric Company is negotiating with the Scranton Electric Company to obtain electricity for light and power in Moscow and other communities. Plans are under way for the erection of a transmission line. J. W. Knedler, Moscow, is president of the Moscow company.

PHILADELPHIA, PA.—The J. S. Ivins Sons, Inc., 627 North Broad Street, is planning extensions to its baking plant. Ovens, power plant equipment, conveyors, etc., will be required. Howard S. Roberts is president.

PITTSBURGH, PA.—Preliminary plans are under way by the Aluminum Company of America, Oliver Building, Pittsburgh, Pa., for a hydro-electric generating plant in the vicinity of Long Sault Rapids, N. Y. J. W. Rickey, Oliver Building, is engineer.

SCRANTON, PA.—Plans are under way by the Scranton Electric Company for extensions and improvements to its power plant and system, to cost about $1,000,000. The project includes an addition to the generating plant on North Washington Street and the installation of a 20,000 kw. turbo-generator with auxiliary machinery.

CLEVELAND, VA.—The Cleveland Light & Power Company, recently incorporated with a capital stock of $10,000, proposes to establish and operate a light and power system in Cleveland. S. C. Couch is president.

North Central States

ADRIAN, MICH.—The Citizens' Light & Power Company will install a 2,000-kw. turbo-generator with surface condenser and other necessary apparatus. It is planned to have the new equipment in use by Aug. 1, 1922. H. A. Fee is president.

CRYSTAL FALLS, MICH.—The Peninsular Power Company, Madison, Wis., contemplates the construction of a power house, 50 ft. x 125 ft., at Crystal Falls, Mich., to cost about $[illegible].

DELPHOS, OHIO.—The Northwestern-Ohio Light Company is considering the erection of a transmission line from Delphos to Van Wert.

RUSSELL, KY.—The Boyd County Electric Company, Ashland, is planning to install fifty 100-cp. series incandescent street lamps in Russell. The company obtains electrical energy from the Consolidated Light, Heat & Power Company, Huntington, W. Va., of which W. R. Power is general manager.

BLOOMINGTON, ILL.—Steps have been taken for the installation of an ornamental lighting system on Washington Street, to cost about $[illegible]. A total of 220 lamps will be required to complete the system.

JACKSONVILLE, ILL.—Plans are under consideration for the installation of an ornamental lighting system in Jacksonville. F. E. Farrell is a member of the boulevard light committee.

SPRINGFIELD, ILL. — The Springfield Gas & Electric Company is planning the construction of an underground conduit system in the downtown section, to cost about $300,000. It is proposed to start work April 1, 1922.

BELOIT, WIS.—The Beloit Water Gas & Electric Company has purchased the plant of [illegible] Brothers at Rockton, Ill. The company, it is said, will abandon the Rockton plant and supply electricity for light and power from Beloit.

MILWAUKEE, WIS. — Contracts have been awarded by the Wadhams Oil Company, 359 Clinton Street, for the construction of a new refinery group, to cost about $275,000, at Thirty-third Avenue and Burham Street, including main building, 100 ft. x 155 ft., tank house, 85 ft. x 110 ft., and power plant, 30 ft. x 50 ft. The general contract has been awarded to C. B. Danielson, 638 Mineral Street.

ALBERT LEA, MINN. — The Southern Minnesota Gas & Electric Company has recently completed an extension of its lines to Kiester, Minn. and Joice, Iowa. The company has changed 44 three-lamp clusters to single lamps, using General Electric Novalux lamps and King posts, and has also erected thirty-four additional posts using the same equipment. L. O. Gordon is general manager.

FOND DU LAC, MINN.—The Great Northern Power Company, Duluth, is having plans prepared for the construction of a power house and dam in Fond du Lac, to cost about $1,000,000. Oscar Mitchell is president.

EXCELSIOR SPRINGS, MO.—The Excelsior Springs, Water, Gas & Electric Company, it is understood, is negotiating for the purchase of the plants and properties of the Plattsburg (Mo.) Light & Power Company, Kearney (Mo.) Electric Company and the Holt (Mo.) Electric Light Company. Extensions to the power plants, with new transmission lines and distributing system, are planned.

JAMESPORT, MO.—The question of issuing bonds for the erection of a transmission line from Jamesport to the plant of the Trenton Gas & Electric Company is under consideration.

LAMAR, MO.—Plans are being prepared by the Osage Power Site Company for the construction of a power plant near the Osage River, to cost about $3,000,000. W. E. Banks is manager. R. Wilson, Lamar, is engineer.

OSCEOLA, MO.—The Osage Resort Company is planning the construction of a power plant, to cost about $150,000. G. Linn is manager.

OMAHA, NEB.—Plans have been prepared by the Nebraska Power Company for the construction of a new power house on North Thirty-ninth Street.

Southern States

DUNN, N. C.—At an election to be held Dec. 13 the proposal to sell the municipal electric plant to the Carolina Light & Power Company will be submitted to the voters. If the proposition is ratified, the company plans to purchase the transmission line between Benson and Smithfield, now owned by the town of Benson, and connect it with the distributing point of the company at Smithfield and extend the lines to Dunn.

PLAINS, GA.—The Council is considering the installation of an electric lighting system in Plains.

ARCADIA, FLA.—The DeSota County Commissioners are contemplating purchasing an electric light plant for the county court house and jail. B. Vance is deputy clerk and auditor.

JACKSONVILLE, FLA.—The City Commission has authorized the construction of a high-tension cable from Jacksonville to Pablo and Atlantic Beaches, to provide for the transmission of electricity to the seaside towns.

MEMPHIS, TENN.—Bids will be received by C. O. Pfeil and George W. Awsumb, architects, 1403 U. & P. Bank Building, until Dec. 15, for the contracts not already let in connection with the municipal auditorium and market, including electrical equipment, refrigeration, power, mechanical features, heating, plumbing, etc. R. R. Ellis is chairman of the building committee.

CRICHTON, ALA.—The United States Turpentine & Rosin Company, Mobile, recently organized with a capital stock of $1,250,000, is planning the establishment of a plant at Crichton. Power plant equipment, crushing machinery, retorts, boilers, etc., will be required. Frank W. Boynton is president.

CENTERVILLE, MISS. — Improvements to the municipal electric light plant, to cost about $16,000, are contemplated. H. S. Archer is clerk.

PICRON, ARK.—Plans are under consideration by the Arkansas Light & Power Company, Pine Bluff, for extensions to its power plant at Picron, involving an expenditure of about $[illegible].

NEW ORLEANS, LA. — The Louisiana [illegible] Canal Company is considering the construction of five power plants, with a combined capacity of [illegible] hp. in the vicinity of Lake Charles, Oberlin and Ville Platte. The project includes interconnecting reservoirs on the Calcasieu River, Whiskey Chitto Creek and Bayou Cocodrie and a system of canals covering the larger portion of Evangeline, Acadia, Allen and Jefferson Davis parishes. Under the present plan a power house will be located at the outlet of each reservoir, and others at Jones Bluff on the Calcasieu River and at Chaumont's Ferry at the head of Tidewater. The proposed plants will supply electricity for construction purposes, for the operation of gates, pumps and locks, and for domestic and manufacturing purposes in the towns and rural districts in that vicinity.

EL PASO, TEX.—The El Paso Electric Railway Company has been authorized by the County Commissioners' Court to erect an electric transmission line to a point near the Country Club, a distance of 9 miles, then as far as the jurisdiction of the county court extends.

EL PASO, TEX.—The City Council is considering the installation of a street-lighting system in the downtown section of El Paso.

FORT WORTH, TEX.—The installation of an ornamental lighting system on West Seventh Street is under consideration. R. A. Hunter is City Commissioner.

Pacific and Mountain States

OAK GROVE, ORE. — Plans are being prepared by the Portland (Ore.) Railway Light & Power Company for the construction of a hydro-electric generating plant on the Clackamas River, near Oak Grove, to cost about $2,000,000. The initial installation will provide for the development of about 200,000 kw.

VALE, ORE.—J. Edwin Johnson of Vale has refiled an expired application for the diversion of 500 sec.-ft. from the middle fork of Malheur River for the development of electricity for a municipal lighting and irrigation pumping. The plans provide for a dam, canal of about 5 miles in length, and waterwheel. The cost of the project is estimated at $300,000.

FULLERTON, CAL.—Petitions have been filed for the installation of ornamental lamps in nine sections of the city.

LOS ANGELES, CAL.—The City Council has authorized an appropriation of $20,000 for the installation of new street lamps.

RIVERSIDE, CAL.—The Southern Sierras Power Company has been granted permission by the Federal Power Commission at Washington, D. C., to construct a 3,200 hp. hydro-electric plant on Mill Creek.

SAN FRANCISCO, CAL.—Plans are being prepared by the Pacific Gas & Electric Company for the construction of a power house on the Pit River, in Shasta County, to cost about $100,000

Canada

PENTICTON, B. C.—The West Kootenay Power & Light Company, Rossland, is negotiating with the Okanogan Valley Power Company of the State of Washington for an exchange of power. The West Kootenay company is planning the erection of a transmission line from Penticton through Naramata to Kelowna. It is proposed to erect a branch transmission line from Penticton to Summerland next year. Lorne Campbell is manager of the West Kootenay company.

MONCTON, N. B.—The New Brunswick Hydro-Electric Commission has reported favorably to the provincial government upon the application of the city of Moncton that 4,000 hp. be furnished to that city. The commission has asked for permission to proceed with a survey for the erection of an electric transmission line from St. John to Moncton.

DUTTON, ONT.—The Dunwich Township officials are considering the installation of an electric lighting and power distribution system, to cost $50,000. J. N. Wilson, 90 University Avenue, Toronto, is engineer.

NAPANEE, ONT.—The local power house of the Hydro-Electric Power Commission of Ontario was recently destroyed by fire. W. A. Grange is clerk.

WINSDOR, ONT.—The City Council has passed a bylaw providing for the installation of an ornamental street-lighting system in Winsdor.

ST. HONORÉ, QUE. — La Compagnie Electrique de St. Honoré is considering the construction of a hydro-electric plant, to cost about $60,000. J. F. Grenon, Chicoutimi, Que., is engineer.

VERDUN, QUE.—Plans are being prepared by the Town Council for the installation of two [illegible] electrically operated pumps to replace the steam system now in use.

Directory of Electrical Associations

Printed in the First Issue of Each Month

Alabama Light and Traction Association. Secretary-treasurer, J. P. Ross, Birmingham Railway, Light & Power Co., Birmingham, Ala.

American Association of Engineers. Secretary, C. E. Drayer, 63 East Adams St., Chicago, Ill.

American Association of Operating Engineers. Secretary, H. C. Bristol, Calderwood, Tenn.

American Electric Railway Association. Executive secretary, J. W. Welsh, 8 West 40th St., New York City.

American Electrochemical Society. Acting secretary, A. D. Spillman, Lehigh University, Bethlehem, Pa.

American Engineering Standards Committee. Secretary, P. G. Agnew, 29 West 39th St., New York City.

American Institute of Consulting Engineers, Inc. Secretary, F. A. Molitor, 143 Liberty St., New York City.

American Institute of Electrical Engineers. Secretary, F. L. Hutchinson, 33 West 39th St., New York City. Board of directors meets monthly. Sections and branches in the principal electrical centers throughout the country.

American Physical Society. Secretary, Dayton C. Miller, Case School of Applied Science, Cleveland, Ohio. Annual meeting Toronto, Dec. 27.

American Society for Testing Materials. Secretary-treasurer, C. L. Warwick, 1315 Spruce St., Philadelphia, Pa.

American Welding Society. Secretary, M. M. Kelly, 29 West 39th St., New York City.

Arkansas Utilities Association. Secretary, R. I. Brown, Little Rock Railway & Electric Company, Little Rock, Ark.

Associated Manufacturers of Electrical Supplies. General secretary, C. E. Dustin, 30 East 42nd St., New York City.

Association of Edison Illuminating Companies. Secretary, Preston S. Millar, 80th St. & East End Ave., New York City.

Association of Iron and Steel Electrical Engineers. Secretary, John F. Kelly, Empire Building, Pittsburgh, Pa.

Association of Municipal Electrical Utilities of Ontario. Secretary, S. R. A. Clement, 190 University Ave., Toronto. Semi-annual convention, Toronto, Jan. 26-27.

Association of Railway Electrical Engineers. Secretary-treasurer, Joseph A. Andreucetti, Chicago & Northwestern Railway, Room 413, C. & N. W. Terminal Station, Chicago, Ill.

British Columbia Electrical Co-operative Association. Field Manager, R. E. Chatfield, 108 B. C. Electric Bldg., Vancouver, B. C.

Canadian Electrical Association, affiliated with N. E. L. A. Secretary-treasurer, Eugene Vinet, Shawinigan Water & Power Co., Montreal, Canada.

Colorado Electric Light, Power and Railway Association. Secretary-treasurer, Miss Minnie B. W. Baker, 900 15th St., Denver, Col.

Conference Club. Secretary, Sullivan W. Jones, 19 West 44th St., New York City.

Electric Hoist Manufacturers' Association. Secretary-treasurer, E. Donald Tolles, 165 Broadway, New York City.

Electric Furnace Association. Secretary, Dr. C. G. Schluederberg, Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.

Electric Power Club. Secretary, C. H. Roth, 1410 West Adams St., Chicago, Ill.

Electrical Manufacturers' Club. Secretary, F. L. Bishop, Hartford Faience Co., Hartford, Conn.

Electrical Manufacturers' Council. Executive secretary, Frederic Nicholas, 522 Fifth Ave., New York City.

Electrical Safety Conference. Secretary, Dana Pierce, 25 City Hall Place, New York City.

Electrical Supply Jobbers' Association. General secretary, Franklin Overbagh, 411 South Clinton St., Chicago, Ill.

Electrical Supply Jobbers' Association, Atlantic Division. Secretary, E. Donald Tolles, 165 Broadway, New York City.

Electrical Supply Jobbers' Association, Pacific Coast Divsion. Secretary, Albert H. Elliot, 502 Flatiron Building, San Francisco, Cal.

Electrical Trade Association of Canada. Secretary, William R. Stavely, Royal Insurance Building, Montreal, Canada.

Empire State Gas and Electric Association. Secretary, Charles H. B. Chapin, Grand Central Terminal Building, New York City.

Florida Engineering Society. Secretary, J. R. Benton, Gainesville, Fla.

Great Lakes Geographic Division, N. E. L. A. Secretary-treasurer, R. V. Prather, 305 Illinois Mine Workers Bldg., Springfield, Ill.

Illinois State Electric Association. Secretary-treasurer, R. V. Prather, 305 Illinois Mine Workers Bldg., Springfield, Ill.

Illuminating Engineering Society. General secretary, Clarence L. Law, 29 West 39th St., New York City. Sections in New York, Philadelphia, Chicago and Boston. Chapters in San Francisco, Cleveland, and Toronto.

Indiana Electric Light Association. Secretary, Thomas Donohue, Lafayette, Ind.

Institute of Radio Engineers. Secretary, Alfred N. Goldsmith, College City of New York, New York.

International Association of Municipal Electricians. Secretary, C. R. George, Houston, Tex.

International Electrotechnical Commission (international body representing various national electrical engineering societies contributing to its support). General secretary, C. le Maistre, 28 Victoria St., Westminister, London, S. W., England.

Iowa Section, N. E. L. A. Secretary, W. G. Linn, Des Moines Electric Co., Des Moines, Iowa.

Kansas Public Service Association. Secretary-treasurer, W. W. Austin, Cottonwood Falls, Kan.

Michigan Electric Light Association. Secretary, Herbert Silvester, Edison Bldg., Ann Arbor, Mich.

Mississippi Electric Association, affiliated with the N. E. L. A. Secretary, W. A. Sullivan, Gulfport & Mississippi Coast Traction Co., Gulfport, Miss.

Missouri Association of Public Utilities. Secretary-treasurer, F. D. Beardslee, 315 North 12th St., St. Louis, Mo.

National Association of Electrical Contractors and Dealers. Secretary, Farquson Johnson, 15 West 37th St., New York City, N. Y. State associations in Alabama, Arkansas, Connecticut, Georgia, Kansas, Illinois, Indiana, Iowa, Louisiana, Maryland, Massachusetts, Michigan, Minnesota, Missouri, New Jersey, New York, Ohio, Oregon, Pennsylvania, Tennessee and Wisconsin. Also members in Canada and unorganized states.

National Council Lighting Fixture Manufacturers. Secretary, Chas. H. Hofrichter, 23. Gordon Square Bldg., W. 65th and Detroit Ave., Cleveland, Ohio.

National Association of Electrical Inspectors. Executive Secretary, T. H. Day, 59 Deerfield Ave., Hartford, Conn.

National Association of Railway and Utility Commissioners. Secretary, James B. Walker, New York Transit Commission, New York City.

National Electric Light Association. Executive manager, M. H. Aylesworth, 29 West 39th St., New York City.

National Electrical Credit Association. Secretary, Frederic P. Vose, 1350 Marquette Building, Chicago, Ill.

National Fire Protection Association. Chairman of electrical committee, Dana Pierce, 25 City Hall Place, New York City. Secretary of electrical committee, Ralph Sweetland, 141 Milk St., Boston, Mass.

Nebraska Section, N. E. L. A. Secretary-treasurer, H. [illegible], [illegible] Life Bldg., Lincoln, Neb.

New England Electrical Credit Association. Secretary, [illegible] Devonshire St., Boston, Mass.

New England Geographic Division, N. E. L. A. Secretary, Miss O. A. Bursiel, 149 Tremont St., Boston, Mass.

New Mexico Electrical Association. Secretary-treasurer, Charles E. Twogood, Albuquerque, N. M. Annual convention, Albuquerque, Feb. 13 and 14.

New York Electrical Credit Association. Secretary, W. [illegible], 47 West 34th St., New York City.

New York Electrical Society. Secretary, George H. Guy, 29 West 39th St., New York City.

North Central Electric Association, Geographic Division, N. E. L. A. Secretary, H. E. Young, Minneapolis General Electric Co., Minneapolis.

Northwest Geographic Division, N. E. L. A. Secretary-treasurer, J. F. Orr, Idaho Power Co., Boise, Idaho.

Ohio Electric Light Association. Secretary, D. L. Gaskill, Greenville, Ohio.

Oklahoma Utilities Association. Manager, H. A. Lane, 1106 First National Bank Bldg., Oklahoma City.

Ontario Association of Electrical Contractors and Dealers. Secretary, J. A. McKay, 24 Adelaide St., West, Toronto, Ont.

Pacific Coast Geographic Division, N. E. L. A. Secretary, S. H. Taylor, 527 Rialto Bldg., San Francisco, Cal.

Pennsylvania Electric Association, State Section N. E. L. A. Secretary, H. M. Stine, 212 Locust St., Harrisburg, Pa.

Public Service Association of Virginia. Secretary, R. M. Booker, Newport News & Hampton Railway, Gas & Electric Co., Hampton, Va.

Public Utilities Association of West Virginia. Secretary, A. Bliss McCrum, Charleston, W. Va.

Radio Club of America. Secretary, Renville H. McMann, 150 Nassau St., New York City.

Rocky Mountain Geographic Division, N. E. L. A. Treasurer, A. C. Cornell, Denver, Col.

Society for Electrical Development, Inc. Assistant to the president, W. L. Goodwin; secretary-treasurer, R. F. Paige, 522 5th Ave., New York City. Annual meeting second Tuesday in May; directors' meetings second Tuesday in May and November; executive committee meetings every sixty days.

Society for the Promotion of Engineering Education. Secretary, Dean F. L. Bishop, University of Pittsburgh, Pittsburgh, Pa.

Southeastern Geographic Division, N. E. L. A. Secretary-treasurer, Charles A. Collier, Georgia Railway & Power Co., Atlanta, Ga.

Southwestern Geographic Division, N. E. L. A. Secretary, H. A. Lane, Oklahoma Utilities Association, 1106 First National Bank Bldg., Oklahoma City, Okla.

Southwestern Electrical and Gas Association. Secretary, E. N. Willis, 403-4 Slaughter Bldg., Dallas, Tex.

Tri-State Water and Light Association. Secretary-treasurer, W. F. Steiglitz, Columbia, S. C.

Vermont Electrical Association. Secretary-treasurer, C. E. Warsaw, Burlington, Vermont.

Western Association of Electrical Inspectors. Secretary, W. S. Boyd, 175 West Jackson Blvd., Chicago, Ill. Convention, Chicago, Jan. 17-19.

Western Society of Engineers, Electrical Section. Secretary, E. S. Nethercut, 1735 Monadnock Block, Chicago, Ill.

Wisconsin Electrical Association. Secretary, W. M. Chester, 1408 First National Bank Bldg., Milwaukee, Wis.

Wyoming Utilities Association. Secretary, C. [illegible], Western Light & Power Co., Boulder, Col.

Electrical World

New York, Saturday, December 10, 1921

Distributing Electrical Goods

PEOPLE are particularly interested today in the great problem of distribution. Our food, our clothes, everything we use, is produced or procured for us by somebody at some far or near point, is brought to us across the intervening distance by somebody else; and finally is sold to us in our own town. The price we pay is always made up of three parts—the cost of producing, the cost of transporting and the cost of local selling. So with everything we purchase we spend some of our money, not for goods, but for delivery.

But that is all right, for every value is based on the location of the goods and every price conditioned on where they are sold. And nothing is worth buying unless it can be laid down where we want it. Therefore the so-called "middleman" who passes things along, though he has added to the cost of goods, has added also to their value, and his cost and service have been essential ones. Yet, with the growth of industry, the numbers and variety of distributers have grown into questionable complexity, and we have today in the electrical business this many-linked chain:

The producing manufacturer,
The association jobber,
The non-association jobber,
The agent jobber,
The manufacturer's branch office,
The manufacturer's agent,
The electrical contractor,
The electrical dealer,
The hardware, drug and department store,
The central-station merchandising department,
The consumer of the goods.

Ranged between the producer and the consumer of electrical commodities there are nine different kinds of distributing agencies that operate in different ways with different classes of goods to perform the two functions of wholesaling and retailing. Not all of these, of course, function in any one transaction, but always one or two. These men gather the assorted lines from scattered factories and present them in convenient combinations, where the purchaser may buy them easily. Each manufacturer uses the kind of distribution that he likes the best. Each distributer sells the kind of goods that he prefers. But which electrical distributer performs his economic function best? Nobody knows.

The nation has awakened to the fact that too much work and money is being wasted in our traditional system of distributing foodstuffs. It is ruining both the farmer and the householder. And the country has decided that something must be done. The problem before electrical men is very similar. It must be studied and worked out.

We *ought* to know which form of distribution pays. We *should* have standards under which distributers would qualify. For goods must be marketed with both the price and profit right to all if present troubles are to end.

Harvey Hubbell

Inventor and manufacturer who has played a conspicuous part in the perfection of electrical schedule material and machine tool operation.

DOMESTIC use of electricity began in the early eighties and spread like wildfire, but in those days had to contend against the popular feeling that, while a wonderful servant, it was nevertheless a dangerous one. Many persons had been badly shocked because of poorly insulated switches, or sockets, or other fittings. Thus it is seen that schedule material, while comparatively small as an individual item, has played a really significant part in the growth and development of the electrical art. Better and more easily operated switches and plugs have made the domestic use of electricity more appealing. To a large degree the credit for developing schedule material along these lines must go to Harvey Hubbell, head of Harvey Hubbell, Inc., of Bridgeport, Conn. More than a hundred patents, not all for schedule material, however, have been granted him. He is credited with the origination of the pull-chain socket-switch mechanism and several different attachments for its use. Among other patents are those for converting key or keyless sockets into pull-chain sockets, the double-T plug, T-cap and three-point shade holder. He has developed a locking lamp to prevent theft. He is also credited with seeing the value of the English toggle switch and of bringing it to this country and perfecting it.

Mr. Hubbell is, in addition, a leader in the machinery field. He was the first to make rolled-thread machine screws with automatic machinery, and a large part of his company's plant is given over to this department. He is the inventor and manufacturer of a tapping machine.

Week after next Mr. Hubbell will celebrate his sixty-fourth birthday. He was born in Brooklyn, N. Y., Dec. 20, 1857, and received his mechanical and technical education at Cooper Institute in New York City. He obtained his early factory training with builders of printing presses and in ship and marine engine works. Having patented one or two articles, he started in 1888 to manufacture them in Bridgeport, Conn. Not long afterward he became interested in electricity and, seeing the need for wiring materials, he bent his inventive mind in that direction. As the field expanded he began to devote more and more time to this work until he now heads one of the largest schedule-material manufacturing organizations in the country. Mr. Hubbell still spends a large part of his time in developing and improving various items of schedule material. He virtually acts as factory manager and financial head of the company. One other reason why he has been so successful is because he is keenly interested in employee relations and has spent much time in perfecting a spirit of good fellowship and loyalty in the company.

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People Understand the Grocery Business— Why Not That of the Central-Station Company?

COMPETITION by the chain store has brought many changes in the conditions of the drug and grocery businesses. Little "cash-and-carry" shops in some communities have virtually driven many old and well-established grocers out of business. The public has shown a keen interest in the situation, and it has often been the subject of discussion in every household. For the public understands the grocery business, and it is generally intelligent and sympathetic in its judgment of the retail merchant.

The grocery store is a simple, old, traditional institution with which the public has been in close contact for generations. The central-station company, however, conducts a business that is of more recent origin and one complicated by conspicuous technical features with which the public is not acquainted. Here is a basic reason, therefore, why the central-station company has been so often misunderstood. The business aspect of public utility service must be emphasized by friendly human contact between the utility employee and the customer that will eventually make the public understand that, after all, the central-station business is just like any other retail business, though selling, not food in bags, but light and heat and power through wires. This thought must be instilled into all employees to carry to their friends and to the customers whom they serve, so that in time the public will become accustomed to the electric service business also and will understand it.

What the Figures Show About Tariff Retaliation

SOME people say that if America establishes a higher tariff foreign countries will retaliate and build a wall against our goods. Apparently these objectors have not seen the figures. For last year Canada collected $19.50 in import duties for every man, woman and child in the Dominion. Great Britain, heralded the world over as the great free-trade country, collected $16.50 per capita. We collected but $3.15. There is a margin, and a wide margin, therefore, between the plane of our present tariff imports and the point where friendly foreign countries might be expected to rise in their wrath and smite us back.

One year under the Payne tariff law we received imports totaling $1,812,000,000—the greatest in our history—on which we collected duties totaling $331,000,000. Last year our imports were $5,300,000,000, and we charged exactly the same amount—$331,000,000 —or but one-third the duty. At the present time we have the lowest tariff against importations imposed by any principal country on the face of the earth, and this we have had since 1913. The fear of a blighting retaliation against our exports is therefore absolutely unfounded.

And we must remember also that our exports figure as only 10 per cent of our production. We might even well afford to risk it, if need be, for the protection of the nearly 90 per cent of our production which is for domestic business.

A higher, more protective tariff is needed, and needed now, unless our markets are to be flooded with German and Japanese goods at prices far below our factory costs. For if American labor is to have employment, we must be able to sell the goods that it produces. And if we cannot sell our goods at home in our own markets, and our factories close down and our people have no work, of what use are the cheap importations anyway, when there is no money to buy them at any price?

Already electric motors, heating appliances and other goods are coming in at prices unapproachable. An adequate protective tariff supported by the American valuation plan is absolutely vital to the electrical industry. The whole country suffers for the need of it.

Recent Sleet Storm Teaches Operatives and Public Valuable Lesson

THE recent sleet storm which put out of service the wire systems of a considerable portion of northern New England impressed a series of valuable lessons on operatives and the public. Especially around Boston the wreckage was of the most disastrous kind and, despite the utmost diligence, some of the service is even yet unrestored. Perhaps the most striking thing demonstrated was the dependence of the community upon its electrical utilities—power, light, telephone and telegraph. Two million people went peacefully to bed on Sunday in the year of grace 1921 and woke up Monday morning about A.D. 1881, without light or power or the now ordinary means of communications, and the two million, being dependent on the butcher, the baker and, especially, the candlestick maker, had to hustle for necessities after the manner of their grandfathers.

The strenuous efforts of the electric light and telephone companies to overcome the calamity beggar description. Every available man had to take hold with both hands and help clear wreckage. And very curious wreckage it was. Power and light wires held up well unless actually carried down by main force. Telephone and telegraph wires, lighter and often much older, suffered very heavily. When circuits ran through trees they stood little chance against the crashing branches.

What it all signifies it is not easy to say. It is hardly practicable in a scattered suburban territory like that which surrounds most American cities to put all wires underground, certainly not until very different installation methods are available. Overhead power circuits clear of destruction by trees have again proved their reliability. It is in the primary and secondary distribution where trees are plentiful that the main trouble is encountered. One is tempted to say a word for the policy of running wires, not on streets, but on the rear lines of lots wherever possible—something akin to the alley distribution which has here and there worked well. If the obtaining of rights-of-way were made legally simple, it would be feasible in many places to keep off tree-lined streets almost entirely, so that wholesale destruction of lines would be very unlikely. The situation shows the importance of working out schemes of distribution to take account of just such contingencies as put back the almanac about forty years last week. Distribution systems have "just grown," and the time is ripe for some general efforts at co-ordination.

Municipal Utilities Need Commission Control

MUNICIPALLY owned utilities should be controlled by the public utility commissions for exactly the same reason that the privately owned utility is. As a basic proposition the municipally controlled system is subject to all the mistakes of operation and policy that private ownership may be charged with. Its management as an average cannot be said to be free of the selfish aims that other managements may be cursed with. In short, eliminating politics, the municipal utility is much the same in characteristics as any other organization made up of human beings.

If privately owned utilities must be regulated to control the evils of which they may be the victims, there is no argument that will free the municipal utility from the need of the same control. As a matter of fact, the management of the municipal utility has the opportunity not only to indulge whatever evil propensities it may have, but they may be indulged behind a screen of political jealousies, ambitions and selfish aims that is the most effective barrier to real knowledge by the owners of what is taking place. Here lies ample reason why there should be some competent, unprejudiced body that can hold a check rein on the acts of the municipally owned utility. The evils enumerated by Edwin O. Edgerton elsewhere in this issue are the most obvious ones that arise in the lack of such control, and while they should receive careful attention, the basic reasons why they exist and the fact that municipally owned utilities are in no fundamental sense free from possibility of corruption should be brought home to the public. Less of heated discussion and more of calm consideration will help to bring the solution.

Precedent Observed Too Closely in Building Rural Lines

LONG spans on the lines carrying a limited number of wires for irrigation or other rural service have long been an accomplished fact in the West, where climatic conditions have not been so severe as those in the Middle West and East. The heavier high-tension lines in the Eastern territory, particularly those using steel towers, have employed long spans, but there has been a fear of applying the practice to the lighter distribution lines where savings in investment cost are obvious if the practice should prove successful. Some individuals a little bolder than others have dabbled with the longer spans in the Eastern territory, but the Empire State Gas and Electric Association has boldly overstepped precedent and its sub-committee on standard construction for farm lines has issued a tentative specification for such construction as a guide to the members. A saving of almost one-third with an average span of 250 feet as against one of 125 feet is shown in the cost figures submitted. This is one matter on which precedent has cut entirely too large a figure. The limiting factors on the span lengths that can be used are the number of wires carried, the transverse stresses under the weather conditions encountered and the clearance of wires from the ground in the center of the spans. Another factor that must receive consideration appears when sags become great enough to require excessive cross-arm spacings or make the lines themselves objectionable in other ways.

The number of wires on the average rural line is small enough for wood poles to have ample strength, and the conductor stresses can be controlled within rather wide limits by adjustment of sags. There is no reason why the most should not be made of these opportunities to reduce the original costs of construction, particularly when the poles can be so spaced that if the number of conductors ever becomes great enough to justify shorter spans, the problem can be met by setting another pole in the middle of each span. The whole problem is one of intelligent design of lines to meet the conditions under which they must operate and of the avoidance of practices that have been developed to meet wholly different conditions.

Knowledge of Ultimate Nature of Electromagnetic Phenomena Essential

EVERY trained physicist and electrical engineer who knows the basic facts regarding electromagnetism and electromagnetic induction usually can foretell the results of any particular combination of electric circuit and magnetic field which may be suggested. However, when the attempt is made to write statements of these fundamental laws in terms of the concrete structures constituting electric and magnetic circuits, difficulty is found in so expressing these statements that they will cover all possible forms and combinations of circuits. The trouble lies in the fact that we must speak of electric circuits and magnetic fields when we really have not a complete knowledge of the nature of either. As a result, in the case of virtually every existing statement of the laws of electromagnetism and electromagnetic induction, it is possible to point out some particular experiment or phenomenon which would seem to be in direct violation thereof. Perhaps the best known instance of this is found in the ordinary statements of the law of electromagnetic induction. The induced electromotive force may be defined in terms of the total change in magnetic flux through the electric circuit or in terms of the rate of passage of a portion of the electric circuit through the magnetic field. All known instances of induced electromotive force can be explained in terms of either one or the other of these conceptions, but neither one embraces all.

In the November issue of the *Journal* of the Franklin Institute Dr. Carl Hering presents an interesting collection of these apparently "outlaw" experiments and phenomena. Several of them were presented a number of years ago to the A. I. E. E. and elicited an extensive discussion of the law of electromagnetic induction, from which there emerged a general consensus of opinion that in any statement of this law the fundamental principle should involve the passage of the material substance of the conductor across the magnetic field, or vice versa. This is quite in line with modern theories of the ultimate nature of the phenomenon as discussed by Lorentz and others. These theories take their start from the interaction of the magnetic field and the electrons within the atoms of the conductor. They apply equally well to conductors and dielectrics and take due account also of the displacement currents in dielectrics, first suggested by Maxwell, which may also be set up by electromagnetic induction.

None of these freak experiments casts any doubt on the validity of the laws as we now know them. For example, practically all of the experiments on the mechanical interaction of electric circuits, including the pinch effect as described by Dr. Hering, may be explained in terms of one fundamental physical principle, that the potential energy associated with an electric circuit is the product of the strength of current in it and the magnetic flux threading it in a negative direction. This is the electrical law which is the parallel of the mechanical analogy employed by Dr. Hering.

In spite of the firmness of the foundations of these laws and of our wide knowledge of a number of curious outstanding manifestations, it remains true, as Dr. Hering points out, that we have no universal and all-satisfying statements of the laws. This problem has for a long time engaged and is still engaging the thoughts of leading physicists. It appears that complete and accurate statements covering all possible cases can come only from a more complete knowledge of the ultimate nature of the phenomena involved.

Careful Cost Accounting Shows Electric Truck Economies

NINE years of electric truck service under careful cost accounting yield very interesting data on economic performance. Such an analysis is presented in this issue of the ELECTRICAL WORLD by Walter R. Metz of the Government Printing Office. Eight electric trucks have been operated under the author's supervision at Washington through the entire period, with two more added three years ago. The capacities range from 1,000 lb. to 10,000 lb., and the units are all in service today, energy being obtained at from 1.25 cents to 2 cents a kilowatt-hour. The largest-size truck has been in service three years, but no battery renewal expenses have been imposed upon Uncle Sam so far. The other units range in over-all expenses, less drivers' wages, from 17.53 cents to 41.2 cents per mile for duties ranging between 54,600 miles and 30,419 miles.

The operating costs and fixed charges tabulated by Mr. Metz might well stand by themselves as detailed evidence of the value of electric truck in city service; for whoever figures the corresponding costs of gasoline truck performance will have no easy task to approach these outlays. The author has strengthened his paper materially by including for comparison actual costs of gasoline truck operation from the government fuel yard and postal services, together with some significant data from private practice.

Intelligence in selecting electric trucks for particular services is of more importance than used to be thought the case in many quarters, but, given areas of moderate size requiring a total daily run of about 20 miles to 40 miles, moderate speeds, rapid accelerations from standstill and slowdown and with reasonably good highways, the prospects of the electric truck winning the day over both horse and gasoline traction are excellent indeed. It is unfortunate from some points of view that it is seldom possible to compare the over-all costs of identical services before and after electrification; but as increased outputs generally follow the application of electricity to every branch of business and production, the lack is not so serious after all. Altogether too few users of electric trucks, whether for road or industrial plant service, maintain records as complete as those printed here, and we hope that their publication will stimulate other users of such equipment to put their accounting houses in order and share the results.

New Hartford Station Reflects Credit on Owners and Designers

TO MAKE provision for carrying increasing loads with the least possibility of interruptions is a large enough problem in itself for central-station managers, but when this duty is combined with the development of a plant efficiently to fit into regional systems of energy supply, the engineering problems involved are particularly intricate. The new South Meadow station of the Hartford (Conn.) Electric Light Company, described with relation to its mechanical equipment elsewhere in this issue, illustrates a problem solution of this type. For twenty years the Dutch Point steam plant of this company has met the chief load requirements of the Hartford system, growing in that period from 6,000 kw. to 36,000 kw. rating. It is now supplemented by the new station, designed to function acceptably as a key plant in giving either local or regional service.

Ample provisions for expansion, centralized boiler-plant control, excellent fuel storage and supply, water supply and facilities for high-tension structural development characterize the South Meadow plant. It is designed for an ultimate capacity of 130,000 kw., although this can be greatly increased without crowding the site. One 25,000-kva. unit is now in service, with a second on order. Four water-tube boilers equipped with integral economizers and underfeed stokers compose the present steam-generating equipment, and the design provides for a subdivision of coal-handling plant and auxiliaries which doubly insures reliability and economy of operation. Great care has been taken in this installation to avoid needless expenditure for excessive piping and wiring runs. Steam-driven apparatus is located near the boiler installation and electrical equipment toward the electrical bay or else within it. Apparatus of all types will be operated under daylight conditions to an unusual extent. The closed system of generator ventilation has been adopted, with provision for quick transfer to the open system in emergencies; special attention has been given to conserving heat units in carrying the condensate and make-up water to the boilers, and the heat balance has been carefully considered in relation to plant development, with the result that no house turbine was provided. Both electric and steam drives are used in the auxiliary equipment service, yielding a highly desirable flexibility.

Solidity of design, avoidance of "frills" in equipment, a plant layout of complete symmetry, potential development by unit groups of apparatus, liberal clearances, and withal a low unit area and volume, are features of this station. In architectural appearance the initial structure happily avoids the "sawed-off" effect frequently found in "nucleus" plants and is a building of attractive aspects. Orthodox in equipment selection, straightforward in arrangement and clearly adapted to render efficiently both local and regional service, this station reflects credit upon those responsible for its design and takes immediate rank among the notable installations of the year.

New Pacific Gas & Electric Line Which Will Operate Eventually at 220,000 Volts

ONE CIRCUIT of the new Pit River line of the Pacific Gas & Electric Company, which will ultimately operate at 220,000 volts, has been completed from the two Hat Creek plants to a point near Red Bluff. At present it is operating at only 60,000 volts, but it will later be energized at 110,000 volts and eventually converted to 220,000 volts. Aluminum conductor having 500,000-circ.mil cross-section is used in the mountains and copper in the valleys. While only one circuit has been installed, right-of-way has been cleared for two lines. So far steel towers have been provided only at dead-end or anchor points. The wood poles between them will be replaced by towers as soon as their butts decay.

New Hartford Station Has Superpower Characteristics

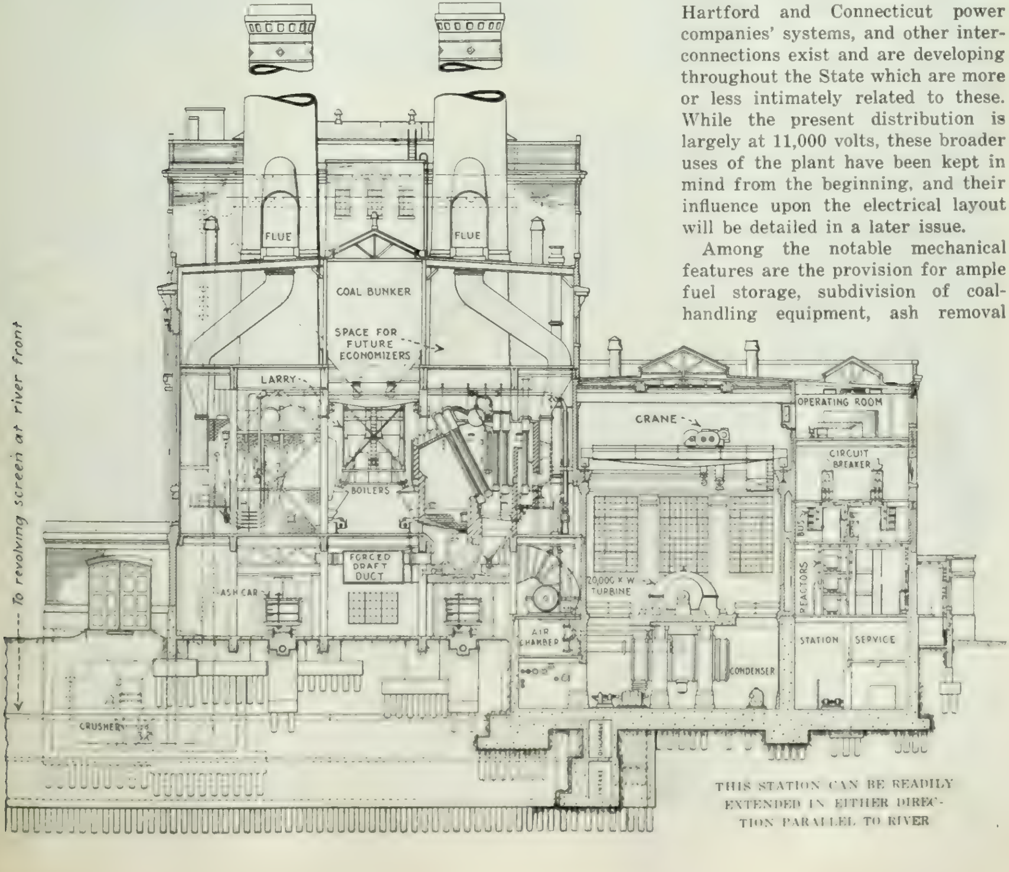
Provision for Simultaneous Development for Local and Regional Service Is Dominating Feature of the South Meadow Plant—Boiler Plant Illustrates Advances in Co-ordinated Control of Operation—Designed for 130,000 Kw. Ultimate Capacity

CONSPICUOUS among the latest additions to the central stations of New England is the South Meadow station of the Hartford (Conn.) Electric Light Company, which is designed as a "key plant" in relation to local and regional interconnections present and prospective and combines to an unusual extent symmetry of arrangement, avoidance of equipment congestion and adherence to apparatus of demonstrated necessity. In twenty years the well-known Dutch Point steam plant of the company has risen in rating from 6,000 kw. to 36,000 kw., now the economic limit of its expansion. During the war the necessity of building a new plant for handling future loads was forecast, and in 1917 a 50-acre tract bordering the Connecticut River about a mile south of Dutch Point was acquired. Two years later Stone & Webster, Inc., of Boston, were instructed to undertake the design and construction of a new plant. Construction soon began, and the new plant will be opened officially on Dec. 19, 1921.

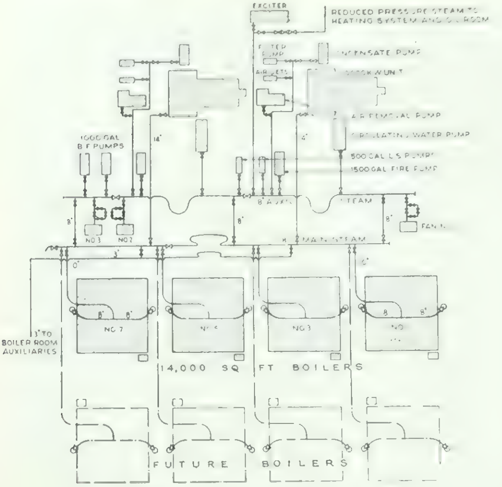
An ultimate capacity of 130,000 kw. in five units is contemplated in the new plant, but this rating can be extended to 260,000 kw. without difficulty owing to the site available. Two 20,000-kw. turbo-generators and four 1,400-hp. boilers have been purchased. Sixteen boilers of this size are contemplated for the ultimate station, which is readily adapted to "superpower" service as well as planned to supply the Hartford district at high efficiency. The guaranteed turbine water rate at the point of best loading is 10.1 lb. per kilowatt-hour.

The necessity of twofold service—local and regional—constantly controlled the design. Energy is today interchanged at 66,000 volts between the Hartford and Connecticut power companies' systems, and other interconnections exist and are developing throughout the State which are more or less intimately related to these. While the present distribution is largely at 11,000 volts, these broader uses of the plant have been kept in mind from the beginning, and their influence upon the electrical layout will be detailed in a later issue.

Among the notable mechanical features are the provision for ample fuel storage, subdivision of coal-handling equipment, ash removal



THIS STATION CAN BE READILY EXTENDED IN EITHER DIRECTION PARALLEL TO RIVER



SIMPLIFIED PIPING IS A FEATURE

boiler-plant units and auxiliary apparatus to insure minimum interruption of service and economical operation through proper loading. Centralized boiler-plant control from a room specially assigned and equipped for this purpose is another feature of advanced design in this plant. Very thorough study of the question of heat balance was made in connection with the choice of auxiliaries, and reliability of service without excess investment in piping systems also received careful attention. The closed system of ventilation was adopted for the generating units with provision for fire extinguishment by carbon-dioxide gas under pressure.

A pleasing exterior* has been attained in the use of a red brick with precast concrete trimmings, the structure being of the steel-frame type with concrete foundations supported by piling. Dull-shaded enameled brick is used in the turbine room to avoid glare, while the turbine platform and condenser floor are of red quarry tile laid in squares. The present boiler room is 205 ft. long by 67 ft. wide, the turbine room being 203 ft. long by 55 ft. wide. Three turbines can be housed in the present structure. The present building has a ground area of only 0.57 sq.ft. per kilowatt, and in the ultimate station this will be reduced to 0.54 sq.ft. The cubical contents are 60 cu.ft. per kilowatt and ultimately will be 56.

A boiler house with central crosswise overhead bunker, an adjoining turbine room and beyond an electrical bay on the side away from the river, and on the opposite side of the station a coal-handling bay and intake and discharge tunnels make an excellent layout. The auxiliaries are installed in very accessible open spaces on the condenser floor. Variations in the river stage reaching a maximum of 30 ft. necessitated placing the condenser floor 20 ft. below high water and waterproofing the portion of the turbine room below that elevation. As the turbine floor is virtually a platform only 4 ft. wide along each side of the units and 15 ft. wide between their ends, ample light reaches the auxiliaries from above.

The boiler room floor is 21 ft. above the turbine floor and 27 ft. above the ash room floor, thus affording ample space beneath for the forced draft and the ash-handling equipment. The ashes are removed by standard gage railroad cars from hoppers below the stokers. The hoppers are brick lined and will hold twenty-four hours' accumulation. There are no boilers under the coal bunker, this space being utilized by heaters, water-treatment equipment, elevators and other apparatus.

The usual double row of boilers is planned, with a firing aisle 13 ft. 6 in. wide between stoker ends. Excellent light and ventilation result from the spread between boiler fronts.

Coal is handled by rail from ground storage or direct from cars to receiving track hoppers at the river side of the boiler house. Each hopper is rated at 140 tons per hour capacity. Space is available for handling coal by barges in future. From the hoppers the coal is conveyed to either of two 36-in. x 48-in. double-roll crushers

Data on Principal Equipment in South Meadow Station of Hartford Electric Light Company

Boilers and Allied Equipment:

Boilers (Bigelow-Hornsby), heating surface, 13,920 sq.ft.; ratio of heating surface to grate area, 49 to 1; furnace volume, 6,370 cu.ft.

Economizers (Bigelow-Hornsby); integral part of boiler; heating surface, 2,750 sq.ft.

Superheaters (Foster); heating surface, 6,250 sq.ft.; superheat, 225 deg. Fahr., total steam temperature, 646 deg.

Stokers (Sanford-Riley); sixteen-retort, extra-long underfeed; geared Terry turbine and four-speed General Electric motor.

Ash gates (Baker-Dunbar-Allen).

Forced-draft fans (Sturtevant), 200,000 cu.ft. per minute, Westinghouse geared turbine.

Control for forced-draft fans, and stokers (Hagan).

Stack, one (Heine) concrete; 15.5 ft. inside diameter at top by 215 ft. above grates.

Coal Handling:

Coal-storage crane (Ohio Locomotive), 20-ton, 50-ft. boom.

Coal conveyors and crushers (Stephens-Adamson), 130 tons per hour.

Larry (McCarthy Brothers & Ford), weighing type, 15-ton.

Feed Water:

Feed-water heaters (Cochran), open; 540,000 lb. per hour.

Boiler-feed pumps (Jeansville-Worthington); two 1,000-g.p.m. three-stage and one 500-g.p.m. four-stage; (Terry) turbine drive.

Water filters (International); two sand-pressure type; 250 g.p.m.

Prime Movers and Auxiliaries:

Prime movers (General Electric), two 20,000-kw. (and three 30,000-kw. ultimately); 1,800-r.p.m.; 250-lb. steam pressure; 10.1 lb. steam consumption at 14,000 kw. and 29-in vacuum.

Oil filtration (Richardson-Phenix), continuous type.

Condensers (Westinghouse), 30,000 sq.ft.; (Chase) Muntz metal tubes; Fort Pitt Springs.

Circulating pumps (Westinghouse); 18,000-g.p.m.; driven by one motor and one turbine.

Condensate pumps (Worthington); 450-g.p.m.; driven by one motor and one turbine.

Air pumps (Le Blanc), two-jet single-stage; driven by Westinghouse turbine.

Intake screens (Link-Belt); sluice gates and hoists (S. Morgan Smith).

Air conditioner (Carrier), closed-system; water spray, 60,000 c.f.m.; horizontal supply pump and vertical discharge pump (Worthington); 500 g.p.m.

Station crane (Northern Engineering); 100-ton; five-motor.

Accessories, Instruments and Supplies.—Damper control (The Engineer); feed-water regulators (Williams); safety valves (Consolidated); blow-off valves (Yarnall-Waring and Everlasting); Venturi meters (Simplex); steam flow meters (General Electric); recording instruments (Foxboro); indicating instruments (Star); indicating thermometers (Tagliabus); CO_2 recorders (Uehling); master steam gage (Ashton); draft gages (Precision); stoker speed tachometer (Brown); fireclay and brick (Queens Run); brick and cement (Carborundum); Sil-o-cel blocks (Celite); Adamant fire cement (Batfield); Apexior boiler paint (Dampney); furnace side wall ventilation (Bernitz).

Piping, Valves, Coverings, Etc.—High-pressure semi-steel pipe and fittings (Lumsden & Van Stone); atmospheric exhaust piping (Abendroth & Root); cast-iron circulating water pipe and fittings (Lumsden & Van Stone); miscellaneous cast-iron pipe and fittings (Pittsburgh); ventilating sheet-metal work (Delbrook); pipe covering (Collins-Lotz); Holly drip system (Hodson); expansion joints (Westinghouse and Badger); miscellaneous valves (Edward, Pittsburgh, Warren-Webster, Pratt & Cady).

Miscellaneous Pumps (Worthington) with (Terry) turbine drive in part, viz., two single-stage 500-g.p.m. service pumps, one 1,500-g.p.m. fire pump, two 300-g.p.m. clean-drip pump, two 100-g.p.m. dirty-drip pumps; two intake well pumps. The last three sets are motor-driven.

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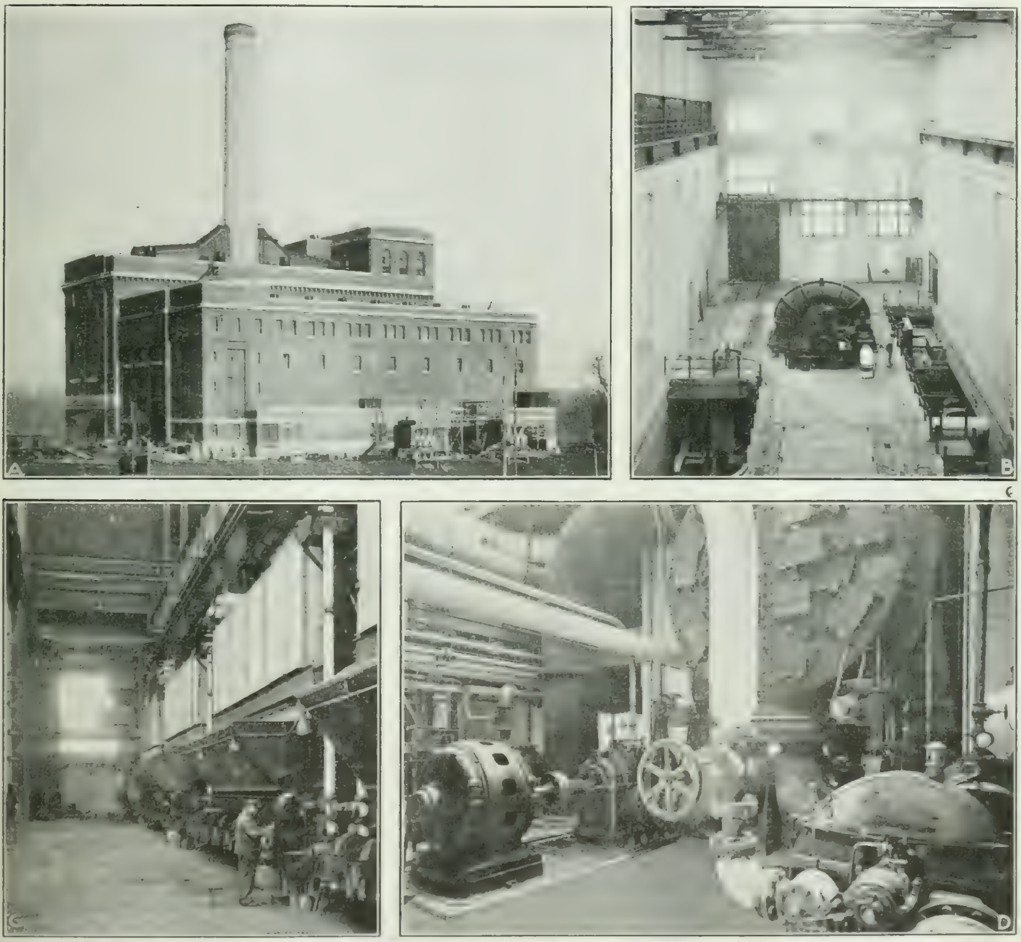
*Station is within 1.5 miles of center of city.

of 130 tons per hour capacity each, and thence by either of two bucket elevators of this capacity to the bunker, which holds 1,850 tons. Only one set of coal-handling equipment is included with the first installation. Induction motor drives with interlocked controls to insure starting and stopping equipment in proper sequence are provided. A motor-driven traveling weighing lorry distributes coal to the stokers.

Each boiler is equipped with an integral economizer of about 20 per cent of the boiler-heating surface, placed in the rear of the setting, and also with a superheater of 6,250 sq.ft., designed to give 225 deg. Fahr. at 200 per cent rating. The steam pressure is 275 lb. The furnace volume is 6,370 cu.ft. or 22.2 cu.ft. per square foot of grate surface. The furnace walls are perforated to prevent clinker formation, and the bridge walls are faced with carborundum brick 24 in. high, opposite dump plates, to resist abrasion by clinkers. A sixteen-retort underfeed stoker with 286 sq.ft. area is provided for each boiler, with combination steam turbine and motor drive and multi-speed control. Two forced-draft fans with a capacity of 200,000 cu.ft. per minute supply air to the furnaces. Six fans will be required in the ultimate station. Fans are installed in forced-draft supply chambers below the boilers and are driven by turbines installed in the turbine room.

For every four boilers a concrete stack 15 ft. 6 in. inside diameter and 210 ft. high above the grates is required. The boiler uptakes discharge into horizontal flues run uninsulated along the roof and terminating at the stack. Space is available for the installation of induced-draft fans above the boilers and just below the roof in case separate economizers are installed, such fans then becoming essential to secure the draft required at high ratings. The uptake dampers for each boiler are automatically regulated.



OUTSIDE AND INSIDE THE SOUTH MEADOW STATION

A—Viewed from the electric gallery side and looking toward river. The building area is only 0.57 sq.ft. per kw. B—One of the 29,000-kw. turbo-generators; areaways in floor afford ample light to auxiliary room below. C—Looking down row of 1,400-hp. boilers having centralized control. D—Steam and electrically driven circulating pumps in well lighted space.

Centrally located with respect to the ultimate station will be a room for auxiliary and combustion control equipment with indicating and recording instruments for measuring pressures, temperatures, steam flow, carbon-dioxide and kilowatts, and including automatic control equipment for forced-draft turbines. This arrangement brings the operation of the various pieces of auxiliary and combustion equipment under the observation and control of one man and enables him to maintain the proper heat balance at all times.

Each of the first two generating units is composed of a 25,000-kva., 11,000-volt, three-phase, 60-cycle generator driven by a twenty-three-stage horizontal turbine equipped with a direct-connected exciter. One reserve steam-driven exciter has been provided for present use. A 30,000-sq.ft. surface condenser is provided for each turbine and is mounted beneath it on spring supports. To insure economical and reliable service the condenser auxiliaries are in duplicate, including two circulating water pumps of 18,000 gal. per minute rating with bottom-suction and motor-operated discharge valves, one pump being turbine-driven and the other motor-driven. One pump is sufficient to produce an economical vacuum most of the year. There are also two condensate pumps per condenser, motor and turbine-driven, and either is of sufficient capacity to handle the entire load, and a hydraulic air-pump and a two-jet air exhauster. The relatively small initial installation at South Meadow and uncertain rate of plant growth precluded the use of a house turbine in connection with heat-balance requirements on account of its first cost.

The closed system of generator air cooling is used at this plant, 55,000 cu.ft. of air per minute being required per unit. The chamber for continuous recirculation and water spraying is located under the generator end of the turbine foundation and is of brick and concrete to eliminate noise. Two sets of sprays are provided, one in the uptake to each end of the generator. Increased space, reduced air velocity and a flexible damper arrangement result from this arrangement. Turbine-room air can be recirculated if desired, or in cold weather generator air can be used in warming the turbine room and in cutting down roof condensation. In case the water pressure fails, interlocked dampers permit a rapid change to an open system of ventilation. River water is normally used for cooling and for boiler feed.

Rounding up the Heat Units

After passing through the turbine oil coolers and the condensers for the steam air jets, if the latter are in service, the prime-mover condensate discharges into an overhead surge tank. Make-up water is added by float control from the service tank. The water flows from the surge tank to the heaters under float control and reaches the pumps under 50-ft. head. An emergency cold-water connection to the feed pumps from the circulating water tunnel is provided. Duplicate boiler-feed discharge piping is furnished, and the service tank is designed to separate filtered from unfiltered water, eliminating the interference of unusual house-service requirements with power-service needs.

Feed-water heaters, tanks and pumps are placed under the coal bunker, the tanks including a 20,000-gal. oufit on the roof and a 5,000-gal. surge tank under the bunker. Two 12,000-hp. open feed-water heaters, one 500-gal. and two 1,000-gal.-per-minute feed pumps are provided. Space is available in the plant for future evaporating equipment for make-up water and for air-removal equipment.

Welded nozzles of the interlocking type and line welds of the telescopic type are used on the main high-pressure piping, which has cast-steel fittings and valves.

Minimum duplication has been sought in the piping layout, but sectionalization has been required for operating convenience, together with symmetrical arrangement. Each boiler has two 8-in. outlets connecting through a 10-in. line to a main header 18 in. in diameter. The latter is run near the boiler-room floor level, is sectionalized with valves between every four boilers, and feeds the turbo units by leads of 14 in. outside diameter taken off the top, one per section. An 8-in. auxiliary steam header, sectionalized correspondingly to main units, is accessibly located under the forced-draft air chamber in the turbine room. Subdivision of steam supply to auxiliaries further insures continuity of service. There are no unusual features in the circulating-water tunnel system, which has a capacity of 70,000 kw. in the initial installation, with provision for extension as required.

The impression received on entering the building is its compactness and simplicity of arrangement. Adequate space has been provided despite the low unit areas and volumes given.

Features of the electrical equipment will be described in the next and concluding section of this article.

The information upon which the foregoing description is based was obtained through the courtesy of T. H. Soren, vice-president Hartford Electric Light Company, and from the engineers of Stone & Webster, Inc.

Spain Adopts Electrical Standards

ANNOUNCEMENT comes from Commercial Attaché C. H. Cunningham, at Madrid, that a royal decree has been issued by the Ministry of Fomento arranging for the adoption of legal electrical standards, as follows:

I. The legal units for the measurement of electric power in Spain shall be founded upon the electromagnetic system, adopting as basis units for resistance the international ohm and for intensity of current the international ampere.

II. The Minister of Fomento, consulting with the permanent Spanish Commission on Electricity, shall dictate the necessary regulations for the application of this decree, which shall comprise the following:

(1) Specification of the two above-mentioned primary units in accord with international regulations.

(2) Definition and specification of all the other units used in the application of electricity, which are subject to legal requirements, or, in the absence of same, to the agreements adopted by international assemblies which have met for this purpose; also the definition and specification of units relative to those magnitudes for which the above-mentioned precedents are lacking.

(3) Fixing and regulating the process or procedure by which the exactness of electric measurements may be assured within industrial and commercial limits, it being obligatory for all classes of functionaries intrusted with the technical inspection of industrial measuring apparatus to observe these regulations.

III. For the purpose of studying these questions and the formulation of the proper regulations, there shall be formed a national federation which shall embody the official laboratories already radicated in Spain.

Regulation Should Cover Municipal Systems

Failure to Include Them Allows Wasteful Competition—Their Inclusion Would Prevent Ruthless Cutting of Rates and Discrimination in Serving Public

By Edwin O. Edgerton

STATE regulation of privately owned public utility service having become an accomplished fact and being now looked upon as permanent, discussion is becoming more vigorous and extended as to the wisdom of similar state regulation of municipally owned and operated public utility services. This question, of course, should be determined on its merits, free from all prejudice for or against public ownership, and inasmuch as there is now, except in a few instances, no state regulation of municipally owned and operated utility service in the United States, this comparatively new activity of regulation should not be entered upon unless there exist recognized evils to be corrected or clearly established benefits to result.

If we start with the premise that unnecessary economic waste is a loss to the whole community regardless by whom or against whom committed, it will appear at once by mere recitation of the facts that regulation or restraint must be had of the activities of municipalities recklessly entering into competition with privately owned and operated and regulated utilities.

Monopoly Under Regulation Sound Policy

In the privately owned public utility field today it is universally conceded that with state regulation the creation of monopoly and the prevention of competition is sound policy in the interest of the people. It is not seriously contended by informed people that where a public utility is adequately serving at reasonable rates a competitor should be allowed to enter the field, parallel the existing system and cut rates, as experience has time and again demonstrated that this results in grave economic loss, inability to give service and injury to the public.

Precisely the same reasons are good as against a municipality entering a field already adequately served by a privately owned utility, paralleling its system, creating a duplicate investment, and by mercilessly cutting rates wholly or partially destroying its rivals. It must appeal to all reasoning people that, conceding the right of a municipality to go into the business of serving its citizens with a utility service, this right should either only be exercised by acquisition of an existing utility system or restraint should be laid upon the city to the extent of compelling it first to make an adequate offer to purchase the existing system, in the event of the refusal of this offer permission to be accorded to the city to compete.

In a situation where competition already exists between a municipally owned plant and one privately owned and operated regulation of the publicly owned plant should be had precisely for the same reasons as prevail in regard to the privately owned plant.

Rates should be controlled, so that the power to cut rates could not be used to annihilate a rival and destroy investment. Neither should a municipality be left wholly unrestrained in the matter of discrimination in giving service in a competitive field. The city should give service as freely and as fairly as the privately owned company and without discrimination or favoritism.

To accomplish these ends continuous regulation is necessary—that is to say, there must be an effective body of trained men thoroughly familiar with the principles and practices involved in utility service at all times available to make decisions, and such body exists in every state in the Union in the public utility commissions. It is only necessary by law to empower these commissions to regulate the municipally owned utility services.

Municipal Zealots' Arguments

I realize that this reasoning is vigorously, if not violently, objected to by the zealous municipal ownership advocate. He argues that the right of the city to serve its citizens with a utility service is and should be unrestrained and not regulated, and that it is neither immoral nor illegal ruthlessly to sacrifice the investment made in a privately owned public utility which is adequately serving the citizens and to parallel and compete, even to the extent of cutting rates below the cost of operation—the deficit to be made up out of taxation.

Some of these zealots concede that economic loss results in unrestrained competition, but they justify the imposition of this loss upon the people by arguing that ultimately public ownership is a vastly beneficial institution fully compensating for the economic loss whch occurs in the destruction of a private rival.

I never have been able to agree either as to the morals or the economics of such proposals. Considered from the moral side, it must be remembered that the public invited the privately owned company to institute and install its service. Frequently this invitation was vigorously extended even to the point of urging, but in most instances the invitation is evidenced by the granting of a franchise by municipalities, which alone and of itself is an indication of a desire that private capital undertake the job of serving the public.

While it must be admitted that there is no governmental guarantee of protection against municipal competition, nevertheless there is an implied agreement that private capital thus invited into a city will be fairly dealt with. Certainly it is true that if at the time of the investment of the money in the privately owned public utility the city had announced that any one investing in such an enterprise must do so with the clear understanding that it was the purpose of the city to exercise its legal privilege of completely paralleling and competing with the proposed system, not one dollar of investment would have been made.

Unselfishness Characterizes Private Plant as Much as Municipal

It seems to be assumed by those who argue against state regulation of publicly owned utilities that there is some peculiar and unselfish status of publicly owned enterprises which distinguishes them in every respect from those privately owned, even though those privately owned are devoted entirely to public service. It must be pointed out, however, that your public ownership zealot appeals to the people on wholly selfish grounds in an attempt to get support for his municipal project. In effect he says, "Let me build for you a municipal utility system, vote the necessary bonds, tax yourselves for this purpose, and I, acting on your behalf, will wreck and ruin the existing utility for your benefit in order that you may have cheap rates." Of course he does not say this in terms, but analyze his appeals to the people and these precise suggestions will be found, if only by inference.

What sound objection can be raised to state regulation of municipally owned utilities? If these enterprises are sound, if they are being properly conducted, if they are in every respect successful, then those who are interested in them should welcome the opportunity for complete public exposition before a state commission trained to analyze utility operations and capable of laying down sound rules in the interests of the people. Would it not be a great satisfaction to the people of a city to know that at all times there was a wholly impartial trained body of experts under the guidance of experienced commissioners constantly available to consider complaints and with constant supervision of the activities of those engaged in operating a municipal enterprise?

Longer Spans Proposed for Rural Lines

By Selecting Conductors with High Elastic Limit and Properly Guying Poles at Sharp Corners and Dead-Ends Urban Factors of Safety Can Be Obtained with Poles Placed 250 Ft. Apart

In considering the type of line construction best adapted for electric service in rural districts it is evident that some type of construction less expensive than that standardized for urban work is necessary to make farm lines an economic possibility. On the other hand, it is essential that there be no sacrifice of a reasonable factor of safety, that the construction involve a minimum amount of maintenance since it is relatively difficult to reach, and that easily obtainable materials be used.

There are two generally used methods of running distribution circuits to supply rural districts. Such circuits may be run from outdoor substations connected to transmission lines or may be simply extensions of urban distribution circuits. The method adopted will depend on the character and extent of the territory to be served. The standard voltages for such circuits include 2,300 volts, single-phase or three-phase, 2,300/4,000 volts, three-phase, four-wire, and 6,600 volts and 11,000 volts, single-phase or three-phase. It is advantageous for a company to use the same voltage for rural lines as for urban distribution circuits where this arrangement is practicable, because transformers, insulators and other accessories are then interchangeable. If it is necessary to use a higher voltage, the choice will depend upon an analysis of the individual case, in which the load, distance and cost of wire, insulators, transformers, fuses and lightning arresters must all be considered.

The use of 125-ft. (37-m.) spans has been inherited by the electric companies from the telephone companies, whose large number of wires made this practice necessary. In general the maximum span length is fixed by the transverse strength of the poles, or, with a given height of pole, by the clearance to ground obtained at the center of the span with the conductor used. On rural lines it will generally be found necessary to string only two or three primary wires of comparatively small size. It is therefore possible, so far as the poles are concerned, to increase the span length very materially, at the same time keeping the same factor of safety usual in urban construction. One of the accompanying sets of curves shows the relation between transverse strength of new and old poles and the safe number of wires for 250-ft. (75-m.) spans.

It is believed that this span length offers a number of advantages. It may be used for primary line extensions with Class B or Class C poles without sacrifice of the required factor of safety. Using 30-ft. (9-m.) poles and suitable conductors, the necessary clearance to ground can be obtained with this span, and finally, if increased business makes additional wires necessary, such a line can be changed to 125-ft. spans by setting the intervening poles. With such construction it is desirable to shorten spans and double-arm poles at sharp corners and dead-ends and to guy the poles thoroughly at such positions.

With the long-span construction outlined above it is necessary to use a conductor having a higher elastic limit than the No. 6 soft drawn copper in common use for light lines. There are four materials which have the necessary strength—steel wire, copper-clad steel wire, hard-drawn copper wire and steel-cored aluminum cable. Except in cases where the line current is very small and the distance short, the first material is unsatisfactory because of its low conductivity. For general service on long-span rural lines the choice appears to rest between hard-drawn copper wire and steel-cored aluminum cable, since there is usually no important price differential between those materials when purchasing wire of equal conductivity. Steel-cored aluminum requires somewhat more care than copper in instal-

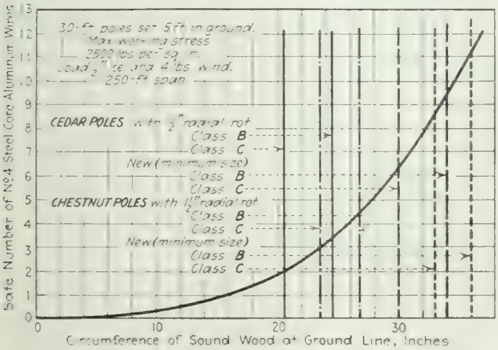
COMPARATIVE COST OF 125-FT. AND 250-FT. SPANS FOR 1 MILE OF 2,300-VOLT, SINGLE-PHASE LINE

Item	Quantity		Cost	
Material	125-Ft.	250-Ft.	125-Ft.	250-Ft.
Western cedar poles, 30-ft., butt-treated	48 [illegible]	28 [illegible]	$447 20	[illegible]
Four-pin fir cross arms with pins and braces	45	27	45 00	27 00
Galvanized machine bolts:				
½ in. x 10 in.	41	[illegible]	4 [illegible]	2.38
½ in. x 14 in.	2	4	.31	.62
Double-arm bolts, ⅝ in. x 14 in.	4	8	65	1 30
Lag bolts, ½ in. x 4 in.	45	27	1 35	81
Guy anchors, 6-ft.	2	2	7 12	7.12
Galvanized steel cable, ⅜-in.	100 ft.	400 ft.	1 00	4 00
Guy clamps, three-bolt	4	8	[illegible]	1 [illegible]
Strain insulators	8	[illegible]	[illegible]	2 46
Porcelain insulators	90	54	40 50	24 30
Conductor (T. B. W. P.)	11,000 ft. No. [illegible] copper	10,560 [illegible] No. 4 [illegible] 200-ft. tie wire	221 00	212 [illegible]
Miscellaneous			10 00	[illegible]
Labor and Cartage:				
Drawing poles			4[illegible]	[illegible]
Setting			230 00	128 00
Cartage			62 00	40 00
Framing			22 50	11 50
Guying			12 00	[illegible]
Stringing wire			110 00	[illegible]
Supervision			48 45	34 20
Total labor and material			$1,3[illegible]	$946 11
Overhead, at 15 per cent			197 07	141 92
Total cost			$[illegible]	$1,0[illegible]

lation, and the junk value of copper is a much higher percentage of its first cost than is the case with steel-cored aluminum. Steel-cored aluminum is, however, much stronger than hard-drawn copper of the same conductivity and is, therefore, better adapted in small sizes for stringing long spans on low supports. Two curve sheets are appended showing the recommended sags for No. 6 hard-drawn copper wire and No. 4 steel-reinforced aluminum cable.

Standard N. E. L. A. cross-arms with standard 1½-in. (3.75-cm.) locust pins are suitable for the construction proposed. The use of cross-arms long enough to give 30-in. (75-cm.) conductor separation is suggested, and standard *galvanized* line hardware should be used.

The saving to be effected by the proposed construction will vary with different companies, being dependent principally on the material used for poles and on the cost of labor. For comparison data are given showing the cost of one mile of single-phase, 2,300-volt line of standard construction and one mile of long-span construction on reasonably straight road, free from trees and where no conflicts would be encountered with the construction of other utility companies. It is assumed that both lines are dead-ended at each end of the mile. In localities where chestnut poles can be easily obtained it will be possible to reduce the first cost of the line materially by their use.



TRANSVERSE STRENGTH OF LINE COMPOSED OF WESTERN RED CEDAR AND CHESTNUT POLES

The foregoing information was prepared by the subcommittee of the Empire State Gas and Electric Association on construction standards for farm lines, consisting of Sydney Alling, chairman; G. W. Ide and E. P. Peck. It is one part of the work of the general committee on rural service, headed by Bert H. Shepard, which is now giving particular attention to the rate situation. The same committee has prepared specifications for the construction of long-span farm lines on wood poles. Parts of the specifications follow:

General Arrangement of Line Supports.—The maximum span length shall be 250 ft., and spans of this length shall be used throughout except as specified below. Spans may be shortened to clear obstructions such as roads, driveways, streams, lawns, etc., and shall be shortened at dead ends and angles of over 45 deg. Spans adjacent to a dead-end pole or pole carrying a corner of over 45 deg. shall not be more than 125 ft. long. Poles adjoining dead end poles or adjoining poles carrying sharp corners shall be double-armed.

Poles.—Poles shall be Western cedar, Northern cedar or chestnut and shall conform to N. E. L. A. specifications for the kind of pole used. Poles shall have the following minimum dimensions for the various kinds and classes specified:

WESTERN CEDAR

Length of Poles (Ft.)	Class A (Minimum Top Circumference 28 In.) Circumference 6 Ft. from Butt	Class B (Minimum Top Circumference 25 In.) Circumference 6 Ft. from Butt	Class C (Minimum Top Circumference 22 In.) Circumference 6 Ft. from Butt
30	37	34	30
35	40	36	32
40	43	38	34
45	45	40	36
50	47	42	38
55	49	44	40
60	52	46	41
65	54	48	43

NORTHERN CEDAR

Length of Poles, Ft	Class A		Class B		Class C	
	Top	6 In. from Butt	Top	6 In. from Butt	Top	6 In. from Butt
30	24	40	22	36	18½	33
35	24	43	22	38	18½	36
40	24	47	22	43	18½	40
45	24	50	22	47	18½	43
50	24	53	22	50	18½	46
55	24	56	22	53	18½	49
60	24	59	22	56	—	—

CHESTNUT

Length of Poles, Ft.	Class A		Class B		Class C	
	Top	6 In. from Butt	Top	6 In. from Butt	Top	6 In. from Butt
30	24	40	22	36	20	33
35	24	43	22	40	20	36
40	24	45	22	43	20	40
45	24	48	22	47	20	43
50	24	51	22	50	20	46
55	22	54	22	53	20	49
60	22	57	22	56	..	
65	22	60	22	59	..	.
70	22	63	22	62	..	..
75	22	66	22	65	..	..
80	22	70	22	69	..	..
85	22	73	22	72	..	..
90	22	76	22	75	..	..

Poles shall be Class C for two-wire or three-wire lines and Class B for four-wire or five-wire lines. Where more than five wires are run Class A poles may be used, but it is recommended that the use of spans shorter than specified above be considered for such lines.

Poles shall be set in accordance with the following table:

Length of Pole, Ft.	Depth of Setting, Ft. and In.		Length of Pole, Ft.	Depth of Setting, Ft. and In.	
30	5	0	50	6	6
35	5	6	55	7	0
40	6	0	60	7	6
45	6	0			

. . . In backfilling holes, two tampers shall work with one shoveler, the earth being thoroughly tamped in place. All water shall be removed from pole holes before poles are set. The ground shall be graded up around the base of the pole to provide for settlement, the premises being left in as good condition as found. It is recommended that the use of poles treated with preservative by the open-tank process be considered.

Cross-Arms and Accessories.—Cross-arms shall be made of close-grained Douglas fir having not less than twelve annular rings per inch width of cross-section. Two-pin cross-arms shall be 3½ in. x 4½ in. x 3 ft. 2 in. with 2-ft. 6-in. pin spacing. Four-pin cross-arms shall be 3½ in. x 4½ in. x 5 ft. 7 in. long with pins arranged for 2 ft. 6 in. climbing space and 14½-in. pin spacing. Six-pin cross-arms shall be 3½ in. x 4½ in. x 8 ft. long with pins arranged as specified for four-pin arms. . . . Cross-arms shall not be treated or painted. . . . Double arms shall be joined by two ⅝-in. double-arming bolts installed 11 in. from the outer ends of the arms on four-pin and six-pin arms and 6-in. from the outer ends of two-pin arms. Extension arms shall be provided with an extension arm brace made of 1¾-in. x 1¾-in. x 3/16-in. steel angle, 7 ft. long, and having a suitable step, in addition to the standard braces. Two extension arm braces shall be used on double extension arms. . . .

Guys and Anchors.—All angles in the line of over 1 deg. shall be securely guyed. In the following table it is assumed that the guys specified make an angle of not less than 30 deg. with the center line of the pole. Where the angle is less than this proper allowance must be made in selecting the guy and anchor to be used:

TWO-WIRE LINE

Angle in Line, Deg.	Number and Size of Guy Cables	Size and Length of Anchor Rod	Size of Diameter	Dead-Man Length
10	One, $\frac{3}{16}$ in.	[illegible]x5 ft.	12 in.	1 ft. 6 in.
30	One, $\frac{5}{16}$ in.	[illegible]x6 ft.	12 in.	2 ft. 6 in.
45	One, $\frac{3}{8}$ in.	[illegible]x6 ft.	12 in.	3 ft. 0 in.
60 Dead-end	One, $\frac{3}{8}$ in.	$\frac{3}{4}$x7 ft.	12 in.	3 ft. 0 in.

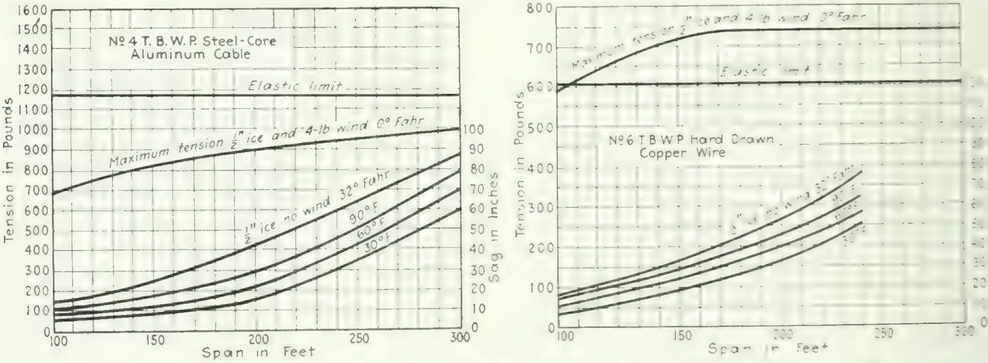
FIVE-WIRE LINE

Angle in Line, Deg.	Number and Size of Guy Cables	Number, Size and Length of Anchor Rod	Number and Size Dead-Men Diameter	Length
10	One, $\frac{1}{4}$ in.	One, $\frac{5}{8}$x6 ft.	One, 12 in.	2 ft. 0 in.
30	One, $\frac{7}{16}$ in.	One, [illegible]x7 ft.	One, 12 in.	4 ft. 0 in.
45	Two, $\frac{5}{16}$ in.	One, 1x8 ft.	One, 12 in.	4 ft. 0 in.
60 Dead-end	Two, $\frac{3}{8}$ in.	Two, [illegible]x7 ft.	Two, 12 in.	4 ft. 0 in.

All guy cable shall be double-galvanized Siemens-Martin steel strand. Anchors shall be set at such a depth that the entire length of the anchor rod specified except the eye is buried, the rod being nearly vertical but inclined slightly so that the anchor bears against undisturbed earth. All-metal anchors may be used instead of the dead-men specified provided that an anchorage is secured which will develop the full strength of the guy cable specified. All anchor rods shall be double hot-galvanized and shall be secured to dead-men by a 3-in. x 3-in. x $\frac{3}{8}$-in. washer and nut. Guys shall be attached to poles close to cross-arms by taking one and one-half turns around the pole and fastening with a three-bolt clamp. Suitable strain insulators shall be used in all guys and shall be placed not less than 9 ft. from the ground and not less than 6 ft. from the pole. Guys from pole to pole shall be provided with a strain insulator at each end not less than 6 ft. from the pole. Guys small be attached to strain insulators and anchor rods by a three-bolt clamp and a made-up joint. Suitable galvanized thimbles shall be used in attaching guys to anchor rods. Suitable guy hooks or lag bolts shall be used to secure guys in place on poles. . . .

Wire.—Where aluminum cable, steel-reinforced, is used for line conductors, the following specification applies: Wire shall be covered with triple-braid weatherproof insulation. No. 6 D. B. W. P. aluminum wire shall be used for tie wire. Line conductors shall be tied in the top groove of insulators on straight runs with an unprotected bridle tie, the wire being snug around the line conductor five turns on each side of the insulator. On corners wires shall be tied in the side groove of insulators with an unprotected bridle tie as described above so that the strain is carried by the insulator and not by the tie wire. On insulators without top groove wires shall be tied in the side groove on the pole side of the insulator with an unprotected bridle tie as described above. All splices in line conductors shall be made with suitable two-piece aluminum sleeves. The ends to be spliced shall be properly stripped, cleaned and inserted in the sleeves the full length plus 1 in. and each sleeve twisted, with suitable wrenches, four complete turns, the two sleeves being twisted in opposite directions. Where possible sleeves shall be twisted in a direction to tighten strands of cable. Joints shall be covered with not less than four layers of friction tape. Great care shall be taken not to kink or nick line wires and any wire so damaged shall be cut out and a splice made. The accompanying curves show the sags and tensions for No. 4 A. C. S. R. with T. B. W. P. insulation. All joints between copper conductors and aluminum conductors shall be made with suitable aluminum clamps provided with a copper bushing. Clamp joints shall be covered with four layers of friction tape after installation. In making joints with clamps both copper and aluminum conductors shall be carefully cleaned so as to remove all foreign matter from the metal before the clamp is installed.

Where medium or hard-drawn copper wire is used for line conductors the following specification applies. Wire shall be covered with triple-braid weatherproof insulation. No. 6 D. B. W. P. soft-drawn copper wire shall be used for tie wire. Ties shall be made as specified for A. C. S. R. All splices in line conductors shall be made with suitable one-piece copper sleeves. The ends to be spliced shall be properly stripped, cleaned and inserted in the sleeves the full length plus 1 in. and the sleeve twisted with suitable wrenches four complete turns. Joints shall be covered with not less than four layers of friction tape. Tape shall be made with sleeves as above specified or with properly wrapped joints over which solder shall be poured. Medium or hard-drawn copper conductors shall not be soldered with a blow torch. The accompanying curve sheet shows the sags and tensions for No. 6 T. B. W. P. hard-drawn copper conductors.



SAGS TO LIMIT MAXIMUM TENSION UNDER ICE AND WIND LOAD TO SAFE VALUE

Hydro-Electricity in Czechoslovakia

THERE are, according to an official report of an agent of the British government, as quoted in the London *Electrician,* few countries in which electric supply has reached such an advanced stage of development as in Czechoslovakia. In 1919 there were 390 power stations, including six of more than 10,000 kw. rating, three of from 5,000 kw. to 10,000 kw. and twenty-eight of from 1,000 kw. to 5,000 kw. The Prague central station has a normal output of 22,500 kw. There are several hydro-electric installations in operation, and many more are contemplated. In Bohemia it is estimated that the maximum output of hydro-electric power (mainly on the Elbe and Moldau) is equal to 355,000 kw., in Slovakia to 200,000 kw. and in Moravia to 59,000 kw., or a total of more than 600,000 kw. for the entire republic. The standard trunk-line voltage as development proceeds will be 100,000, with permission to employ 50,000 volts temporarily.

To Protect Junior Securities*

Suggestion Made to Investment Bankers' Association of America for Amortization of Discounts on Utility Securities

By CYRUS PIERCE

THE financing of public utilities through the medium of junior securities is becoming of more and more importance all the time, but before it can be done in any large way there are two vital points that must be safeguarded. First, the income of the company must be sufficient and so stabilized that the dividends on these junior securities will be paid with the same punctuality as the interest on the funded debt; and, second, the security upon which the issues are based must be ample to safeguard the principal. In order to accomplish these two things it seems to me to be necessary for the Investment Bankers' Association to use the weight of its influence with the various public utility commissions to the end that the rates may be adequate not only to pay the dividends but to maintain the physical property.

It has been current practice recently when public utility bonds are issued to limit the issue at par and the face amount of the issue to 75 per cent of the cost of the improvements to be made. Therefore, the other 25 per cent, and in addition thereto such discount from the sale of the bonds as the company is compelled to stand in order to market them, must be made up. Somewhere, somehow, the utilities have been called upon to find this money. It is now the fashion to provide this from the sale of stock. In most cases it is preferred stock. It is customary to say to an intending investor that every dollar he puts into the preferred stock is represented by a dollar of fixed assets, and this is true in most instances. It also is true that recently most utilities had to sell their preferred stocks on an 8 per cent basis, which, if the stock is a 6 per cent stock, means the sale of it at about 75. Ordinarily 8 per cent is all a company is permitted by the commissions to earn on the investment. Therefore there is no profit to the company. The earnings do not provide a means by which these discounts may be quickly amortized or a surplus built up to protect the investor, the further result being that there is little chance of there being an increase in the intrinsic value of the securities of the corporation which are junior to the preferred stock and which should be the vehicle for providing additional equity. And, as their market can't improve, their price cannot go up, and consequently the price at which the company must continue to sell its preferred stock remains low. Discounts continue excessive and the vicious circle goes on.

RESERVE FOR LEAN YEARS

This attitude on the part of regulating bodies too closely restricting earnings cannot help but eventually result in two things—first, that the sale of junior securities will become increasingly difficult at relatively higher costs of money, and finally that it will become impossible to raise money from that source at all because the company cannot afford to pay the price which investors will demand where there is regulation of security but no assurance that the issuing corporation will have such earnings as will enable it to administer its financial affairs along those lines which experience has shown to be necessary. Those lines are that there should be sufficient earnings to enable the corporation to lay up in good years a reserve which may be applied to dividends as an assurance against the time, which always recurs in every corporation's experience, when earnings will not be sufficient to pay such dividends. This reserve, of course, also constitutes an assurance of the continuity of the promised dividends upon the preferred stock; and, over and above this, there should be earnings sufficiently beyond this to make it possible for the company within a comparatively short space of time to build up in actual property against which no securities can be issued an equity equal in par value to the amount of discount upon its outstanding securities.

If a company were static, this would be easy, but in a growing company where the annual construction requirements run into the millions this has become a grave problem and the cord is being drawn tighter each year around the neck of the unfortunate corporation.

CREDIT IS NOT CAPITAL

This matter of discount upon securities is a very vital one and one which I believe has not had the attention it deserves. Your public utility commission says that this receives due weight in computing the cost of money ascertained through a table which is scientifically accurate, and where the company is permitted to sell its definite maturity bonds upon a definite basis this amortization has been foreseen and provided for. This reasoning, however, overlooks a very important consideration. Assuming that a company spends $10,000,000 cash in one year for a new development and issues against it $7,500,000 of bonds and $2,500,000 of preferred stock which are sold at 90, the company is in the position of having an installed property which costs $10,000,000 but against which it has received but $9,000,000. One million dollars must be provided from some source, and that $1,000,000 is immediately reflected in floating debt. This may temporarily be carried as open accounts and then as notes in favor of the vender, and finally, when the vender must be paid, these notes or their successors find their way into the hands of the banks with which the company does business, with the result that the company has made permanent capital expenditures of $1,000,000 and obtained the money therefor by using bank credit. This is a highly improper proceeding as credit must never be confused with capital.

What is the remedy?

Let us refer back for a moment to the example of the company that spent $10,000,000 and received $9,000,000 from the sale of its bonds and preferred stock. This $1,000,000 of deficiency which must be provided should be made up by the sale of common stock. It is apparent, however, that after the common stock is sold there is no property value behind it. It, therefore, must either bear such a dividend as to make it a good speculation or it must be safeguarded, and the only way that it can be safeguarded is to build up the property value behind it. Let us assume that the $1,000,000 is provided by the sale of common stock at 75. This would mean that there must be sold common stock to the par value of $1,333,333, against which, as stated before, there is no property value. Under present conditions this stock is not salable, but the public service commissions must be brought to a point of view where they will regard the discount of $1,333,333 as a construction charge to be added to the property value—a view that is more or less fallacious—or they must allow the company to make sufficient earnings not only to pay the interest on the bonds and the dividends on the $2,500,000 preferred and $1,333,333 common stock, but earnings sufficient also to provide proper depreciation, and over and above all this to build up within a reasonable time, say five years, a property value of $1,333,000. In other words, they must allow the company to earn, in addition to the above items, $266,666 each year in additional property against which no securities, either bonds or stock, may be issued. And when something of this kind is done, and only then, can a reasonable amount of the financing of our public utility companies be properly accomplished through the sale of junior securities.

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*A paper read before the recent convention at New Orleans.

Isolating Single Frequency from Irregular Waves

Combinations of Inductance and Capacitance for Filtering Harmonics—Useful in Bridge Work and Wave Study as Well as in Communication

ELECTRIC filtering arrangements for different purposes are coming into increasing prominence as the need for purity of wave form is more felt in alternating-current bridge work, etc. The recent applications of selective circuits in the new carrier-wave multiplex telephony have directed attention to the usefulness of electric filters also for commercial purposes. It has been known for a long time that combinations of inductance coils and condensers in periodically recurring sections are remarkable for their high selectivity with respect to frequency. The design and application of filters was studied by Shepherd (*London Electrician*) and has recently been taken up at some length by G. W. Pierce ("Electric Oscillations," McGraw-Hill Book Company). We produce here a few illustrative oscillograms, selected from a most remarkable and interesting collection, published in an article by K. W. Wagner (*Archiv für Elektrotechnik*), where the general theory of filters is studied and curves of the damping and retardation factors are given for various old and new types of filters. The most commonly applied form of electric filter is that shown in Fig. 1. In this form the filter section is identical with an ordinary artificial transmission-line section. Up to a certain frequency such a section offers very little damping if the resistance is small, although the phase lag of received voltage may be considerable. Currents of frequencies above the so-called "cut-off point," however, will suffer an exceedingly large attenuation, so that a filter of only very few sections is often sufficient to nearly cut out all overtones in a distorted wave, provided, of course, that the cut-off point is above the fundamental frequency, but below that of the first overtone.

Fig. 2 gives a very clear demonstration of this filtering action. The upper curve represents the impressed voltage, which has a fundamental of 250 cycles but shows pronounced overtones. The lower curve is the ø voltage at the fifth section of a filter according to Fig. 1, with $L = 190$ mh., $R = 10$ ohms. $C = 2$ mf., having a cut-off point of $f_{,} = 512$ cycles. The distance ø represents the phase lag of voltage. Just the opposite characteristic has a filter of the series-condenser type shown in Fig. 3. Such a section will let through all frequencies above a certain limit, but will greatly attenuate all lower frequencies. The filter therefore may be used to sift out all the overtones from a given wave, as Fig. 4 shows. The same reactors as before were used, when this oscillogram was taken, and the filter had 5 sections, but the capacity was $C = 1$ mf. and the frequency cut-off point was at 182 cycles. During the experiment the fundamental frequency was 100 cycles, and since the filter completely suppressed the fundamental, the lower curve may be used for a schedule analysis leading to accurate values of all the higher harmonics. It is even possible, by combining sections of the two described types to construct a filter which will pick out one particular overtone from an impure wave. The same results can be reached by giving each section a double frequency response, as in Fig. 5. This is shown very admirably in Fig. 6, an oscillogram obtained with three sections, using reactors with $L = 195$ mh. and with $C = 1.36$ mf. and $K = 0.085$ mf. The received voltage contains practically nothing but the fifth harmonic of the impure 250-cycle wave impressed at the input end of the filter. It is filters of this latter type that find application in multiplex telephony, for separating the simultaneously transmitted carrier waves, each representing a band spectrum of frequencies and each carrying the voice of one of the ten or more persons talking simultaneously over the same wires.

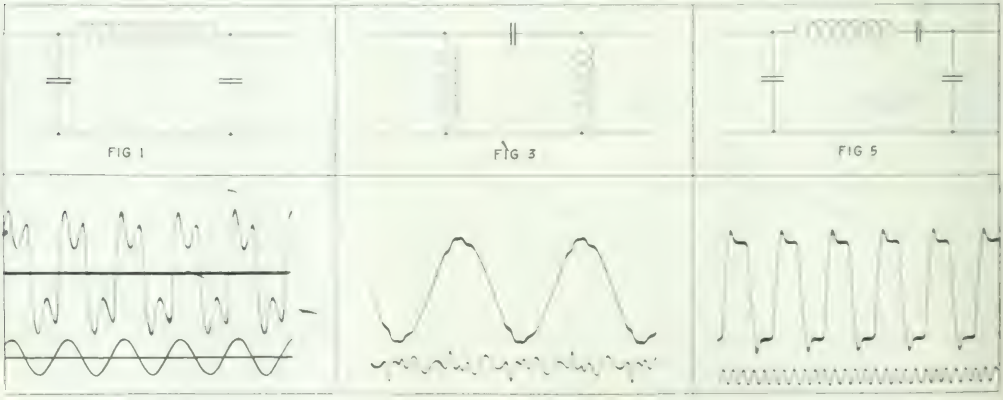

FIG 1 FIG 3 FIG 5

FIG 2 FIG 4 FIG 6

CIRCUIT ARRANGEMENTS FOR FILTERING AND THEIR EFFECTIVENESS AS SHOWN BY OSCILLOGRAMS

Electric Vehicle Operation Cheaper than Gasoline Truck

Operating Costs of Electric Trucks in Government Service in Washington, D. C., Compared with the Cost of Gasoline Trucks Under Similar Conditions—Electric Trucks Superior for City Requirements

By WALTER R. METZ
Superintendent of Buildings, Government Printing Office, Washington, D. C.

AFTER nine years' experience in the maintenance of electric vehicles and keeping the most reliable cost figures obtainable in connection therewith, I am convinced that the electric truck has a distinct place in commercial life and in this place is far cheaper to operate than either horse-drawn or gasoline-driven trucks. As a general proposition, it appears that the electrically driven machine is better for city service where the streets are in fairly good condition, and that the gasoline-driven machine is better for long hauls over rough roads and in the open country, mainly on account of the ability to obtain gasoline and water and the chances of making greater speed.

ELECTRIC TRUCKS IN GOVERNMENT PRINTING OFFICE SERVICE ARE SHOWING GREATER ECONOMY THAN GASOLINE TYPE

During the period mentioned the department under my supervision has operated eight electric trucks and for the last three years two additional ones. All these trucks are still in operation, making their regular trips without unusual interruption of the service. Table I shows the average cost of upkeep of the variously sized machines based on data kept for the last nine years. Since the operating cost of machines of similar size is aproximately the same data are given for each size only. In these tables the cost of energy is the actual cost of production at our own plant and varies from about 1¼ cents to 2 cents per kilowatt-hour. The battery upkeep and tire upkeep cover actual repairs and renewals. Electric repairs cover repairs to motors, lamps, wiring, etc. Mechanical repairs cover all repairs to the machine proper, including the body repairs and painting. Inspection and cleaning cover all miscellaneous garage work, which is equally divided among all cars in service.

In this particular department the cost of upkeep of the buildings, including heat and light, was 35 cents per

TABLE I—AVERAGE OPERATING EXPENSE* OF FIVE SIZES OF ELECTRIC TRUCKS IN GOVERNMENT SERVICE BASED ON NINE YEARS' DATA

Size of trucks	1,000 Lb.		2,000 Lb.		5,000 Lb.		8,000 Lb.		10,000 Lb.†	
Total mileage	54,600 miles		54,051 miles		40,181 miles		30,419 miles		9,595 miles	
Size of tires	F. 34x3, R. 34x3		F. 34x3½, R. 34x3½		F. 36x4, R. 36x4 Dual		F. 36x6, R. 36x4 Dual		36x4, 5 or 6, or 36x10 Dual	
	Per Year	Per Mile	Per Year	Per Mile	Per Year	Per Mile	Per Year	Per Mile	Per Year	Per Mile
Energy	$36.88	$0.0061	$45.43	$0.0070	$58.04	$0.0130	$58.40	$0.0150	$77.14	$0.0240
Battery upkeep	154.22	.0250	170.21	.0280	157.77	.0350	210.46	.0550		
Tire upkeep	35.35	.0058	63.21	.0105	78.98	.0177	73.54	.0193	89.44	.0277
Electric repairs (exclusive of battery)	32.30	.0051	51.69	.0086	31.90	.0071	27.21	.0071	54.94	.0170
Mechanical repairs	108.82	.0179	108.22	.0180	111.90	.0250	84.86	.0223	29.53	.0090
Inspection and cleaning	324.69	.0535	318.66	.0530	314.91	.0705	339.42	.0893	325.83	.1020
Total operating expense	$692.26	$0.1134	$757.42	$0.1251	$753.50	$0.1683	$793.89	$0.2080	$576.88	$0.1797
Interest on investment...	69.60		$82.50		$106.26		$165.27		$171.30	
Depreciation	232.00		275.00		354.20		550.90		571.00	
Garage	70.00		70.00		70.00		70.00		70.00	
Total expense	$1,063.86	$0.1753	$1,184.92	$0.1971	$1,283.96	$0.287	$1,580.06	$0.412	$1,389.18	$0.434

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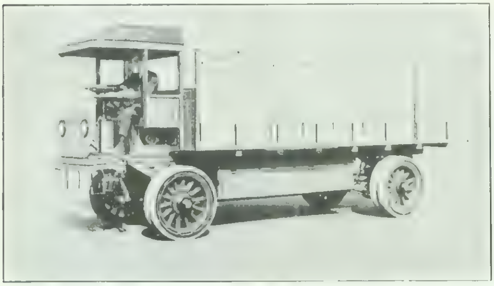
* Two types of vehicles are used, namely, Baker and Commercial. The former are rated at 1,000 lb., 2,000 lb., 5,000 lb. and 8,000 lb. capacity, while the Commercials are rated at 10,000 lb. All of the vehicles are equipped with Ironclad Exide batteries. Wages of drivers are not included. Interest is figured at 6 per cent on half the investment, depreciation at 10 per cent.

† The extremely low operating cost of the 10,000 lb. car is partly due to the fact that it is only three years old and no battery renewals have been required to date.

square foot for the past year. Allowing 200 sq.ft. per truck, the garage rental space may, therefore, be taken as $70 per year. Depreciation can be figured at most at 10 per cent as the trucks have already been running ten years, and interest on investment may be taken as 6 per cent on one-half the original cost, as is usual. Adding these items to the average operating cost of each truck since its installation gives the total average cost for each size of truck shown at the bottom of Table I.

It is interesting to compare these costs with costs as published by other departments of the government. The report of the chief clerk of the Department of the Interior gives an analysis of cost of gasoline-driven trucks in the government fuel yard service for the period of Oct. 1, 1919, to June 30, 1920. These costs are shown in Table II. The operating expense has been calculated on the basis of the number of days the trucks were used, since it covered only the cost of supplies and labor and material for repairs. The overhead is figured on the basis of the total days the trucks were on hand. The total is a combination of the two just mentioned. The cost of the 1-ton and 2-ton trucks is very low, probably because they have been used very little and because the mileage per day is very low.


ONE TRUCK WHICH HAS BEEN IN SERVICE THREE YEARS WITHOUT ANY BATTERY UPKEEP EXPENSE

The cost record of gas-driven trucks in the Post Office Department is given in the annual report of the Postmaster-General for the fiscal year 1920. Detailed figures are not given, but it is stated that depreciation and interest rate per annum is based on sixteen hours per day and 365 days per year. This rate varies from 20 per cent on from 2-ton to 3-ton equipment to 33 per cent on 1,000-lb. and 1,500-lb. equipment. The average cost for each size in the table mentioned is given in Table III. These costs evidently include garage repair charges and all operating expense. If the item of garage rental space is to be included, 22 cents should be added to the cost per day for each size truck.

Records of private firms are a little difficult to obtain but the cost data of one in the Middle West are available. The trucks haul concrete materials weighing about 100 lb. per cubic foot. The total mileage was about 50 miles per day, during one-half of which (the return trips) the trucks ran without load. Table IV shows the cost records. All costs are exclusive of drivers' wages.

TABLE II—AVERAGE COST OF OPERATING GASOLINE TRUCKS EMPLOYED IN GOVERNMENT FUEL YARD SERVICE

Truck Capacity (Tons)	Operating Expense		Overhead		Total Exclusive of Drivers' Wage	
	Per Mile	Per Day	Per Mile	Per Day	Per Mile	Per Day
7½	$0.378	$16.07	$0.214	$5.32	$0.592	$21.39
5½	.336	14.04	.200	4.45	.536	18.49
2	.197	2.07	.163	3.08	.360	5.15
1	.275	2.23	.688	3.10	.963	5.33

NOTE: Leave of absence with pay is charged to overhead, as are also rent, light, heat, supervisory officials and watchmen, and miscellaneous labor. Overhead is distributed over each type of truck on the basis of its capacity.

TABLE III—ANALYSIS OF GASOLINE TRUCK OPERATING COSTS* IN POST OFFICE SERVICE

Truck Capacity (Tons)	Operating Expense		
	Per Mile	Per Hour	Per Day
[illegible]	$0.16	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	16.24
[illegible]	.21	.95	15.20
1	.20	.71	[illegible]
1½	.27	[illegible]	13.76
2½	.15	[illegible]	8.00
3	.42	[illegible]	15.04
3½	.25	.70	11.20

* Includes repairs and all operating expenses, but exclusive of drivers' wages.

A comparison of the costs of electric and gasoline-driven trucks (Table V) shows very conclusively that the electric is far cheaper to operate. It must be remembered that each type has a field of its own. The field of the electric truck probably lies largely in the cities, where high speeds cannot and should not prevail, where streets are well paved and where mileage is low.

There are numerous establishments throughout the country that apparently imagine that because a truck runs all day it must cover a lot of ground. Such is not the case. The average truck that operates eight hours per day is only actually running about 30 per cent of the time—and most run far less than this—the rest of the time being taken up in loading, unloading and waiting for one thing or another. Thirty per cent of eight hours is 2.4 hours, and at an average speed of 10 miles per hour a truck will cover only 24 miles per day. For light trucks this may be a little low, but for heavier trucks it is high, and it may be taken as a fair average.

TABLE IV—EXPENSE* OF OPERATING GASOLINE TRUCKS USED IN HAULING CONCRETE CONSTITUENTS

Size Truck (Tons)	Operating Expense		Overhead		Total	
	Per Mile	Per Day	Per Mile	Per Day	Per Mile	Per Day
2	$0.104	$5.20	$0.052	$2.63	$0.156	$7.83
3	.130	6.50	.052	2.63	.182	9.13
5	.152	7.50	.074	3.70	.226	11.30

* The operating expenses include gasoline, lubricants, tires, repairs and maintenance. The overhead includes interest on investment, insurance, taxes and depreciation at 10 per cent. Drivers' wages are not included.

It is estimated that there are 900,000 commercial gasoline-driven trucks in this country, and it is safe to say that from an economical standpoint a large portion of these trucks might well be replaced by electric trucks.

Transformer Development Is Recalled by Anniversary

IN THE article by W. S. Moody entitled "Transformer Development Is Recalled by Anniversary," appearing on page 1018 of the ELECTRICAL WORLD for Nov. 19, the comparative tabulation of old-type and new-type air-cooled transformers should read 97.90 per cent for half-load efficiency of the Niagara units (1896 design), instead of 98.90 per cent. The floor space dimensions for present practice noted in Fig. D and in the tabulation should be 27 in. x 53 in instead of 47 in. x 53 in.

Harriman Points Out Need for St. Lawrence Power

THE general plan and benefits of completely canalizing and electrically developing the St. Lawrence River was the subject of several intensely interesting addresses presented before a joint meeting of the four major engineering societies in New York not long ago. The large auditorium of the United Engineering Societies was filled to its capacity. Addresses were delivered by W. I. Harriman, president of the New England Power Company; Julius H. Barnes, representing Secretary of Commerce Hoover; Governor Allen of Kansas, ex-Governor Harding of Iowa and R. S. McElwee of Georgetown University.

Mr. Harriman expressed the belief that New York and Boston do not understand the basis of the St. Lawrence River project or they would not object to it. Despite the fact that the canalization of the St. Lawrence and the development of one power site (1,500,000 hp.) will cost about $250,000,000, the sale of energy from the one development at only 2 mills per kilowatt-hour would offset the total operating expenses, Mr. Harriman declared. Considered as a whole, the St. Lawrence development will afford about 4,500,000 hydro-electric horsepower, which is equivalent to 24,000,000 tons of coal burned for power generation in the most efficient stations.

If the St. Lawrence is developed, New York State will be entitled to one-quarter of the total output, New England to an equal amount and Canada to one-half. Mr. Harriman expressed the belief that Canada would be willing to let the United States have more than its share because the Dominion could not find a market for the output for some years to come. However, he pointed out that the entire power needs of the Middle Atlantic Superpower Zone in 1930 would not be much more than that which would be made available by development of the St. Lawrence.

Referring to the uses to which St. Lawrence power could be put in New England, he declared that there are 1,500 miles of railroad in that territory that could be electrified at a cost of $60,000,000 to $80,000,000. The annual charges on this investment would be offset to a great extent by the substitution of a thirteen-million-dollar power bill for the present thirty-million-dollar fuel bill. The saving in coal is only one economy that would be effected, however. In the course of ten years New England utilities would be able to absorb one and one-half to two billion kilowatt-hours. An equal amount could be absorbed by industries now generating their own power.

Governors Allen and Harding referred to an organization of eighteen states in the upper Mississippi valley, represented by their respective governors; that favor canalization of the St. Lawrence River and are intent on pushing it through. Both speakers made the claim that the saving in freight charges on grain alone which would be effected would pay for the St. Lawrence project in one year. Countries as distant as Argentina are now 12 to 18 cents per ton closer to New York in transportation charges than Iowa or Kansas. This makes it difficult for American farmers to dispose of their surplus production.

Mr. Barnes, who had charge of shipping food products abroad during the war, expressed the belief that the St. Lawrence project offers opportunities for large economies and great relief to agriculture.

Letters from Our Readers

This is a readers' forum. Comments on questions before the electrical industry presenting economic, financial, engineering or commercial aspects and new or supplementary viewpoints on published articles are cordially invited

Colorado River Development

To the Editors of the ELECTRICAL WORLD:

The Colorado River Commission was created by the League of the Southwest. The object of this commission is to collect the physical data relative to the available water supply and irrigable areas in the Colorado River basin to be used in the adjustment of the claims of the various states for power and irrigation. This adjustment is to be made by the Treaty or Compact Commission which has been created by the legislatures of the several states and the Congress of the United States.

The Colorado River Commission has no work before it at present except the collecting of the data above mentioned for the use of the Treaty Commission. The treaty commission can be ready to function as soon as the President appoints the government member, as all the states interested have already acted. In five of the states, I believe, the members of the Treaty Commission are members of the River Commission, and it is expected that the River Commission will act as consulting engineers for the Treaty Commission.

The public has been informed of some of the objects of these commissions. They are to get rid of the interminable, expensive and exasperating litigation that will surely occur unless such action as contemplated by the commission is taken. With such a compact entered into by all of the states and the federal government, development may go on uninterruptedly in all the states and in an orderly manner.

The United States Reclamation Service has already collected sufficient information relative to the water supply of the basin to show that there is enough water for the irrigation needs of the whole basin if properly handled. Consequently irrigation development in any particular territory need not be halted to any appreciable extent.

The power problem is somewhat different. We assume that irrigation should take precedence over power, since in a large measure, taking the basin as a whole, much of the territory will be without a market for power unless there is irrigation development. But large power units cannot be developed without great storage basins. In most cases it is hoped these can be planned so as to be utilized both for power and irrigation, and in such cases both interests can share in the cost of construction and maintenance. There may arise some delicate problems in this connection which will have to be ironed out, and the River Commission should be able to give material aid.

Looking to the operation of this basin as a whole, the configuration of the country is such that the various irrigation units can be operated independently and should by all means be so operated, but we can conceive of a time when the water power of the basin may give the best service by being tied together and operating as a unit.

These problems must be treated in a liberal and unselfish manner. It is a problem that should be given our best and most conscientious thought, and selfish extremists on one side should not scheme to prevent development by the other.

A. J. McCune,
Chairman Colorado River Commission and
Colorado State Engineer.
Denver, Col.

Future of Vacuum Tube in General Engineering Field

To the Editors of the Electrical World:

From my personal observation it appears that the profession is inclined to look upon vacuum-tube development with more or less indifference. Of course, every engineer must admit that the application of the electron or vacuum tube to the art of radio communication has brought about a revolution in that field, but it would seem that the vacuum tube is going to experience the period of doubt and criticism that other great inventions have weathered, since the mere mention of the possible entrance of this device into the general engineering field brings forth a storm of objections. There appears to be a lack of vision and foresightedness on the part of many men who are so seasoned with experience and practice that they are unable to appreciate the possible application of a device more or less shrouded in theoretical calculations.

That the electron tube is a real healthy youngster well worth watching there is no doubt. But a very short time ago it was just able to take a few milliamperes as a regular diet; then it grew up and now it is able to digest no small number of amperes, and Dr. Hull of the General Electric Company believes that it will soon have an appetite that will have to be satisfied with kiloamperes. When it reaches the last stage it will be an engineering device of no mean importance looking for a place in the affairs of the electrical field.

Will the perfection of the electron tube usher in a new era of direct-current application? To some this may sound like the rankest kind of idle speculation, but to those of us who have kept our eyes on vacuum-tube development the suggestion is at least alluring. The writer does not mean to infer that the vacuum tube as a rectifying device is going to abolish the use of alternating current. He simply means that it will be possible to use direct current where it is most needed and where its place is being taken today by alternating current for good engineering reasons.

The supremacy of the direct-current motor for locomotion is well known and the reasons are well understood. Will it ever be possible to install a battery of vacuum-tube rectifiers on an electric locomotive and operate the driving motors with direct current from an alternating-current line as a source?

The power substation offers another possible field for the application of the vacuum-tube rectifier. Here it would replace the costly synchronous converters. It almost sounds too good to be true to say that a few glass tubes tucked away on a shelf will replace a machine that would cost several times as much as the tubes.

High-voltage direct-current transmission is the most interesting phase of the question to be considered. At this point it might be well to quote Dr. Hull of the General Electric Company: "Twenty years will see direct-current transmission lines, fed through transformers and kenotrons at any convenient points by alternators of any frequency and tapped by the same tubes, acting as magnetron alternators, or some equivalent pliotron or combination vacuum-tube alternator." It is certain that the use of high-voltage direct current would be a remedy for most of the ills of our present-day long-distance lines. The serious power losses now caused by inductive effects, capacity effects and "skin effects," with the consequent fluctuations in line voltage, would be entirely abolished.

The use of vacuum tubes in the electrochemical industry is also another possibility. However, special conditions exist in this field, and the tubes that are being developed at present could not be applied to this work since they are essentially high-voltage devices and electrochemical service calls for a low-voltage tube. Tubes, as they stand today, can be operated on low voltages, but their efficiency falls off rapidly. It is more than remotely possible, however, that a low-voltage rectifier will be perfected that will function with reasonable efficiency. Perhaps a vapor tube of some sort will find use in this work.

Although the efficiency of vacuum-tube rectifiers is low when they are operated with low voltages, the efficiency increases rapidly with increases in voltage. Engineers who are at work in this field see no reason why tubes cannot be made to operate with an efficiency as high as 99 per cent.

There are a thousand and one other applications of the vacuum tube that cannot be mentioned in the space of this letter. The whole thing deserves the careful thought of every engineer. What is needed is more tolerance and patience on the part of those who are skeptical. There were probably a great number of skeptics when Tesla brought forth his induction motor. Will history repeat itself? Already the vacuum tube has got past the stage of being a scientific plaything, in which light many engineers have regarded it. It has reached a stage where at least its possibilities must be recognized.

Raymond Francis Yates.

New York City.

Unifying Great Britain's Electric Service

To the Editors of the Electrical World:

One of the most remarkable pieces of reconstruction work undertaken by Great Britain since the war is being carried out by the Electricity Commission. It aims at establishing one great electric service system which, with minimum coal consumption and standardization of generating systems, frequencies and pressures, shall supply the manufacturing and domestic needs of the entire country. So far as possible these stations will be set up near mining areas to insure cheap transportation of coal. The reduction of costs will be reflected in the prices of all manufactures so that England should be better able to compete with world markets than at present. Besides, labor conditions will be greatly improved.

In the course of time it is safe to say that a great part of Britain's railways will be electrified. The saving will be immense, because of the amount of coal and labor now required to run them. When that period of development has been reached it will be possible to supply electric service to the country each side of the lines and to reduce the manual labor now demanded there.

Mark Meredith.

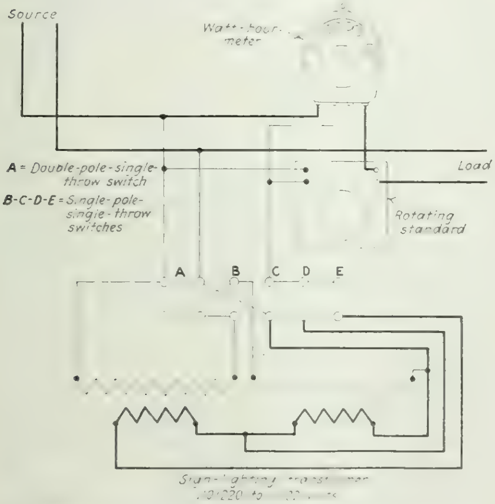
Liverpool, England.

Industrial and Station Practice

Installation, Operation and Maintenance of
Generating and Distribution Equipment and Economical Utilization of Electrical Energy
in Mills and Factories, Including Testing and Repair Methods

Testing Meters to Prevent Creeping on Abnormal Voltage

AFTER experiencing considerable difficulty from meters creeping while in service and finally tracing the trouble to high voltage on some of the lines, the Alabama Power Company adopted a simple and inexpensive method of testing all meters for creeping on voltages as high as 20 per cent above normal. The result is that not a single meter installed during the past eight months has been reported as creeping on no load.


Source
Watt-hour meter
Load
A = Double-pole-single-throw switch
B-C-D-E = Single-pole-single-throw switches
Rotating standard
A
B
C
D
E
Sign-lighting transformer 110/220 to 11/22 volts

CONNECTIONS FOR TESTING METERS FOR CREEPING ON ABNORMALLY HIGH VOLTAGES

Line Volts	Switches Closed	Volts on Meter	Voltage Raised, per Cent
110	C	110	0
110	B & D	115.5	5
110	A & D	121	10
110	A & E	132	20
220	C	220	0
220	B & D	231	5
220	B & E	242	10

An ordinary sign-lighting transformer (110-220 volts to 11-22 volts) was installed in the potential circuit of each meter-test bench as shown in the accompanying sketch. The primary coils were arranged for either series or multiple connection by means of the switches *A* and *B*, and the secondary coils were connected in the familiar booster manner to raise the voltage 5, 10 or 20 per cent. The opposite effect of lowering the voltage can be obtained by reversing the connections of the secondary coils.

In practice the meters are first tested for creeping at ordinary line voltage with no load; next the regular test is made, and finally they are again tested on no load but at 10 per cent above normal voltage. The table shows voltages obtainable by this method.

J. B. RIVES,
Alabama Power Company, Meter Department.
Birmingham, Ala.

Single-Lamp White-Way Posts Supplant Cluster Lights

DURING the past year the small cities and towns throughout the Middle West have shown a very gratifying interest in improved ornamental illumination for their streets. Many of these towns have never had any form of street illumination other than relatively low-intensity overhead fixtures at street intersections, but the majority of them are interested in replacing obsolete and inefficient systems of ornamental lighting with more modern equipment. The old style cluster post operated on low-voltage multiple circuits and manually controlled, individually or in small groups, was very popular ten or twelve years ago—so popular, in fact, that it is still difficult in some localities to convince the prospective buyer that it is not the most suitable and attractive post. However, in the majority of cases the installations made in recent years have been of single-lamp units similar in design to that shown in the photograph and operated on series, constant-current circuits. Chief among the advantages of this system are increased illumination at a lower power consumption and lower maintenance cost due to this and to less glassware and fewer lamp renewals. A typical instance presents itself in the town of Marion, Ill., where a cluster-post installation had been in operation for a number of years. The cluster posts had been installed without particular regard for uniform illumination or symmetrical appearance, and their operation was made difficult for the reason that there was no central point from which all the units could be controlled. These obsolete units were recently removed, and in their place were installed single-lamp posts equipped with 2,500-lumen 6.6-amp. series units. In the illustration the cluster post and the single-lamp post replacing it are shown side by side.

NEW SINGLE-LAMP DECORATIVE POST TAKING PLACE OF OLD CLUSTER POST

These units are operated on six series circuits fed by three 24-kw. 6.6-amp. constant-current regulating transformers, each transformer being arranged to carry two circuits, one circuit burning all night and the other part of the night. Each circuit is only partly loaded so that there is ample capacity for making extensions in any direction by simply extending the cable and adding lamps as required.

The regulating transformers are virtually automatic in their operation, requiring no attention other than the opening and closing of the switches by a patrolman. Each outgoing panel is equipped with a 10-amp., 4,000-volt self-contained ammeter so that the secondary or lamp current in each pair of circuits may be read separately and a close check kept on the operation of the system. The main panel is provided with a full automatic oil circuit breaker with overload trip and under voltage release and also with an integrating watt-hour meter.

The ornamental standards are of cast iron, as this material is believed to be the most durable commonly used in ornamental post construction and at the same time lends itself readily to manufacture in pleasing shapes and designs. It is of interest to note that the cluster posts, which were also of cast iron, showed no appreciable deterioration after years of service, but were apparently in as good condition as when installed. It was first decided to use concrete posts, but after a thorough study of numerous installations of both concrete and cast-iron posts the specifications were rewritten for cast-iron ornamental standards. Further considerations were that the greater wiring space within the cast-iron post enables the use of safety devices and at the same time facilitates wiring. The cast-iron post is also more easily replaced in case of breakage due to a street accident.

The single-lamp standard is approximately 11 ft. (3.3 m.) in height over all. It was found that this height harmonized best with the building heights and gave a reasonably wide distribution of the light. An opal or diffusing top is used which avoids glare and gives a pleasing effect to the light. In this way the lighting units are not mounted so high that the ornamental and decorative effect is lost. There seems to be a tendency in some localities to ignore the fact that an ornamental lighting installation is intended primarily for ornamentation. This is sometimes lost sight of in attempting to obtain the very widest possible distribution and the maximum uniformity of intensity.

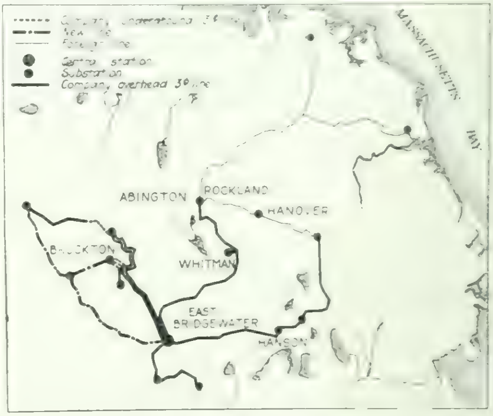
Westinghouse Electric & Mfg. Co., P. Y. DANLEY,
East Pittsburgh, Pa. Lighting Specialist.

Increasing the Reliability of Energy Supply

IN THE development of a territory such as that served by the Edison Illuminating Company ring transmission has proved to be very valuable in assuring continuity of service and permitting repairs to be made on sections of the line without interrupting service.

Originally the territory was fed from a single two-circuit line, but as the load steadily grew the two circuits rapidly approached the limit of their capacity. Moreover, being on a single-pole line, repairs were difficult to make without serious inconvenience through shutdowns. Consequently increased capacity over an alternate route became necessary.

A study of the territory and its probable growth led the company to believe that a new line running from the East Bridgewater generating station to the Stoughton substation and passing through the west side of Brockton would be of the maximum advantage. It was found that a connection could be made from the central Brockton substation to this line at a switching and transformer station to be erected on the line at the point where it came nearest to the center of the city. A study of the transmission plan shows that this line with its Brockton connection provides a ring feed through Brockton by way of the new and old lines and a larger ring through Stoughton and the northern industrial section of Brockton.



RELIABILITY OF TRANSMISSION SERVICE IN INDUSTRIAL SECTION INSURED BY FEEDING WITH LOOP SYSTEM

This meant that any of the substations in this district could receive energy from either direction and that any section of the line could be cleared, if made necessary by trouble or for ordinary maintenance work, without interrupting service at any point.

A private right-of-way was acquired and this line was built during 1920. As erected it is a wooden-pole line with 125-ft. (38-m.) spacing. It is armed to carry two circuits, but for the present only one has been run. This consists of three No. 1/0 stranded bare copper conductors run in triangular position on one side of the poles. The arms are long-leaf pine, 3¾ in. x 4¾ in. (9.5 cm. x 12 cm.), with wooden pins on the straightaways and malleable iron on the angles. The insulators are Locke No. 2012. No overhead ground wire was run. Considerable grading of poles was necessary, but the basic size was 30 ft. (9 m.), this small size being made possible by the fact that the entire line is on private right-of-way.

The connection to the Brockton substation is by cable, partly overhead and partly underground. The route followed is one of the main thoroughfares to the center of the city and the use of open wires was impossible. The cable is three-conductor No. 4/0 varnished-cambric-insulated, the underground portion being lead-covered and the aërial section steel-armored. The cable operates at 13,200 volts nominal pressure. There is nothing unusual in the cable installation. All lines are underground in the central portion of the city, the company's duct lines running out about one-half mile from the main substation. It was easy to use these as far as they extended. With construction costs at their recent level, the company hesitated to build additional duct lines for the remainder of the route and, in fact, felt that an aërial cable would be equally satisfactory.

The overhead line is just under 11 miles (17.6 km.) in length. It traverses much swampy land which made construction difficult, and the work was done when labor conditions were at their worst. The result was that costs were higher than had been hoped would be the case.

The switching and transformer structure was built to care for two through circuits, two cables to Brockton and two step-down transformer banks, with a building to house the 2,300-volt distribution panels and equipment. Only the control and metering equipment for the 2,300-volt distribution was housed, the other apparatus being of the outdoor type. The cable to Brockton is not yet complete, but the company expects to do the work this coming summer.

The ring feed has already proved itself most valuable, permitting repairs to be made on the old Stoughton line during regular working hours without interrupting the service.

W. A. FORBUSH,
Plant Superintendent.
Edison Electric Illuminating Company,
Brockton, Mass.

Adapting a Small Hydro-Electric Plant to Semi-Automatic Operation

RECENTLY it became necessary to adopt a 75-kva. hydro-electric plant where water was available only half the year to semi-automatic operation. The generating equipment was about quarter of a mile distant from the main station. Remote control from the latter was investigated, but was given up on account of expense. Therefore the semi-automatic scheme of control illustrated in the accompanying diagram was adopted, the plan being to start and stop the plant manually, but to do away with attendance during the running period and to get the utmost possible use out of the water. It was decided to take the risk of trouble from hot bearings or windings, depending on periodic inspections for indications of abnormal conditions.

The plant consists of a 90-hp. horizontal turbine belted to a 60-kw., three-phase generator having a direct-connected exciter. The control connections are taken from the line side of the automatic generator oil switch. The circuit passes through a three-pole main switch from which the middle leg is carried to a 550-volt, three-phase gate-controlling motor. The two other legs connect with two limit switches arranged to open against a spring by a dog attached to the hand wheel of the gate mechanism. From these the wires run to a double-throw float switch operated by a float in the forebay.

When the water in the forebay rises to a predetermined height the float trips the switch and causes the motor to open the waterwheel gate until the dog engages the arm of one of the limit switches and opens it, thus leaving the gate in this position. When the water in the forebay drops, the float throws the float switch into the opposite position, which is so wired as to reverse the motor and close the gate until stopped by the other limit switch.

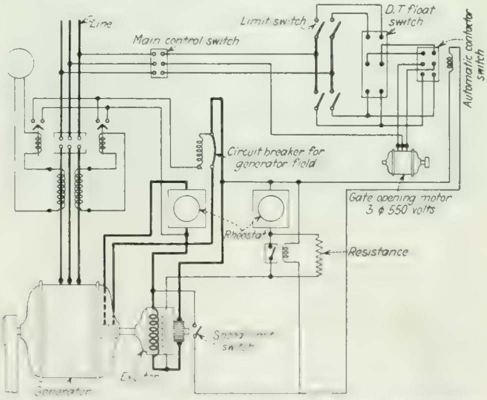
In order to prevent overspeeding of the generator when load is suddenly removed at full gate opening, an automatic contactor switch is placed in the closing side of the motor and so arranged that when it operates it will cut out the float switch. The voltage controlling this automatic device is obtained from the exciter through a speed-limiting device attached to the shaft of the generator.

To prevent excessive voltage while the generator is running at high speed a resistance is placed in series with the shunt field of the exciter. This resistance is normally shunted by an automatic circuit breaker, which also receives voltage for its operation from the exciter through the speed-limiting device. When the generator speeds up above normal the limiting device acts to close the contactor switch, thus lowering the speed, and at the same time opens the circuit breaker, throwing the resistance in series with the shunt field of the exciter. This position is maintained so long as the speed is above normal, but as soon as the gate has been closed to reduce the speed to normal the speed-limit switch ceases to act and the contactor and circuit breaker return to normal position.

An automatic circuit-opening hand-reset circuit breaker with field-discharge clip is placed in the generator field circuit and its operating coil connected to the exciter through contacts on the circuit-opening relays of the main oil switch, so that if any trouble occurs on the line or in the generator sufficient to open the main oil switch it will also kill the generator field and voltage cannot again be obtained until an examination has been made by an operator and the generator field circuit has been closed.

Voltmeters and synchronizing apparatus are installed at both ends of the line, and at the lower end is an indicating watt-meter with a zero-center scale.

Although this scheme does not include all the protective apparatus generally supposed to be necessary for an automatic station, it was considered satisfactory for this installation, especially as its expense is not prohibitive, for it can be assembled from standard apparatus. The development of reliable equipment of this kind which can be installed at a reasonable price should have a stimulating effect upon the development of the small water powers throughout the country.

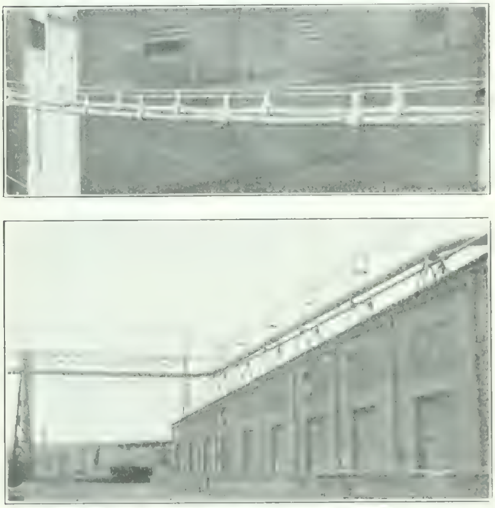

Line
Limit switch
D.T float switch
Main control switch
Automatic contactor switch
Circuit breaker for generator field
Gate opening motor 3 φ 550 volts
Rheostat
Resistance
Exciter
Generator

ARRANGEMENT OF GENERATING PLANT WHICH REQUIRES NO ATTENDANT WHILE RUNNING

I. W. PHILLIPS,
Electrical Engineer.
Perry & Whipple, Consulting Engineers,
Providence, R. I.

Revising Distribution System of Industrial Plant

THE distribution system of a growing industrial plant which uses a relatively large amount of power should be checked at frequent intervals and should grow in proportion with the load. With the low voltages customarily used for these systems the distribution system usually does not allow sufficient margin for large increases in load without a corresponding increase in the feeders. An underground-duct system, with its absence of overhead wires, gives probably the most nearly ideal solution of the distribution system for the average industrial plant. Especially with low voltages, a point is finally reached in a system of this kind where the aggregate heating effect of the cables will reduce the current-carrying capacity to a point at which it is not economical to add more copper unless the duct runs are split into two or more separate runs with sufficient space between to avoid heating between runs. Heating depends upon the current carried, and thus a limiting amount of power per run will be reached more rapidly as the voltage is reduced. When a duct system approaches this point cable temperatures must be carefully watched as unsafe temperatures will be reached at current densities far below the rated carrying capacities of the individual cables. Owing to the low utilization efficiency of the copper, it is sometimes economical to adopt other measures, and it may prove advantageous to step the voltage up and down again for comparatively short distances.



HEAVY THREE-PHASE CABLE FOR INDUSTRIAL-PLANT DISTRIBUTION SYSTEM

Above—Cable supported by split porcelain insulators attached to steel messenger. Below—Extensions to pipe supports hold up messenger wire.

In a recent survey of one industrial-plant distribution system using an average load of approximately 2,500 kw., at 440 volts, three-phase, 60 cycles, with an underground-duct system and paper-insulated, lead-covered cables, the following conditions were found: Much additional load had been added since the cables had been checked. Some old-type, low-speed motors gave a very low power factor on a portion of the feeders. The cables were being operated at currents closely approximating the limiting values for paper insulation in the tables given by the National Board of Fire Underwriters. The manholes had not been opened or the cables inspected for several years. The cables were operating at some points with a temperature of 130 deg. C., which would cause rapid deterioration of the insulation. The insulation had been damaged to a considerable extent. The total number of large cables in the ducts was such that the aggregate heating effect allowed a rather low current-carrying capacity in order to maintain a safe operating temperature in the ducts. Manhole ventilation could not readily be applied. Furthermore, a considerable amount of additional load was contemplated for the immediate future.

In studying the various possible solutions of this problem the cost of replacing the damaged cables and the addition of sufficient copper to carry the load without undue heating appeared prohibitive as an additional duct run would have been necessary. Somewhat less copper but a greater total outlay would result from replacing the duct run by a cable tunnel cooled by natural draft. Overhead construction for carrying the low-voltage cables was considered and discarded for several reasons. The weight to be carried would necessitate heavy structures. The large number of heavy cables would require a considerable overhead space, which could not readily be arranged. A locomotive crane was used quite generally around the plant; therefore overhead construction would probably be a nuisance. Large quantities of dust were produced which would accumulate and add considerably to the weight to be supported.

Stepping the voltage up to 2,300 would greatly reduce the copper required and offered the advantages of a reasonable cost, better deliveries of equipment, more nearly standard equipment and greater flexibility. The average feeder length was less than 800 ft.; and thus 2,300 volts was sufficiently high for satisfactory transmission and in addition presented some other advantages. Several large motors rating up to 400 hp. were to be added. With motors of this size 440-volt starting and control equipment is cumbersome and expensive and the higher voltage will be decidedly advantageous. In laying out the new work plans were made for the ultimate conversion of the entire system to 2,300 volts, including the rewinding of some of the larger motors. The demand has grown to approximately the full rated generating capacity of the power plant, and any extensive future growth will require additional generating equipment. A generator of from 3,000-kw. to 5,000-kw. rating at a voltage less than 2,300 is not desirable. Thus the introduction of higher voltages at the present time is merely anticipating a necessary move of the future if present plant growth is to be maintained.

Transformer capacity was determined by future as well as present requirements. Two groups consuming approximately 40 per cent and 50 per cent seemed a logical division of the load to be transmitted. The difference in the power factors of the two groups brought the kilovolt-amperes almost to an equal figure on both groups. In laying out the initial installation it was planned to feed the first group from one step-down station and to rearrange the old feeders to give additional copper to the departments in the second group. Six duplicate transformers of 500 kva. capacity, single-phase, 2,200 440 volts, with 5 and 10 per cent taps on the high-voltage side, were installed, three in each of the substations. As there was some doubt as to the location of future stations and as the step-up station was designed for an outdoor station, all the transformers were of the outdoor type. At such time as it becomes advisable to extend the 2,300-volt transmission the present step-up bank will be moved to the location for the second step-down station and a larger bank installed for the step-up station.

The location of the 2,300-volt lines between the stations was a rather stiff problem. For reasons already stated it did not appear advisable to install them overhead. The last duct in the cable system was filled and overloaded, a condition which could not be relieved until after the new lines were in operation. At this time deliveries were very poor on any type of cable. Sufficient 500,000-circ.mil, three-conductor cable was finally obtained for immediate delivery. This cable was not exactly what was desired, but it could be used. It was built to the following specifications: $\frac{3}{32}$-in. varnished-cambric insulation, $\frac{3}{32}$-in. varnished-cambric belt and tape and weatherproof braid finish. Obviously this cable could not be pulled into a duct system where partial submergence in water might be expected at times.

An overhead route was finally selected which apparently would cause comparatively little interference with operations of the locomotive crane. The general line of the steam main from the waste-heat boiler plant to the power plant was followed. Structural-steel extensions were placed on the pipe-line supporting towers, and $\frac{3}{8}$-in. seven-strand galvanized-steel messenger wire was stretched along the top of the extensions, the power cables being suspended from the messengers like telephone cables. The messenger was run continuously between dead-end points and was secured to the top of the towers by means of "J" bolts. The pipe-line supports were placed with average centers of 20 ft., which gave rather short spans for this type of construction. With a tight messenger and these short spans the sag was very small.

In order to provide some additional insulation and to prevent chafing, split-porcelain cable-clamp bushings were used at all points of support. Standard iron cable clamps were used around the porcelain bushings at the towers to prevent side sway. The intermediate span hangers were made of strips of galvanized sheet iron formed into the correct shape. A loose fit was obtained so that they were free to slip along the messenger in case of expansion or contraction.

At some points it was necessary to pass the cable through some of the buildings. At such points a form of conduit construction was used. As the runs included no bends, a piece of $4\frac{1}{2}$-in. steel well casing was placed in position. This was lined with $3\frac{1}{2}$-in. fiber conduit, which made a tight fit inside the casing. The cable was then drawn through the conduit. The ends were closed by means of split bushings which were made of treated hard wood.

Splices were made at several places in the line. A piece of $3\frac{1}{2}$-in. fiber conduit approximately 30 in. long was first prepared with treated hard-wood bushings of suitable size for a slip fit on the cable. The bushing and conduit were slipped over the cable ends. A standard sleeve joint splice was then made in the cable and insulated. The conduit was then slipped over the joint and both bushings were driven into the ends. All openings were filled by calking in friction tape. The joint was then poured full of a standard joint compound, and the filling openings were closed by wrapping with waterproof tape. The method was designed to follow as closely as possible the construction of the wiped joint in a lead-covered cable. The completed joint makes a very neat appearance and is far superior to the taped joint for large cables. The joint is more quickly made and the material cost considerably less than the taped joint.

No operating troubles have been encountered to date, and the installation is giving highly satisfactory service. The actual construction costs were considerably below the estimated cost for the customary type of overhead construction, although the cable used was somewhat larger than that called for by the original designs. The design and construction were rushed to relieve a pressing situation, and plans were radically altered where necessary to fit material available for immediate shipment. T. H. ARNOLD.

El Paso, Tex.

Steam-Storage Locomotive Successful for Shifting Coal Cars

FOR switching freight cars and other material a fireless steam-storage locomotive has been found very satisfactory by the Union Gas & Electric Company, Cincinnati, Ohio. On one charge the locomotive makes six to eight round trips (900 ft. and return) hauling three cars of 35 tons load each, weighing 28 tons empty. About 450 ft. of the trip is over a 2 per cent grade in combination with a 40-deg. curve. The remaining 450 ft. is straight and level. Three loaded cars are hauled on the up grade and three empties on the down grade, this making the round trip. Thus from 630 to 840 tons of coal will be handled per charge.

The locomotive, which was made by the H. K. Porter Company, Pittsburgh, is used for various purposes. When the railroads were hard pressed it was sent out to the nearby railroad yards, where it was connected to five or six loaded coal cars of 50-ton capacity and successfully brought them into our yards. It does miscellaneous switching of cars containing material and parts for our construction forces.

The locomotive is charged from a suitable connection provided alongside the track, the steam coming from our regular boiler plant at the West End Station, where this locomotive is in service. The charging periods are not regarded as a nuisance. The locomotive holds before charge 25,000 lb. of water. Steam at 250 lb. pressure and 200 deg. Fahr. superheat is fed in from the station boilers until there is a pressure of 225 lb., saturated, and a temperature of 397 deg. Fahr. in the locomotive. If the initial condition of the boiler is 312 deg. Fahr. temperature, 65 lb. pressure, 60 lb. (weight) of steam, the charge requires 2,400 lb. of live steam and the locomotive holds 27,400 lb. of water and 60 lb. (weight) of steam. Assuming an evaporation of 7.5 lb. of steam per pound of coal, a charge requires approximately 320 lb. of coal. This is approximate in that it does not take into consideration heat supplied or changes in weight of steam, but the latter are very small percentages of the total. The traction force is at least 20,800 lb. with the 40.-in. driving wheels. The weight of the engine is 45 tons. C. W. DE FOREST,

Manager Electrical Department.

Union Gas & Electric Company,

Cincinnati, Ohio.

Management and Policy

Embracing Central Station Commercial Organization and Management,
Customer and Trade Relationships, Public and Financial Policies, Advertising,
Selling and Service Methods

Allowing Customers to Finance Line Extensions

By "Kassandra"

THOUGH Mark Twain was not an electrical engineer, yet his account of Tom Sawyer and the whitewashing of the fence shows a grasp of a sound principle. Tom was annoyed when his aunt told him he must whitewash the fence. After he had started to work Tom let the other boys see how interesting it was to whitewash a fence until they wanted to take the job off his hands.

A recent commission decision was to the effect that a company should not require customers to finance extensions, but is there any reason why they should not be allowed to?

If a customer finances an extension by depositing with or loaning to the company the cost, the company can afford to pay a rate of return at least as high as it earns on its investment. Further, if it is agreed that the return or interest on the deposit or loan shall be paid only out of the income from that extension, the company can afford, when there is enough income, to pay a higher rate of return because the company is relieved of any obligation to pay the return if the extension is not profitable.

If the customer deposits the cost of the extension, the company has no initial outlay. If the company then keeps, say, one-half the gross income in ordinary cases (or perhaps two-thirds or four-fifths if the supply is to a large customer at a low rate per kilowatt-hour), the company gets cash to cover the increase in operating expense because of the energy supplied. So long as the initial cost is deposited by the customer and, say, half the gross income is retained by the company, the transaction needs no cash.

The balance of the gross income can then be applied, first, toward paying, say, 10 per cent on the deposit. If the use or gross income is small, there may not be enough to pay 10 per cent, but the company does not suffer, because it is not the company but the customer that has invested the money.

If, on the other hand, the gross income is so large that the company after reserving, say, one-half for operating expenses has enough left to pay 10 per cent and something more, the company can then gradually return the customer's deposit or pay off the loan just as it would have done if it had obtained the money from the bank. For various reasons it would be desirable to put a limit of time, say seven years, so that if at the end of seven years the deposit or loan had not been repaid in full, there should nevertheless be no further payment by the company, but after the seven years the company should retain all the income. In the ordinary case, however, the deposit or loan would be repaid long before the seven years was up.

If the customer was not in a position personally to finance the extension, he could nevertheless often arrange for it, as he could well afford to pay 6 per cent if he were going to get 10 per cent from the company on the extra amount.

It will be asked: "Why pay a customer 10 per cent for financing an extension when the bank will loan the company money at 6 per cent?" One reason is that the bank wants its 6 per cent and also wants its money back even if the extension is unprofitable, while the customer gets his money only out of what he pays for electricity. If the extension is unprofitable, it is the customer who loses, while if the company had borrowed the money it would be the company that would lose.

In the days of high money rates a company hesitates to solicit business which requires it to raise money, but it can well afford to solicit business on the terms described above. Such contracts should be very attractive to many prospective customers and can be taken without any risk.

The point is that though it is usually unwise, and under the commission decision above referred to is unlawful, for a company to require its customers to finance extensions, yet, on the other hand, a company can wisely permit customers to finance their extensions and can make such financing very attractive—so attractive, in fact, that the customer who is going to use the service may even get the money from his bank if he has not the cash on hand. The chief point, however, is to make the financing by the customers permissive and attractive rather than obligatory.

Electrical Equipment of a House Adds 25 per Cent to Selling Value

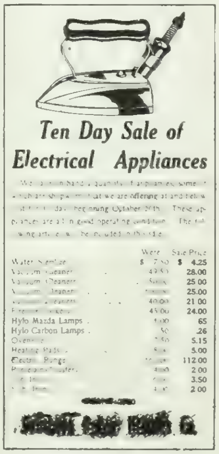
THE recent sale of the Louisville (Ky.) electrical home proves conclusively how complete electrical equipment of a house enhances its actual selling value by at least 25 per cent. Built to sell for $11,000 to $12,000, the home, which was promoted by the Electrical Club of Louisville and the electrical interests of the city, was sold at auction for $15,025 without furnishing.

CROWD AT AUCTION OF LOUISVILLE ELECTRICAL HOME

The extra price secured for the home is laid to the added appeal of the electrical equipment and conveniences. More than 15,000 people visited the home during the week's public exhibition, and on the day of the sale the house brought at auction $3,025 above the original maximum price.

Good Advertising Gone Wrong

IN THIS advertisement clipped from a newspaper in a certain city electrical appliances are offered at figures ridiculously lower than list prices. Moreover, the regular price of each appliance is stated and directly accompanying this is quoted the sale price of one-fourth to one-half that amount—one-hundred-dollar vacuum cleaners for $25, four-dollar electric flatirons and toasters for $2 and others almost as bad. At a time when every one in the electrical industry is striving to build up and standardize merchandising methods the advertisement comes as a startling reversion to old practices.



Ten Day Sale of Electrical Appliances

We have on hand a quantity of appliances, some of which are shopworn, that we are offering at and below [illegible] days beginning October 20th. These appliances are all in good operating condition. The following articles will be included in this sale.

	Were	Sale Price
Water Sterilizer	$ 7.50	$ 4.25
Vacuum Cleaner	42.50	28.00
Vacuum Cleaners	[illegible]	25.00
Vacuum Cleaner	[illegible]	25.00
[illegible]	40.00	21.00
[illegible]	45.00	24.00
Hylo Mazda Lamps	1.00	65
Hylo Carbon Lamps	.50	.26
Ovens	[illegible]	5.15
Heating Pads	[illegible]	5.00
Electric Range	[illegible]	112.00
[illegible] Toasters	4.00	2.00
[illegible]	[illegible]	3.50
[illegible]	4.00	2.00

[redacted]

A MIS-STEP IN ADVERTISING

It is stated in the advertisement that some of the appliances are shopworn and that the sale prices are below cost. But this statement is in small type and is an explanation that does not explain. The result is that these appliances are belittled by price cutting. Into customers' minds comes the question whether these appliances, if they are shopworn, were ever worth their original prices, or whether, if appliances can be sold for such prices, there must not be an enormous profit in electrical merchandise.

Such advertising may sell some appliances, but it is demoralizing to the local trade and worse for the public. True, stocks must be moved and shopworn devices can legitimately be sold for what they will bring. But the public must clearly understand the circumstances so that it will not confuse the value of a modern electrical device with that of a ten-year-old type of the same appliance.

Selling $364,000 of Preferred Stock to Electric Appliance Customers

SINCE January this year $364,000 par value of the Northern States Power Company's preferred stock has been sold to 600 of the persons who visited the company's Minneapolis salesroom to look at electric appliances. This is in addition to the ordinary sales by the securities department in that city, and it was accomplished by means of a sign, a desk and a man to answer questions.

Last winter T. C. Erringer, manager of the department, observed the large number of customers shopping daily in the electric appliance display room and decided to call their attention to the company's stock as an opportunity for investment. Results far surpassed all expectations, and the sale of stock in the display room has become as permanent as the sale of electric appliances.

Here is a fine example of the fact that the sale of stock to customers has become as much a part of the electric utility's service as is the supplying of electrical energy or the sale of electrical merchandise. The shopper should be enabled to investigate and purchase stock in the utility as easily as he inspects and buys a flatiron or a vacuum cleaner. Selling a few shares of stock to a customer in the display room is easier, too, because he is in the buying mood, and when he is sufficiently interested to make an inquiry he is already half sold.

What Other Companies Are Doing

Shell Rock, Ia.—The Shell Rock Electric Light & Power Company is having a report prepared by Holland, Ackerman & Holland, consulting engineers of Chicago, concerning the projected construction of a hydro-electric plant at Shell Rock. Definite plans will be formulated after the report is completed some time next spring.

New England.—Power engineers in New England working with the divisional N. E. L. A. organization are preparing a list of manufacturers classified under different industries which will give the names and addresses of a large number of representative concerns in different parts of the country that are using central-station service. Many central-station executives believe that in negotiating contracts for power service it helps materially to show the prospective customer a list of names of concerns in his own business which are buying energy from public utility companies.

Reading, Pa.—More new contracts to supply electric light and power are being signed now than at any previous period in the history of the Metropolitan Edison Company. As the same time, the company is again giving employees and customers an opportunity to share in its earnings through an offering of its 7 per cent cumulative participating preferred stock. The stock may be purchased for $93 a share cash or for $95 a share under a five-dollar monthly payment plan. In April, 1920, the same plan resulted in a total subscription by customers and employees of $600,000 of stock.

Illinois.—Cash sales of electrical merchandise by the Public Service Company of Northern Illinois during the first nine months of this year were $406,000. Although a slight decrease is shown as compared with the same period in 1920, it is because of the drop in appliance prices. Moreover, while the cash sales have decreased the time payment sales are increasing and the number of sales of the most popular appliances, namely flatirons, toasters, grills, percolators, chafing dishes, vibrators, fans and portable show increases. Vacuum cleaner sales increased from 1,436 in 1920 to 1,738 in 1921 for the nine-month period.

Ashland, Ohio.—Believing that "eating is learning," T. C. Brill, commercial manager of the Ashland Gas & Electric Light Company, staged a demonstration of electric waffle irons in the company's store at a time when customers were coming in to pay their light bills. A series of three letters had previously been sent out to a selected list of women inviting them to attend the demonstration. As each visitor entered the store she was greeted by a demonstrator, was seated at a table and was served with waffles cooked on the table before her. No attempt was made to sell appliances, but each visitor was asked to write her name and address on a card. These made an excellent mailing list of prospects for waffle irons and other appliances.

Digest of Electrical Literature

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press of the World

Generation, Transmission and Distribution

Locating Faults in Direct-Current Single-Series Windings.—B. A. BRIGGS.—This article explains the requirements for single-series armature windings, effects of open circuits, how to test and locate these defects, and methods of repairing open circuits.—*Power*, Nov. 1, 1921.

Commutation on Direct-Current Machines.—CLAUDIUS SHENFER.—A discussion of the design features of commutators with relation to decreasing reactance voltage. Experimental data are given to prove the theoretical statements.—*Journal A. I. E. E.*, November, 1921.

Hydro-Electric Developments in Foreign Countries.—F. ROWLINSON.—An article discussing the principal hydro-electric developments in other countries which by their size or originality are of especial interest. The countries taken up are Norway, Canada, Australia, Tasmania, New Zealand, India, Switzerland, Spain, Italy and the nations of South America.—*Beama* (British Electrical and Allied Manufacturers' Association), October, 1921.

St. Lawrence Waterway Project Report.—W. A. BOWDEN and Col. W. P. WOOTEN.—The text of the engineering report on canalization and power development submitted to the International Joint Commission. This particular report deals with Divisions No. 4 and No. 5 and ice conditions on the St. Lawrence River.—*Canadian Engineer*. Oct. 6, 1921.

Queenston-Chippawa Power Scheme.—A discussion especially of the difficulties in constructing the canal and a description of the hydraulic equipment installed in the plant being built at Queenston.—*Electrical Times*, Sept. 22, 1921.

Lamps and Lighting

Car Lighting by Electricity.—CHARLES W. T. STUART.—A description of one type of safety lighting equipment used on railroad cars.—*Railway Electrical Engineer*, November, 1921.

Railway-System Lighting.—J. H. KURLANDER.—A treatise on the proper light intensity, quality and distribution for railway shops, stations, yards, etc. The foot-candles necessary for proper lighting and the different types of units and desirable spacings are listed for all of these locations, including roundhouses, erecting shops, car shops, foundries, machine forge and wheel shops, yard and scale houses, turntables, coaling stations, terminals, train sheds, loading platforms, repair pits, etc.—*Bulletin of Edison Lamp Works* (L. D. 128, Index 71).

Illumination Values and Measurements.—A listing of the foot-candle intensities for almost every important industry, arranged in alphabetical order. The majority of the listed locations require an illumination within a range of from 3 foot-candles to 6 foot-candles or from 6 foot-candles to 12 foot-candles. The industries are arranged in another set of groups, in which those taking like numbers of foot-candles are all in one group. The method of making and recording illumination measurements is described so that it may be applied to any type of building. — *Bulletin E-101, Westinghouse Lamp Works.*

Reflectors for Incandescent Lamps.—A. B. ODAY and A. S. TURNER, JR.—A general discussion of the different types of reflectors and detailed data on each separate type. These data include a distribution curve for each type of reflector and a description of such characteristics as materials, shape, distribution, diffusion, glare and maintenance. The applications to which the reflectors are suitable are named under each type.—*Bulletin of Edison Lamp Works* (L. D. 123, Index 22).

Traction

Electric Traction Proposed for Eleven Railroads.—An estimate of the results which will be brought about on the railroads of the Northeast by the adoption of a superpower scheme. It is held that about 19,000 miles of railroad in this section could be electrified. This would cost nearly half a billion dollars, but it is estimated that it would pay from 11 to 19 per cent, or an average of 15 per cent, per year on the investment. The maintenance of the electric distribution system is taken at $600 per mile of train track and $400 per mile of yard track. The cost of operation and maintenance of substations is based on $1.50 per kilowatt per year of capacity, giving 0.7 mill per kilowatt-hour for a capacity factor of 25 per cent. Cost of the catenary system and electric equipment is recorded in this article in complete form in a table.—*Railway Electrical Engineer*, November, 1921.

High-Speed Monorail Traction System.—M. MAHL.—Between the twin cities of Barmen and Elberfeld in Germany there has been in successful operation for about twenty years a monorail overhead-trolley system traveling at the rather high average speed of 20 miles an hour. The author of the somewhat visionary paper under notice gives a very elaborate and detailed description of a similar monorail road, capable of traveling 200 miles an hour, and intended to connect Paris with Nice, a distance of 600 miles, to be traversed in three hours. Instead of using a solid girder construction to support the single running rail, Mr. Mahl has chosen a rail held by a catenary cable suspension system. There is one driving wheel provided for each meter's length of the vehicle. Each of these driving wheels has an inbuilt gearless 40-kw. motor weighing 550 kg. The complete car would weigh about 1,350 kg. per meter, or for a length of 50 m. about 65 tons, including passengers. To increase the adhesion of the wheels, a magnetizing winding is embedded in the outer part of the wheels. Steel towers, weighing each about 7,000 kg., are supposed to be erected every 50 m. on the level and every 30 m. on grades. Six steel cables, 45 mm. in diameter, support the rail. The entire supporting structure would weigh about 400 tons and cost about 500,000 francs per kilometer. The author suggests that a similar system could be used for hauling ships along the many navigable canals in France. In that case the monorail would be a cog rail, into which a pinion driven by a 10-hp. motor would mesh.—*Bulletin de la Société Française des Electriciens,* July, 1921.

Stimulating Freight Transportation on Street-Car Lines.—R. WOLFF.—The author suggests maintaining, besides the regular passenger service, a regular service of trolley cars for exclusive freight transportation. To each freight trolley car he would connect one or two storage-battery-driven trucks with pneumatic wheels, which would run from the end of the trolley line to the establishments of out-of-town customers. Figures are given to show the rentability of such a system.—*Elektrische Kraftbetriebe und Bahnen,* October, 1921.

Installations, Systems and Appliances

Locating Electrical Trouble on Elevators.—WILLIAM ZEPERNICK.—Definitions are given for grounds, short circuits and open circuits, and the proper methods of grounding power systems are described. The troubles which may develop in elevator control apparatus are explained and various methods of locating them are illustrated by examples. Troubles which may develop on the motors themselves are also discussed.—*Power,* Nov. 15, 1921.

Protection of Transmission Lines with Condensers.—GEORGE LEWIS.—Use of condensers for protecting transmission lines against high-voltage high-frequency potentials. This type of arrester, it is stated, is used commonly in Europe.—*Electrical Review,* Nov. 5, 1921.

Application of Electrical Energy in Lumber Mills.—W. A. SCOTT.—A description of motor application to various drives in the lumber mills of the Southwest. Sizes of motors and methods of connection to driven machines are given. Special requirements peculiar to the lumber industry and the use of mill refuse as a fuel to generate electric power are also discussed.—*Electrical Review,* Nov. 5, 1921.

Oil Switches for Voltages Up to 35,000.—S. TAUBE.—The author describes in minutest detail the mechanical and electrical construction of the latest types of B.B.C. oil switches, placing greatest stress upon the automatic opening device, clutch construction, magnetic and motor drive, signaling system and remote control. The short article contains twenty-seven illustrations.—*Brown-Boveri Mitteilungen,* November, 1921.

Electrochemistry and Batteries

Commercial Electrolysis of Zinc Sulphate Solutions.—SAMUEL FIELD.—Description of the deposition of compact yet detachable sheets of pure zinc from zinc sulphate solutions derived by the leaching of zinc ores with sulphuric acid. The kilowatt-hour consumption per ton of zinc deposited with various currents and compositions of liquors is tabulated.—*Transactions of Faraday Society,* Vol. XVI, Part 3, 1921.

Electroplating for the Prevention of Corrosion.—LESLIE AITCHISON.—A discussion of the protection of iron and steel against corrosion by covering the surface with a layer of some material which will perform two functions. The first function is that the layer must possess permanence in a high degree, and the second is that the layer must be one which will prevent any access to the metal of corrosive agents usually destructive.—*Transactions of Faraday Society,* Vol. XVI, Part 3, 1921.

Gray-Iron Castings from Electric Furnace.—THOMAS ROBSON HAY.—Present electric practice for making gray iron and some of its advantages over the older methods are recounted. The better qualities of the product and the ease of regulating temperatures are pointed out.—*Iron Age,* Nov. 10, 1921.

Electrophysics and Magnetism

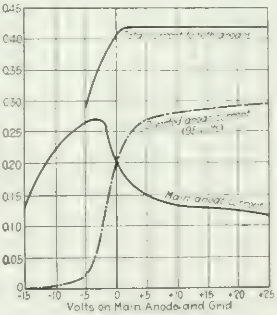
Advances in Production and Application of X-Rays.—J. S. SHEARER.—A discussion of the history and the principles of X-rays and their application to fluoroscopy and radiography. Their uses to discover flaws in metals and in the examination of crystals are two noteworthy applications in addition to the usual ones in the field of medicine.—*Journal of Franklin Institute,* November, 1921.

Magnetic Susceptibilities. — S. R. WILLIAMS. — An article treating first of the classification of magnetic substances into diamagnetic, paramagnetic and ferromagnetic. An attempt is made to locate the origin of the property of susceptibility.—*Science,* Oct. 14, 1921.

Telegraphy, Telephony and Signals

Development of Army Wireless During the War.—A. G. T. CUSINS.—A history showing the progress of developments in the wireless field, the evolution of service apparatus, the present trend and possible advance in this field.—*Journal of Institute of Electrical Engineers,* Vol. 59, No. 303.

Negative Resistance Device for Wireless Telegraphy.—JOHN SCOTT-TAGGART.—Two articles regarding the use in wireless telegraphy of devices having negative resistance characteristics. These devices are respectively the "negatron" and "biotron." The chief value of a negative resistance is that if it is connected in series with a positive resistance circuit, it will comparatively or completely neutralize the ordinary resistance of the circuit. This property enables signals of all kinds to be greatly amplified and is therefore of great value in radio telegraphy.—London *Engineering,* Oct. 21, 1921.



NEGATRON WHICH HAS A NEGATIVE RESISTANCE COEFFICIENT

Miscellaneous

Science of Electric Welding.—W. E. RUDER.—This article starts with a history of the art of electric welding carried through to the present development. A comparison between the carbon and the metallic electrode is made. The physical properties of welds are discussed, and a number of illustrations show micrographs of various welds and welding rods, telling what is good and what is bad. Methods of testing welds are also discussed. The article states that during 1920 the sum spent for arc-welding apparatus, exclusive of accessories and supplies, was $2,000,000, while the accessories and supplies cost $2,500,000. A discussion of welding generators and of automatic arc welding is included.—*Journal of Franklin Institute,* November, 1921.

Books of Technical and Industrial Interest

Waste in Industry. By the Committee on Elimination of Waste in Industry of the Federated American Engineering Societies. Washington, D. C.: Published by the Federated American Engineering Societies. Sole selling agents, McGraw-Hill Book Company, Inc., New York. 399 pages.

How can the American workman maintain a high standard of living and yet compete with cheap foreign labor? The socialist, the social worker, the political economist and others have proclaimed their respective plans, but it has remained for the engineer to get at the root of the thing, namely, to point out the giant evil that must be overcome and place the responsibility for its existence. Waste—unproductive, lost effort, money thrown to the four winds, in tremendous amounts—here lies the great obstructive factor in the problem, and to its reduction the serious thought of industrial leaders and labor leaders, and indeed of all good citizens, must be directed.

Herbert Hoover, when he became leader of the Federated American Engineering Societies, called for a study of the causes of industrial waste. An organization was quickly formed, plans were made, work was laid out, and a study of six typical branches of industry was started which continued for five months. These industries were: Building, men's clothing manufacturing, shoe manufacturing, printing, metal trades, and textile manufacturing. A few plants were chosen in each field for analysis, and from these reports the extent of the waste and the responsibility for it were evaluated. To management, it is shown, belongs the greatest responsibility because of its greater opportunity; to labor falls the next largest share, and to outside causes the remainder. There has been no attempt to make the report a complete handbook on how to detect and eliminate waste. It does, however, reveal a carefully thought-out method for searching out waste in any establishment. For those engaged in the particular industries studied the report, of course, has an added value, but its application is by no means limited to these industries. A number of very interesting situations are revealed. For instance, it is shown that the loss from strikes and lockouts is almost negligible, at least so far as labor is concerned. The loss, on the other hand, from illness is tremendous, as is also that from accidents. The lack of careful planning of production is evident. The volume concludes with general reports by specialists in each of the following topics: "Unemployment," "Strikes and Lockouts," "Legal Machinery for Adjusting Disputes," "Industrial Accidents," "Health of Industrial Workers," "Eye Conservation," "Purchasing and Sales Policies."

To factory executives this report is recommended (1) as a means for understanding the enormity of industrial waste and (2) as a means for studying individual plants. The work of the committee might be profitably supplemented by a more detailed analysis of the engineering conditions and a fuller interpretation of the data supporting the conclusions drawn.

Wechselstrom-Leistungs-Messungen. By Werner Skirl. 278 pages, 215 illustrations. Berlin: Julius Springer.

In extended networks it is frequently necessary to make electrical measurements of various characters in the field rather than in the laboratory. Such measurements will therefore be made in many cases by men less skilled and experienced in the proper use of methods and instruments than the regular laboratory force. For these less experienced men this book is written. Not only is the method best suited for each particular case given, with necessary wiring diagrams, but also a full description of the instruments used and directions for their proper care will be found in this book. Special attention has been given to all high-voltage measurements and to the proper use of potential and current transformers. The use of these transformers is urged also for low-voltage lines, and very reliable so-called semi-indirect methods are described where the transformer is used in a manner similar to a shunt in direct-current practice. Of special interest will be found the section on calibrating methods used for wattmeters and watt-hour meters. In its arrangement the book is primarily a reference book, giving ready and exhaustive information on all matters pertaining to alternating-current measurements and methods.

Die Porzellan Isolatoren. By Prof. G. Benischke. Berlin: Julius Springer. 94 pages, 128 illustrations.

It is impossible in a book of such small compass as this to treat the entire subject of electric porcelain insulators in a way to satisfy fully both the ceramic manufacturer and the electrical engineer. The author has, therefore, confined himself to a rough and very short outline of the manufacture of insulators and deals at length with their electric properties, types and testing. The book contains nothing new to the experienced high-voltage engineer, but contains, well described and illustrated, all necessary data on its diversified subject.

A. S. T. M. Standards. Philadelphia: American Society of Testing Materials. 890 pages.

The 1921 edition of this volume, which is issued triennially, contains 160 standards as follows: Sixty-one relating to steel and wrought iron, thirty-one to nonferrous metals, nineteen to road materials, eighteen to cement, lime, gypsum and clay products, ten to preservative coatings and lubricants, seven to pig and cast iron and finished castings, six to timber and timber preservatives, four to coke and coal, two to rubber and two to miscellaneous. These standards are recognized as authoritative in the field of engineering materials.

Books Received

Coil Ignition for Motor Cars. By C. Sylvester. London: Sir Isaac Pitman & Son, Ltd. 224 pages, 221 illustrations.

The Electrical Transmission of Photographs. By Marcus J. Martin. London: Sir Isaac Pitman & Sons, Ltd. 134 pages, 132 illustrations.

Electrical Transmission of Energy. By W. M. Thornton. London: Sir Isaac Pitman & Sons, Ltd. 113 pages, 49 illustrations.

The Electric Furnace. By J. N. Pring. London: Longmans, Green & Company. 483 pages, 426 illustrations.

Switzerland: A Commercial and Industrial Handbook. By H. Lawrence Groves. Washington: Government Printing Office. 128 pages, 13 illustrations.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

Adjusting Government Undertakings to Business Needs

IN ORDER that the federal government may be in a better position to adjust the volume of public works undertaken by it to conform with the needs of business Senator Kenyon of Iowa has introduced a bill granting additional authority in this regard to the executive departments and authorizing the collection of additional statistics. Hearings on the bill have been set to begin Dec. 2.

Government to Make Legal Powers of Trade Associations Clear

FUNCTIONS and activities that trade associations may legally engage in will soon be announced by the government, E. W. McCullough, manager of the fabricated production department of the Chamber of Commerce of the United States, told the American Face Brick Association at its annual convention, held on Dec. 2 at White Sulphur Springs, W. Va. He said that such a statement would have been issued before this but for the fact that several governmental cases are now pending against certain trade associations, involving such questions as the proper use of statistics, open price plans and averages in cost accounting.

According to Mr. McCullough, Secretary Hoover of the Department of Commerce desires closer contact with the industries through their associations, but Secretary Hoover has intimated that such organizations should put themselves in position to speak for their industries by including in their membership the largest possible representation, and also through the perfection of their machinery for gathering, analyzing and compiling all desirable information of service not only to themselves but to the government and the public.

Patent Office Conditions Become Still Worse

WHEN Commissioner Newton was in charge of the Patent Office in July, 1919, he testified before a committee of Congress to the effect that the situation in his bureau was deplorable and worse than at any time since he joined the service in 1891. The present Commissioner of Patents asserts in his report to Congress that conditions have grown steadily worse since the testimony of Commissioner Newton. Between July, 1919, and June 30, 1921, the Patent Office lost 163 of its examiners. "These men," says the Commissioner in his report, "were scientifically trained and also members of the bar. They have been replaced by inexperienced men, fresh from college, without any knowledge of patent law and without legal training." Continuing, the report says in part:

"The number of applications for patents increased 34 per cent during the period under discussion, while the trademark applications increased 85 per cent. In July, 1919, when Commissioner Newton testified, there were 18,000 patent applications awaiting action. There are now about 50,000. A number of divisions are over eleven months behind in their work. One out of every four examiners has resigned in sixteen months and more than one-half have resigned in thirty-two months. Relief is, therefore, indicated as imperative."

The assistant examiners, who are a highly educated and picked corps of scientific men, receive the same initial salary as clerks who perform routine duties in other branches of the government service. Note is made in the report of the inadequacy of the salaries paid to these technical men, which has made it impossible to retain them.

It is shown that there are many industries which cannot enter into development work on account of the doubtful status of their applications for patents. A bill is now pending in the House which is designed as an emergency measure to help relieve the situation.

Electric Utilities Have Average Coal Stocks Sufficient for Fifty-four Days

AN INVENTORY of coal stocks as of Nov. 1 taken jointly by the Department of Commerce and the Geological Survey shows that there was at that date a total of about 47,400,000 tons of coal in the hands of consumers, or approximately forty-three days' supply. This compares with stocks as high as 63,000,000 tons in the past. Electric public utilities were credited with an average supply sufficient for fifty-four days. The next inventory will be as of Jan. 1.

New Company to Develop Northern Indiana Water Powers

PLANS of the Indiana Hydro-Electric Power Company for the establishment of five large hydroelectric power plants along the Tippecanoe River in northern Indiana have been made public following the filing of a petition with the Public Service Commission asking authority to issue $1,250,000 in gold bonds and $4,500,000 of common stock. Of this stock $1,125,000 is to be placed on the market at once. The capital of the company is to be $5,000,000. Announcement of the completion of the plans marks the realization of a project that has been under consideration for many years.

The first power plant and dam of the company is to be erected at Norway, in White County, 2½ miles north of Monticello. When completed the plant will be operated by the Interstate Public Service Company, one of the largest electric operating companies of Indiana. Power developed after the needs of the Interstate company are met will be sold to other utility companies and the public. Through the construction of additional transmission lines, which are to connect with the Insull electric properties, all the power that is needed by many local plants will be available.

Incorporators of the new company are Harry Reid, Ira E. Guthrie and John A. Shafer. Samuel Insull of Chicago, president of Middle West Utilities Company, will be a director. Mr. Reid, who is president of the Interstate Public Service Company, will be vice-president and general manager of the new company. In addition to the Insull interests it is understood that Eastern capitalists are back of the project.

The five proposed units of the new company will have an aggregate installed capacity of more than 20,000 kw. The first unit at Norway, where construction work is to begin at once, will have a capacity of 6,500 kw. and will be capable of generating 25,000,000 kw.-hr. annually. The new company will take over all of the property of the Tippecanoe Hydraulic Company, which was organized a number of years ago. Approximately $300.-000 has already been expended in the acquisition of land, right-of-way and flowage rights.

Dayton Company to Lower Industrial Rates Voluntarily

EFFECTIVE Jan. 1, 1922, surcharges of 35 per cent against commercial light and power consumers supplied by the Dayton Power & Light Company of Dayton, Ohio, will be reduced to 25 per cent. This will make a net reduction of approximately 7½ per cent in the amount of the monthly bills to this class of consumers, company officials say. The reduction, which is voluntary on the part of the company, will not affect domestic rates, it is said.

The surcharges were placed in effect when increases in rates due to higher operating costs were made necessary. Prior to that time a blanket rate applied. Instead of changing this blanket rate, a system of surcharges for the different classes of service was instituted. The decision to lower the commercial rates, officials said, was based upon the expectation that coal prices will be lower after April 1, 1922, when new fuel contracts are to be made by the company.

Electrical Commercial Men to Meet in New Orleans in January

A SOUTHERN midwinter meeting of commercial electrical men has been arranged by the Electrical League of New Orleans to be held at the Grunewald Hotel, Jan. 17-20. The basis for this gathering will be the meeting of the bureaus and committees of the Commercial Section of the National Electric Light Association. The wiring committee of the N. E. L. A. is to meet on the seventeenth, the bureaus and committees of the Commercial Section on the next two days and the sections executive committee the twentieth.

Coincidentally with these meetings it is expected that there will be held meetings of the executive committee of the Southwestern Geographic Division, N. E. L. A., and also of the commercial men of the division and of the South generally, Louisiana and Mississippi members of the National Association of Electrical Contractors and Dealers, the Dixie Club, which is the Southern jobbers' association, and the Conference Club. Arrangements include the large general meeting for all to discuss broad questions of timely interest to the industry.

The local committee in charge of the meeting is composed of Robley S. Stearns, chairman; W. E. Clement, Lyman C. Reed, C. S. Barnes and Frank H. Ames.

Arrangements are being made also for a stop-off at Atlanta for the wiring committee and any others interested to see an exhibition of changing insulators on live high-tension lines of the Georgia Railway & Power Company.

Chamber of Commerce Studying Distribution Problems in the Field

IN ITS investigation of the varied problems affecting distribution of goods the committee of the domestic distribution department of the Chamber of Commerce of the United States will hold a series of open hearings in different parts of the country so as to learn by intimate contact with distributers what their problems are. More effective distribution methods are the ultimate goal of the committee. The first of the hearings has just been held by the committee at Kansas City and developed helpful information as to distribution problems of the Middle West which the committee will be able to use in its study of the whole question of distribution. Three important distribution questions were dealt with—"Problem of Keeping Up Sales," "Re-establishment of Confidence in Prices" and "Elimination of Waste in Distributive Processes."

Milwaukee Electrical Interests Combine to Promote Better Lighting

VARIOUS electrical interests of Milwaukee, including illuminating engineers, contractors and dealers, manufacturers and jobbers, the local electric light and power company and the Chandelier Club, have combined to promote better lighting in the city and throughout the state. The work is being carried on under the auspices of the Electrical Development Association of Wisconsin, which has established an office in the First Wisconsin National Bank Building, where all questions relating to the wiring of buildings and electrical illumination will be answered without charge by experts. The association will not take contracts or sell fixtures, but will furnish approximate estimates on both as part of its free service. Its main purposes, however, are the dissemination of a knowledge of the latest developments in lighting among those connected with the electrical industry, the education of business men and the public at large in the value and economy of good lighting in factory, store, office and home, and the support of the movement by actual demonstrations.

R. M. Van Vleet is the president of the Electrical Development Association of Wisconsin, and F. A. Coffin is the secretary. Mr. Coffin, J. C. Schmidtbauer and Arthur Polacheck compose the publicity committee.

New Mexico Companies Plan Local Efforts to Sell Stock

MEETING at El Paso, Tex., last month, the executive committee of the New Mexico Electrical Association fixed Feb. 13 and 14, 1922, as the date for the annual convention of the association, to be held at Albuquerque, N. M. Full co-operation with the Rocky Mountain Geographic Division of the N. E. L. A. was pledged, and especially with the new public utility information committee. There was a discussion on the customer ownership of stock, and a few companies reported that they were planning to sell stock to their patrons.

Arthur Prager is president and Charles E. Twogood secretary-treasurer of the New Mexico Electrical Association.

Federal Reserve Board Sounds Optimistic Note in Business Survey

A SURVEY of the general business and financial conditions throughout the country made public a week ago by the Federal Reserve Board indicates that steady progress back to normal conditions may be expected, although no sudden expansion or "boom" is in sight. The investigators for the board in all of the Federal Reserve districts are convinced that the worst conditions have been faced, and that the unemployment situation is somewhat relieved.

Although improvement in business conditions was not quite so pronounced in November as in the preceding two months, the progress toward normal conditions has been continuous, as may be seen by a comparison with the corresponding month of a year ago. Another hopeful sign is found in the fact that export trade has continued in substantial volume, showing an increase in October and indicating a strong foreign demand, especially in staples.

"Carrier Current" for Interstation Communication Demonstrated

APPLICATION of the "carrier-current" system of telephony as a means of more effective communication between generating stations and distribution centers was demonstrated for the first time at the plant of the General Electric Company, Schenectady, N. Y., on Dec. 7 before a group of about twenty-five central-station company executives, engineers and radio men. Communication was effected between the power house in the General Electric plant and the hydro-electric station of the Adirondack Power & Light Corporation at Schaghticoke, N. Y., 38 miles distant. Conversation between these points was carried on freely in both directions. In many respects the tests were similar to those of last week on the Schenectady Railway Company as reported in the ELECTRICAL WORLD; but in this instance the superimposed or "carrier" current was impressed on the high-voltage transmission line instead of the trolley wire.

The apparatus used for the demonstration, which was developed by the radio department, utilizes the normal power supply available at the station and consists of a double-current generator directly connected to a 110-volt motor, either alternating current or direct current, equipped with suitable starting and control apparatus. The motor-generator set produces current at audio frequencies, but higher than normal voice frequencies. The current is transferred to the transmission line by a capacity coupler.

Among the advantages claimed for the new system as determined by the tests are that the energy required is virtually negligible as it is guided by the transmission lines instead of being radiated in all directions through the ether as in wireless telephony. The system has proved itself free from inductive interference and atmospheric disturbances such as static, and it does not of itself produce inductive interference to a degree that would cause disturbances in other communicating systems. No elaborate antennas are required. Finally, the system will function satisfactorily even if a considerable gap exists in the transmission line. Through the use of the system communication is made possible between the load dispatcher at the distribution center and any or all of the generating stations on the line, and between the generating stations and all power houses for the interchange of instructions having to do with proper operation of the whole system.

Underwriters' Code to Be Enlarged to Cover Safety to Persons

A MOTION to develop the National Electrical Code to cover both safety to persons and fire hazards was passed at the meeting of the electrical committee of the National Fire Protective Association held in New York Dec. 5 and 6. Another action of great interest was the formation of a committee to pass upon distinctly new forms of equipment not covered by the present rules with a view to recommending trial installations, where the local authorities are willing, without waiting until a new code is issued. Plans for future committee work on code revision were also discussed.

A long discussion was held on the relation of the National Electrical Code to general safety requirements. The result was the vote to instruct the standing committee that it should consider safety to persons as well as safety from fire hazards in its future development of the code. By thus increasing the phase of safety devoted to protection of persons it is planned to make this code eventually cover completely both phases.

The "committee on new developments" was organized for the purpose of receiving and considering new devices, materials, systems and methods for which there is no provision in the existing code. After investigation, the committee will, if it desires, recommend the new product for introduction in trial installations for the purpose of field experience. The committee will not deal with products which involve only changes in the existing rules.

The primary purpose of the committee meeting held last Monday and Tuesday was to discuss plans for the committee work upon the next edition of the code. The ten standing committees will report to the main committee in November, 1922, after which a bulletin will be issued announcing the proposed changes. The final public hearing will be held in March, 1923, and as soon as possible thereafter a new edition will be published.

There was considerable further discussion on the rule limiting the amount of energy to be supplied from one lighting circuit, as well as on grounding rules, motion-picture machines and lamps, extensions to wiring in fireproof buildings, equipment in dusty places and wireless rules. It was voted to omit entirely the rules on marine installation.

Higher Prices for Utility Bonds

THIS week was another large week in electric light and power company financing, and prices were higher than they have been. An issue of $12,500,000 first lien and refunding gold bonds, 6 per cent series, due 1941, of the Philadelphia Electric Company was quickly over-subscribed at 99, which gave a 6.05 per cent yield. The issue was later quoted at a premium.

The Penn Public Service Corporation's $750,000 first and refunding mortgage gold bonds, 6 per cent, ten-year, series A, came out at 96, which is on a 6.7 per cent basis.

A new issue of $1,500,000 twenty-year, 7 per cent gold notes was marketed at par. Some other large issues are expected to come out before the holidays.

Harding Would Prevent Issuance of Non-Taxable Securities

AMONG the high spots in the address of President Harding at the opening of Congress on Tuesday of this week was the recommendation that Congress consider an amendment to the Constitution which would prevent the further issuance of non-taxable securities. This is a matter the public utilities have been urging for some time because of the difficulty that business organizations have in financing when governmental agencies are able to offer payers of high income surtaxes securities free from taxation.

Among the other outstanding points in the President's message were those relating to the tariff. He advocated a law providing that urgent changes in the tariff shall be made by proclamation of the President on the recommendation of the Tariff Commission. He also favored an early completion of the tariff bill and that the President receive authority to fix tariff duties with the assistance of the commission. He recommended the "American valuation plan" as a means for offsetting the inequalities in exchange rates that now prevail.

The President also suggested a national industrial relations court to regulate labor disputes.

Vehicle Men Are Told That Electric Trucks Are Not Being Properly Sold

THE future of the electric truck, the past twenty years' developments in such vehicles, and the nature of work which the National Electric Light Association is doing to increase the use of "electrics" were the subjects of three addresses presented before a meeting of transportation engineers and automobile dealers in New York on Dec. 2. The meeting was held under the auspices of the automobile bureau of the New York Edison Company, the discussions being contributed by James H. McGraw, president of the McGraw-Hill Company, Inc.; Henry S. Baldwin, General Electric Company, and A. Jackson Marshall, of the National Electric Light Association.

In the unavoidable absence of Mr. McGraw his views were presented by W. H. Onken, Jr., editor of the ELECTRICAL WORLD. "For package delivery the horse will quickly disappear from our streets and the gasoline truck will have to fight hard to maintain its existence," he declared. "Of all motor-driven trucks, those electrically driven have proved themselves best suited in every respect to supersede horse traction in city delivery service. The speed of the 'electric' is double or triple that of horses with equal loads. It is self-starting and is easily controlled. The vehicle has a short wheel base so that it takes up less space than any other vehicle on the public highways and in garages. It is clean, sanitary and has no fire risks. Operating within a radius of 10 miles, which embraces most of the trucking of department stores, express companies and others, with frequent stopping and starting, the electric vehicle is supreme.

"The question naturally arises, 'Why are not more electric trucks used?' Is it because they are inefficient? No! Tests show them to be more efficient than the horse-drawn or gasoline-driven truck. Is it because they do not give satisfaction? No! Experience shows that the greatest purchasers of electric trucks are those who already have them in operation. Is it because of excessive repairs and upkeep? Most assuredly not, for it is just in low upkeep and insignificant repairs that the electric vehicles excel all others. Are they unreliable? Hardly, since the most conservative business organizations in the city, including the express companies and others to whom reliability of transportation is of vital importance, are the greatest users of 'electrics.' Are they intricate? Quite the contrary; they are so simple that a child can operate them. Are they more expensive? Not exactly; for while the first cost may be higher, the ultimate cost, taking into consideration the life and upkeep of the truck, is less than that of the gasoline truck.

"Why then are not more of them used? Because they are not being properly sold."

Mr. Baldwin covered the development of the electric truck during the last twenty years in a masterly and thorough manner that left very little to be said on the subject. In doing so he considered virtually every part that makes up such a vehicle.

Jobbers See Need for Greater Effort in Construction Field by Contractors

PARTICULAR attention to the prospect of steadily growing activity in wiring construction and the need for guiding and stimulating the electrical contractor-dealer to greater effort to develop this side of his business as well as the sale of appliances was given at the midwinter convention of the Electrical Supply Jobbers' Association, held in Cleveland, at the Hotel Cleveland, from Nov. 28 to Dec. 2. The meeting was well attended and productive of spirited discussion and wide interest.

The opening day was given up to work of the executive committee. On Tuesday morning there was a meeting of the Atlantic Division with an address by W. L. Goodwin, assistant to the president of the Society for Electrical Development, in which he presented the plans and purposes of that society and discussed broadly conditions in the industry, explaining how the society is endeavoring to function for the closer co-ordination of the different groups of electrical men. The first open session of all divisions was held on Wednesday morning, with Frank E. Watts, assistant to the president of the Gage Publishing Company, and James R. Strong, president National Association of Electrical Contractors and Dealers, as speakers.

Under the title "The Electrical Contractor-Dealer as a Construction Man and a Merchant," Mr. Watts sounded a warning against the neglect of the wiring business by contractor-dealers who during the reconstruction period, while construction work has been scarce, have devoted their attention mainly to appliance selling. With the increase in building operations, he said, more thought should be given to developing the contractor as a construction man.

Mr. Strong was on the program to discuss "Electraging for Electragists" and explained the reason why these new terms have been indorsed and adopted by the contractor association, following this with a free discussion of Mr. Watts' recommendations. His organization, he said, is encouraging construction work in every way and working for the properly balanced development of the trade, and particularly for the proper keeping of cost data.

A general discussion of both addresses ensued, in which the sense of the meeting was that the development of the contractor is a natural process of evolution and cannot be controlled, but that the influence of the jobber should clearly be thrown toward the selective influencing of the contractor-dealer to follow the work for which he is individually best fitted. The prospects for construction work are increasingly good, but the stimulation of construction need not carry with it any curtailment of profitable appliance selling.

Thursday afternoon's open session was addressed by W. W. Freeman, president Union Gas & Electric Company, Cincinnati, and also president of the Society for Electrical Development, and by F. M. Feiker, assistant to the Secretary of Commerce and vice-president of the McGraw-Hill Company. Mr. Freeman spoke on "The Merchandising of Electrical Appliances" and delivered a message of hope and confidence. Without extending lines to another customer, he said, $10,000,000 worth of electrical appliances and supplies can be sold in Cincinnati before the market is saturated. This opportunity is tremendous, and though electrical men cannot expect to get together on all policies, they should combine in the support of the many policies on which they can agree.

Mr. Feiker, in discussing "The Electrical Industry," described the reorganization of the Department of Commerce, in which he is assisting Secretary Hoover, and gave some most interesting facts concerning the practical work which is being done for the elimination of waste in industry. He stressed the great need for better standardization in electrical manufactures. The Bureau of Standards, he said, is being simplified and readjusted to render a service of prophecy rather than of history.

Executive sessions were held on Wednesday, Thursday and Friday and were devoted mainly to discussing the progress which has been made in the study of the jobbers' cost of doing business, the probable influence of the non-electric store as an element in the distribution of electrical goods, and measures for increasing the creative influence of the jobbers. It was decided that the association's publicity campaign would not be continued next year. The next convention will be held at Hot Springs, Va., in May.

Boston Edison Company Restores Service to Over 35,000 Customers in Nine Days

SEVENTY-FIVE per cent of the customers of the Edison Electric Illuminating Company of Boston who lost their service during the great New England sleet storm of Nov. 27-28 were receiving energy from the system by the night of Dec. 4. To a representative of the ELECTRICAL WORLD President C. L. Edgar said on Monday that by Wednesday night it was expected that 97 per cent of the 35,000 to 40,000 customers who were cut off by the storm would be getting service again. Many of these are in suburban territory. Local difficulties, especially in remote rural districts, cannot, however, be overcome to give 100 per cent service to the remaining 3 per cent of the cut-off customers for one week to four weeks more. It is estimated that the total loss of the company in line equipment will reach in the neighborhood of $150,000 in its 700 sq. miles of territory. About 150 poles were down as a result of the storm.

W. H. Atkins, general superintendent of the company, stated Monday that about 200 extra linemen are at

SOME OF THE EFFECTS OF THE SLEET STORM IN NEW ENGLAND work on the system and that the public has shown a remarkable appreciation of the situation. Boards of trade, newspaper editors and many individuals have pledged their support in the accident prevention efforts the company has been making and have voiced their realization that the interruption to service was beyond any previous one in New England utility history. Last Sunday cautions against touching loose wires were given in the Greater Boston churches through the company's suggestion. Officers and employees generally are working with might and main toward restoring service, but no night work is permitted on the lines.

No Recommendation Made on Depreciation to Federal Power Commission

The statement published last week to the effect that O. C. Merrill, executive secretary of the Federal Power Commission, had recommended the acceptance of the changes proposed by the National Electric Light Association in the regulations dealing with depreciation was an error. Owing to a misunderstanding, our Washington office, which solicited the statement, believed it had reference to the recent hearing, whereas Mr. Merrill's brief dealt with a previous hearing before the Federal Power Commission. Mr. Merrill, who is now en route to the Pacific Coast, sends us the following communication from Chicago, dealing with the matter:

> I have just had called to my attention the statement on page 1140 of the Electrical World of Dec. 3 which quotes me as recommending for approval the acceptance of the proposed changes in the regulations of the Federal Power Commission with respect to depreciation which were recently suggested by the National Electric Light Association.
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> There has evidently been a misunderstanding with respect to the material which you have quoted. That material was part of a memorandum addressed to the Federal Power Commission concerning proposed amendments to the regulations which were submitted to the commission last May as a result of conferences held with the water-power development committee of the National Electric Light Association and has no reference to the present situation, in which the National Electric Light Association, notwithstanding the agreement reached with its committee after two weeks of conference last spring, now requests amendments in addition to those which were at that time, with one exception (the multiple in regulation 17), jointly approved by the committee and by the staff of the commission and were adopted by the commission in Orders No. 11 of June 6.
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> There has been a difference of viewpoint between certain members of the National Electric Light Association and the staff of the commission both with respect to the fundamental basis upon which depreciation should be computed and to the practical application of that basis. In the discussions last spring it became apparent that, whatever basis might be adopted by the commission, difficulty would be bound to arise if the method of accounting for depreciation on properties under government license differed from the method employed on the remainder of the property in the same physical system; and that this situation would exist if the Federal Power Commmission had one rule for one part of the property and the state had another rule for another part of the property. To obviate this difficulty the regulation as then existing was amended so that in all cases where licensees of the commission were public utilities subject to rate regulation by their respective states they would be permitted to follow the depreciation requirements of the state with respect to all their properties, would so report to the commission, and would not be required to follow any rule which the commission might adopt for licensees wholly under its jurisdiction, the commission merely reserving the right to make inquiries and issue appropriate orders in individual cases if it should be apparent that a licensee is not maintaining for the properties covered by his license depreciation reserves adequate for the purposes of the federal water-power act.
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> The general rule for accounting for depreciation as now contained in Regulation 16 applies, therefore, only to two classes of licensees: (1) those operating in states which have no commission or other similar authority with powers of rate regulation, and (2) those in other states not engaged in public utility service. For the first class the act specifically confers general power of regulation upon the commission; for the second class there is no agency other than the commission with any authority to determine what are adequate depreciation requirements. It has accordingly been necessary for the commission to establish some rule of depreciation to be applicable to these two classes of licensees.
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> In preparing such rule it has been the purpose to follow what appears to be the best established practice. The rule adopted is the same as that employed by the Interstate Commerce Commission for railroad properties, by the Internal Revenue Bureau in allowing deductions to determine taxable income, and by a considerable number of leading state commissions. There is the possibility that the application of the rule in the existing regulation is too rigid, and the National Electric Light Association has been requested to submit proposals for the application of the general principle in such a way that due consideration may be given both to the financial structure of the licensee and to the desirability of maintaining its capital assets unimpaired. Meantime those questions are being taken up with some of the state commmissions, and it is hoped that early in the year it may be possible for the commission's staff to make its recommendations to the commission. We have never been unwilling to consider any constructive suggestions, whatever modifications of existing regulations might be involved, if it could be shown that such suggestions have a sound economic basis and conform to the requirements of the federal water-power act.
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> Out of the 17,000,000 hp. involved in applications before the commission, over 96 per cent involves public utility service in states which have agencies for rate regulation, and less than 4 per cent would be subject to any rule for depreciation which the commission might adopt. It should be perfectly apparent, therefore, regardless of the opinion which may be held with respect to the rule for depreciation now contained in the commission's regulations, that it can have no appreciable effect in hindering, as some have claimed, the development of water power under the federal water-power act. Projects involving an ultimate installation of 1,276,000 hp. are already being constructed under license from the commission, an amount greater than has ever hitherto been undertaken under federal authorization. Still more will be started when the general economic conditions which are hindering all development are improved.
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> The federal water-power act requires that licensees "shall maintain the project works in a condition of repair adequate . . . for the efficient operation of said works in the development and transmission of power," and many of those who oppose the existing regulation read nothing else in the act. The same section and paragraph require the maintenance of reserves adequate for making all necessary renewals and replacements, and what are necessary replacements and what are adequate reserves cannot be determined wholly upon the language of a single, isolated paragraph, but must also be viewed in the light of the act as a whole, for Section 10, paragraph (c), is by no means the only place where depreciation reserves are considered. The fundamental principle underlying the whole structure of the act is the maintenance, unimpaired, of the capital invested in the project. The necessary renewals and replacements can be assured and the integrity of the investment maintained only when the reserves represent within reasonable limits the depreciation in value which the properties necessarily undergo in service. This should be a matter of common prudence on the part of the licensee himself, for the Supreme Court has said that no one can be expected to see his properties waste away, as they inevitably must, in the public service without having such current losses replaced through current earnings.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Radio in the Aviation Service.—The Army Air Service has approved plans for a country-wide series of radio stations intended to permit constant communication with aviators. Among other things, it is expected to reduce the hazard of flying by making possible the dissemination of storm warnings.

Appalachian Power Company to Enlarge Capacity. — The Appalachian Power Company of Bluefield, W. Va., has begun construction of an addition to its steam plant at Glen Lyn, Va. The present capacity of this plant is 25,000 kw., and the addition, which is expected to be completed about June 1, 1922, will bring it up to 38,750 kw.

Architects and Electricity.—The New Orleans Electrical League entertained the members of the New Orleans Chapter of the Louisiana Architects' Association at dinner recently, and John A. Corcoran, New York, publicity manager for the General Electric Company, gave an illustrated address designed in part to dissipate the idea that the electrical contractor and the architect cannot co-operate. The architect must interest himself in electricity, Mr. Corcoran declared. His clients need it, and it is the one mechanical art that the architect must study. Contractors and dealers look to the architect to set a standard.

Electricity at the Lyons Fair.—The activity in hydro-electrical development now prevailing in France lent especial importance to the electrical exhibits at the famous Lyons fair. These were on a large scale and included a transformer with a possible maximum rating of 350,000 volts. The cheapness of hydro-electricity has created a vast industry in domestic electrical appliances, and its employment in industrial establishments is spreading rapidly, although the Paris correspondent of the London *Engineer* notes a drawback in the heavy initial expense incurred through the practice of putting in reserve suction-gas plants. These are held to be made necessary by the possible service interruptions due to drought, frost or accident to the turbine.

Santa Barbara Electric Company Absorbed by Southern California.—Authority has been given by the California Railroad Commission to the Southern California Edison Company to acquire all the properties of the Santa Barbara Electric Company. The Southern California Edison Company is to pay $682,634.50 for the properties and to assume the payment of all the indebtedness and liabilities of the Santa Barbara company. The indebtedness to be assumed amounts to $1,056,863 80. The Edison company owns already all but 635 shares, face value $63,500, of the outstanding stock of the Santa Barbara company and has offered to purchase these 635 shares at $70.50 a share. The company urged that its offer to the minority stockholders was fair for the reason that the price of $70.50 is based upon a 6 per cent dividend while the Santa Barbara company has been paying only a 4 per cent dividend. The $682,634.50 is the equivalent of the $400,000 of outstanding preferred stock at par and the $400,900 of common stock at the rate of $70.50 a share.

London to Extend Its Underground Electric Railway Service.—Government aid is being sought by the London Underground Railways in carrying out improvements and extensions that have been under contemplation for several years. It is proposed to raise £6,000,000 new capital, and, in view especially of the fact that the work would provide 20,000 men with employment, as well as the urgent need for the new extensions, the government is asked to guarantee the interest on the securities.

Preaching by Radio.—Non-sectarian sermons and hymns delivered and sung in a private New York City residence before a score of persons were broadcasted on a recent Sunday to a "congregation" estimated at between 25,000 and 150,000 in hospitals and public homes and on shipboard. This service was the first of a series to be given weekly by the "Radio Church of America," which are expected to be welcome incidents in the lives of the ill and of others forced to remain indoors or away from shore.

Expert Advises Buffalo Against City Electric Plant.—F. W. Ballard, a consulting electrical engineer of Cleveland, who was formerly Commissioner of Light and Heat for that city, has reported to the Buffalo city authorities adversely on the question of establishing a municipal electric lighting plant at this time. He asserts that the city could not compete with the Buffalo General Electric Company in the sale of electricity for lighting purposes on account of the superior load factor that the company derives from its industrial business; that a plant on a scale large enough to compete with the central-station company in the sale of lighting and power would necessitate a bond issue of $20,000,000, and that even were such a plant built it would not, in his opinion, be possible to reduce rates below those now existing.

Electricity in Modern Vaults.—In the great steel vaults of the National City Building, New York City—formerly the Hotel Manhattan and, like the Knickerbocker Building, another recently converted hotel, now supplied throughout with central-station service—electricity performs a function of unique character. The two-story vaults have, the *Edison Monthly* explains, entrances from the basement and the sub-basement. They are so placed with respect to the floors that the great circular time-clock doors cannot be opened without shifting of the floor sections immediately in front. These floor sections are shaped like a half circle and are about ten feet wide. With the beginning of the day's business, the interior of the vaults must be readily accessible. Switches connecting with small motors are thrown in, and the floorings are lowered to a new level. The vault doors are then swung open, and the motors elevate the floorings to their natural positions. This function is reversed at the close of banking hours. There are 14,000 safe-deposit boxes in the vault.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

Pittsburgh Section, A. I. and S. E. E.—This section will, at its regular monthly meeting on Dec. 19, have a celebration of the fifteenth anniversary of the Association of Iron and Steel Electrical Engineers.

Massachusetts State Association of Electrical Contractors and Dealers.—This association will hold its annual meeting and banquet at the Hotel Kimball, Springfield, Mass., on Jan. 5, the business meeting to be held at 2 p.m. and the banquet at 6 p.m.

Radio Club of America.—This club met at Columbia University, New York, on Monday evening, Nov. 28, when L. C. F. Horle, consulting engineer of New York, read a paper on modulation methods with particular attention to their use in amateur radio telephony.

Philadelphia Section, I. E. S.—This section of the Illuminating Engineering Society will meet jointly with the Philadelphia Safety Council on Tuesday, Dec. 13. S. G. Hibben of the Westinghouse Lamp Works will discuss "Safety Factors of Industrial Lighting."

A. I. E. E. Section Meetings.—Section Institute meetings scheduled for next week are: Dec. 12, Philadelphia, "The Steel Tank Rectifier," by J. H. Milliken, Midstates Engineering Company, Chicago; Dec. 15, Hartford (Connecticut Section), "Caribou Hydro-Electric Development of the Great Western Power Company," by Albert A. Northrop of Stone & Webster; Dec. 16, Chicago, "Application of Electric Power to Iron and Steel Industry," by W. S. Hall, Illinois Steel Company. The New York Section meeting in conjunction with the A. S. M. E. announced for Dec. 14 has been canceled.

Coming Meetings of Electrical and Other Technical Societies

A. I. E. E. Section Meetings—Philadelphia Dec. 12; Hartford (Connecticut Section), Dec. 15; Chicago, Dec. 16.

A. I. and S. E. E.—Cleveland Section, Dec. 12; Chicago Section, Dec. 16; Pittsburgh Section, Dec. 19; Philadelphia Section, Dec. 20.

American Physical Society—Toronto, Dec. 27-30.

American Association for the Advancement of Science—Toronto, Dec. 27-31.

Massachusetts State Association of Electrical Contractors and Dealers—Springfield, Jan. 5.

American Engineering Council—Washington, Jan. 5-6.

Western Association of Electrical Inspectors—Chicago, Jan. 17-19.

American Society of Civil Engineers—New York, Jan. 18-19.

Association of Municipal Electrical Utilities of Ontario—Toronto, Jan. 26-27.

Lighting Fixture Dealers' Society of America—Milwaukee, Jan. 30-Feb. 2.

New Mexico Electrical Association—Albuquerque, Feb. 13-14.

American Institute of Electrical Engineers—Midwinter convention, New York City, Feb. 15-17.

National Meter Committee, N. E. L. A.—Springfield, Ill., Feb. 1[illegible].

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies

Rating of Motors Versus Power Consumed.—A lease requiring the lessee to pay for electrical energy in excess of 8 hp. has been declared by the St. Louis Court of Appeals (Eisenstadt Manufacturing Company vs. Star Building Company) to entitle the lessee to 8 hp. actually consumed, in the absence of a provision stating whether the power was to be thus based or whether the rated capacity of the motors should govern. (233 S. W. 285.)*

Powers of Oklahoma Commission.—The Supreme Court of Oklahoma has declared, in Chicago, Rock Island & Pacific Railway vs. State, that the prima facie presumption of the reasonableness, justness and correctness of an order of the Corporation Commission applies only to the facts found by the commission or established by evidence upon which the commission failed to make a finding. Where a material fact is lacking in the commission's finding and is not supplied by the evidence the presumption alluded to does not apply and on review in the Supreme Court the commission's order cannot be sustained. (201 Pac. 260.)

Present Cost of Reproduction a Necessary Element in Valuation.—Reversing the lower court and remanding the suit of the Potomac Electric Power Company against the Public Utilities Commission of the District of Columbia, the District of Columbia Court of Appeals has ordered a review of the findings of the commission as to the value of the property of the power company "actually used and useful for the convenience of the public." "Whereas here," the Court of Appeals says, "the decision is challenged on the ground that it is based upon a mistake of law, or that it is wholly unsupported by evidence, or is so clearly contrary to the weight of the evidence as to amount to an arbitrary exercise of power, it is the duty of the court, under the rule announced by the Supreme Court, to exercise 'its own independent judgment as to both law and facts,' so far as it is necessary to determine the question in issue." The Court of Appeals further holds that "the present cost of reproduction is one of the necessary elements for consideration, along with other relevant facts, in fixing the fair and reasonable value of the property," observing: "In the present case the commission, in effect, declined to find the present value of the property because not satisfied as to how long existing conditions would continue. In our view it was the duty of the commission to have considered and given due weight to the evidence as to the then value of the property. As conditions changed and values were substantially affected, it would have been the further duty of the commission to exercise its discretion and revalue the property. The conditions existing were world-wide, and while their duration and future effect were problematical, there was no immediate prospect of a return to normal conditions. It may be suggested, although the point was not raised in the opinion of the commission, that practical difficulties would have been encountered in an attempt to ascertain the increase in value of the property between July 1, 1914, and Dec. 31, 1916. But there was substantial evidence before the commission as to the rise in values, and a brief investigation would have enabled the commission to determine, with substantial accuracy, how much in fairness should be added to the earlier valuation."

City Commissioner's Prohibition of Rate Increase Overruled.—In denying an injunction sought by one Silberberg against the Citizens' Water Supply Company of Newtown, the Supreme Court of New York declared that for the Commissioner of Water Supply, Gas and Electricity of the City of New York, without knowledge of the reasonableness or unreasonableness of the old or new rates fixed by a water-supply company, and without investigation, to prohibit any increase over the old rates is in effect an arbitrary determination that the old rates are present reasonable rates, and such a determination may be disregarded by the company. (190 N. Y. S. 349.)

Railroad Not Owning Fee Cannot Enjoin Telephone Wires Across Right-of-Way.—Reversing the lower court in Citizens' Telephone Company vs. Cincinnati, New Orleans & Texas Pacific Railroad Company, the Court of Appeals of Kentucky declares that, both railroad grants and telephone lines being for public use, a railroad company not owning the fee has no such property in the right-of-way as will enable it to enjoin a telephone company from maintaining at a reasonable height across it a properly constructed and managed line, even without grant from the railroad or other authority, as against all but the owner of the fee. (233 S.W. 901.)

Wisconsin Courts Not Divested by Commission Law from Jurisdiction Over Controversies Regarding Failure of Service.—In a suit brought by the Waukesha Gas & Electric Company against the Waukesha Motor Company the defendant interposed a counterclaim, in which it was alleged that the plaintiff had entered into a contract by which it undertook and agreed to furnish the defendant with all of the electrical energy necessary properly to operate its plant and with 2,000,000 cu.ft. of gas a month; that by reason of this contract the defendant equipped its plant with electric motors and with proper appliances, and that plaintiff broke said contract by failing to furnish electrical energy or gas in sufficient quantity, to the heavy damage of the manufacturing company. A demurrer to this counterclaim was sustained in the lower court on the ground that the Railroad Commission had jurisdiction of the case. This demurrer has been overruled by the Supreme Court of Wisconsin, which in remanding the case declared that the jurisdiction of the commission is confined to prescribing rates and regulations for the future and that it has no jurisdiction to redress past wrongs or grievances. (184 N.W. 702.)

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*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities

Uniform Rates Compulsory.—By an order of the Public Utilities Commission of Michigan the Consumers' Power Company is required to charge uniform rates for power delivered to consumers of the same class and using similar quantities of electrical energy under similar circumstances. The company is authorized to reprint its rates for various communities and put them all together in a single schedule.

Extraterritorial Service — Rural Lines.—The Indiana Public Service Commission has authorized the municipal plant of the town of Pendleton to make a higher minimum charge to its rural patrons than to residents of the town on the ground that the cost of rural line upkeep is greater and also because patrons residing adjacent to the town have to pay no part of the construction cost of the municipal plant. The commission has also decreed that a step schedule of electric rates is discriminatory and should be changed to a block basis.

Bars Increase in Rate for Lighting.—The Massachusetts Department of Public Utilities has handed down a decision whereby the Cambridge Electric Light Company is prohibited from charging the Metropolitan District Commission more than $19 a year for each of the 234 electric lamps along Charles River Parkway, Cambridge. At a recent hearing the Metropolitan Commission charged that when it took over control of the parkway by direction of the Legislature the electric light company increased the amount for each lamp from $19, which amount was paid by the city of Cambridge, to $28.70. Officials of the light company gave as a reason that the Metropolitan District Commission was regarded as a "separate customer" and not entitled to the same rate as the city.

Allocation of Expense and Revenue in Two-Department Company.—In an allocation of operating expenses and revenues between the two departments of a combined electric and steam-heating utility made by the North Dakota Board of Railroad Commissioners, operating expenses were apportioned on the basis of labor charges to each department, coal charges were apportioned according to actual demand, general expense was apportioned on the basis of coal cost, office expense on the basis of gross earnings, miscellaneous plant repairs on the basis of coal cost, insurance on the basis of investment, interest on the basis of operating expenses, taxes on the basis of investment and earnings before paying income tax, bad accounts at actual amount, ash conveyor repairs on basis of coal cost, building repairs on the basis of building requirements for each department, certain other repairs on the basis of coal cost, and truck repairs, line labor repairs, meter repairs and meter changing were charged to the electric department.

Men of the Industry

Changes in Personnel—Responsibilities and Association Appointments of Men Engaged in Professional, Executive, Operating and Commercial Branches of the Industry

Theodore E. Burger has been elected secretary of the Society for Electrical Development, Inc. Mr. Burger started his electrical career in 1905, when he became associated with the Western Electric Company in Los Angeles, Cal. He was appointed manager of the Los Angeles branch of this company in 1907 and served in that capacity until 1917. He was chairman of the Los Angeles Electrical League for two years, and contributed largely to the present co-operative conditions existing on the Pacific Coast.

T. E. BURGER

Charles H. Talmage, formerly manager of the Salt Lake City office of the Rocky Mountain Electrical Co-operative League, has been made secretary of that body in succession to Earl T. Millham, resigned.

Harry Reid has been elected vice-president of the newly formed Indiana Hydro-Electric Power Company, which has been organized for the development of the waters of the Tippecanoe River in the State of Indiana. Mr. Reid is also president of the Kentucky Utilities Company, the Interstate Public Service Company of Indianapolis, and the Southern Indiana Power Company of Indianapolis.

Arthur S. Blair, who has been appointed assistant superintendent of the Edison Illuminating Company of Boston, was formerly connected with the standardizing and testing department. He will now serve as assistant to Mr. Atwood in the general service department. Mr. Blair first entered the service of the Boston company in 1896 in the generating department, but resigned in 1897. He re-entered the company's employ in October, 1903, as test man in the laboratory, later becoming chief clerk and finally head of the office division, which position he held up to the time of his recent transfer.

Weller Rose, consulting electrical engineer, has recently opened an office at Binghamton, N. Y.

E. C. Van Diese has again taken charge of the affairs of the Intermountain Railway, Light & Power Company of Colorado Springs as vice-president and general manager, to replace E. J. Condon, Jr., who recently resigned.

Julian C. Smith, prominent in hydro-electric circles in Canada and vice-president of the Shawinigan Water & Power Company, has associated himself with the Manitoba Power Company as supervising engineer in the construction of the Great Falls power plant.

W. Carrick Wedderspoon of Carrick, Wedderspoon & Company, Christchurch, New Zealand, was a recent visitor in San Francisco and expects to include New York in his United States itinerary. Mr. Wedderspoon has been for some years connected with hydro-electric development in the Antipodes.

Nelson B. Gaskell of New Jersey assumed the chairmanship of the Federal Trade Commission on Dec. 1 for a period of one year. Mr. Gaskell, who was vice-chairman during the past year, succeeds to the chairmanship under the rule of the commission which provides for rotation in the office of chairman among the several commissioners.

Dr. Tatsumi Mochida and Jiuji G. Kasai, representatives of the Fuyigasu Spinning Company of Tokyo, are in San Francisco for the purpose of making a study of the hydro-electric developments of California and with a view to purchasing equipment for additional plants contemplated by their company, which operates by electricity plants having an annual output valued at $50,000,000 and in addition supplies light and power to the city of Yokohama.

Wilbur E. Coman has resigned as vice-president and general manager of the Washington Water Power Company to accept a position as Western traffic manager of the Northern Pacific Railroad Company, with headquarters at Seattle. He will be in charge of freight and passenger traffic for the western end of this system, taking up his new duties on Dec. 1. Mr. Coman is one of the best known electric light and power men in the Northwest, his special work being the inspiring of public confidence in public utilities. He began his career as a clerk with the Oregon-Washingon Railway & Navigation Company and rose quickly in the freight department. In 1910 the new Spokane, Portland & Seattle Railway commenced operations with Mr. Coman as its general freight and passenger agent. In 1912 he accepted the position of vice-president and general manager of the new Portland power company, the Northwestern Electric Company. In 1919 he was elected vice-president and general manager of the Washington Water Power Company.

W. R. Arbuckle, the recently elected president of the International Association of Municipal Electricians, has been superintendent of the fire and police telegraph system at Bayonne, N. J., for the past fourteen years. He has also been prominently identified with the affairs of the association during that time. Mr. Arbuckle, who has been a resident of Bayonne for twenty-two years, is a native of New York City. Before taking his present position he had charge of the Bayonne office of the New York & New Jersey Telephone Company and was with that company in Newark, N. J. He has been prominently identified with municipal affairs in Bayonne.

R. A. Manwaring has been appointed general manager of the New Haven (Conn.) division of the United Illuminating Company, and H. F. Leavitt has been appointed superintendent. A. W. Kraft, formerly cashier, has been appointed treasurer, Frederick D. Adams, the previous treasurer, having resigned on account of ill health.

R. A. MANWARING

A. W. K. Billings, who has recently returned from Barcelona, Spain, will act as construction manager for English and Canadian interests controlling large public utility companies in Mexico, Brazil and Spain and as vice-president of the Canadian Engineering Agency, Inc., of New York City. At present the Mexican Light & Power Company is constructing near Mexico City two hydro-electric plants of 52,000 hp. During the war Mr. Billings was in charge in Europe of naval aviation construction work ashore. He was promoted to the rank of commander in the Naval Reserve and was awarded the Navy Cross and the Legion of Honor.

Dr. E. D. Ball, recently appointed director of scientific work for the Department of Agriculture, has been designated as the representative of that department on the research information service committee of the National Research Council. He fills the place made vacant by the resignation of Dr. Carl L. Alsberg. Dr. Alsberg's place on the division of federal relations of the National Research Council has been filled by Dr. Frederick D. Power, for many years the director of the Wellcome Research Laboratory in London and now in charge of the phytochemical laboratory of the Bureau of Chemistry.

H. C. Soule, formerly manager of the apparatus department of the Westinghouse Electric International Company, with headquarters at East Pittsburgh, sailed from New York on Nov. 19 for Buenos Aires, Argentina, where he will take up duties in the office of L. T. Peck, managing director of the Cia. Westinghouse Electric Internacional, S.A., of Argentina. Mr. Soule has been associated with the Westinghouse company since 1903. After being graduated as an electrical engineer from Syracuse University he entered the apprentice course at East Pittsburgh. He finished his apprenticeship in 1905 and was detailed as design engineer on power transformers. In 1907 he was reassigned as section engineer on air-blast and railway transformers. Three years later he was made section engineer, and as a consequence of this work in 1913 he was appointed general engineer on transformers and central-station work. In March, 1919, he transferred to the Westinghouse Electric International Company, taking charge of the negotiation section, and after a year on this work was made manager of the apparatus section.

H. C. SOULE

O. Q. Hinds has disposed of his interest in the Anderson Electric & Equipment Company, Chicago, and has severed his connection with the company to engage in the production of electrical automobile accessories in company with B. J. Grigsby, O. E. Grigsby and W. C. Grunow.

T. Charles Brown, formerly with the Electric Service Supply Company and recently with the National Conduit & Cable Company, is now associated with the American Jobbers' Supply Company, Woolworth Building, New York City. In his present connection he will specialize in the product of the Porcelain Insulator Corporation, Lima, N. Y. Mr. Brown has been engaged in engineering sales work in the transmission field since 1910.

William Murdock has resigned after twenty-five years of service as manager of the Northern Electric Company of Halifax, Nova Scotia. During this period he was closely identified with the development of the electric light and power industry of northeastern Canada, and it was largely through his efforts that the Electrical Association of Nova Scotia was brought into being. At the first annual meeting of this association he was unanimously elected its president. Mr. Murdock has not definitely decided on his future plans, but expects to remain in Halifax.

Emory M. Coffin, formerly sales manager of the Pierce Fuse Corporation, Buffalo, N. Y., and B. F. Perry, district manager of the same company in the Ohio territory, have formed a new organization known as the Coffin-Perry Company, with headquarters in Columbus, Ohio. The new company will represent well-known electrical manufacturers in the states of Ohio, Kentucky and West Virginia and in western Pennsylvania.

Obituary

Theodore Stave, who died Nov. 13, at Ballston Spa, N. Y., was born in Naples, Italy, forty-four years ago, of Scandinavian parentage, his father being an artist there. After his studies in electrical engineering in Italy, he finished his education at one of the technical schools of Germany and became an assistant professor in electrical engineering in one of the English colleges, where he attracted the attention of Charles Yerkes, the American builder of the London "Tube," who employed him on electrical construction of this important work, although Mr. Stave was only twenty-four years old. He afterward carried on important electrical development work in Greece and France. He then assisted in perfecting a flaming-arc lamp, brought this article to the United States and organized the Stave Flaming Arc Light Company, which made many important installations. This company was eventually sold to the General Electric Company about 1914. He was later prominent in the American Insulator Company. During the past year he was an important factor in the negotiations of the Chilean government for the placing of a large loan in this country. Only recently he returned from a visit to Peru, where he was the guest of the President of that republic. He was a member of various New York clubs, including the Railroad, Chemists' and Rocky Mountain. Mr. Stave, who was an accomplished linguist, did important work for the Allies during the Great War and was active particularly in Belgian relief.

THEODORE STAVE

W. M. Wood, assistant general manager of the Pacific Power & Light Company, Portland, Ore., died on Nov. 4. Mr. Wood was born at Vancouver Barracks, Wash., on Jan. 23, 1884. He was educated in Portland and graduated from the Portland Academy in 1902. After studying for a short while in Germany, he entered Cornell University and was graduated as an electrical engineer in the class of 1908. Except for a short period Mr. Wood was with the Pacific Power & Light Company continuously after his graduation from Cornell, having been purchasing agent, local manager at Sunnyside, Wash., assistant manager at Lewiston, Idaho, and assistant general manager at the time of his death. Mr. Wood possessed an attractive personality and exceptional analytical powers. As assistant general manager he accomplished some unusually fine work in the study of economic, rate, interest, depreciation and annuity problems.

W. M. WOOD

James M. Dickie, auditor of the American Public Service Company at Abilene, Tex., died at Dallas last week. Mr. Dickie was born in Aberdeen, Scotland, in 1885 and was educated at Aberdeen University. At the time of his death he was chairman of the Accounting Section of the Southwestern Division of the National Electric Light Association and had also been treasurer for some time of the Southwestern Electrical and Gas Association.

Timothy J. Lynch, superintendent of the municipal electric light system of Danvers, Mass., died three weeks ago from the results of an automobile accident. Mr. Lynch had been in the service of this company for thirty years, having been one of the original committee appointed in 1888 by the Town Council to organize a municipal electric light system. He was made superintendent and general manager of the system and served in that capacity for eleven years, when he resigned to take up work in the leather business. After three years he resumed his former occupation and was again placed in charge of the system, retaining this position until his death.

Trade and Market Conditions

Business Reviews, Together with Market Letters from Important Trade Centers, on the Supply, Demand and Prevailing Prices of Electrical Apparatus and Supplies

Armored Conductor Manufacturers Finding Demand Heavy

A SURVEY of the flexible armored conductor market discloses a condition more or less unusual in the electrical field at present, practically all the manufacturers having close-to-capacity business. Demand all through the fall has been steady and manufacturers have kept their production just a step behind orders all the time so that a slow week now and then has not affected them. A few plants are reported to be sold out until after the first of the year while the rest are delaying delivery from two to three weeks. At least one manufacturer has given up production of the smaller sizes in order that he may devote all his capacity to the larger sizes, for which demand has been very good.

Prices are very close to pre-war levels, and there is a desire among producers to raise prices at least until they exceed production and commercial costs. However there are at present three times as many manufacturers in the field as before the war and competition as a result is very keen. While representative manufacturers state that there is absolutely no chance for lower prices, there were none who were of the opinion that an advance was imminent.

Washing-Machine Sales Going Ahead Steadily

WASHING-MACHINE sales since the first of July have increased steadily month by month, and November will be the first month during 1921 to equal 1920 sales for the same period, according to a statement issued by the secretary of the American Washing Machine Manufacturers' Association. This rising curve is a continuation of the one that started last January and increased every month until the slump came in June. In spite of the fact that the country is passing through a critical financial period, the continued sale of these machines would seem to indicate that they are not a luxury, as it is disclosed that the majority of purchasers are of the wage-earning class and not the wealthier class. Dealers all over the country are pushing Christmas drives, and it is felt that if the sales continue in their present volume many prospective purchasers will be disappointed through inability of the factories to make deliveries until after Christmas. Manufacturers state that further price reductions can happen only through reduction of wages and cost of materials.

The washing-machine industry, which was one of the first in the electrical field to feel the effect of the business depression, is also one of the first to show signs of convalescence, according to this report. A number of manufacturers of this appliance have reported very good sales since September, the output of their factories having been increased several times since that date. The recovery evidently caught some manufacturers unawares, as deliveries have become slower. One particular maker has issued a notice to his dealers to the effect that machines ordered after a certain date cannot be delivered before Christmas. Dealers' stocks have not been extremely heavy. Production was cut down to the bone early in the year, so that the whole industry is starting out for new business with a clean slate.

Manufacturers of fractional-horsepower motors report good business from this source, which they are in a position to supply on account of the large stocks left on their hands when the demand for washing machines dropped off last year. The washing-machine manufacturers themselves at that time had large stocks of motors which present orders seem to indicate have been for the most part used up.

Revision and Change of Motor Prices Announced

SEVERAL manufacturers of motors have announced a revision of their price lists within the last few days. In some cases this has not meant a great deal of change in the average price for the whole line made by a manufacturer, but rather a co-ordination of prices. One manufacturer has reduced small two-phase and three-phase motors under 5 hp. from 3 per cent to 7 per cent, while prices on the larger motors are untouched. Three representative manufacturers have reduced prices on alternating-current motors from 5 to 13 per cent, according to size and type. In this case motors from 50 hp. to 100 hp. are not much affected. Direct-current motors are firm, though demand is not heavy.

The demand for motors varies considerably in different sections of the country. Around New York, it is reported, sales are increasing, more orders having been booked by a large manufacturer in November than in either October or September. Both inquiries and sales were about double the number received in January. Inquiries in New England are better, with gradual improvement in sales. Improvement in general industrial conditions is resulting in better motor sales. In the Middle West the improvement is less noticeable, large-size motors being very slow. Fractional-horsepower motors are moving better. Increased industrial activity is bringing more sales in the Southeast. Synchronous motors and induction motors for ice-plant operation have been in demand there.

Average Building Cost Index Still Almost Double 1913

SINCE the recovery of business, it is agreed, depends to a large extent on construction, it is interesting to note that figures supplied by the Department of Commerce show that on the average the costs of building material are still far above the average of 1913. Taking that year's prices as an index of 100, the general average for twenty-eight principal commodities is 192. This, however, is not a weighted average, so that the actual cost of building a house is lower than is indicated by that figure, the index of the most-used materials being below the average index. Only the most important items are listed in the table below. The indices are all based on Pittsburgh prices where obtainable and on base prices otherwise. It will be noted that the index for steel is lower than for

INDEX OF VARIOUS BUILDING MATERIALS, SHOWING VALUE ON NOV. 1, WITH 1913 AVERAGE AS 100

Common brick	213	Wire nails	197
Portland cement	149	Window glass	22[illegible]
Yellow pine	150	Hollow tile	166
Red cedar shingles	153	Reinforcing bars..............	118
Lime	138	Structural steel	117
Building sand	162	White lead	163
Crushed stone	219	Tar paper roofing	488
Average for twenty-eight commodities			192

any other material. This bears out the denial of steel interests that high price of steel is a deterrent to building.

A sidelight on the building situation comes from the Chamber of Commerce of the United States, which has announced that 57.9 per cent of the total construction in the first ten months of 1921 has been for residences against only 36.1 per cent during the same period of 1920. The total to Nov. 1, 1921, is only a few per cent behind the total for all of 1920. The estimated cost of all construction reported in forty-four important cities for the first ten months of 1921 exceeds $722,000,000, of which $349,000,000 is residential and $254,000,000 non-residential. Alterations, repairs and special construction cost $119,000,000. As costs have been reduced, each dollar this year represents an increased volume of construction.

Ten per Cent Cut Announced on Northern White Cedar Poles

POLE producers have published a cut on Northern White cedar poles, effective Dec. 1, which makes a difference in delivered cost of from 5 to 10 per cent, according to size. The decrease was made in order to bring prices on the Northern poles into line with those on Western poles, which had been reduced during the early part of November: Prices on Northern white cedar poles, f.o.b. New York, are as follows: 40-ft., 8-in., $16.50; 40-ft., 7-in., $14.35; 35-ft., 8-in., $14.10; 35-ft., 7-in., $11.85; 30-ft., 7-in., $8.55; 30-ft., 6-in., $6.80; 25-ft., 7-in., $6.80; 25-ft., 6-in., $5.05. There has been an increase of 10 to 15 cents per pole on Western red cedars within the last few days to take care of changing through freight rates.

Demand for the Northern white cedar pole in the East is normally small. The main supply goes to the Middle West. Stocks are good and immediate deliveries can be made. Cross-arm quotations have been reduced several times in the last few months, and producers state that prices are now as low as possible. Some hope has been placed in a reduction of freight rates, but even if these were down to 1913 levels it would make only about 10 per cent difference in delivered prices.

Revision and Extension of Export Classification

A REVISED and extended export classification has been approved by the Secretary of Commerce to be effective on exports from the United States on Jan. 1, 1922, according to the announcement of the Department of Commerce. Instead of the alphabetical listing heretofore used in the published statistics the commodities in the new schedule are classified into ten great groups, according to origin of material or according to use, bringing together related items for each industry. The large groups are subdivided according to kinds of material or products, and further according to distinctive lines of industry or degree of manufacture, with the individual commodities shown under each heading. The arrangement facilitates comparisons of the exports with the imports and with statistics of production collected, by the Census Bureau, Geological Survey, and individual industries, which are in many cases difficult under the present statistical arrangement.

The new classification also lists 1,250 items, an increase of 76 per cent over the 710 previously listed. A particularly valuable innovation is the decision to list quantities on all commodities so that fluctuations in volume of trade can be noted. On account of price fluctuations it has been impossible to do this heretofore on commodities whose money value only was given. Information on this point is to be required of all shippers, according to the announcement, the detailed description of the merchandise to be furnished to the collector of customs at the port of exit before the shipment will be permitted to clear. The new schedule will be ready for distribution by Dec. 15 and will be for sale at district and co-operative offices of the Bureau of Foreign and Domestic Commerce.

Line Hardware Prices Reduced an Average of 10 per Cent

REDUCTIONS on line hardware of all sorts have been announced. New net prices quoted by a representative manufacturer include suspension-insulator fittings, pierce-forged steel pins for wood and steel arms, cross-arm saddles, centering washers, pole-top brackets, steel pins, clamp pins and clamps, wood-top pins, ridge irons, angle and standard cross-arm braces, through, machine, spacing and eye bolts, washers, strain plates, anchor or guyrods, pole steps, turnbuckles and tools. The average reduction is approximately 10 per cent and is the second since July 1, the other having been made Sept. 1.

Manufacturers state that the drop was put into effect in an effort to stimulate the market for line material and that some increase in demand has been noted. Many central stations are well stocked against seasonal requirements, as was the case with the utilities in eastern Massachusetts that made repairs out of stocks to lines damaged in last week's sleet storm there. A heavy call for this material recently came from the Pacific Northwest, where a blizzard had done considerable damage.

Metal Market Situation

SALES of copper in the month just ended were the largest in any month since the armistice, and the market is holding strong as a result. Definite figures are not available, but authorities estimate the total sold in the export and domestic market at over 160,000,000 lb. Great Britain, France and Germany have been particularly heavy buyers, with Japan and Italy also buying. A good percentage of this total has been sold on future delivery but it is thought that the stock of surplus copper in the country has been reduced by at least 100,000,000 lb. The outlook for resumption of mining is considerably brighter from a statistical point of view.

The first week in December has been equally satisfactory, and prices have advanced, not sharply but just enough to encourage the buyers. The policy of the producers seems to be not to force the market unduly but to take advantage of the law of supply and demand. Too heavy future buying, which might create a lull, is discountenanced by higher prices. Thus the nearer positions are the weaker, and December copper was obtainable Tuesday at 13.75 cents. Some producers, having disposed of all they care to at present prices, have withdrawn from the market entirely and are holding for 15-cent copper. Some predict this price as certain by the first of the year. On account of the withdrawal from the market of so many producers, it is rumored that plans are under way to borrow 100,000,000 lb. from the export association for domestic use. This, of course, would be replaced later. The London market has advanced 2s. 6d.

Copper wire has followed the market as had been expected and has advanced from 14.50 cents to 15 and 15.25 cents per pound within the last two weeks.

NEW YORK METAL MARKET PRICES

	Nov. 28, 1921	Dec. 5, 1921
Copper	£ s d	£ s d
London, standard spot	66 7 6	67 5 0
	Cents per Pound	Cents per Pound
Prime Lake	13.50	13.75
Electrolytic	13.50	13.62½
Casting	12.87½	13.00
Wire base	14.75–15.00	15.00–15.25
Lead, Am. S. & R. Co. price	4.70	4.70
Antimony	4.55	4.55
Nickel, ingot	41.00	41.00
Sheet zinc, f.o.b. smelter	9.00	9.00
Zinc, spot	5.15	5.40
Tin, Straits	30.00	31.75
Aluminum, 98 to 99 per cent	19.00	19.00

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	10.50–11.00	10.50 —11.37½
Brass, heavy	5.00 – 5.25	5.00 — 5.50
Brass, light	4.75 – 5.00	4.75 — 5.25
Lead, heavy	3.75 – 4.12½	3.75 — 4.12½
Zinc, old scrap	2.50 – 2.75	2.50 — 2.75

THE WEEK
IN TRADE

Prices When Quoted Are Those Prevailing at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

JOBBERS and dealers in the past week have focused much of their attention on Christmas business, and reports indicate that it will be good but not startling. The Pacific Coast is optimistic concerning the probable total of holiday trade, San Francisco jobbers and dealers declaring that already it has surpassed the same period last year. In the Pacific Northwest reports are less optimistic, many dealers depending on the jobber to carry stocks. Prospects are fair in the Intermountain region, despite tight money. Coming further east, both St. Louis and Chicago report holiday business started and progressing moderately. Atlanta advises of a slump in this trade, but it is expected to disappear as soon as fill-in orders materialize. New York and Boston note Christmas business as beginning to pick up.

Wiring supplies seem to be in demand, steady rather than heavy, in all parts of the country. This finds its explanation in the pleasant weather which has prevailed, permitting construction of all sorts to go ahead. Building permits all over the country maintained their high volume during November, and employment, both in the building and industrial field, has increased somewhat.

NEW YORK

Business in the electrical trade continues at about the same level as last week. The demand for wiring supplies is steady, and jobbers are making most of their shipments out of stock. Heating appliances and household devices are showing more activity, but jobbers generally feel that holiday sales this year will not come up to those of last year unless there is a last minute spurt of buying on the part of the consumer.

Sales of unit-type commercial lighting fixtures have been good, and those jobbers who have special salesmen on this class of business report very satisfactory results. The demand for industrial-type reflectors has increased noticeably, indicating an improvement in manufacturing activity. A leading manufacturer of schedule material stated that the company's factory is now working about 750 employees as against a minimum of 150, the lowest point reached during the past year. This manufacturer is operating only on orders actually received and at the present time is from a week to two weeks behind on deliveries.

Conduit.—Demand has been steady, the smaller sizes showing the most activity. Prices remain unchanged, jobbers' quotations this week being as follows: For ½-in. black pipe in 2,500-ft. lots, $48.90; ¾-in., $62.70, and 1-in. $89.32 per 1,000 ft. Galvanized pipe in the same sizes was quoted at $53.97, $69.58 and $99.47 per 1,000 ft.

Flexible Armored Conductor.—This material continues in strong demand and, while jobbers are able to make immediate delivery of small quantities, stocks are rather spotty. Some manufacturers cannot make deliveries short of two or three weeks. No change in price was reported. No. 14, two-wire, single-strip, was quoted at $44.50 to $46 per 1,000 ft., and double-strip at $46.50 to $48 per 1,000 ft. in lots of that quantity.

Rubber-Covered Wire.—Although quotations on copper have strengthened, this has not yet been reflected in prices on rubber-covered wire in this section. Large stocks in some jobbers' hands tend to hold prices at their present level. No. 14 was quoted this week at $6.50 to $6.77 per 1,000 ft. in 5,000-ft. lots.

Motors.—Two leading manufacturers have announced a reduction in the prices of alternating-current motors. The new prices are from 3 per cent to 13 per cent lower than formerly and apply to some motors up to 50 hp. in size.

Lamp Cord.—There has been no change in demand for this material. Stocks generally are good. No. 18, cotton, twisted, is quoted at $12.90 per 1,000 ft., and parallel in the same size at $15.60 per 1,000 ft.

Fuse Plugs.—Demand is steady, and most jobbers' stocks are fair to good. In lots of 1,000 or more standard fuse plugs sell for $22 per 1,000.

Heating Appliances.—Household devices, including grills, chafing dishes, curling irons and hollow ware, show more activity. Jobbers report, however, that orders are for smaller quantities than last year and a last-minute rush is expected. Stocks are fair and prices remain unchanged.

CHICAGO

Activity along electrical lines continued fairly steady during the week. Wiring materials in general have not advanced in price and are moving fairly well. A few jobbers report that Christmas business has started and is progressing well. Since the industries have not been operating at capacity for some time, the call for motors of large size has been dull, and the demand for fractional-horsepower motors here has not been very much better, although prices quoted are often cut.

Although unsettled disputes in the building industry combined with the approach of winter have tended to reduce the number of building permits issued for November, the total number of permits for that month was 721, with a valuation of $12,389,000, an increase over the number issued in November, 1920, of 481. The citizens' committee which is backing the Landis award is making the majority of reluctant contractors and building trade unions see some light on this matter. During the week it was announced that the builder who had been refused a loan of more than $1,000,000 by reason of his failure to obey the Landis wage award had changed his mind and is willing to abide by it.

Wire.—Activity on rubber-covered No. 14 is still maintained at prices varying between $6.40 to $6.60 per 1,000 ft. in 5,000-ft. lots. Some jobbers have good stocks, though the majority of them are operating on fairly low supplies. Weatherproof wire is continuing its steady movement and is still selling at about 16½ cents per pound in 1,000-lb. lots. Bare-wire base is also quoted at 16½ cents.

Flexible Armored Conductor.—This material is going fairly well. No. 14 two-wire, double-strip, varies from $44 to $50 per 1,000 ft. in 5,000-ft. lots.

Conduit.—The call for conduit is holding steady along with wire, and some good prices have been quoted by a few jobbers. Black ½-in. pipe in lots of 5,000 ft. sells at prices between $43 and $48 per 1,000 ft.

Heating Appliances.—Good sales on these are reported, but several dealers declare that the people in general are so interested in prices that they do not buy until after they have "shopped around" for better quotations. On the whole, dealers' stocks are sufficient.

Motors.—Large-size motors are not moving well, although one manufacturer reports sales on several large-size synchronous motors to central-station and industrial plants. Another company has revised its price lists, which now contain reductions in some cases amounting to about 8 per cent. Fractional-horsepower motors are moving better than the larger sizes.

Signs.—Electrical signs are reported moving briskly, with an increase over the preceding month. This activity includes both large and small sizes.

Meters.—Sales have held steady during the last month. Demand for switchboard meters for central stations has increased every month since July, but at present they are moving a little slower. The demand for portable meters has been brisk.

BOSTON

Trade this week is being maintained fairly well, with unusual activity in linemen's tools and supplies following the recent disastrous sleet storm. Cross-arms are moving faster for the same reason, and the smaller companies have been buying more pole-line material. Prices are lower on several makes of alternating-current motors, but are steady in other lines, barring upward tendencies in wire. Open weather has enabled building operations to be continued into early winter. General industry in New England looks much more hopeful, although the metal-working plants are slow to advance to large volumes of business. No shortages of supplies are reported outside linemen's equipment. Central-station companies are losing considerable revenue from interrupted street-lighting and residential service, but service is rapidly being restored by extra crews. The beginnings of a holiday retail trade in appliances are now well apparent.

Motors.—Prices on three representative makes of alternating-current motors have been reduced from 5 to 13 per cent, varying according to sizes and types. Larger motors are less affected, one leading maker of units of 50-hp. to 100-hp. rating having made no change in these. One manufacturer has reduced his squirrel-cage motors of 5 hp. and under by 10 per cent. Direct-current motors are firm. Inquiries are better, with gradual improvement in orders.

Wire.—The market is rather dull, notwithstanding upward price tendencies. Reserve stocks of public utilities were large enough to mean little immediate increase in purchases for post-storm reconstruction. No. 14 rubber-covered was moving Monday at $6.25 per 1,000 ft. in 5,000-ft. lots to $5.75 in 25,000-ft. lots. Weatherproof base is 16 cents, and bare base, with slight movement, 15½ cents.

Flashlamps and Dry Cells.—Jobbers report a good seasonal business, without spectacular sales resulting from the temporary interruption of street-lighting and residential service. Undoubtedly retail demand has been somewhat increased by the recent storm, but it has not hit the distributer to any extent.

Appliances.—Quickened retail trade is evident in the smaller appliances, but washers and cleaners are dull this week. Interest in hollow ware, radiators and portable lamps is encouraging. Stocks are plenty large.

Linemen's Tools.—Climbers' straps, body belts, etc., are very scarce, following the requirements of line reconstruction due to the recent storm. Among even the largest houses this material was at a premium Monday.

Pole-Line Material.—Cross-arms are in great demand, but stocks are apparently satisfactory. Poles are moving a trifle faster as a result of last week's storm. One leading house sold three carloads of poles and 10,000 cross-arms last week, chiefly to smaller utilities. Hardware is plentiful, and reserve stocks among users are being drawn upon to meet the reconstruction needs.

ATLANTA

Electrical jobbing interests report a slight falling off in the volume of orders during the past week, caused largely by the fact that the more substantial firms had placed holiday orders previous to this time, while the smaller firms are holding off as long as possible. The jobbers seem to think that within the next ten days or two weeks the volume will again increase as fill-in orders for holiday goods begin to materialize. Orders from contractors for wiring material continue to hold up quite satisfactorily, owing largely to the record building that is going on throughout the section. In Atlanta all building records for the month of November have been broken, the total valuation reaching $667,661, making the aggregate for the year $10,666,220, as against $13,000,000 for the same period of 1920, when prices were much higher. It is worthy of note that May, July, August, October and November of 1921 have exceeded the same months of 1920, while September was practically the same as in 1920. Building permits in the principal cities of the Sixth Federal Reserve District for October totaled 3,126, valued at $5,716,912. Of the eight lines of wholesale activities in this section, five showed increases in sales during the month of October over the previous month, while in the three lines showing decreases the drops were very slight.

Air Heaters.—Owing to the very mild weather this line is dormant. Because of the heavy carry-over from last winter, few orders are being made on manufacturers, and all jobbers report very satisfactory stocks on hand.

Poles.—A recent price reduction of approximately 10 per cent seemed to stimulate the movement of poles, and all jobbers report very satisfactory orders. Chestnut and cypress varieties continue to lead in popularity, one jobber reporting that sales in the latter variety this week equaled those for any month since April. Producers have good stocks on hand and are making prompt shipments.

Oil-Engine Generating Sets.—An extensive campaign by one of the jobbers in this section is causing an increased movement in individual lighting plants, while reports indicate that there is increased interest in and up to 100-hp. sets. Stocks in the smaller sizes are low, but factory shipments on the larger sizes are prompt. A recent price reduction of from 10 per cent to 12 per cent is reported.

Industrial Motors.—Increased industrial activity is responsible for increased sales in this line, particularly in the past two weeks. There is an increased demand to be noted in synchronous motors, as well as in induction motors for ice-plant operation. Stocks are good with shipments from one to four weeks.

Heating Appliances.—Owing to the holiday demand business is very brisk, with flatirons leading in sales. Hollow ware is also reported as moving satisfactorily. Confidence in the price guarantee to Jan. 1 is assisting materially in the sales to the retail trade. Stocks are in fair to good condition.

Washing Machines.—A price reduction of approximately 12 per cent in this speciality was announced this week. A feeling is quite apparent among all the trade that considerable time will elapse before this line will again become active. All firms report heavy stocks on hand.

ST. LOUIS

A slight recession in the volume of sales was experienced by jobbers here last week, but it was not of sufficient magnitude to cause concern. In fact, except for these slight variations, business has been steadily bettering for several months. November sales of the various jobbers were from 10 per cent to 15 per cent better than those for October. Demand for electrical goods for use in residential construction is falling off slightly, and the appliance business is taking its normal decline, but these factors are to a large extent offset by better buying on the part of industrial concerns.

While buying in every field is on a very conservative basis, business throughout this entire territory is gradually bettering. The farmers have been in a precarious position because of the marked drop in prices for farm products, but are showing some ability to get out of their difficulties. Factories are continually increasing their production. Shoe factories are all running well, and those making the lower-priced shoes are operating at capacity. All metal industries are in improved condition and a number of the steel mills are running full force. The packing plants are quite busy, but may be adversely affected by a strike expected to be called next week. Woodworking plants are steadily increasing their output.

Wire.—Movement for the week was about the same as for the past month, though some decline was felt in the call for No. 14 rubber-covered. Stocks are becoming more in line with the demand. No. 14 rubber-covered is selling for $6.50 per 1,000 ft. in 5,000-ft. lots and for $6.40 per 1,000 ft. in 10,000-ft. lots. The base price on bare is $15 per 100 lb. and that for weather-proof is $15.50 per 100 lb.

Tape.—In 100-lb. lots rubber tape is priced at 36 cents per pound, friction at 38 cents and sticker at 34 cents.

Stocks have been increased to a normal basis and sales are maintained in good volume.

Lamp Cord.—Cotton cord is moving fairly well, but the silk-covered is still quiet. Good stocks are on hand in the cotton, but, because of the slow movement, silk stocks are very low. In 5,000-ft. lots No. 18 twisted cotton is selling for $18 per 1,000 ft., No. 18 twisted silk for $27 per 1,000 ft., and No. 18 parallel silk for $28.80 per 1,000 ft.

Knobs.—"Nail-it" knobs are quoted at $19.50 per 1,000 in barrel lots, with slightly easier prices where large stocks were bought before the recent price increase. The demand has been strong and stocks generally are in line.

Fuses.—Lower prices prevail on plug fuses, the clear-window style being sold for $2.75 per 100. Stocks have been short but are well up this week. The demand is holding up in good shape and the railroads have recently been heavy buyers.

Sockets.—Improved sales are reported and stocks are complete. The following are representative prices when sold in standard packages: Key, $18.15 per 100; keyless, $16.50 per 100; pull, $33 per 100.

Conduit.—Brisk sales are reported by a number of jobbers. The low stocks in the smaller sizes have been built up, and the heavy stocks in the larger sizes have been to a slight extent decreased. The following net prices have been established: In bundle lots of 100 ft., ½-in. black, $4.73 per 100 ft., and ½-in. galvanized, $5.32 per 100 ft.; in bundle lots of 50 ft., ¾-in. black, $6.20 per 100 ft., and ¾-in. galvanized, $6.86 per 100 ft.

SALT LAKE CITY—DENVER

"Say Merry Christmas electrically" is the holiday slogan of electrical dealers. The campaign is launched and, backed by liberal advertising, bids fair to bring a big volume of sales. Just now the daily papers are carrying more electrical merchandise advertising than has been seen in their columns for many months. On many items price reductions are featured as the chief selling argument. Jobbers report that while dealers are not stocking holiday merchandise in big quantities, yet they are placing orders that indicate considerable anticipated activity. Jobbers' stocks are good.

Heavy tax delinquencies, especially among farmers, are evidence that money is still tight and that Christmas spending will be conducted along extremely frugal lines. It is still hard to negotiate loans, except from sources provided by the government as emergency help. A "buy-something-made-of-copper" campaign has been started in the hope that a larger demand for the product will be created and the revival of the industry hastened.

Buying generally is improved over the condition that has obtained for several weeks. A flurry of snow and a sharp cold wave have revived shopping gratifyingly.

Christmas-Tree Lighting Outfits.—Dealers are stocking well in anticipation of a good demand. Units of light festoons that can be plugged on and lengthened indefinitely are most called for. Stocks will likely be ample.

Flashlights.—Flashlights are in high favor as a gift for men and boys. The holiday trade will be up to standard, jobbers say. Dealers are stocking a good assortment.

Electric Dishwashers.—Dishwashers are making slow progress in finding a market in this region. The need for such an appliance does not seem imperative enough to the housewife to warrant the investment. The size for domestic use is selling at about $100 to $125. A great deal of educational work is benig done by the jobbers.

SAN FRANCISCO

Business conditions are much better and are more nearly approaching the briskness of the summer of 1920. Christmas business especially is of an appreciable volume, many firms reporting that early in December it already surpassed the sales of Christmas week last year. However, 1922 is being conservatively expected just about to equal the business volume of this year. Export business is far better than it was a few months ago. Its volume is chiefly composed of such natural products as oil and dried fruit, but the fact that this business is better proves that the export business is opening up.

The list of building permits for November, 1921, is as follows: Los Angeles, $8,454,387; San Francisco, $2,444,606; Oakland, $1,235,174. The corresponding figures for November, 1920, were as follows: Los Angeles, $6,267,660; San Francisco, $1,340,950; Oakland, $563,676. San Francisco shows a steady and cumulative increase of building since the building strike of last summer.

Fuse Plugs.—New prices on standard 125-volt non-refillable fuse plugs are $2.75 per 100 in package lots, with a 7½ per cent better price in quantities of 5,000. Sales are good and local stocks are well maintained.

Snap Switches.—Indicating snap switches of 5-amp. rating are now selling for 23c. each, non-indicating for 20c. each in standard package lots. Carton lots take a 10 per cent higher price. Local stocks are good.

Push Switches.—Radio-handle push switches are being sold in standard package lots for 54c. each in the single-pole cheaper grade and at 63c. each for the higher grade. Three-way switches of this kind are selling respectively for 90c. and $1.08 each. Cartons take a 15 per cent addition to the above prices.

Wire.—No. 14 rubber-covered, single-braid, solid is being quoted generally at $7 per 1,000 ft. in 5,000-ft. lots, with 5 per cent additional for single coils. Weatherproof wire is moving rather slowly. What little is being sold is priced at 19c. per pound for the base sizes of the three-braid solid style in 500-lb lots.

SEATTLE—PORTLAND—SPOKANE

A terrific gale struck Portland on Thursday, Dec. 1, the worst in twenty years, and the high wind together with falling trees interfered with service seriously and caused considerable damage to the distribution lines and service lines of the light and power and telephone utilities. Stocks of line hardware, insulators and some sizes of wire of the local electrical supply houses were in many instances entirely depleted as a result of the unprecedented demand for these lines occasioned by the sleet storm of the previous week, which did damage to distribution and service lines amounting to many thousands of dollars. Manufacturers and jobbers report business a trifle weaker, probably owing primarily to the stormy weather. Activity centers around heating devices, lamps, fixtures, wiring materials and holiday goods.

A well-sustained building program in and around Seattle makes rubber-covered wire, porcelain and other material entering into this class of construction in good demand. Lumber shipments and production show a slight falling off from previous weeks, indicating something of a slowing down of the activities in the industry.

The following quotations come from Seattle:

Knife Switches.—A price reduction of 20 per cent became effective during the week. Safety switches are required in th urban districts by city ordinance, whereas open switches are sold largely through the country districts. Unfused double-pole, single-throw 30-amp. switches sell at $1 each.

Tape.—The demand for this item is fair. Slight increases in price for certain of the better qualities were recently made. Half-inch friction tape now sells at $25.95 per 100 rolls.

Sockets.—Sockets in standard packages are quoted as follows: Pull-chain, $36.60; key, $19.80; keyless, $18. Jobbers note a tendency on the part of retailers to buy parts rather than standard packages. This procedure enables them to make up from parts the sockets desired and considerably cut down the stock which they must carry.

Christmas Business.—Retailers apparently are not laying in Christmas stocks as heavily as could be expected, but seem to be going on the supposition that the jobbers will carry the stock for them, and it is feared that there may be some disappointment later owing to short jobbers' stocks.

Manufacturers' Activities

Devoted to the Business Side of Manufacturing, Distribution and Sales, News from Jobbers and Foreign Fields and a Record of New Devices and Trade Literature

Kilbourne-Clark to Have New Factory

The Kilbourne-Clark Manufacturing Company, whose Seattle (Wash.) plant was recently purchased by the Westinghouse Electric & Manufacturing Company to be used as its Northwestern distributing headquarters, will occupy a new factory which is being erected at the corner of First Avenue South and Spokane Street. When completed the building will be one of the most complete in the West and will employ approximately 300 men. The company will continue to manufacture electrical and wireless equipment.

Robbins & Myers to Make Radio Apparatus

Announcement was made at a conference of district sales managers of the Robbins & Myers Company of Springfield, Ohio, held in that city Nov. 25 to 29 inclusive that the company would begin the manufacture of high-voltage radio apparatus. This is a new line for the Robbins & Myers Company, which heretofore has devoted its activities to the making of motors for power machinery, fans, etc.

District sales managers from all parts of the country were present at the conference and reported on conditions in their territory. In the main a spirit of optimism pervaded the conference over the outlook for the coming year, although some of the managers reported that conditions in their districts were not promising owing to local depression. Sales and advertising plans for 1922 were explained and discussed.

The company expects largely to increase production after Jan. 2. The plants at Springfield will be closed from Dec. 17 to Jan. 2 for inventory.

Motor Manufacturer to Increase Output with New Factory

Plans are under way by the Jeannin Electric Company, Toledo, Ohio, for the construction of a new factory, according to an announcement of the company. The new building, which will be situated at Fassett Street and the New York Central crossing, will enable the company to triple the present output of single-phase, repulsion induction electric motors, ranging from $\frac{1}{4}$ hp. to 25 hp.

Work on the first unit, which is to consist of a one-story brick and concrete factory building and an office building, has been started and is expected to be finished by Jan. 1. The plans are so drawn that additional units may be added as needed. The company had not expected to build for another year, but a sudden increase in orders caused the officials to take the necessary steps for the return to better business conditions, which they anticipate from the recent influx of orders.

The company was formed in July, 1919, and started production immediately. It has had a rapid growth. At the present plant, on Eleventh Street near Monroe Street, it employs fifty men, while in the new plant it will employ 150 men, consisting largely of skilled labor. The officers are: Carl H. Clement, president; H. W. Jeannin, vice-president, and M. C. Seeley, secretary. The capitalization is $250,000.

Apex Company Adds Ironer to Line

The addition of an electric ironer to the other home appliances manufactured by the Apex Electrical Distributing Company, Cleveland, Ohio, has just been announced. The company has been manufacturing suction cleaners and washing machines. The ironer is being made in the 42-in. size and is gas-heated and electrically operated. It is listed at $137.50 east of Denver and at $147.50 in Denver and west of there.

Two-Year Construction Record for Stone & Webster

Within the last two years steam and hydro-electric plants have been completed or placed under construction for public utilities by Stone & Webster, Inc., to the extent of 328,700 kva. in seventeen companies and independent boiler plants for five other companies, aggregating 20,521 boiler-hp. Construction work of various kinds for sixteen different companies was begun this year.

Vacuum Company Issues Lubrication Data

Four carefully prepared pamphlets dealing with the proper lubrication of horizontal steam turbines, stationary steam engines, oil engines of the surface ignition type and air compressors have just been issued by the Vacuum Oil Company, New York, for distribution to central stations and owners of private power plants. The booklets are profusely illustrated, showing by diagrams and pictures the operation and the methods of lubrication of the various power units described.

Increased Sale of Commutator Dressers Noticed

Orders booked by the Ideal Commutator Dresser Company for commutator dressers during the past few months have shown a very good percentage of increase, according to J. W. Becker of that company. Both central-station companies and industrial plants are ordering more freely than was the case six months ago, indicating increased activity. On account of larger sales and increased production, according to the announcement, a reduction in price has recently been put into effect by the company.

Navy Magnet Wire Order to Rockbestos

The Rockbestos Products Corporation, New Haven, Conn., has announced that it has secured the order for the asbestos-insulated magnet wire to be used in the electrical installations on a number of United States Navy submarines now under construction. The order was placed by the Ridgeway Dynamo & Engine Company, Ridgeway, Pa., which has the contract for the entire electrical installation. It is estimated that about twenty-six tons of this kind of wire will be required.

Storage-Battery Campaign in Newspapers

In an effort to familiarize the public with the various uses of storage batteries and to create confidence in the ability of battery-propelled vehicles to compete with gasoline vehicles, the Electric Storage Battery Company, Philadelphia, is carrying on a widespread newspaper advertising campaign. The latest advertisement appeared on Nov. 17 in 133 newspapers, published in 117 cities throughout the country. The combined circulation of these papers is more than 8,000,000, and the company estimates that this means that the advertisement will be brought to the attention of over 25,000,000 people throughout the country. The latest advertisement in the series is entitled "Lifting Labor's Yoke" and emphasizes the part that industrial tractors are playing in industrial plants and in moving baggage and freight for railroads.

Westinghouse Opens New Radio Broadcasting Station

On account of the great success and widespread interest that have been the outcome of pioneering in radio-telephone broadcasting by the Westinghouse Electric & Manufacturing Company the company has announced a complete plan for covering the United States with a service to the home that will allow anyone anywhere in the country to enjoy the many benefits of radio. The first radio broadcasting station of its kind in the country has been operated at East Pittsburgh, Pa., for the past twelve months.

In order to cover certain parts of the country not reached by this station and to intensify the service to other parts, the Westinghouse company has laid out a complete program and has added three stations. At Springfield, Mass., station WBZ supplies New England; at Newark, N. J., station WJZ takes care of the Middle Atlantic and Southern States, and at Chicago, station KYW gives service to the Middle and Western States.

The service at East Pittsburgh started with the transmission of Presidential election returns in November, 1920, and has progressed through the broadcasting of phonograph music, entire church services, speeches of prominent men, acts from theaters, musical recitals, sporting events, market reports and national and international news of all sorts. There will be various local features at the other stations, including broadcasting of complete operas from Chicago.

In order to perfect the transmission of music by radio, engineers of the Westinghouse company have made considerable research studies of the different frequencies of music. A studio has been built especially for the singing of artists so that the reproduction will be accurate. The studio at East Pittsburgh consists of a room 20 ft. x 30 ft. completely lined with burlap and cloth and without windows, so that there will be no reflection of sound. A chart is used to determine the proper position of the microphone and a report is made for each musical selection. These reports are checked later with the reception qualities at a receiving outfit. Data already obtained indicate the proper methods of transmitting various types of music.

Independent Steel Merger Reports Confirmed

Reports that plans are under way for merging several independent steel companies have been confirmed by James A. Campbell, president Youngstown Sheet & Tube Company, who states that consolidation of his company with the Steel & Tube Company of America and the Inland Steel Company is under consideration and may be put through by April 1, 1922.

It is further reported that another steel merger is being considered, to include the Republic Iron & Steel Company, Midvale Steel & Ordnance Company, Lackawanna Steel Company, Brier Hill Steel Company, Youngstown Sheet & Tube Company, Steel & Tube Company of America and Inland Steel Company. Both of the proposed consolidations, however, are far from completed.

There is reason to believe that physical valuations of the properties have not yet been made and that nothing like a definite exchange basis for stocks of the several companies has been arrived at. The seven companies together have developed a producing capacity of 7,400,000 tons of steel and an aggregate present capitalization of $467,000,000. Only two of the companies, the Youngstown Sheet & Tube Company and the Steel & Tube Company of America, make finished products for the electrical industry, but several others sell a percentage of their products to electrical manufacturers as raw material. It is pointed out that consolidation of the independents would put them in a position to meet the prices of the United States Steel Corporation and produce real competition

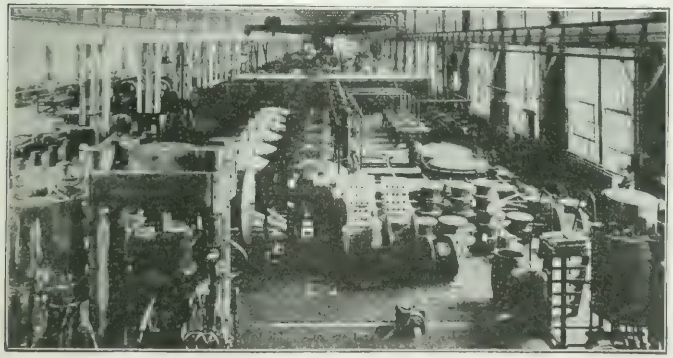
New G. E. Cable Shop at Schenectady

Increased facilities for the manufacture of paper-insulated cable are afforded the General Electric Company by the recent completion at Schenectady of a new cable shop having 85,000 sq.ft. of floor space. The new shop is 850 ft. long by 100 ft. wide. The various machines in the shop are so arranged that the raw materials enter at one end of the building and the finished lengths of cable, tested and wound on reels ready for shipment, are loaded into cars at the other end. In their course through the building the cables are stranded, insulated, leaded and tested for dielectric strength, insulation resistance, etc.

Among the various machines are a number of large bobbin stranders, high-speed insulation machines for applying the paper insulation, impregnating vats, vacuum driers, lead presses for applying the lead sheaths, and a number of other machines for various purposes, such as applying band steel armor, wire armor, or coating the cables with compounded jute.

Besides the lead-sheathed paper-insulated cable, the shop is equipped for making single and multiple conductor band-steel armored cables and steel-wire armored submarine cables. Cable sizes which are manufactured at present range from 3,000,000 circ.mil to No. 10 B. & S. in single conductor, from 1,500,000 circ.mil to No. 14 in double-conductor and from 750,000 circ.mil to No. 14 B. & S. in three-conductor. The single-conductor cables are made for Y-connected grounded neutral circuits up to 60,000 volts, 60 cycles, and the three-conductor ones up to 33,000 volts, 60 cycles.

The capacity of the cable shop is indicated by the amount of materials used weekly. This totals 300,000 lb. of lead, 300,000 lb. of copper and 150,000 lb. of miscellaneous metal, such as steel strip for armor, etc.



GENERAL ELECTRIC CABLE SHOP AT SCHENECTADY EQUIPPED WITH MOST MODERN CABLE-MAKING APPARATUS

United Electric Publishes "Red Band"

An article on page 1151 of the Dec. 3 issue of the ELECTRICAL WORLD stated that a quotation relative to business conditions had been taken from the *Red Band*, the house organ of the Ohio Electric Company, Cleveland. This house organ is published by the United Electric Company, Canton, Ohio.

The American Battery Company has changed its location to 2,053-7 North Racine Street from 1,134 Fulton Street, Chicago. This company manufactures storage batteries, storage-battery equipment and home electric lighting apparatus.

The Sunbeam Electric Manufacturing Company, Evansville, Ind., has an order for 100 locomotive headlights and turbo-generators from the Baldwin Locomotive Works in Philadelphia.

S. and H. Lippman, who have managed the Reliable Electric Motor Company, 165 Grand Street, New York City, for the past twelve years, have entered the electrical supply field with Max Lippman, under the name of the Reliable Electrical Supply Company, at the same address.

The Combustion Engineering Corporation, 43 Broad Street, New York City, announces the opening of two branch offices, one at 216 Latta Arcade, Charlotte, N. C., in charge of T. E. Nott, and the other at Seattle, Wash., where it is represented by the Fryer-Barker Company, 1133 Henry Building.

The Universal Electric Bracket Company, 1109 Pine Street, St. Louis, has been organized to manufacture on a large scale a recently developed device for lighting brackets consisting of a joint with metal and insulation so arranged that all wiring in the joint is eliminated. The device is finding application in a number of plants, particularly in the shoe industry. H. Scharff is manager of the company.

Candy & Company, 401 North Paulina Street, Chicago, have purchased the property of the Dearborn Truck Company, 2515 West Maplewood Avenue, which includes a three-story factory, 110 ft. x 118 ft. This building will be ready for occupancy about Jan. 5, when Candy & Company will use it for making insulating materials.

The Welborn Corporation, incorporated under the laws of Delaware for $4,000,000, has been organized. The corporation has acquired the patents, good will, plant and equipment of the Coleman Tractor Company, and also the patent on a new storage-battery electrolyte. Headquarters of the company will be in Kansas City, Mo. The officers are Frank I. Welborn, president; Earl L. Wood, vice-president and Arthur Coleman, secretary.

The Hub Electrical Supply Company, 558 Melrose Avenue, New York, has acquired the three-story building at 616 Courtland Avenue, and alterations and improvements are under way to adapt the building to the needs of a jobber of electrical supplies. Announcement was also made that the retail business of the company would be discontinued at once in order to permit entire attention to be devoted to jobbing. The company may be addressed in care of Martin Newman.

The Standard Electric Manufacturing Company, manufacturer of schedule material, is now occupying its new building at 941 Wrightwood Avenue, Chicago. This company was formerly at 216 North Clinton Street, Chicago.

The G-A Ball Bearing Manufacturing Company, 3051 West Lake Street, Chicago, has purchased a site, 124 ft. x 324 ft., at 3305-35 Harrison Street, on which it is erecting a one-story factory and office building to contain 22,000 sq.ft. and cost $50,000.

Foreign Trade Notes

DEMAND FOR INSULATED WIRE IN CHILE. According to Consul D. C. McDonough at Concepcion, Chile, insulated wire is one of the principal articles containing rubber which are imported into that part of the country. Formerly it was imported principally from Germany, but now it comes mainly from the United States, although Japanese insulated wire is entering the market and competition is keen. Some English wire and cable is also imported directly by the West Coast Cable Company and Chile Telephone Company, Ltd. (both English). The Chile Telephone Company controls most of the telephone business in Chile and makes its purchases through its office in London, which buys from both England and the United States. The company neither buys nor sells insulated wire in Chile. The insulated wire used in Chile is not of the best quality. Both the English and the Japanese wire are of too good quality for this market. The kind in demand seems to be procurable most easily in the United States.

PROPOSED WATER-POWER DEVELOPMENTS IN ITALY. The Provinces of Venezia, Treviso, Belluno, Padova, Rovigo, Vicenza and Ferrara, *Electrical Industries* states, are by a decree appearing in the *Gazette Ufficiale* authorized to form an autonomous group for the utilization of the hydraulic forces of the hydrographic basins of the Brenta and the Piave Rivers and their tributaries, as well as the other water courses of the provinces. The bodies entitled to form part of the group include the various communes, reclamation and irrigation consortiums, chambers of commerce, savings banks, the Instituto Federale di Credito pel Risorgimento delle Venezie and other public bodies and companies. The group will construct electric plants and distribute and sell electricity.

ELECTRICALLY OPERATED FLOODGATES TO BE INSTALLED IN INDIA.—Details of electrically operated floodgates to be erected at Hyderadad Deccan, India, in connection with a storage reservoir now being built on the River Musi, have been received by the Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C. This project is to prevent the recurrence of floods like that in 1908, when the unusual rains caused the river to overflow its banks and inundate one-fourth of the city of Hyderadad. The giant shutters to be installed will so control the discharge from the reservoir that the maximum carrying capacity of the river below cannot be exceeded. Further particulars in regard to this project may be obtained from the electrical equipment division of the Bureau of Foreign and Domestic Commerce by referring to Exhibit File No. 39,353.

ITALY'S WATER-POWER PROJECTS.—Italy is in a position to dispose of numerous easily exploited water powers in her Alps and Apennine Mountains, according to advices received from a foreign correspondent to the ELECTRICAL WORLD. If up to the present time, three years after the close of the war, nothing has been done in this respect, the fault, it is declared, may be laid at the door of the Italian government, which has displayed a certain shortsightedness. While in Switzerland, for instance, the federal and various local governments have built a great number of the most important electric power stations of the country, in Italy all electric works are private property, the government tendering only slight financial assistance, and this only from time to time. The chief cause, however, for the paralysis in the Italian central-station industry is the fear of foreign capital, including French, Swiss and American that the government will pass a proposed law surrounding the issue of shares with certain disadvantageous conditions. For this reason foreign capitalists are very chary about putting their money into these projects, however great the natural advantages seem to be. As a matter of fact, these fears are in a way unfounded, for the draft of the bill applies only to the case of speculative securities and not to industrial capital, to which the electrical stocks belong. Be this as it may, foreign capital is alarmed even at the prospect of these industrial securities being dealt with on the public exchanges, which might lead to their being considered speculative paper. The same reason prevents the Italian capitalists from investing their large profits of the last few years in these domestic undertakings, and thus this capital is lost not only to the Italian electrical industry but even to the state, for a great deal of it is now being invested in industrial enterprises operating outside of Italy. The Chamber of Deputies is to assemble at Rome during the first part of December, and it is expected that it will make a final decision on the compulsory legitimation bill. Another proposed law will be acted on at the same time the effect of which will be to prohibit foreigners from being members of the management or board of directors of any Italian hydro-electric power company. The passage of this bill also would tend to keep foreign capital out of Italian hydro-electric developments.

ELECTRICITY FOR SMALL TOWNS IN AUSTRALIA.—Arrangements are being made by the St. George County Council, according to the *Industrial Australian and Mining Standard*, for the loan of £100,000 for the installation of an electric light and power plant to supply electricity for the municipalities of Rockdale, Bexley, Kogarah and Hurstville, on which work will begin at an early date.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

A commercial corporation in Spain (No. 381) desires to secure the representation of manufacturers of electrical apparatus for the sale of electric fans, irons, ovens and grills, heaters and vacuum cleaners.

A merchant in Italy (No. 386) desires to purchase or secure an agency for the sale of electrical supplies, technical supplies, etc.

A merchant in Italy (No. 390) desires to purchase or secure an agency for the sale of electrical supplies.

New Apparatus and Publications

UNDERFEED STOKERS.—The Sanford Riley Stoker Company, Worcester, Mass., is distributing a circular covering the "Riley" underfeed stokers, safety shearing pin, moving grates, rocker dump and two-speed gear box.

WIRING DEVICES.—"Weber Wiring Devices" is the title of the 1921 catalog issued by Henry D. Sears, general sales agent, 80 Boylston Street, Boston, covering the wiring devices manufactured by the Weber Electric Company, Schenectady, N. Y.

STOKERS.—The Roach Stoker Company, 221 South Fifteenth Street, Philadelphia, is distributing a booklet describing the "Roach" stoker. The company has also issued a pamphlet covering the "Simplex" type of the Roach stoker.

CENTRIFUGAL PUMPS.—The Wheeler Condenser & Engineering Company, Carteret, N. J., has issued catalog 108-C, covering its centrifugal pumps, including double-suction, single-stage horizontal and vertical types and multi-rotor types for every purpose.

FLOODLIGHT PROJECTORS.—The Reflector & Illuminating Company, 565 West Washington Street, Chicago, has issued bulletin No. 10, describing its "Flood-O-Lite" projector. The bulletin also contains a table showing the light flux at various distances away from the projector.

SHOWCASE LIGHTING.—The National X-Ray Reflector Company, Chicago, has developed a small spotlight for showcases which concentrates the light of a 250-watt lamp at any angle desired. It can be attached to a 3¼-in. shade holder of the regular window reflector or bolted to any supporting surface. The spread of the light can be adjusted from the outside, and color mediums can also be used.

WASHER AND WRINGER.—The Star Washing Machine Company, 644 West Jackson Boulevard, Chicago, has recently developed a new electric washer and wringer, known as the "Silver Star."

REFRIGERATOR.—The Utility Compressor Company, Harper and Rivard Streets, Detroit, has recently placed on the market the "Utility" electric refrigerator.

EXHAUSTER.—The L. J. Wing Manufacturing Company, 352 West Thirteenth Street, New York City, has recently brought out an exhauster "Wing-Seruplex" adaptable to any hood or system of ductwork.

MOTOR-DRIVEN PUMP UNIT.—Burleigh, Morrison & Gowing, 80 Boylston Street, Boston, have recently placed on the market a small motor-driven pump unit under the name of the "Washerpump."

WASHER.—A new electric washer, under the name of "Rightway," has recently been placed on the market by the American Gas Machine Company, Albert Lea, Minn.

MOTOR STARTER.—An automatic direct-current motor starter for small motors has recently been developed by the Automatic Reclosing Circuit Breaker Company, Columbus, Ohio.

BATTERY RECHARGING CLIP.—The Du Chanois Electric Company, Youngstown, Ohio, has recently brought out a battery "Tiger" recharging clip.

ELECTRICAL SUPPLIES.—Harvey Hubbell, Inc., Bridgeport, Conn., is distributing a four-page circular calling attention to the Hubbell "Te Tap Ten" display container, which holds ten standard Hubbell electrical specialties.

INSULATED BRUSH AND SCOOP.—The James B. Prouse Company, 37 North Sixth Street, Philadelphia, is distributing a leaflet describing its insulated brush and insulated scoop.

WIRING DEVICES.—The Beaver Machine & Tool Company, Inc., 625-643 North Third Street, Newark, N. J., is distributing a ten-page folder describing its "Beaver" switch plug, "Feed-thru" switches, couplings, etc.

New Companies

THE ROCK CREEK (OHIO) ELECTRIC LIGHT & POWER COMPANY has been incorporated with a capital stock of $15,000 by H. M. Ackerman and others, to operate an electric power plant.

THE AMERICAN ELECTRIC EQUIPMENT COMPANY has been chartered under the laws of the State of Delaware, with a capital stock of $2,000,000, to manufacture electric light, gas and other fixtures. The incorporators are Frank Jackson, W. I. N. Lotland, Mark W. Cole, Dover, Del.

THE GREENE TOWNSHIP ELECTRIC COMPANY, Chambersburg, Pa., has been organized with a capital stock of $5,000, to operate a light and power system in Chambersburg. J. G. Schaff is treasurer.

THE FAYETTEVILLE (PA.) ELECTRIC LIGHT & POWER COMPANY has been organized to operate a light and power system in Fayetteville. H. G. Sollenberger is treasurer.

THE A. P. MERCHANT COMPANY, Boston, Mass., has been incorporated by Alfred P. Merchant, Gloucester, Mass.; Frank W. Johnson, Milton, Mass., and P. L. Troy. The company is capitalized at $100,000 and proposes to manufacture electrical appliances.

THE BUGBEE BATTERY COMPANY, Trenton, N. J., has been organized with a capital stock of $20,000 to manufacture electric batteries and other electrical equipment. The incorporators are Newton A. K. Bugbee, Alvin Bugbee and Robert H. Steele, 265 Rutherford Avenue, Trenton, N. J.

THE PORCELAIN APPLIANCE CORPORATION has filed articles of incorporation at Dover, Del., with a capital stock of $25,000, to manufacture and deal in electrical appliances. The incorporators are J. H. Parker, Parkersburg, W. Va.; H. R. Holmes, East Liverpool, Ohio, and H. G. Spencer, Carey, Ohio.

THE ILLINOIS POWER COMPANY, 111½ East Washington Street, Springfield, Ill., has been incorporated with a nominal capital stock of $1,000 to furnish electricity for light, heat and power in the vicinity of Springfield. The incorporators are William B. Jess, Arthur D. Mackie and Philip B. Warren, all of Springfield.

THE CONSUMERS' HEAT & POWER COMPANY, Lilly, Pa., has been organized to operate a light, heat and power system in Lilly. W. L. Piper is treasurer.

THE GEM ELECTRIC COMPANY, El Paso, Tex., has been incorporated with a capital stock of $30,000 by John Blake, S. A. Milliron and August Albrecht.

THE MOULTON (TEX.) LIGHT & ICE COMPANY has been organized with a capital stock of $30,000 by F. T. Fehrenkamp, Edward Boehn and J. T. Jaeggle.

THE PEOPLES ELECTRIC SUPPLY COMPANY, 36 West Lake Street, Chicago, Ill., has been incorporated by D., Joseph H. and P. Landerman. The company is capitalized at $50,000 and proposes to manufacture and deal in electrical devices, etc.

Record of Electrical Patents

Notes on United States Patents

(Issued Nov. 8, 1921)

1,396,335. Constant-Speed Vibrating Motor and Method. Leslie R. McDonald, Montreal, Que., Can. App. filed Dec. 28, 1916.

1,396,336. Direct-Current Vibratory Motor; Leslie R. McDonald, Montreal, Que., Can. App. filed Dec. 28, 1916.

1,396,337. Variable Amplitude of Vibration-Motor and Method; Leslie R. McDonald, Montreal, Que., Can. App. filed Dec. 29, 1916. Means for regulating speed.

1,396,350. Electrical Measuring Instrument; Leon T. Wilson, West Somerville. Mass. App. filed April 19, 1920. Alternating current of high frequency.

1,396,370. Clock-Controlled Electric Signal System; John F. Hielscher, Seattle, Wash. App. filed April 2, 1918. For automatically controlling call-bells.

1,396,374. Electric Furnace; Walter Lohrey, Bloomfield, N. J. App. filed May 21, 1921. Alloying magnesium and other metals.

1,396,390. Separator for Storage Batteries; Charles F. Williams and Ira C. Williams, De Long, Ind. App. filed May 15, 1918. Strong and impervious to acid.

1,396,415. Identification of Plates and Films; Julius Fried, New York, N. Y. App. filed May 1, 1920. X-ray photography

1,396,426. Electrically Operated Brake; Edward V. Hartford, Deal, N. J. App. filed Aug. 27, 1914. For automobiles.

1,396,434. Metal Box or Receptacle for Electrical Switches; Bryson D. Horton, Detroit. Mich. App. filed Feb. 15, 1919.

1,396,451. Brush Holder; Lawrence A. Merk, Los Angeles, Cal. App. filed April 11, 1921. Used in a confined space.

1,396,521. Dynamo-Electric Machine; Romaine W. Myers, Oakland, Cal. App. filed Nov. 26, 1918. Slot-closing device.

1,396,525. Coil Retainer for Dynamo-Electric Machines; H. Pieper, Liège, Belgium. App. filed Nov. 12, 1917. Wires formed corresponding to outline of slot.

1,396,538. Protective Device; Beverly L. Stemmons, Charlotte, N. C. App. filed May 20, 1918. Spark gap which will discharge at dry arc-over voltage setting independent of weather conditions.

1,396,551. Electrical Transformer for Regulating or Varying the Voltage of the Current Supplied Therefrom; Frederick E. Berry, Hayes, England. App. filed Oct. 31, 1918.

1,396,552. Voltage-Controlling Mechanism; [illegible], Neuilly-sur-Seine, France. App. filed Sept. 28, 1918. Applicable to dynamos.

1,396,559. Protective Device; Elmer E. F. Creighton, Schenectady, N. Y. App. filed Jan. 10, 1918. Lightning arrester.

1,396,563. Electrical Apparatus; Guiseppe Faccioli, Pittsfield, Mass. App. filed Oct. 11, 1916. Large transformers.

1,396,571. Radio Receiving System; Alfred N. Goldsmith and Julius Weinberger, New York, N. Y. App. filed Sept. 13, 1918. Duplex system.

1,396,[illegible]. Induction Motor; [illegible] Isono, Tokyo, Japan. App. filed May 24, [illegible]

1,396,[illegible]. Repulsion Motor; [illegible], Schenectady, N. Y. App. filed Feb. 13, 1918. Improved control for starting, stopping and dynamically braking.

1,396,[illegible]. Electrical Apparatus [illegible]; Harold C. [illegible], Newport [illegible]. App. filed July [illegible]

1,396,6[illegible]. Lighting Fixture; [illegible], Findlay, Ohio. App. filed Nov. 6, 1919. Portions exposed to view constructed of wood.

1,396,660. Sanitary Mouthpiece for Telephone Transmitters; William H. [illegible], Cleveland, Ohio. App. filed Sept. 18, [illegible]

1,396,677. Electric Rotating Furnace; Cornelius E. Cornelius, Stockholm, Sweden. App. filed March 27, 1920. Melting zinc powder into liquid zinc.

(Issued Nov. 15, 1921)

15,228. Automatic Trunking System; Franklin J. Truby, Chicago, Ill. App. filed Aug. 30, 1916. Non-numerical trunking switch.

1,396,728. Unreeling and Tension Device; Penrose E. Chapman, St. Louis, Mo. App. filed April 24, 1917. For unreeling wire to wind armatures, etc.

1,396,739. Telephone-Exchange System; Clarence B. Fowler, New York, N. Y. App. filed Sept. 30, 1920. Common and local battery lines at central office.

1,396,741. Machine-Switching Telephone System; Charles L. Goodrum, New York, N. Y. App. filed Oct. 31, 1919. Trunking arrangements.

1,396,745. Vacuum-Tube Circuits; Arthur Haddock, East Orange, N. J. App. filed May 19, 1919. Multistage amplifier.

1,396,746. Telegraph System; Carl Halter, Chicago, Ill. App. filed Dec. 22, 1917. Correcting devices.

1,396,747. Telephone Receiver; Henry C. Harrison, New York, N. Y. App. filed Sept. 10, 1918. Improved magnetic structure.

1,396,750. Signaling Generator; Owen E. Hill, New York, N. Y. App. filed Dec. 4, 1916. For telephone systems.

1,396,760. Signaling Circuit; Kenneth S. Johnson, Jersey City, N. J. App. filed Jan. 4, 1918. Subscriber's telephone station.

1,396,771. Receiver Shield; John P. Minton, East Orange, N. J. App. filed March 27, 1918. For shielding from extraneous noises.

1,396,786. System for Transmission of Intelligence; Edward O. Scriven, New York, N. Y. App. filed Nov. 6, 1916. By high-frequency oscillations.

1,396,800. Testing System; Ray S. Wilbur, Lyndhurst, N. J. App. filed Dec. 28, 1918. Signaling over telephone circuits.

1,396,803. Electric Indicator; Frank W. Wood, Montclair, N. J. App. filed Aug. 7, 1919. Rotating transmitter and indicator.

1,396,812. System of Control; J. A. Clarke, Jr., Edgewood Park, Pa. App. filed Nov. 4, 1918. Automatic acceleration of railway motors.

1,396,818. Electric Air Heater; Ora A. Colby, Irwin, Pa. App. filed April 4, 1919. Rods of solid conducting material.

1,396,826. Electrical Distributing System; Charles LeG. Fortescue, Pittsburgh, Pa. App. filed May 2, 1917. Phase-modifying means.

1,396,835. Electrical System; Edward A. Hanff, Irwin, Pa. App. filed Oct. 14, 1916. Starting of electric motors.

1,396,838. Damping Windings for Dynamo-Electric Machines; Rudolf E. Hellmund, Swissvale, Pa. App. filed July 6, 1917. To reduce liability to flashovers.

1,396,839. High-Voltage Direct-Current System; Rudolf E. Hellmund, Swissvale, Pa. App. filed Sept. 10, 1917. Inherent overload protection of generators.

1,396,853. Electrical System; Edwin S. Lammers, Jr., Wilkinsburg, Pa. App. filed Nov. 7, 1916. Used with hoists or rolling mills.

1,396,857. Cap for Electric Light Sockets; Alexander W. Limont, Bridgeport, Conn. App. filed Aug. 26, 1915.

1,396,866. System of Control; Harry R. Meyer, Wilkinsburg, Pa. App. filed Nov. 4, 1918. Electric railway motors.

1,396,871. Expanded-Metal Resistor and [illegible]; Harry [illegible] Nagel, Wilkinsburg, Pa. App. filed March [illegible]. Metal simultaneously cut and stretched.

1,396,897. Condenser; Phillips Thomas, Edgewood Park, Pa. App. filed Oct. 8, 1917. Insulation of stacked-foil condensers.

1,396,[illegible]. Regulating System; Allen A. [illegible], Pittsburgh, Pa. App. filed Sept. 19, 1918. Vibrating-contact type.

1,396,919. Automatic Operation of Electrolytic Cells; [illegible] H. [illegible], Pittsburgh, Pa. App. filed Nov. 20, 1919. Production of metals from fused salts.

1,396,[illegible]. Method of Measuring [illegible]; Edward E. [illegible], Los Angeles, Cal. App. filed Jan. 17, 1920. X-ray.

1,396,928. Trolley Pole; Arthur W. Carroll and George P. Stoddard, Seattle, Wash. App. filed March 9, 1921. Trolley-wire replacer.

1,396,930. System for the Equalization of Transmission Lines; Bancroft Gherardi, Bayhead, N. J. App. filed Dec. 27, 1917. Characteristics of telephone lines equalized.

1,396,947. Dynamo-Electric Machines; Vincent G. Apple, Dayton, Ohio. App. filed Feb. 14, 1918. Improved end plate.

1,396,948. Commutator Brush; Frank L. Cooley, Brooklyn, N. Y. App. filed Jan. 6, 1921. Body of metallic fibers.

1,39[illegible]. [illegible] Wax-Warming Device; Jay A. Heidbrink, Minneapolis, Minn. App. filed Nov. 19, 1919.

1,397,007. Card-Punching Device; August Knistrom, Binghamton, N. Y. App. filed Dec. 12, 1919. Combination with ordinary typewriter of punching attachment.

1,397,008. Method of Preparing Finely Divided Metals; Albert McGall, New York, N. Y. App. fild Sept. 16, 1918. In non-oxidized condition.

1,397,034. Telephone-Exchange System; Henry P. Clausen, Mount Vernon, N. Y. App. filed July 19, 1910. Machine switching.

1,397,040. Cable Splice; James F. Dillon, Crown City, Ohio. App. filed Feb. 24, 1919. Strip of metal bent to embrace overlapping ends of cable.

1,397,093. Radio Repeating System; Lloyd Espenshield, Hollis, N. Y. App. filed Sept. 27, 1919. For amplifying at intermediate points.

1,397,137. Portable Telephone Apparatus; Alexander Miclaush, Mattoon, Ill. App. filed Oct. [illegible], 1918. Easily [illegible]

1,397,182. Dry Battery and Process of Manufacture; Otto E. Ruhoff, Madison, Wis. App. filed Nov. 14, 1918. [illegible] construction.

1,397,212. Electric Candle Socket; Max Herskovitz, Chicago, Ill. App. filed May 1, 1919.

1,397,222. Electrolytic Refining of Tin; Frank C. Mathers, Bloomington, Ind. App. filed Oct. 11, 1918. From impure cast anodes.

1,397,228. Electrical Measuring Apparatus; Harry Nyquist, [illegible], N. J. App. filed Sept. [illegible], 1920. For comparing magnitude and phase [illegible]

Construction News

Projects, Plans, Bids and Contracts Contemplated or Under Way

New England States

PORTLAND, ME.—The [illegible] County Power & Light Company is considering the construction of an auxiliary steam power station on the site of the old dry dock near the Portland Bridge, to cost about [illegible]

PORTLAND, ME.—The William Underwood Company, 50 Fulton Street, Boston, Mass., contemplates the construction of a seven-story packing plant, with power station [illegible], in Portland.

KEENE, N. H.—The [illegible] of an ornamental lighting system in Keene is under consideration. Walter R. Kirk is chairman of a special committee.

BURLINGTON, VT.—Steps have been taken for the installation of an ornamental lighting system [illegible] Street.

[illegible], MASS.—[illegible] Kirkpatrick [illegible]

LONSDALE, R. I.—A contract has been [illegible] Gas & Electric [illegible] line from the Hazle Street substation in the Fairlawn district to the Lonsdale plant. The contract provides for the purchase of [illegible]

WARWICK, R. I.—The [illegible] Town Council [illegible] ascertain the cost of the installation of an [illegible]

Middle Atlantic States

BUFFALO, N. Y.—The construction of a steam power house to provide service for the county jail and other buildings is under consideration by the Board of Supervisors, Buffalo. William F. Waldow is county sheriff.

LANCASTER, N. Y.—Plans have been prepared by the Depew & Lancaster Light, Power & Conduit Company for the erection of a 12-mile transmission line, to cost about $25,000. A. R. Tremaine, 173 Central Avenue, is engineer.

PLEASANTVILLE, N. J.—Bids will be taken at once, it is reported, by the Penn Motors Corporation, 1714 North Broad Street, Philadelphia, Pa., for the construction of a one-story automobile manufacturing plant, 50 ft. x 300 ft., with power house, at Pleasantville, N. J. Charles H. Donehower, Pleasantville, is engineer.

HARRISBURG, PA.—Plans are under consideration by the Board of Directors of the Harrisburg Hospital for the construction of a new power plant, with ice-manufacturing and cold-storage plants, in connection with proposed additions to the institution, to cost about $900,000, including site.

PHILADELPHIA, PA.—The Producers' Cold Storage Terminal, Inc., 1214 Widener Building, contemplates the construction of an ice and cold storage plant, 90 ft. x 275 ft., at Water and Swanson Streets, to cost, including machinery, about $1,000,000. Bids, it is understood, will be asked for the proposed work about Jan. 1, 1922. Andrew J. Sauer, Denkla Building, is the architect. C. P. Sharpless is president.

PHILADELPHIA, PA.—Bids will be received at the office of William S. Twining, director Department of City Transit, 1211 Chestnut Street, Philadelphia, until Dec. 20, for electrical equipment for the substations on Cumberland Street east of Kensington Avenue and on Griscom Street, north of Arrott Street. (Contract No. 6[illegible]7 Frankford Elevated Railway.)

PITTSBURGH, PA.—The West Penn Railways, which controls the West Penn Power Company, has taken over the West Virginia & Maryland Power Company, recently organized to supply electricity for lamps and motors in Grafton, W. Va., and eastward through Taylor and Preston Counties in West Virginia, and Garrett County, Md., into the coal fields along the upper Potomac. Work has been started on transmission lines into this territory, extending from the present system of the West Penn Power Company to Kingwood and as far south as Tunnelton, Rowlesburg and Newburg, on the main line of the Baltimore & Ohio Railroad. Additional transmission lines will connect with the larger power plant of the Monongahela River Power & Railway Company, just below Fairmont.

DELAWARE CITY, DEL.—The plant and property of the Delaware City Light & Water Company have been purchased by Daniel Hoch, William P. Bowman and Charles D. Buckley, representing the bondholders' protective committee, Reading, Pa.

FAIRMONT, W. VA.—The Monongahela Power & Railway Company is considering extensions and improvements to its electric power plants and system.

HILLSVILLE, VA.—The Skaags Brothers Electric Company contemplates the construction of a hydro-electric plant on Little Reed Island Creek, consisting of a dam 22 ft. high and 225 ft. long and a power house, 14 ft. by 18 ft., to cost about $25,000. A transmission line, 2½ miles long, to connect Hillsville and vicinity will be erected. The equipment will include two pedestal-type, 165-kva., 2,300-volt, 60-cycle alternators.

North Central States

BATTLE CREEK, MICH.—The city commission has adopted a resolution authorizing the mayor to engage an engineer to prepare plans and estimates of cost of a municipal electric light and power plant, and to submit such proposition of municipal ownership to the voters at the spring election.

GRAND HAVEN, MICH.—The Story & Clark Piano Company, Grand Haven, has had plans prepared by Byron E. Parks & Son, Grand Rapids, for the construction of a one-story power house.

LANSING, MICH.—Bids will be received by the board of electric light and water commissioners until Dec. 15 for the construction and equipment of a new municipal power plant. The initial installation will have a generating capacity of 10,000 kw. O. E. Bulkeley is superintendent of the board.

TOLEDO, OHIO.—Bids will be received by the Board of Commissioners of Lucas County, at the office of the County Auditor, Court House, Toledo, until Dec. 29, for furnishing material and labor for rewiring of various buildings at the Lucas County Home.

MONTICELLO, IND.—Plans are under way by the Indiana Hydro-Electric Power Company, Indianapolis, recently organized with a capital stock of $5,000,000, for the construction of the first of five hydro-electric generating plants on the Tippecanoe River. The proposed plant, which is to be built at Norway, near Monticello, will cost about $1,000,000, including machinery. Subsequent plants, all to be tied in with a transmission system, will be erected at Oakdale, Springboro and Tioga, with final site to be selected. Samuel Insull, president of the Middle West Utilities Company, Chicago, is president of the new company, and Harry Reid, president of the Interstate Public Service Company, Indianapolis, Ind., is vice-president and general manager.

SHELBYVILLE, ILL.—The city council is having plans prepared for the construction of a power house in Shelbyville, to cost about $75,000. Fuller & Beard, Chemical Building, St. Louis, Mo., are engineers.

GREEN BAY, WIS.—The Fort Howard Paper Company has awarded general contract to Ludolf M. Hanson Company, Green Bay, to design, construct and equip a new three-story-and-basement paper mill, 100 ft. x 120 ft., to cost about $125,000. The work includes a separate power plant and boiler house. A. E. Cofrin is general manager.

MAYKING, WIS. (Antigo P. O.)—Plans are under consideration by the C. and R. J. Wunderlich Company, Antigo, for rebuilding electric light plant and dam. The cost is estimated at $50,000.

ST. PAUL, MINN.—The Midwest Power Company has been organized to take over the property of the General Utilities Company. The management will be under the Savage & Winter Company, Pioneer Building, St. Paul. The only improvement contemplated by the new company is the erection of a high-tension transmission line from the city of Devils Lake to Devils Lake, a distance of about 4 miles. This is a correction of the item regarding the reorganization of the General Utilities Company which appeared in the issue of Nov. 19.

CORNING, IOWA.—Bids will be received by the city council early in January for the construction of a one-story municipal electric power plant, to cost about $60,000. C. K. Munns, Corning, is engineer.

EMINENCE, MO.—Plans are being prepared by the Western Tie & Timber Company, Syndicate Trust Building, St. Louis, for the construction of a hydro-electric plant on the Current River at Eminence.

FERGUSON, MO.—The Republic Photographic Company, Kansas City, Mo., contemplates the construction of a power house in connection with its new plant, 77 ft. x 163 ft. and 54 ft. x 250 ft., in Ferguson, which will cost about $250,000. Albert F. H. Seelig, 2194 Railway Exchange Building, St. Louis, is engineer. E. B. Fish is president.

JAMESPORT, MO.—Bonds to the amount of $25,000 have been voted for the erection of 17 miles of transmission lines.

MOUNTAIN GROVE, MO.—The Mountain Grove Creamery, Ice & Electric Company is planning to build a dam on the North Fork River to furnish electricity in Mountain Grove and other towns. The project includes the erection of a transmission line from Gainesville to Mountain Grove, a distance of 37 miles.

OSCEOLA, MO.—H. O. Smith of Springfield, Mo., is considering the construction of a power plant, to cost about $150,000.

ST. LOUIS, MO.—Bids, it is understood, will soon be received by the Polar Wave Ice & Fuel Company, Grand and Olive Streets, for the construction of a two-story ice-manufacturing plant on Gravois Avenue, to cost about $500,000, including machinery. H. G. Clymer, Wainwright Building, is architect.

MOOREFIELD, NEB.—A petition is being circulated requesting the village board to call a special election for the purpose of submitting to the voters the proposal to issue bonds for a municipal electric light plant.

Southern States

CHARLOTTE, N. C.—The Board of Education is planning the installation of a machine and mechanical shop in the proposed three-story high school, 215 ft. x 270 ft., to cost about $300,000. A power plant and cold storage department will also be installed. Bids, it is understood, will be received about Dec. 15. Lockwood, Greene & Company, 101 Park Avenue, New York City, are architects and engineers.

ATLANTA, GA.—The Fulton Bag & Cotton Mill Company, 10 South Boulevard, has engaged J. E. Sirrine & Company, engineers, Greenville, S. C., to prepare plans for the construction of a power plant.

SPRINGFIELD, GA.—Plans are being prepared by the Savannah Battery Company, 207 West York Street, Savannah, for the construction of a municipal electric light plant in Springfield.

MIAMI, FLA.—The City Council is considering the installation of a lighting system on Ocean Drive from First Street to Biscayne Avenue.

SEBRING, FLA.—The purchase of the local electric light and water plant is reported to be under consideration by the City Council.

LEPANTO, ARK.—Plans are under way for the installation of electric light, water and sewer systems in Lepanto. Machinery, including a 50-kw. and a 100 kw. generator, oil engine, tanks, motors, pump and air compressor, will be required. J. Paul Gaines, 206 Falls Building, Memphis, Tenn., is engineer.

NEW ORLEANS, LA.—Arrangements are being made by the New Orleans Railway & Light Company for an appropriation of $1,000,000, most of which will be used to purchase new electric generating and other power plant machinery.

BOLEY, OKLA.—The installation of an electric light system to cost about $25,000, is under consideration by the Council.

LUBBOCK, TEX.—Plans are under consideration by the Texas Utilities Light & Ice Company for rebuilding its electric power and ice-manufacturing plants, recently destroyed by fire. The loss is estimated at [illegible]

Pacific and Mountain States

CAMAS, WASH.—The local substation of the Northwestern Electric Company, Portland, Ore., was recently destroyed by fire, causing a loss of about $75,000. The plant, it is understood, will be rebuilt. S. C. Carlton is local manager.

SEATTLE, WASH.—A permit has been filed by the Northwestern Power & Manufacturing Company, New York Building, Seattle, for the construction of a hydro-electric generating plant at Lake Crescent and Lyre River, Clellam County, to cost, including machinery, about $400,000.

McMINNVILLE, ORE.—The city of McMinnville has been granted permission by the State Engineer for the development of a water project, including the construction of a reservoir on the Nestucca River and Walker Creek; tunnel and pipe line about 5 miles long, and a power house on Panther Creek to cost about $250,000.

MERCED, CAL.—The Merced Irrigation District contemplates the development of an irrigation and hydro-electric project at Exchequer on the Merced River, for which $12,000,000 have been authorized. The scheme includes the construction of a storage dam at a cost of $3,763,000 and a power house to cost $2,000,000. The power developed will be sold to the San Joaquin Light & Power Corporation, under a contract which has already been approved by the State Railroad Commission.

OROVILLE, CAL.—The Great Western Power Company has plans under consideration for the construction of a hydro-electric plant near Oroville, to cost about $2,000,000.

SAN BERNARDINO, CAL.—The Santa Fe Railroad Company, Los Angeles, is having plans prepared for the construction of a steam-driven electric power house at San Bernardino, to cost about $200,000. H. S. Wall, mechanical superintendent of coast lines, is in charge.

Canada

CHATHAM, ONT.—The Township Council of Harwich has entered into contract with the local Public Utilities Commission for the erection of a transmission line from Chatham through Kent Centre to Harwich.

LONDON, ONT.—Surveys are being made by the township authorities for an electric lighting and power distribution system to cost about $30,000. J. N. Wilson, 190 University Avenue, Toronto, is engineer.

Electrical World

New York, Saturday, December 17, 1921

This Policy Brings Better Times

SOME seven million homes have been wired by the combined efforts of the entire electrical industry in the thirty-five or forty years in which wires have been installed in buildings. In just one-half that time one manufacturer of low-priced motor cars has introduced and sold five million of these automobiles to the same kind of people that have bought electric wiring.

There are two reasons why it has been possible for a single manufacturer to build up such a record. First, behind his selling there has been one continuous, clear-cut, unchanging policy. Second, behind the policy there has been the most persistent concentration of efficient work that has ever been applied to any product. Good policy and hard work under direct control of a single corporation have accomplished more in selling a new idea and a new service than all the diverse policies and scattered effort of the whole industry of electrical men.

W. W. Freeman, president of the Union Gas & Electric Company of Cincinnati and also of the Society for Electrical Development, made this interesting point in a recent address before the Electrical Supply Jobbers' Association. And his purpose was to drive home this hopeful thought—that success and progress come from good work supported by good policies, but that the work is worth more than the policy. For good work with poor policies will accomplish practical results that poor work cannot possibly achieve though guided by policies the best conceivable.

And it is good to keep this fact in mind, because no matter what the times, no matter how conditions may combine, good work lies within the power of any man. Good work offers to every one his surest opportunity, his greatest measure of success. And this is especially true right now for electrical men.

The electrical business is organized and maintained at present on the basis of these seven million wired homes plus that portion of industry already electrified. But there are fourteen million other homes unwired and waiting, with unconnected stores and factories in a fair proportion. Good work can wire these other buildings. Good work can build up this further market for everything electrical on the gigantic scale of this apparent 200 per cent of possible immediate increase. For in the homes and business places that now wait for wiring are the same kinds of people as those to whom we have been selling all along.

The policies of the different classes of electrical men should and can be more closely harmonized. It will help tremendously. But what we need the most just now is more good hustling work—and this is possible for every one of us right in his town, right at his job. The better times we want will come to meet each one of us along his way of better work.

Shiras Morris

Manufacturer and co-ordinator whose influence is a tower of strength in circles devoted to electrical material production

ACCURATELY to appraise the services of distinguished executives who for years have worked strenuously for the general good of the industry is no easy task. There are no instruments to measure energy expended in visualizing future needs, pointing out latent opportunities, co-ordinating diverse viewpoints and leading the way in constructive development. Men of this sort are in demand, not only because of their insight and ability to inspire others, but also because in their own businesses they prove the soundness of their judgment and test the principles by which they lead. These men practice what they preach.

Shiras Morris, president of the Associated Manufacturers of Electrical Supplies, of the Hart & Hegeman Manufacturing Company and of the Johns-Pratt Company of Hartford, Conn., treasurer of the Electrical Manufacturers' Council and of the H. T. Paiste Company, Philadelphia, is a leader of the foregoing type. Few important conferences in the wiring supplies branch of the industry are held without him, if his presence can be had. Movements looking toward less duplication of effort in national and local organizations find in him a ready champion, and his keen interest in economics and his faith in the development of the electrical industry and its opportunities combine to render his opinion on policies and trends of business authoritative and much sought. Whatever Shiras Morris undertakes receives the full power of his enthusiasm. He is no hobby rider striving to convince the industry that he holds a panacea for the problems of complex scope which encompass the electrical manufacturer. Rather, he is a persuasive and direct reasoner of open mind and with vigorous opinions derived from wide activities, worth-while reading and an uncommon ability to put himself in another's place.

Mr. Morris was born at Pittsburgh, Pa., in 1875 and was educated in the local public and high schools, thence going to Trinity College, Hartford, Conn., where he was graduated in 1895 in the scientific course. Three years in the advertising department of the Pope Manufacturing Company at Hartford were followed by a term of naval service in the Spanish War. He entered the electrical industry in 1898 as office boy in the Hart & Hegeman plant, then having about twenty employees. His advance through every intermediate post to the presidency in 1914 has been accompanied by a rapid development of this concern, the size of which today is quadruple its size when he became its head. Upon the recent death of his predecessor in the presidency, Edward B. Hatch, Mr. Morris was elected chief executive of the Johns-Pratt Company.

Mr. Morris is active in civic and financial affairs in his home city, being a director in various banking and manufacturing concerns and a trustee of Trinity College and the Choate School for Boys in Wallingford, Conn. For three years he was secretary of the Electrical Manufacturers' Club, and he has been active in the Electrical Safety Conference Committee. For seven years he was a Water Commissioner at Hartford, and he has served in other unremunerative but publicly useful posts. He is keenly interested in employee relations and is a firm believer in the executive of a company being accessible to all co-workers.

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The New York City Electrical Union Scandal

ELECTRICAL men everywhere have been surprised and shocked at the practices which have been brought to light by the Lockwood committee's investigation of the electricians' unions in New York City. Men eager to join the union have been barred out and bled for temporary permits enabling them to work; employers have been victimized; the cost of building has increased. It is the old, old story of the misuse of power put into the hands of men unworthy to wield it and unequal to their trust.

It is well that this bad state of affairs is to be completely uncovered before a grand jury. Union officials must learn that they are representatives and not rulers. The workers must be awakened to the fact that they cannot safely pay their money, lend their collective strength and intrust their affairs to men who are left unguided and uncontrolled. And the public must not be prejudiced against electric service by a high cost of installation forced by self-seeking leaders who through deception have gained the indorsement and support of electrical wiremen and helpers, although as individuals these workmen would never countenance such methods. This is a matter which should have serious consideration if the electrical industry is not to be hurtfully misrepresented before the public.

Cost Accounting Must Back Public-Relations Work

PLEAS for better methods of cost accounting in central-station companies often are met by the assertion that the difficulties are too great and the information is not so essential as it is in an industrial plant because the central-station business is not a competitive one. The fallacy in the argument lies in the assumption that the only sort of competition to be feared is that which prevails in ordinary business dealings, where the success of a man or an organization is measured by the amount of business taken away from competitors. In that sense there is virtually no competition among central-station companies, though in a larger number of cases than is commonly realized there is a very keen competition with other forms of power. In a much bigger sense, however, there is more keen competition in the central-station field than in any other business field. The very protection given against the common forms of competition substitutes a competition for the good will of the public, because any failure to attain the desired result brings about a public controversy based on feeling that the central-station company is gaining advantages that could not be obtained if the public had the ordinary privilege of going across the street and trading with a competitor.

Back of all the excellent public-relations policies that have been developed in the last few years must be a full and complete knowledge of the business that can be obtained only by the same methods of cost accounting which have been forced by the common forms of competition in the ordinary field of business. There is no short road to this knowledge. It can be obtained only by a proper "set-up" of the accounting system and careful and periodic analyses of the various factors going to make up the business. It means expense, but very probably far less than is commonly supposed and certainly not proportionally greater than in the industrial field. The article by E. J. Burtt elsewhere in this issue contains some excellent suggestions for the smaller light and power companies, where the problem has seemed insurmountable. This problem may not be simple, but the biggest obstacle is the unwillingness to go even far enough to become acquainted with it. As in many other things, when the first step is taken many of the mountainous difficulties of anticipation become mere bumps in the road.

Water-Power Development and Depreciation

TO THOSE who have not followed closely the question at issue between the electric public utilities and the Federal Power Commission over the depreciation and amortization of water-power projects the controversy may appear trivial. The law stipulates that the licensee shall maintain a depreciation reserve adequate to maintain the project works in efficient operation and provide the necessary renewals and replacements. This all companies under regulation are already obligated to do, so that there can be no objection on their part to this provision. The objection to Regulation 16 of the Federal Power Commission is that it is not in accord with the spirit or letter of the law, because, owing to the life-table method of computing depreciation (which is not the method adopted by state regulatory bodies), not only is a depreciation reserve set up but part of the investment is amortized. This naturally means that the users of hydro-electric service must pay more than a reasonable rate for electricity in order that this excessive depreciation reserve can be set up and maintained. Posterity will gain in that the project works will cost it little or nothing, but the utilities recognize no such obligation to posterity, nor was it the intention of Congress that they should. No fault is being found with the law—it is possible to develop water powers under it—but with the rules and regulations; and even those are in the main reasonable. Where they are unreasonable is where they are theoretical because they do not coincide with experience, and the industry contends for practice as against theory. It is only begging the question to state that utilities under public service commission control are exempt from the regulation, because a careful study will reveal that while the devil may be kicked out the front door there is a back door open to him. Nor should there be any favoritism shown. Manifestly the entire electrical industry and the public service commissions with all their experience would not be a unit against the regulation if it were just or reasonable; and one would think it would be the part of wisdom for those who are responsible for drawing up the regulation to recognize that fact. The presumption is that the country wishes its water powers developed, and Congress has recognized the mandate. Shall the intent of Congress and the wishes of the public be ignored then by a commission which flaunts its theory in the face of practice? We hardly think so, and we doubt if the Federal Power Commission will continue to think so when its members have rightfully considered the matter. The public service commissions of the country insist on adequate depreciation, so does the water-power law; anything beyond that is unwarranted and unreasonable excess.

Increasing Application of Electric Heat-Treating Furnaces

SURVEYS of the electric furnace field reflect a gratifying increase in the number and variety of heat-treating applications as compared with a few years ago. While the business depression now passing has retarded the installation of new equipment, there is little question that an era of large expansion is ahead for this class of electrical apparatus. At the beginning of this fall there were no less than eighty electric heat-treating installations completed or contracted for in the steel field alone. These are operating on many kinds of products, including steel and iron castings, automobile parts, tool steel, sheets, etc. At least seven heat-treating installations are operating on non-ferrous material, and their application to glass and other industries is also developing. The improvement of business in industrial plants dealing with metals and other materials requiring accurate application of heat in concentrated spaces will undoubtedly give a healthy stimulus to both invention and production.

A study of present installations discloses a surprising variation in furnace dimensions, materials, energy consumption and control equipment for particular tasks. The art is young, and experience is yielding much fruit to skilled designers. There seems to be little sign of "mass production" in the furnace field as yet, and while small apparatus suitable for laboratory use shows some evidence of potential uniformity in design, the range of dimensions and capacities for utilizing energy efficiently in the larger industrial units is extraordinary.

The time is fully ripe for the accumulation of graphic and tabular data on electric furnace design and performance, installation costs and operating expenses. It is to be presumed that individual makers of heat-treating furnaces have begun to compile such information. Its wider interchange would be of great benefit, both to manufacturers and users, for existing data are not sufficiently numerous to justify generalization from the experience of single furnace builders as to the best dimensions, materials and energy requirements for all-around maximum economy. The savings in material resulting from the intelligent use of electric heat treatment as compared with older methods are little less than amazing. Rigid standardization is not demanded by present conditions, but the variations in design and performance afford a fruitful field for study.

Huge Utility Bond Issue at Low Rate

THE rapidity with which the thirty-million-dollar, twenty-year first lien and refunding mortgage bond issue of the New York Edison Company was gobbled up shows that electric public utility securities, particularly those issued by the older and larger companies, are very attractive to investors. To be sure, the New York Edison Company's gross earnings are larger than those of any other electric public utility company in the world, and this particular bond issue is the largest so far offered at one time by an electric public utility corporation. The bonds sold at a premium of four and one-half points, yielding the investor at that price 6.1 per cent. While the money cost one and one-half points more than previous issues of the company, it is noteworthy that that is less than many national governments have had to pay for funds within recent months. It is also less than some state governments and municipalities have had to pay, considering the tax-exempt features of the latter securities. Nevertheless, every point is an added burden which must be met out of earnings, and when rates have not been increased it indicates that the company through more efficient operation has been able to effect economies which offset the higher interest rate. Unfortunately, the unthinking public does not always appreciate how many millions it is often spared through wise financing on the part of the utilities or by economical operation. The New York Edison Company is to be congratulated on rendering a service which includes both.

Joint Poles Have Become a Necessity

LITTLE investigation is required to recognize the immediate necessity for all signal companies and central-station companies to come to an understanding regarding joint poles. Not only will it be necessary to safeguard the public safety and the linemen's safety, not only will it be necessary also to consider all engineering features of the problem, but comprehensive and simple forms of agreement must be made. There are many reasons that point to the necessity of adopting a simple, effective and generally applicable policy regarding the use of joint poles. The present-day efforts toward conservation will require the saving of our timber. Many citizens are beginning to consider an excessive number of poles on streets and highways to be as unnecessary as it is unsightly. The same persons want the least expensive service possible from signal and central-station companies, and this demands economy in all directions. It will be difficult to make them believe that it is cheaper for those companies to operate over separate pole lines. Furthermore, the commissions representing the public, ascertaining and anticipating its desires, will be taking action toward the settlement of the question. Already such action is under way in many places.

Therefore it will be advisable for engineers and commercial men to prepare specifications and agreements and work definitely in the direction of joint-pole construction rather than wait for pressure from the outside. It would be well for the companies involved to consider that their reputation as public servants and the confidence of those whom they serve are in some degree at stake.

An Announcement by the Publisher

AS ANNOUNCED in the *Electrical Review* last week, the McGraw-Hill Company, Inc., has purchased that publication and will continue to publish it in Chicago, beginning January, 1922. This pioneer among electrical journals will be renamed *Electrical Review and Industrial Engineer* and become a practical monthly magazine devoted to the operation and maintenance of electrical and mechanical systems in mills and factories. It will form an extension of the work of the ELECTRICAL WORLD, whose constructive efforts in the electrical industry extend back for more than forty years.

I have come to regard the electrical industry more and more as an opportunity for service, with an ever-increasing influence on all phases of community life and development. From the early efforts of scientists and inventors there has grown up the great profession of electrical engineering. Founded upon this profession as a basis there has grown up in turn a far-reaching business—the business of making electrical service available in every nook and corner of the land, of bettering the living conditions in the home, of facilitating the routine of daily life and of mechanically and economically speeding up the wheels of industry.

In this development of the electrical industry, almost from the beginning, the ELECTRICAL WORLD and the *Electrical Review* as contemporary publications have mirrored electricity's progress, interpreted its influence, sought out the ideas and ideals of its leaders, and contended for right principles and right thinking in new lines of achievement. In the proposed co-ordination of these two forces a new avenue for an extended and correlated service is opened, a service that the spirit of the times and the needs of American industry are demanding in a specialized and extended scope.

AS IN the past, the ELECTRICAL WORLD, the national weekly, will be devoted to the problems of executives and electrical engineers responsible for the administration of policies, for engineering developments, and for practices in all branches of the electrical industry. Its editorial scope, except for broadening, remains unchanged, and embraces (1) the fundamentals of electrical engineering *as a profession,* (2) production, distribution and application of electrical energy *as a convenience service to the public and to industry,* and (3) the broad problems of production and distribution of electrical equipment and merchandise *as a business.*

The *Electrical Review* under the new title, *Electrical Review and Industrial Engineer,* will be devoted to the problems of electrical operation and maintenance in mills and factories, a field which the ELECTRICAL WORLD will continue to cover as it has in the past, but from a technical engineering standpoint.

With the extended use of electric service in industrial production processes, there has grown a demand for specific and practical information on the operation of electrical systems by those who take up the work where the consulting, designing and installation engineers leave off. For these practical men a service not heretofore available will be provided.

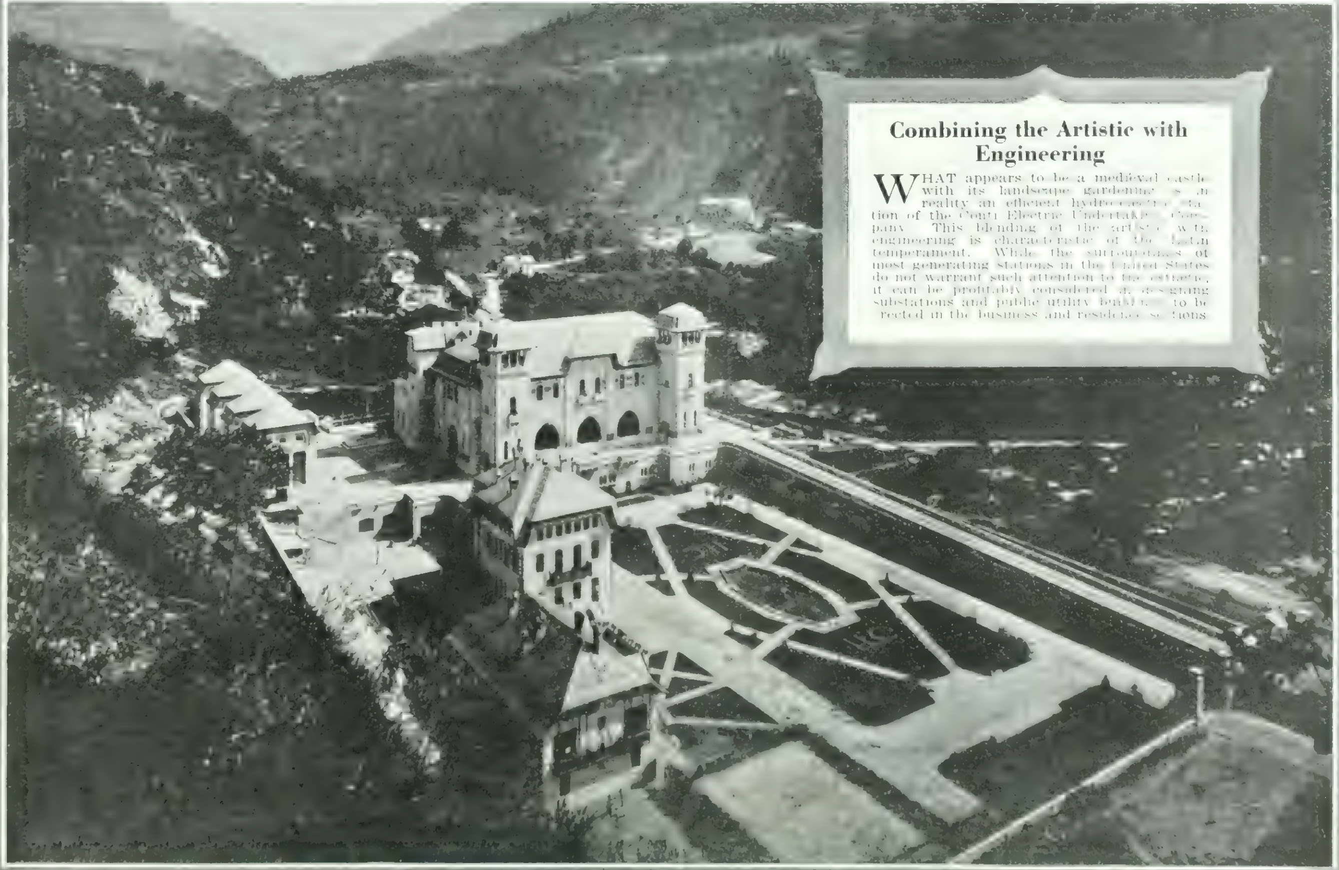
To maintain, through this broader and more clearly defined service to all groups of electrical men, high ideals of editorial standards and service and an intimate contact with the problems of readers will be the guiding ambition of the editors of the ELECTRICAL WORLD and *Electrical Review and Industrial Engineer.*

Present subscribers of the *Electrical Review* will be given an opportunity to select the publication that best suits their needs. They can continue their subscription to the new practical monthly, *Electrical Review and Industrial Engineer,* or change to the ELECTRICAL WORLD, *Electrical Merchandising, Journal of Electricity and Western Industry,* or *Power,* as may be desired.

AS I look back over the thirty-six years that have passed since I became interested in the electrical industry, from the vantage ground of an intimate contact with the various steps of its development, the opportunity looms greater now than ever before for engineers and electrical business men who hold dominating positions to come forward with initiative and leadership and render a constructive service to American business. Never before were our industries more in need of help—the help that comes from men of big brains and broad vision to conceive, to analyze, to formulate and to execute the plans necessary to remove from the path of social, industrial and economic progress the obstacles that lead to entanglements. In the electrical industry this desired result can be brought about to its fullest extent only by co-operation. Bigger, broader and better co-operation than has ever existed is essential.

To inspire, to guide and to assist to the uttermost in this work will be the sincere ambition of the editors and the publisher of these two nationally known publications under the direction of the McGraw-Hill Company, Inc.

James H. McGraw



Combining the Artistic with Engineering

WHAT appears to be a medieval castle with its landscape gardening is in reality an efficient hydro-electric station of the Conti Electric Undertaking Company. This blending of the artistic with engineering is characteristic of the Latin temperament. While the surroundings of most generating stations in the United States do not warrant such attention to the esthetic, it can be profitably considered in designing substations and public utility buildings to be erected in the business and residence sections

Automatic Plant Permits Development of Small Power Site

Generator Started Simply by Energizing Line Connecting Automatic Plant to Main Station—Has Protection Against High Bearing and Generator Temperature, Overspeeding, Failure of Field or of Governor Oil Pressure, High Voltage, Low Load, Etc.

By C. M. GILT
Lighting Engineering Department, General Electric Company

IN ORDER to warrant the expense of constructing a small hydro-electric plant at an overflow and regulating station of the Holyoke Water Power Company an attendantless plant has been installed at this point. The generator is arranged to be started, synchronized and thrown on the line by the simple action of energizing the 6,600-volt line connecting the plant with the main station of the company. Another feature of the station is an automatically reclosing switch which energizes a feeder supplied from the plant. This station has given excellent service since May, 1921, having required but little attention and adjustment. The overflow and regulating station spoken of was situated between two of three canals which were built in 1859 for driving the waterwheels of mills. The water of the canals is still used for this purpose. The water levels are kept constant by the use of overflow weirs and gates for feeding and wasting. In order to utilize for power the water which was previously wasted intermittently in this manner, the Holyoke Water Power Company has installed generating plants at the regulating points. In carrying out this plan it was decided to install at an overflow and regulating station between the first-level canal and the second-level canal the automatic generating plant, which could be used, without attendant, for the discharge of surplus water or for feeding the second-level canal during times of deficiency. The fall at this point is 20 ft. (6 m.)

The generating unit consists of a vertical 625-kva., three-phase, 60-cycle, 6,600-volt, 150-r.p.m. General Electric generator driven by a single-runner Leffel waterwheel and controlled by a Woodward oil-pressure governor. The automatic station feeds into the 6,600-volt bus at the main station over a single line having no branches. This makes possible an extremely simple scheme of load dispatching; *i.e.*, the operator merely opens or closes the oil circuit breaker in the line to the automatic station whenever load or water conditions make advisable the addition or dropping of the automatic. An adjustable stop on the governor of the wheel limits the gate opening so that when set to hold a speed slightly above the system frequency the gate is opened to the position of the stop. The generator then delivers constant load and the governor acts only as a speed-limit device and a convenient means of operating the gates in starting and stopping. The governor is equipped with a solenoid-operated pilot valve that controls its operation. Whenever the solenoid is energized, oil pressure is admitted to the governor from the accumulator and the gates are opened, a dashpot and the compensating device retarding its action during the starting period. When the solenoid is de-energized, the governor closes the gates and oil is cut off so that the oil pressure will not be dissipated by leakages. A ring on the piston snaps into a groove in the governor cylinder, holding the gates closed against the unbalanced water pressure which tends to open the gates. The ring is forced out of the groove when oil pressure is admitted to open the gates.

Fig. 1 illustrates the wiring diagram of the station.

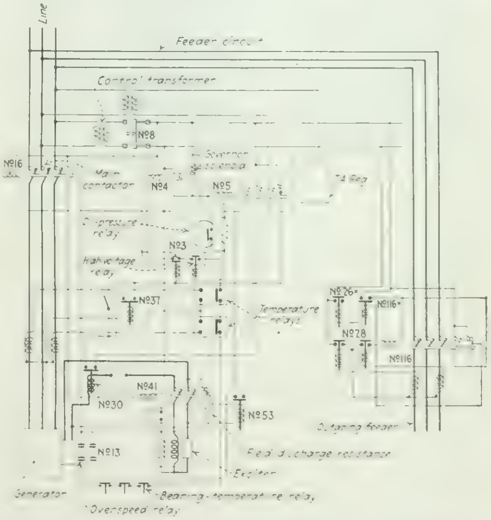


FIG. 1.—WIRING DIAGRAM OF AUTOMATIC HYDRO-ELECTRIC GENERATING STATION

When an operator in the main station wants the automatic station to assist in carrying the load, he closes the oil circuit breaker in the tie line between the two stations. The control transformer then supplies energy for the control circuit through switch No. 8. Contactor No. 4 picks up, energizing the governor's pilot-valve solenoid, and furnishing energy for the remainder of the operations. The governor opens the gates gradually, preventing overtravel and too rapid acceleration. A speed-control switch, No. 13, mounted on the shaft of the generator, closes its contacts when the generator reaches 95 per cent speed, and closes contactor No. 5 if the exciter voltage has built up, as indicated by the closing of relay No. 53. The closing of No. 5 immediately closes the 6,600-volt oil-immersed contactor No. 16, which in turn closes contactor No. 41, opening the field-discharge resistance and connecting the armature of the exciter to the field winding of the generator. The closing of the main-line contactor No. 16 throws the generator onto the full voltage of the line without field. The generator is accelerating and the squirrel-cage winding on the field poles assists in pulling it into step. The exciter is connected at full voltage and the building up of the field flux locks the units in step. The squirrel-cage winding assists in damping out any tendency toward hunting.

This method of connecting the generator to the line is really less unusual and severe than might appear at first thought. Synchronous motors are thrown from the starting taps onto full voltage without field when they are required to start a load so great that they will not pull into step on starting voltage. The line disturbance is really greater when starting a synchronous motor in this way than it is when starting the automatic station. With the station there is only one application of voltage with the unit out of synchronism, while the motor starter has at least two steps. The generator is virtually at synchronous speed when it is connected to the line and field is applied, while the motor speed is appreciably below synchronous speed owing to the drag of the load. The time required for pulling the automatic generator into step is shorter, since the action of the waterwheel assists in bringing the unit up to synchronous speed, while the total energy for accelerating the motor and its load must be supplied from the line. The current drawn from the line is greater than that taken when an operator does a good job of synchronizing in the usual manner, but the shock to the line and equipment is less than that caused by a faulty operation.

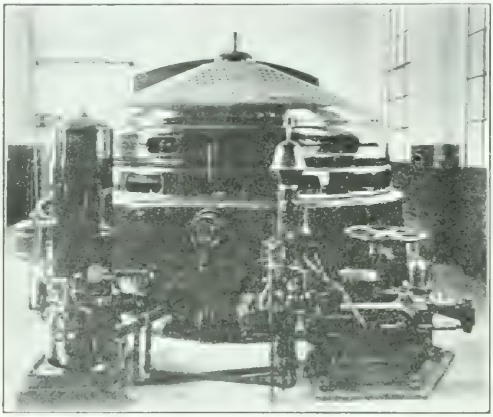


FIG. 2—AUTOMATIC GENERATING STATION SHOWING 625-KVA. GENERATOR AND GOVERNOR CONTROLLED BY A SOLENOID

When once connected to the line, the generator picks up load as determined by the governor setting. When the operator in the main station decides that the automatic unit is no longer needed, he opens the breaker in the line to the small station. An underload relay No. 37 opens the circuit of relay No. 3, which after a short delay opens the control circuit and shuts down the station. The underload relay may be short-circuited so that the unit will not shut down when carrying the light Sunday load.

The generator is carefully protected to prevent damage. Oxide-film lightning arresters bleed off voltage surges before they can puncture insulation. In each bearing there is a sylphon-type thermal relay that will open its contacts and shut down the station if the bearing temperature approaches a dangerous value. These relays are hand-reset so that the station cannot restart until an inspection is made. Temperature relays are heated by the secondary current of current transformers and have thermal characteristics similar to that of the machine. If the generator is overloaded for a period such as to bring its temperature up to an abnormal value, these relays will open their contacts and shut down the station before the temperature becomes dangerous. Relay No. 53 will clear the generator from the line if the exciter fails. A field relay No. 30 will de-energize No. 3 and shut the station down after a short delay should the field circuit open during operation. In case of high voltage the high-voltage relay will shut down the station or prevent it from starting. The oil-pressure relay will produce the effect of high voltage by short-circuiting resistance in series with the high-voltage relay, if the governor oil pressure drops to a point that jeopardizes continued operation. In case of overspeed switch No. 12 will open and clear the generator from the line and cut the excitation off. If a short-circuit occurs between the automatic station and the main station, the oil circuit breaker in the main station will open and the automatic station after shutting down because of low voltage will not start until the line is re-energized.

A feeder circuit with overload protection and reclosing equipment is included to feed a particular load whenever there is water to operate the automatic station. In case of overload on this feeder the overload relays will open the contactor No. 116, and after a short delay relay No. 116-X will pick up and close the line contactor. At the same time the notching relay No. 26-X will move up one notch, but will not open its contacts. If the trouble is cleared and the contactor remains closed, the notching relay will reset itself after a short time. If, however, the overload conditions remain so that the contactor again trips out, the operations will be repeated. If the breaker opens a third time in immedate succession, the notching relay will open its contacts and lock the contactor open until reset by hand. The relays, therefore, take the place of an operator in trying out the circuit.

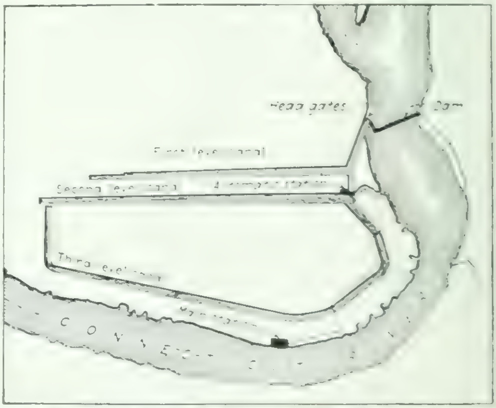


FIG. 3—THREE LEVELS OF CANALS AT THE HOLYOKE PLANTS

Possible Economies in the Cost of Insurance

The Advantages that Would Come of Self-Insurance for Small Losses, Both in Reduced Expense and Fewer Fires

By "KASSANDRA"

IN A RECENT report to the N. E. L. A. reference was made to certain dangers not now coverable by insurance, and the statement was made that if a real demand existed for that form of insurance, the underwriters would arrange for the proper policies at a proper price. It is a familiar story that the English Lloyds will insure against anything even to twins, and this is, after all, the general natural attitude. Anything is insurable at a price and inversely to reduce the cost of insurance it is only necessary to reduce the risk and the form of policy. There is one such economy possible right now that will not only save money but reduce the fire loss as well to all insurers.

The ordinary insurance policy provides for payment in case of any loss, whether large or small. If the policy be for $100,000, payment of this sum may be recovered in case of total loss, and a small loss of, say, $100 is also paid by the insurance company.

THE COINSURANCE CLAUSE

We can therefore consider the policy as having in effect the value of several policies, for example, three, the first providing for payments in case of total or very large losses, down to say $75,000; the second for payments in case of losses of intermediary size, say between $3,000 and $75,000, and the third for payments of the small losses up to say $3,000 in any year. An insured can have one policy covering against all losses, or theoretically he could have three policies each covering against losses between definite amounts. In practice, however, the insurance companies provide only one —which amounts to the insurance against small losses only. This policy covers any loss suffered up to the amount insured for, but in most cases there is a coinsurance clause, which applies when a man takes out several policies on the same level, say four policies of $2,500 each on a ten-thousand-dollar level. The coinsurance on a partial loss prevents him from collecting a loss of $2,000 several times—$2,000 from each policy. He can only collect the total of $2,000 pro rata from each policy.

But suppose that he had only one two-thousand-dollar policy on the ten-thousand-dollar house and had a loss of $2,000. He would have paid for this say $20 against $100 for insurance for the full value. Obviously that would be much worse for the insurance company than if the man had carried the full amount of insurance, and therefore the coinsurance clause provides that in such a case the insurance company will only pay the same sum that it would have paid if the man had carried insurance up to say 80 per cent of the value of the house.

Sometimes policies are issued without this coinsurance clause, but in such case, of course, a higher premium is paid. Or, vice versa, if the standard premium is on a policy without a coinsurance clause, then a reduction in that premium is given to the man who will take policies with a coinsurance clause.

The result of this method is that most people who insure carry insurance up to 80 or 90 per cent of the value of their property. Then in case of any fire or loss up to this 80 or 90 per cent, the insurer gets all his loss back. If, however, he has a complete loss of the whole value of the property, say $10,000, he only gets $8,000 back and is really insuring himself for the last $2,000. He knows that fires that cause a complete loss are comparatively rare and is willing to run that chance in order to save the premium on this last $2,000 of insurance.

SELF-INSURANCE

If an insured can get a three-thousand-dollar policy without a coinsurance clause on a one hundred-thousand-dollar risk, he is covered against all losses up to $3,000, but may be hurt badly by a large loss. In other words, he is insured by an insurance company against the small losses. There is no reason, however, why an insured should not reverse this and insure himself against the small losses while carrying insurance against large losses. He might even combine the two and carry his own risk both on rare large losses and on smaller losses and enjoy the constant saving from a reduced insurance cost. In other words, my suggestion is that either instead of or in addition to the owner of the house insuring himself against the last $2,000 of the loss, in case of a complete fire loss, the owner of the house should also be allowed to insure himself against the first $500 of loss; that is, to insure himself against any losses that do not exceed $500 during a year or during the term of the policy.

This plan is similar to the provision in automobile theft insurance that no losses shall be paid unless they exceed $25, so that if a man merely has a wrench or an ordinary robe stolen out of his car, he has no redress, whereas, on the other hand, he is really protected against the theft of his whole car or of valuable appurtenances.

PROTECTION AGAINST LARGE LOSSES

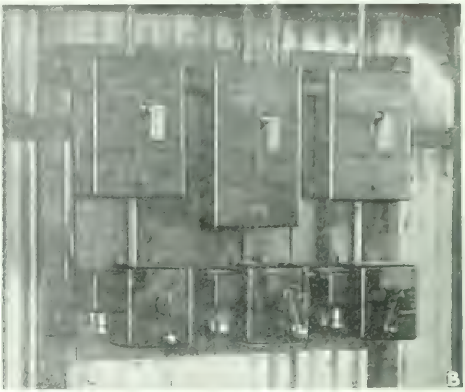
The advantages of such a policy are obvious. Year in and year out the careful man would be able to keep his loss from small fires away below the saving in his premium. Occasionally he might have a year when he made no saving. In fact, he might occasionally suffer a small loss, but he would never be crippled or even hurt since in case of a large loss he would be covered.

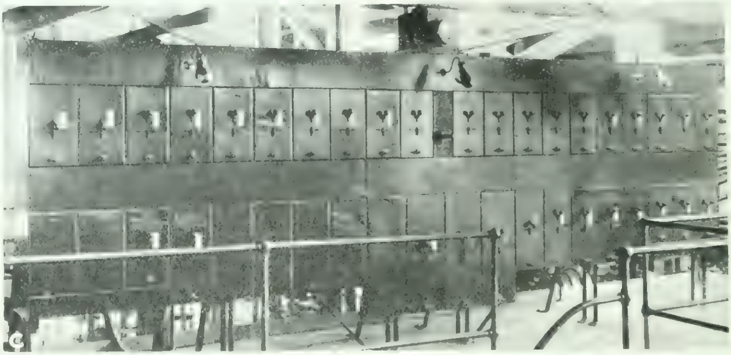
To the careless man who has frequent small fires this plan would bring no saving, but he is the danger spot and should be discouraged by a high premium, or, rather, penalized and influenced to reform.

The kind of insurance agent who is merely looking after larger premiums on which he can collect a larger commission will not welcome this new form of policy, but the high-minded insurance company officers, who really desire a smaller fire loss, should be willing to provide such policies if they are demanded.

It is therefore merely a question of educating the insured until they demand policies under which they can insure themselves against the smaller losses which they can easily stand, while being insured against the large losses which might cripple their business.

If we will only ask for such policies and ask hard enough for them, we shall get them. The careful man will then make savings, and there will be a greater incentive to be careful and a total fire loss less than is now the case. Insurance companies, however, can hardly be expected to act until such policies are wanted.





All Live Parts Are Covered from Switchboards to Motors in San José (Cal.) Industrial Plant

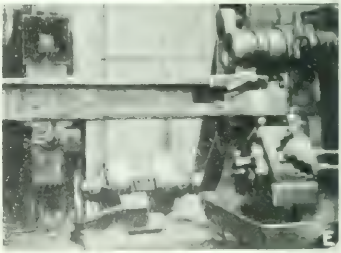
A—Small distributing board. Each switch is numbered and the name of the apparatus controlled is stenciled on the cover.

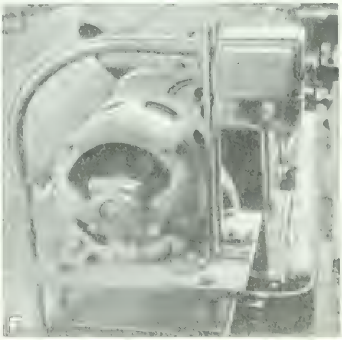
B—Motor controls are grouped at some points as shown in this photograph.

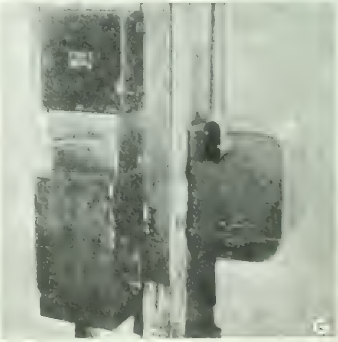
C—Main distribution switchboard designed for safety and for plant growth.

D, E and F—Different motor applications call for adaptations of connections, but in each case all live parts and wiring are inclosed.

G—Old compensators made safe by addition of inclosing cases.







Plant Distribution Layout Combining Safety and Economy

How an Industrial Plant Has Met Problem—All Live Parts Inclosed on Board and at Motors—Relay Protection for All Motors—System Is Reliable, Safe, Flexible and Economical

BY I. A. OLIVER
Plant Engineer Bean Spray Pump Company, San José, Cal.

AN INDUSTRIAL-PLANT distribution system combining marked safety, reliability, flexibility and economy was the object of the reconstruction carried out during the past year in the Bean Spray Pump Company's plant at San José, Cal. Switchboards with "dead" fronts and backs, inclosed wiring at the motors and relay protection for each motor are some of the means used for obtaining this object. This reconstruction had become necessary owing to the plant's rapid growth causing continual relocating of motors and machinery to accommodate production. The old system was very inflexible, seriously lacked modern safety equipment and had become heavily overloaded. As a complete revision was necessary, it was decided to make the new installation a model of its kind.

GENERAL PURPOSES OF NEW DESIGN

The principal factors considered in planning the layout were (1) the most efficient power distribution with the least apparatus, comprising the installation of the highest quality and safest equipment obtainable and at the lowest possible cost; (2) "safety first," that the entire system should comply with all safety requirements; (3) flexible installation, adaptability of the system to changing conditions, motor relocation and future additions, and (4) changing over and adapting the old equipment wherever possible.

There were fifty-eight motors with a total connected load of 600 hp. and a full-load current of 1,450 amp. at 220 volts. The maximum demand averaged about 300 hp. In planning the main feeders and the main switching equipment ample additional capacity was allowed, providing for 50 per cent to 75 per cent increase in growth of the plant. Nearly all the motors were three-phase squirrel-cage induction type, the majority being rated at from 5 hp. to 10 hp. One compressor is driven by a 104-hp., three-phase wound-rotor induction motor. With a few exceptions this motor load was widely distributed throughout the various shops in the plant, which covers an area of four acres.

Power enters the plant at 2,200 volts and is stepped down to 220 volts, metered and served to the main entrance switch on the central switchboard, which controls the power for the entire plant. This main switch is a 1,500-amp., three-pole, copper-link fused safety switch and is one of the most highly rated safety dry switches built. It is mounted on the main board at the center over the busbar compartment, as shown in Fig. 1. This switchboard consists of nine safety switches substantially mounted on a simple iron frame with pipe legs. The busbar compartment is built of black iron and contains the laminated flat bare copper busbars extending the full length of the board and supported at intervals by "Bakelite" micarta blocks suspended from the top of the compartment. Each switch is connected to the buses by rubber-covered stranded leads. The main 1,500-amp. entrance switch is connected to the buses by flat copper bars.

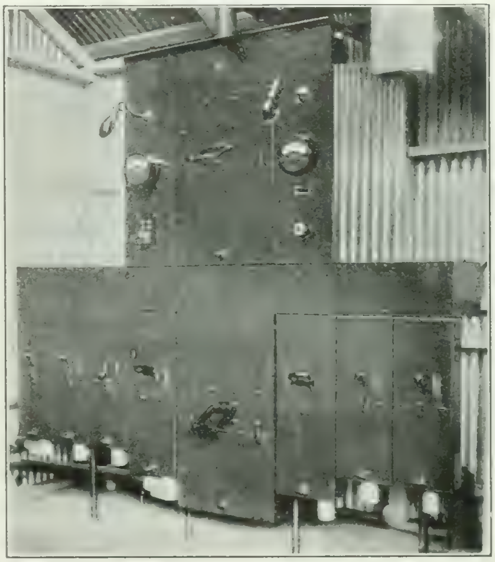


FIG. 1—1,500-AMP. DRY-TYPE SAFETY SWITCH CONTROLS MAIN POWER SUPPLY

The switches are mounted flush and produce a compact, economical job of pleasing appearance. All live parts are entirely inclosed. Extended sheet-iron compartments on each side of the main switch provide suitable mounting for voltmeter and ammeter with accessories. The circuits are led away from the bottom of the switches in the usual manner. Distribution of main circuits to the various sub-boards is by underground and overhead system.

SUB-DISTRIBUTION BOARDS

The machine-shop switchboard controls twenty-nine motors and is the largest in the plant, being itself fed through a 1,000-amp. main switch. This board is mounted on an elevated platform conveniently placed near the center of distribution. As shown in *C* (page 1216), it is also built entirely of safety switches. These are arranged in two rows, top and bottom, with a set of buses and bus compartments for each row. They are grouped according to size, the largest being placed at the lower center. There are at present twenty-four 60-amp., six 100-amp. and three 200-amp. switches connected in, and blanks are provided for two 60-amp., four 100-amp. and one 200-amp. switches. All switches are three-pole and fused to the required capacity for starting the motors that each controls. Power is received over three 1,000,000-circ.mil weatherproof cables carried on an overhead trestle a distance of 200 ft. (60 m.) from the main board. The cables are attached to the upper ends of the tie buses which connect the top and bottom buses through the compartment at the middle of the board.

The buses in the top and bottom compartments are built up of flat bare copper straps, $\frac{1}{16}$ in. x $1\frac{1}{2}$ in. (1.6 mm. x 38 mm.), laminated. These are gradually tapered off toward the ends of the boards as the required capacity decreases. Spacings and insulation were carefully worked out and dangerous magnetic circuits carefully eliminated or properly broken up to prevent eddy currents. At the back of the board, as shown in Fig. 3, one conduit duct is provided for each pair of switches and the circuits are carried to the large pull box at the end, where they may be combined to the best advantage. The individual circuits run direct to the motor starters in rigid iron conduit. Short pieces of flexible conduit are used to connect the conduit lines to the pull box on the switchboard to prevent any vibration being transmitted to the board. A maximum of three three-phase circuits were run in each conduit. This was decreased in size at each point where a circuit was branched off.

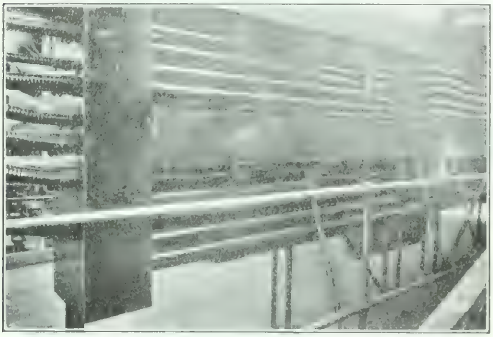


FIG. 2—MAIN DISTRIBUTING BOARD IS DEAD ON REAR AS WELL AS FRONT AND IS DESIGNED FOR PLANT GROWTH

Each motor starter in the plant, regardless of size, is equipped with an inverse-time-limit overload relay and a magnetic undervoltage release. *G* (page 1216) shows how the old equipment was brought up to date and made safe. All the old starters that could be used were modernized by attaching inclosed overload relays. Auto-starters with self-contained inverse-time-limit overload relays and magnetic undervoltage release are used in the new equipment for the larger motors throughout the plant.

From the starters the circuits are carried in rigid and flexible conduit to the motors, where special terminal boxes were installed to fit each type of motor, thereby protecting the wires and grounding the motors and starters to the entire system. This arrangement provides safety and flexibility with the smallest amount of apparatus. The thread ends on all conduit used were thoroughly cleaned to remove the insulating enamel, thus insuring a continuous ground in all parts of the system.

In all other shops of the plant similar equipment is used. The switchboard in the foundries shown in *A* (page 1216) is of the simplest design. It is 100 per cent safe. The pipe-shop switchboard, as shown in *B*, is a characteristic arrangement of motor-controlling apparatus used in various places throughout the plant where a few small motors are operated within a short radius of a central point of control. The type of motor-starting switch employed is well adapted for this purpose.

All switches and motor starters are plainly marked. The circuit-controlling switches at the main board are lettered alphabetically. The switches on the distributing boards and also the motor starters are each lettered according to the main circuit they are on, and in addition they have a number which designates the particular machine or circuit they control.

The entire work of changing over to the new safety equipment was undertaken at a time when the plant was at its heaviest production, most of the machinery being operated day and night. This required considerable parallel temporary wiring as well as temporary cut-overs. The new equipment was installed and completed right up to the motors, then the cut-over was made during the lunch hour or at times when the motor could be stopped for an hour or so. The entire job was accomplished with very little interruption of machinery or production. Every precaution was taken in this work, with the result that not one accident occurred.

Specifications for Lamps Issued by Government

NEW specifications for large incandescent electric lamps have been issued by the Bureau of Standards. These specifications have been prepared primarily for the use of government departments when purchasing lamps, but are also available to others. This is the ninth edition of the bureau's lamp standards.

There have been some changes, an important one being the abandonment of the long-established provision that the light test of lamps shall be considered as ended when the candlepower has fallen to 80 per cent of the initial value. Because means have been found to prevent excessive blackening of tungsten lamp bulbs, the new tests are based on the total life to the time of burn-out.

The performance of the lamp throughout its life is taken into account through two new provisions, one being the valuation of life-test results on the basis of average efficiency throughout the lamp's life instead of the initial efficiency, and the other requirement being that the average light flux during the life of the lamp must not fall below a specified percentage of the initial flux.

Tolerances have been established for possible variations in tests resulting from the small number of test samples available. Furthermore, standardization of lamps is on a smaller number of gradings, the tungsten schedule recognizing only the 5-volt steps in the 110-120 range and the 10-volt steps in the 220-250 volt range.

The publication of these specifications is now ready and may be obtained from the Bureau of Standards, Washington, D. C.

Cost Accounting for Small Companies

Need Exists for Better System—Study of Apportionment of Costs to Various Classes of Service Will Yield Results—Some Suggestions as to Methods

By E. J. BURTT
Jackson, Mich.

AT THE present time, when central-station companies have idle capacity and rate readjustments are being made, it is opportune that they renew their efforts to analyze the total costs of supplying their different groups of consumers. With correct information of this nature any adjustment in rates which it may be necessary to make can be done with the assurance that the revenue under the new rates for the class of service affected will at least provide for its production and distribution and not throw an additional burden on the remaining classes of service.

As a general rule, in the smaller electric light and power companies the apportionment of fixed charges to the different classes of service rendered has not been carried out to the same extent as in the case of operating expenses. Perhaps one reason for this is that central-station companies are not considered to be subject to the keen competition that exists between manufacturing establishments, and that it makes little or no difference whether the "overhead" is prorated or not. In any business that encounters strong competition it is necessary that the true cost of each line be determined. If these costs are not known and the price of the article is not based upon these true costs, sooner or later the firm will find itself in serious difficulty.

The general idea held by many that the central-station business does not meet competition is not altogether correct. The contention may largely be true in the lighting field and perhaps in the small-power field, but it is not true in the larger power field. The power sales are a very large percentage of the present central-station business and the percentage is constantly growing. In the power business the central-station companies are subjected to a very aggressive competition from isolated plants. Many of these plants were built during the war. Then the increase in the refinement of design, and consequently in the efficiency, of internal-combustion engines is a factor to be reckoned with. The low price of crude oil also should be considered, because this will act as a further incentive for introducing the newer types of oil engines as competitors of central-station service.

COST OF ENERGY FOR DIFFERENT SERVICES SHOULD BE KNOWN

In view of the above, it will be seen that central-station companies are subject to more competition than is commonly supposed and that the true costs of generating and distributing energy to the different classes of service should be known. Not only should they be known so as properly to base the power rates, but also to prevent the placing of an additional burden on other classes of service. By ascertaining these true costs the basis for an equitable rate schedule may be determined. With such a rate schedule a company need not fear the investigation of any governing body and will not be subject to criticism in case an investigation is made. Then, again, the commercial department will be in a position to meet new situations and opportunities that are constantly arising in the power business.

For want of sufficient information many central-station managers do not attempt to make a study of these true costs. In the first place the fair value of the plant must be known. This, in turn, must be allocated to determine how much of the carrying charge shall be allotted to cost of carrying each class of business, and there are several methods by which this can be done. In the second place, the apportionment of operating expenses for costs of generation and distribution, as well as for commercial and general and miscellaneous expense, must be made. At first any attenpt to make an allocation of the two classes of expense seems difficult and unsatisfactory. Still, if time and study are applied to this problem, fairly satisfactory results are obtained.

METHOD OF ALLOCATING COSTS

Following is a brief outline of the general method used to determine the annual costs of supplying energy to the different classes of service in a central station supplying a city of about 60,000. Satisfactory results were obtained, and this outline is given here with the thought that it may afford assistance to those who are making an analysis for the first time.

For a starting point an appraisal of the property should be available from which the value of the generating and distributing systems is to be determined. In case there has not been an appraisal made, the fair value of the property can be determined from the plant and investment account on the company's books.

It is generally conceded to be fair to prorate the value of the generating equipment to be carried by each class of consumers by using the percentage that the demand of each class bears to the total load in kilowatts on the station at the time of the maximum peak load. In substantiation of this idea the following case is submitted: In a small town, where the total load on the station is residence lighting, it is self-evident that all charges would be against that class of service. Now, if one-half of the maximum load at the time of the station peak was lighting and the other half was power, then the station investment cost should be in the same ratio. With an increase in the number and kinds of classes of service, the plan would still hold true.

To allocate the value of the distribution system is more difficult. There are several factors which have an influence in this apportionment—among them being the rate of taking energy, or the kilowatt demand; the volume of energy, or the kilowatt-hours, and the number of consumers in each class. In the average-size cities central-station companies would have as the principal classes of consumers the following: Municipal street lighting, residence lighting, commercial lighting, small power, secondary power and primary power.

One method of prorating the distribution investment often used is accorded to the "number of pole contacts" or the miles of wire line in each class. Another method, perhaps more satisfactory, is to make estimates showing the cost of constructing distribution lines to supply separately the total number of consumers in each class. In the case of a typical residence consumer, this would include: (1) Meter, (2) service, (3) secondary lines, (4) transformers, (5) primary lines, (6) sole lines, and (7) necessary labor.

After these estimates are made up covering each class of consumers, the total of several estimates may be found and the percentage of the total estimated cost may be determined for each class, and this percentage can be used to prorate the actual appraisal value.

After a complete allocation of the value of the property has been made, the yearly amount of fixed charges that are to be carried by each class can be readily determined. These fixed charges should include such items as: (a) Return on the investment, (b) taxes, (c) renewals and replacement, and (d) insurance. What rate of return or depreciation shall be used should be determined for each separate property, depending upon the condition of the plant, its earning capacity, etc.

In addition to the fixed charges as shown above, the operating expenses must be also prorated. The first division will be between generating and distribution costs. In actual practice the idea of considering the generating department by itself, with expenses connected with production averaged at so much per kilowatt-hour, seems the most satisfactory. This means that each class of service is charged with the cost of energy to the distribution switchboard in the same proportion as the amount of energy taken by it. These expenses would include station superintendence, labor, fuel, water, lubricants, and station and equipment repairs. The balance of running expenses would be made up of distribution, utilization, commercial, general and miscellaneous.

Under these different headings would be classified the following expenses:

Distribution.—Superintendence, wages, setting and removing meters and transformers, maps and records, shop expenses, repairs to line equipment, meters, etc.

Utilization.—Wages, street lighting, customers, equipment inspection.

Commercial.—Uncollectible bills, salaries of meter readers, salaries of accounting department, promotion of business.

General and Miscellaneous.—Salaries of officers and clerks, office rent, printing and stationery, legal expense, injuries and damages, miscellaneous.

A detailed study will have to be made in order to allocate these distribution expenses correctly. It is self-evident that such items as meter reading and billing should be charged in the same proportion as the number of consumers in each class. Setting and removing transformers would require special analysis as the expense should be charged in part on the basis of kilowatt-hour sales and kilowatt-hour demand, while meter expense should be charged on the basis of kilowatt-hour sales only.

Under "Utilization" street-lighting expenses, of course, would be charged direct, as also a proportion of the distribution superintendent's salary.

The various items under "Commercial" and "General and Miscellaneous" could be prorated to the different classes by considering the number of consumers, the demand in kilowatts and the kilowatt-hours used by each class. In other words, weight should be given to these three factors in the alllocating of these charges.

The scope of this article will not allow detailed consideration of all classes of expenses entering into the cost of generating and distributing electricity, but enough items have been mentioned to indicate what disposition should be made of others. Each station would have to be considered as a separate problem. With all expenses covering investment, production and distribution classified as in the general outline above, it is a simple matter to determine the annual cost fairly chargeable to each class.

To determine what proportion of the station's annual peak kilowatt load should be allocated to each group of consumers will require a study of the company's sales and operating conditions and the general character of the business served. Certain factors which are common to all plants will assist in this study. From handbooks can be taken data relating to yearly load factors and diversity factors which will be found applicable to the plant under consideration. Diversity factors can be determined by making special investigations in sections of the locality served. Time and thought given to the question will yield results which will be of valuable assistance.

The larger companies are constantly making studies of this nature and find them absolutely necessary. The changes from time to time may be of small consequence, but the constant scrutiny of expense and the scientific handling of accounts enable the management to keep in close touch with the operation of the property under its charge. There is no reason why the small companies also cannot make these detailed studies to learn the cost of supplying each class of service. The results cannot fail to be profitable.

Electrical Progress in Sweden

ACCORDING to a comprehensive article recently published in Stockholm and quoted by the *Swedish-American Trade Journal*, while the available statistics for 1917 gives the electrified acreage of cultivated land in Sweden as 6.4 per cent of the total arable land of the country, the corresponding statistics for 1920 show about one-third of the cultivated ground to be electrified.

The Alvkarleby power station serves by far the widest territory, a total of 300,000 hectares (a hectare is a little less than 2½ acres). The Motala power station supplies a total of 60,000 hectares, the Trollhättan power plant wires cover 127,000 hectares, and a fourth large power station is that of the South Swedish Power Company. Thus the southern and middle parts of Sweden are well provided for by large and strong plants.

In the northern part of Sweden, on the other hand, there are as yet no large central power stations, except that the Alvkarleby lines cover part of the territory. However, there are many small water-power plants, and these are increasing in number. In many localities the people have clubbed together and installed turbines in the rivers in order to supply local needs.

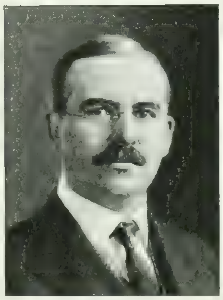
Electric cooking is growing in popularity in Stockholm and the central-station company is planning reduced rates for this service.

Problems Confronting Electrical Apparatus Manufacturers[*]

Need for Developing Demand and Increasing Number of Machinery Manufacturers Fostering Motor-Driven Unit Sales

BY R. J. RUSSELL
President Electric Power Club

DURING the entire year, with marked frequency, problems have been brought to us for solution that have been hard indeed. The degree of confidence we individually have had in ourselves, our organization and the future of the industry is expressed in the effort put forth to meet these problems. We have for several months heard men prominent in finance and business say that business has turned the corner. This statement has caused many of us to wonder what has been the matter with our conclusion-reaching system that we have been prevented from enjoying that mental satisfaction. If we go far enough into this statement, "business has turned the corner," and try to analyze it thoroughly, we shall appreciate that it has turned for those who will work hard and systematically and humbly to create business, but for the others there is nothing but crumbs, as is always the case under normal conditions.



R. J. RUSSELL

That business has turned the corner no one who reads will dispute, although, if he reads carefully, he will admit that it will take some time for it to assume a healthy appearance. It will improve with effort on the part of individual business itself. Money is cheaper, commodity prices indicate adjustment, and prices of electrical apparatus are favorable as compared with pre-war prices. September electrical exports had a value of $4,879,000, 67 per cent of the figure for September, 1920, while for nine months they were $81,730,000, or 20 per cent more than for the same period in 1920 or in 1919. The railroads are doing some buying, and the public is now in the mood for making every one, including railroads, public utilities and labor, adjust conditions with some regard to supply and demand, which, after all, is the great leveler of prices.

The electrical apparatus industry is entitled to a very large amount of credit for having been so fair in the matter of price during the war and in 1920, when the percentage of capacity schedule was so favorable, and for having reduced prices in the last year to a point so close to pre-war figures. The industry will get this deserved credit, too, if you only let the facts be known through your organizations. The information properly spread will help some to decide to buy now.

I want to submit to you that altogether too great a percentage of the business done by some manufacturers in the electrical line is not created by them; it just grows naturally, like Topsy, and is wafted their way somehow from somewhere, and of whatever kind or character or in whatever respect special, if it can be made in the shop, is generally eagerly accepted. This is good neither for the individual nor for the industry.

Individually in most cases, and certainly collectively, we should spend more money in developing the demand for the apparatus we manufacture. Just what this amount should be, expressed in percentage of invested capital, business done or otherwise, is a question so debatable that its decision should not be undertaken now. It might well receive consideration from a committee which would collect statistics for those who would like to be guided but who do not have confidence in the advertising profession and their own ability to establish a budget.

SALES MUST BE DEVELOPED

This development effort should not by any means be confined to trade papers, circulars and the various forms of advertising, but rather a healthy proportion of the total should be used to defray the salary and expenses of well-trained sales engineers who have not progressed to the point where they believe it beneath their dignity to attempt to convince the owner of a gas engine that it is worth while to send it farther out into the country and install a motor, or to attempt to influence the installation of electric drills in the shops and similar matters. And some effort should also be spent on development within our works of new models, designs, types of apparatus, etc.

Another form of development which can be undertaken with results varying with the determination and continuity of purpose put forth is to increase the number of machinery manufacturers who foster the sale of motor-driven units. Well-directed efforts will produce results that will surprise those who have not systematically tried this plan. But when developing such business, or when approached by the manufacturer already convinced, we should remember that the trade in the majority of cases, and the user in every case, is relying upon the manufacturer of electrical apparatus to supply him with the right kind and type of apparatus, and particularly must it be of such capacity that his requirements will be satisfied.

LET ENGINEERING STANDARDS GUIDE SALES

Our business policy should be sufficiently definite to cause us to refuse business when it is plain to us that results will not accrue in keeping with what the relying public expects, and particularly when it is apparent that our nameplate is the part of the products of our works that is most desired by the machinery manufacturer buying for resale. Whenever results of an inferior character have come from the operation of the products of works which have not been guided by the proper engineering and commercial standards, the reputations of all manufacturers of similar apparatus have suffered. And we must, when building for the future, build the product of our works in the way that will best meet the conditions surrounding or forming a part of the installation from the standpoints of safety to person and fire prevention. Individually we cannot afford to attempt to dodge this responsibility.

Records to which you have access show that there were 1,030 electrical apparatus and supply manufacturers in 1914, with a product valued at $335,000,000, and that this number had increased nearly 40 per cent, or to 1,403, in 1919, with a product valued at $884,000,000. A great majority of these manufacturers should be so classified as to suggest that they be members of the Associated Manufacturers of Electrical Supplies. We sincerely trust they will become susceptible to the influence of that association. We are interested indirectly because their policies and acts definitely influence public opinion toward the electrical industry. But the Electric Power Club has numbered among its membership a majority of all electrical apparatus manufacturers, who manufacture, no doubt, more than 85 per cent of the product coming within the scope of the Electric Power Club activities. While these figures may not be generally known, I believe it is a generally accepted fact that the club represents the apparatus industry, and because its designing, laboratory and commercial engineering staffs are so large, the Electric Power Club and its individual members are expected by other accepted representative bodies to see that proper rules are compiled and adopted and in turn recommended to those charged with the responsibility of inspection, for the protection of the public, in all that appertains to safety to person and fire prevention.

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[*] Address at recent meeting of Electric Power Club in Cleveland, Ohio.

INSURING SAFETY FROM ACCIDENT AND FIRE

Since this is considered our duty, and the formation and maintenance of this club is evidence that we have acknowledged responsibility for it, let us make up our minds to discharge it promptly. Let us set about it, if possible, by individually interesting ourselves in the matter and pressing to a conclusion a co-ordination of decisions as to what is best for all interested. The channels through which we work, our safety standardization committee and fire prevention committee, should represent, not the conclusion of the committees only, but the conclusions of our membership as a whole. Rules which read "should be" are worse than none in the hands of one whose actions are susceptible to influence. Such rules should read "must" or be so defined as to leave no room for doubt. If rules are not clear, we may expect fully as much trouble to be caused us by our own salesmen as by the inspectors and others.

The work being done by such organizations as the American Engineering Standards Committee, the International Electrotechnical Commission, the American Institute of Electrical Engineers and the National Electric Light Association is of substantial interest to us.

STANDARDIZATION MUST BE PUSHED

Individual users of our products, associations and engineering bodies and the representative of other industries and professions alike expect the Electric Power Club to establish standards for the guidance of its members, and particularly for those not members, that apparatus may be purchased on an economical basis, and with reasonable assurance of fair value received, when the Electric Power Club rules are used as a guide, and with the hope that through such guidance apparatus of decidedly inferior quality may gradually disappear. We, as Electric Power Club members, have, as is evidenced by the handbook, accomplished a substantial amount in the way of standardization. But there is more to be done, particularly in the matter of commercial standards. Some standards for future design might well be considered as deserving to be dignified by adoption as standard and put in the handbook.

I submit for your earnest consideration the adoption of a resolution, if necessary, and in any event the authorization of your various sections to compile and print on colored paper for insertion in the handbook some of the suggested standards which failed of adoption and therefore are now frowned upon by the Electric Power Club. There seems to be a real need for this. Some member companies are apparently making little, if any, effort to observe the adopted standards of the club, while others have, since standards have been adopted, placed apparatus upon the market definitely opposed to these standards, and in other cases have violated the spirit of the rules as a whole. This is a situation which cannot longer be ignored if we are to accomplish for the public and ourselves those things for which the Electric Power Club stands. While the Electric Power Club should diplomatically endeavor to increase its membership, I do not believe its interests will be best served by electing to membership those who are not prepared to accept its adopted standards.

We might with propriety teach our sales organization that we are not offering for sale terms and conditions, but apparatus which carries a distinct value, probably a greater percentage of value than anything else in the apparatus line that is found in the market, and that we are trying to sell it on such a basis as will give us a profit and enable us to render some service that is necessary along with it. We should make plain that our organization wants to protect the reputation of electrical apparatus as a whole by finding some way to avoid supplying it to those who desire to purchase it for resale under conditions of service which prevent the accrual of the best results, or to sell it under conditions where the nameplate will deceive those charged with the responsibility of its installation and those contracting to supply the energy for it. There are any number of flagrant abuses of confidence by practices of these kinds. And further we should try to aid our commercial organizations to improve their methods of transacting business in that positive way which is customary in many other lines of trade. In other words, when an order is placed with the manufacturer of electrical apparatus, the customer should understand that he has definitely bought something, not merely obtained a place on the manufacturer's schedule, and that we have not in the last analysis agreed to carry apparatus in stock for him. And I believe from observation and from conversation with manufacturers that much good would come to our industry and to ourselves individually if we would be a little more definite in our instructions to our sales organizations by telling them what we will and will not do and buy. Then through the sales organizations we should commence to convince the trade that standard "off-the-shelf" goods are better than something special.

New North American Junior Financing

THE stockholders of the North American Company last week received the privilege of subscribing at par to additional common stock in the total amount of $10,422,400 par value. Of this amount $2,233,350, or 15 per cent, is to be subscribed for on or before Jan. 3, 1922; $2,977,850, or 20 per cent, on or before Dec. 30, 1922; an additional 20 per cent on or before June 30, 1923, and an additional 15 per cent on or before Dec. 31, 1923. In this way the plan for providing for requirements of subsidiaries through junior rather than major financing is effected.

Ornamental Street Lighting[*]

High-Efficiency Gas-Filled Lamps on Series Circuits Are Becoming Common—Considerations to Be Remembered When Installing "White Way" for Business, Park and Residence Streets

By L. A. S. WOOD
Manager Illuminating Section, Westinghouse Electric & Manufacturing Company, George Cutter Works, South Bend, Ind.

THE first requirement of an ornamental street-lighting system is that, while efficiently illuminating the streets during the hours of darkness, it should be inconspicuous in the daytime, blending harmoniously with the architecture of the surrounding buildings. Provision should be made in the lighting units to direct the light emitted above the horizontal to the plane of illumination, but it is desirable that a small amount of light from the upper hemisphere should be directed against the fronts of adjacent buildings.

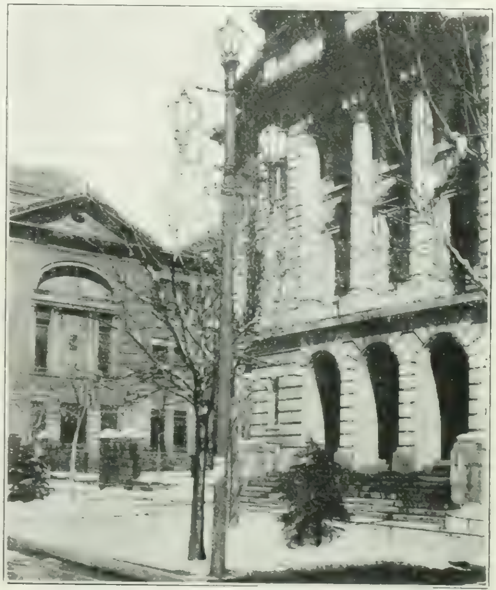
Glare, within the range of vision of the pedestrian or vehicle driver, should always be avoided. Another important requirement of good street lighting is that the intensity of illumination should be graduated in accordance with the conditions of the various localities. An ornamental street-lighting system should be considered as part of a plan to beautify the city as a whole and not as a means of advertising one section, perhaps to the detriment of some other locality.

CLASSIFICATION OF STREETS FOR ORNAMENTAL LIGHTING

In many of the larger cities some exceptionally wide and important streets will be found which will require special treatment. In general, however, for the purpose of determining the correct size of lamp with the best spacing and mounting height, the streets may be divided into three classes. Important business streets, side streets and residence streets. The following table gives approximate data on this subject, which, however, may be varied to meet local requirements:

Type of Street	Size of Lamp in Lumens	Spacing in Feet	Mounting Height in Feet
Important business	6,000 to 15,000	50 to 75	12.5 to 15
Side	2,500 to 4,000	75 to 100	11.5 to 13.5
Residence	1,000 to 2,500	150 to 250	10.6

In the important business streets and side streets the ornamental posts should be set symmetrically opposite each other on either side of the street, while in residence districts the posts should be staggered. For exceptionally wide and important streets a greater intensity of illumination is required, with higher mounting, and for this purpose two-light ornamental posts, for use with 15,000-lumen and 25,000-lumen lamps, have been developed.



LIGHT STANDARD SERVES AS TROLLEY-WIRE SUPPORT

Owing to its flexibility, the "Mazda C" lamp is peculiarly adapted to ornamental street lighting, and when operated on a constant-current series system it affords an efficient and economical unit, easily installed and controlled, giving a range of from 600 lumens[†] (60 cp.) to 25,000 lumens (2,500 cp.). Any size of lamp within this range may be operated in series on the same circuit without changes in the regulating equipment at the central station, and with suitable inclosing glassware a soft diffused illumination or a brilliant sparkling light without glare may be obtained.

CONSTANT-CURRENT SERIES CIRCUITS

Series incandescent lamps have been made for some time in ranges of from 60 cp. to 1,000 cp., but the larger size of lamps did not come into commercial use until the high efficiency "Mazda C" lamps, operating at 15 amp. and 20 amp., were introduced. These lamps, owing to the large size and rugged construction of the filament, are well adapted for ornamental street-lighting systems, except in residence districts. Since the standard rating of series alternating-current circuits is either

SIZES OF HIGH-EFFICIENCY "MAZDA C" LAMPS

Lumens[‡]	Amp	Average Volts	Watts	Light Center, Length, In.
4,000	15	14.9	223.5	9.5
6,000	20	15.5	310	9.5
10,000	20	25.9	518	9.5
15,000	20	37.6	752	9.5
25,000	20	60.7	1,214	9.5

[‡] The nominal candlepower of these lamps is one-tenth their lumen rating

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[*] Features of discussion presented before American Society for Municipal Improvements.

[†] The series "Mazda" lamp is now rated in lumens instead of candlepower, and the lumen rating is ten times the present candlepower rating

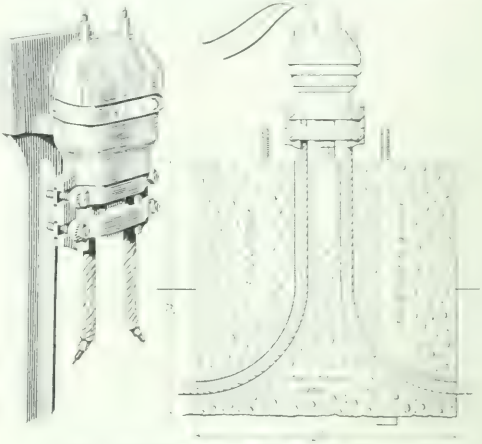
6.6-amp. or 7.5-amp., individual auto-transformers to step up from the line current to that required by the lamp have been designed, and these are generally mounted in the post top, immediately below the socket. In cases where a safety coil is installed in the base of the post, the auto-transformer is omitted and the safety coil serves as the step-up transformer.

The regulating equipment generally consists of moving-coil constant-current transformers and control panels, which limit the current in the circuits, safeguarding the lamps against surges and, at the same time, insuring that sufficient current will flow through the lamps at all times to maintain the rated candlepower. In addition, regulating transformers have been designed for mounting on poles in a high-tension distribution network, thus permitting an ornamental lighting system to be connected to a high-tension line without the necessity of running special lighting circuits back to the substation. This improvement in regulating apparatus, which allows operation from either a time switch or a remote-control device, materially reduces the cost of installing ornamental lighting systems at a distance from the substation.

Another method of control for series "Mazda" lighting is the reactance-socket system. This is generally used for small groups of lighting units. The lamps are operated from a constant-potential transformer with a reactance coil connected in parallel with each socket. When a lamp burns out the current is forced through the reactance coil, which introduces an impedance in the line equivalent to that of the lamp, thus maintaining the current constant.

EFFECTIVE POST INSTALLED IN GRANT PARK, CHICAGO

Until the introduction of steel-armored and lead-covered cable it was customary to lay underground cable in conduit, but modern practice favors the use of steel-armored cable buried in a shallow trench below the curb or in the parkway. The steel-armored cable consists of a copper conductor (usually of No. 8 gage) insulated with rubber, over which is a braided cover and jute filling. A layer of tape is then wrapped around, and this is inclosed in a continuous lead sheath covered with a coating of tarred jute. Around this are wrapped two layers of steel tape so arranged as to insure the steel cover overlapping when the cable is bent. A serving of jute is placed around the cable and affords protection to the steel tape when placed in the ground. If properly installed, the life of this cable is almost indefinite, as the lead cover forms an efficient protection from water, while the steel armor protects the cable from mechanical injury. The posts are usually wired with rubber-covered and braided cable.



CABLE AND POTHEAD FOR BASE OF ORNAMENTAL LIGHTING POSTS

It is important that ends of the cable, where cut, should not be exposed to the weather. A loop should be left at each post sufficiently long to reach the terminal of the disconnecting device in the base of the post, and cement is poured around the loop to form the foundation for the post. This is a more satisfactory method than the one usually used of making the post foundations first with the conduit elbows for the cable to be drawn through, as it leaves the cable intact until the time the connections are made in the base of the post. A disconnecting pothead should be used in the base of the post, and this should be of such design as to seal the ends of the cable and bond and ground the steel armor and lead cover. The accompanying drawing shows a good example. It should also be designed so that if the post is broken the post wiring is automatically disconnected from the underground system and the circuit in the base of the post is re-established by a short-circuiting device. It is desirable that a clamp be used in the top of the post for relieving the terminals of the lamp socket from the weight of the cable.

In the constant-current series system of operation the high-tension current is usually carried up the post, and, although when properly installed this is not objectionable, several cities have preferred to use a safety coil in the base of the post so that a voltage equivalent to the voltage of the lamp only is carried up the post. Safety coils have been designed equipped with disconnecting potheads.

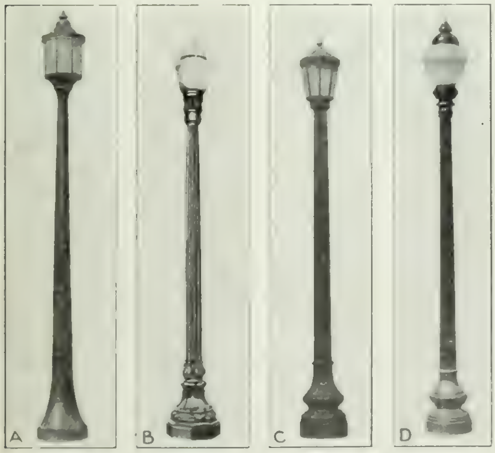
Occasionally, in the interests of economy, it is found desirable to decrease the illumination on the streets after midnight when only protective lighting is required. This is best accomplished by dividing the lighting system into two circuits, one operating the "all-night" lamps and one operating the "part-night" lamps. For this purpose two single-conductor cables may be laid in the same trench, connecting with alternate lamps or in any other combination that may be desired. If preferred, a twin-conductor cable may be used.

Since the introduction of the high-efficiency "Mazda C" incandescent lamp, the single-light post equipped to distribute and direct the light on the plane of illumination has grown in popularity. Cast-iron posts will not corrode; neither will they chip or crack under extremes of temperature. They are designed to withstand severe shocks, such as might be received in ordinary street traffic, and present the slender and graceful appearance so desirable in ornamental street-lighting units. It is the writer's observation that concrete posts, unless manufactured with the greatest care, will chip and crack in Northern climates. Pressed-steel posts present a massive appearance, but a good grade must be selected in order to avoid their being dented and bent by any shock to which they may be subjected.

USE OF TROLLEY POLES AS LIGHTING POSTS

On streets where trolley poles are in service the best method of lighting is by the use of ornamental trolley brackets with suitable lighting units, either with single or double arm, which may be attached to the trolley poles, presenting a very attractive appearance and eliminating the necessity of cluttering up the streets with additional posts. (See accompanying illustration on page 1223.)

Another method of adapting trolley poles as ornamental lighting units is to incase the pole in an ornamental cast-iron shell with ornamental brackets attached. An attractive unit has been designed with double brackets immediately below the trolley span wire and a single light at the top. The span wire is attached to the trolley pole through a hole provided in the capital of the top lighting unit.



FOUR SINGLE-LIGHT STANDARDS OF PLEASING PROPORTIONS

A—Arcadian post and colonial lantern for residential and park sections. B—Ornamental design for commercial section. C—Continental post with octagonal lantern. D—Colony post with refractor top.

Letters from Our Readers

This is a readers' forum. Comments on questions before the electrical industry presenting economic, financial, engineering or commercial aspects and new or supplementary viewpoints on published articles are cordially invited

Engineering Catalogs for European Technical Schools

To the Editors of the ELECTRICAL WORLD:

During the past few months I have become intimately acquainted with Norwegian engineers and student engineers while investigating the hydro-electric possibilities and developments of Norway. Their attitude toward American engineers is a most interesting one, and at times I do not know whether to feel amused over the situation or to take it seriously. In brief it can be stated as follows: American engineers are ultra-practical but lacking in theory; they first construct and then fit the theory to the result. When student engineers compare European apparatus with American, they seem to choose the old and partly obsolete American types, partly because they do not know of the newer types and partly because somebody has been here first (from German firms) and told them that the apparatus was poor.

One professor of hydraulic design who spent a year in America fifteen or twenty years ago told me that the Americans did not know how to build turbines until they copied European methods. I suggested to an instructor in electric transmission that he might mention aluminum cells in connection with his horn gaps and he told me they were not any good. Interested, I questioned, "Why?" "Because Professor —— [I do not remember the name of the German professor or engineer] swears up and down that they aren't." And that settled it.

And so it is every time we discuss the relative merits of American and European products. The attitude is probably typical not only of Norway but of many other countries. It is not altogether surprising that German commercial propaganda has such a firm root here, first on account of the similarity of the languages, making it easier for the Norwegian to learn German, and secondly, on account of the physical proximity of the two countries. In the drafting room where the Norwegian student designs his machines, his power stations and his transmission lines one finds stacks of German catalogs and price lists. He lives in an atmosphere of German engineering, and when he gets out there is no doubt that he will put in German machines and supplies similar to those he worked out on paper back at college. But, worst of all, he grows up under the impression that American engineers are inferior to the German. Granted that foreign exchange is far from being in our favor in foreign markets, what is far worse is the lack of confidence in the American engineer. The former difficulty will right itself in time; the latter, with German encouragement, will continue to grow worse unless some steps are taken further to acquaint the young engineer with American products.

It occurred to me that, in case you deem it a worthy cause, you could bring the matter to the attention of prominent manufacturers who would be willing to donate literature for a little American propaganda. It could be addressed as follows: "Head of Department of [Electrical, Mechanical, etc.] Engineering, Norges Tekniske Hoiskole, Trondhjem, Norway." It would be well to address a note stating that the literature is sent for the use of graduate and student engineers; or, the writer would be glad to take charge of its distribution.

Personally, I think a worldwide distribution of such literature in engineering schools would in another generation materially aid America's foreign market—or, better still, increase foreign good will, when the market would take care of itself. C. N. ANDERSON,

Fellow American-Scandinavian Foundation.
Norge-America Fondet, N. A. L. Building,
Christiania, Norway.

Analysis of Costs by Industrial Meters

To the Editors of the ELECTRICAL WORLD:

Nothing in the operation of a large industrial plant is more important than the accurate knowledge of costs and their proper apportionment among the various divisions of the plant. The electric power costs are easily determined by means of meters so placed as to split up the power consumption to any extent desired. If properly installed and adjusted, these meters not only apportion costs but furnish an excellent check on the accuracy of the power company's totalizing meter. Any discrepancy will be noted as soon as it occurs, and meter trouble can be corrected in time to avoid the difficulty usually encountered in attempting to adjust a back bill.

The object just named is often attained by installing one check meter, which with its accessories is a complete duplicate of the supply meter. Under normal conditions, however, the well-known reliability of the modern watt-hour meter insures that the two meters will run side by side for long periods without material variation, and the check meter has no other use than that of detecting a discrepancy which may never exist.

Unfortunately, the specialized knowledge necessary to install and maintain an electric meter properly is rarely found on the electrical staff of an industrial concern. The result of such conditions may be illustrated by a case recently brought to the writer's attention. The management of a large plant had reason to question the accuracy of its meters and asked the meter department of the power company to test them. The results of the test were rather surprising. Some of the meters were of the self-contained type, some were installed with current transformers, and others had both current and potential transformers. In the two classes last named not one meter was found connected correctly, leads being reversed and the current and potential coils of the same meter element connected to different phases. Every meter showed forward rotation on its normal load, this evidently having been taken as the criterion of proper connection. However, the erratic registration under such conditions may well be imagined. The self-contained meters were properly connected, but several were operating on extremely low power factors and were quite slow on account of having been originally calibrated in the factory for a higher frequency than that of the system on which they were operating.

In addition to rectifying connections and properly adjusting the meters, the power company was enabled to make some recommendations of advantage to both parties in the matter of reducing size of motors and improving power factor.

The central station has usually the best facilities available for the installation and periodic testing of meters, and the consumer will do well to take advantage of this. In view of the mutual benefit involved, it will be possible in most cases to have the work done on a basis of actual cost. HALBERT R. THOMAS,

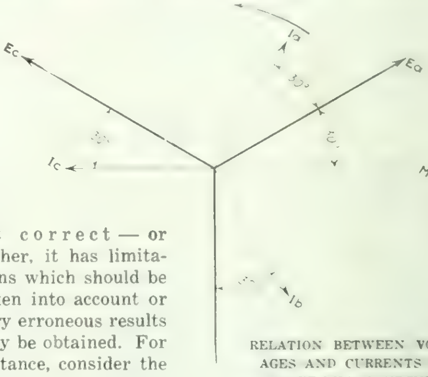
Testing and Meter Department.
Southern California Edison Company, Los Angeles.

Checking Connection of Power-Directional Relays

To the Editors of the ELECTRICAL WORLD:

When installing power-directional relays it is often recommended that the potential be connected to the proper phase so that the current will lead by 30 deg. at 100 per cent line power factor. One of the methods described in various magazine articles and engineering society reports is to use a single-phase wattmeter with the current coil in series with the current coil of the relay and pick out the pair of voltage leads which give the highest reading "with a lagging-load power factor."

A study of the simple vector diagram in the accompanying illustration will show that this statement is not correct — or rather, it has limitations which should be taken into account or very erroneous results may be obtained. For instance, consider the voltage vector OE_a and then its corresponding current vector OI_a which are shown in the correct relation for 100 per cent line power factor. It is quite evident that the reaction of these two will be greater than the reaction between the current OI_a with either voltage OE_b or OE_c.



RELATION BETWEEN VOLTAGES AND CURRENTS IN THREE-PHASE CIRCUIT

Now should the current start lagging it will still give the greatest reaction between OE_a and OI_a until it lags to line *OM*. This is a 60-deg. lag from its original position and is produced by 50 per cent load power factor. At this point there is equal reaction between $OI_a \times OE_a$ and $OI_a \times OE_c$, and any further lag will result in a higher wattmeter reading being produced by the voltage OE_c.

Assuming the original 100 per cent line power factor, the reaction between OI_a and OE_a is the same as between OI_a and OE_b, while if current starts leading, the reaction between OI_a and OI_b will increase while that between OI_a and OE_a will decrease.

This shows that the wattmeter method applies only when the load power factor is between 100 per cent and 50 per cent lag. Consequently great care must be used in selecting the proper voltage leads for power-directional relays when the power factor is either leading or is lagging below 50 per cent. V. H. TODD.

Summit, N. J.

Industrial and Station Practice

Installation, Operation and Maintenance of
Generating and Distribution Equipment and Economical Utilization of Electrical Energy
in Mills and Factories, Including Testing and Repair Methods

Floodlighting Highly Successful in Dusty Industrial Plant

SOME time ago there was considerable discussion in the ELECTRICAL WORLD relative to the methods best adapted to lighting areas exposed to floating dust or lint caused by manufacturing operations. Obviously the ideal requirements of a system of lighting under such conditions are, adequate illumination with a minimum of installation expense, ease of cleaning bulbs and fixtures and economical upkeep.

If we analyze carefully the cost of cleaning lighting equipment, we find that the primary factors are the number of units, the time consumed in cleaning and the supplies necessary for the work. The factor of time may be subdivided further and the essential divisions classified in accordance with the answers to the following questions: Is the lighting unit easily accessible? Is it necessary to take down the fixture or any part of it for satisfactory cleaning? Can the bulb be cleaned without removal? Is it necessary to cut the unit out of service during the cleaning operation? What special equipment or materials must be used to remove the accumulations of dust and dirt quickly and cheaply? Can the work be done during the operating hours in a busy industrial plant? Is it possible to utilize spare labor in the cleaning or must special employees be retained who will devote all of their time to that particular purpose?

Bearing the answers to these questions in mind, the system which would most nearly conform to our ideal would of necessity have the following characteristics: It would consist of a minimum number of units of standard construction; it could be cleaned quickly and simply without removing either bulb or fixture and without cutting the lamp out of circuit; it would require neither special equipment nor expensive supplies in the cleaning operation.

These requirements lead us inevitably to the inclosed floodlight, provided that suitable illumination can be obtained from such a unit and can be adapted to the many varying conditions of industrial-plant lighting. In many instances it has been proved by experience that the problem can be solved in a highly satisfactory manner by the use of such equipment.

The writer installed and placed in operation a short time ago a system based in a general way on an analysis similar to that just outlined, and the results have more than justified the most sanguine expectations. The plant to be lighted was a woodworking shop in which there was a continual cloud of dust arising from the machines, and it was essential that a high illumination be secured on the working plane and on the feed rolls and cutting tools of the various machines doing exact or particular work. Three sizes of floodlamps were used—250, 500 and 1,000-watt. In addition, three types of reflectors, wide-angle, standard and concentrating, were found necessary to meet various conditions. But even this equipment did not exactly fit certain conditions, and it was found advisable to use lenses of opalescent and diffusing prismatic glass in addition to plain lenses.

After suitable locations were decided upon by careful measurements and actual observation, a trial was made of the unit most nearly meeting the theoretical conditions with each size of bulb. If the results were not satisfactory, the reflector or lens was changed until the illumination was correct. The tests were effected by using a floodlamp with a long extension cord and a full equipment of lenses and reflectors. Of course, all the trials were made at night when results could be accurately checked. If necessary, locations, bulbs, reflectors or lenses were changed until the light was of suitable intensity and quality for the particular conditions to be met. Thus, if it became necessary to place a unit very close to a given working plane, the small-size floodlamp was installed and equipped with wide-angle or diffusing fittings. Other units located by necessity at a distance from the working plane or area to be lighted were fitted with concentrating reflectors. In most instances the units were placed so that the rays came to the plane at an angle of 20 deg. to 30 deg. from the horizontal, although an angle of 45 deg. or even 60 deg. was used in specific cases. To increase still further the over-all efficiency of the lighting the interior of the plan was finished in a waterproof flat white paint.

RESULTS OF OPERATION VERY SATISFACTORY

The results actually attained by this method of lighting were high illumination at the exact points where most light was needed, splendid general illumination from diffusion and dispersion aided by the reflecting surface of the interior, and entire absence of glare. The fixtures could be cleaned in ten minutes by simply wiping each lens with a damp cloth. The wiring and control circuits were much simplified in comparison with any general lighting scheme, as comparatively few units were needed to light even large areas. Breakage of bulbs was reduced materially and theft obviated. The cost of such a system appears to be slightly less than that of any other method of lighting furnishing the same amount and quality of lighting service for such special conditions.

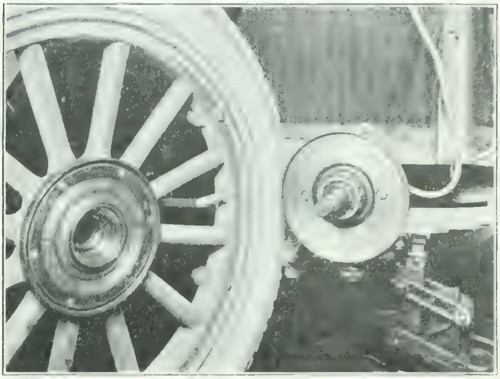
By comparing this installation with others it appears to the writer that this method of shop lighting, especially in dusty locations, will solve many illumination problems if due attention be given to the general design of the layout and to the choice of suitable reflectors and lens equipment for the various fixtures. The one point to bear in mind when designing a system along these lines is that the location, size and equipment of each lighting unit is a problem in itself to be worked out for the specific conditions under which it is to operate.

D. R. SHEARER.

Johnson City, Tenn.

Quick Measurements for Pole-Line Extensions Made in Automobile

LAYING out, estimating and staking pole-line extensions requires fairly accurate measurement of distances along highways and alleys. Such measurements, when made with a tape line, require considerable time and the services of two men. If it is attempted to use an automobile, the trip record of the speedometer is not found satisfactory because of the difficulty in reading distances less than one-tenth of a mile. Lost motion in the driving mechanism also causes considerable error in measuring short distances. In an attempt to develop some accurate and rapid means of measuring distances the following attachment to an automobile has proved satisfactory. A counter, mounted on the instrument board of the car, is operated electrically by an interrupting device attached to the front wheel. Energy required to operate the counter is obtained from the storage battery in the car. A switch mounted on the instrument board, near the counter, serves to open the circuit when the device is not in use. Combined with the switch is a contact button by means of which the counter may be quickly set at the beginning of each measurement. The device operates successfully at any speed less than 25 miles an hour.



CONTACTS ON AUTOMOBILE WHEEL OPERATE COUNTER FOR MEASURING DISTANCES

The interrupter is made up of two small stationary brushes in contact with a revolving surface fixed to the wheel. Insulated segments set in the part attached to the wheel interrupt the circuit through the counter magnet as they pass over the brushes. The parts attached to the wheel are entirely inclosed to protect them from mud and dust, and the interior is partly filled with grease similar to that used in the wheel bearings. Wires leading up from the interrupter to the instrument board are inclosed in flexible conduit. The interrupter is arranged to count half revolutions of the wheel for laying out pole-line extensions, each count representing approximately 4 ft. For use in making preliminary surveys for underground street lighting the interrupter has been arranged to count four times per revolution.

Since the device records revolutions of the wheel, it is necessary to interpret the result in feet by means of a correction factor or by a reference table. It has been found, however, that in practice any one using the counter regularly eliminates the necessity for such interpretation by using as a unit the distance represented by one count. In this way only a portion of the field record need be converted to feet. A 32-in. x 4-in. nonskid tire has a rolling circumference when properly inflated of 8.38 ft. With an interrupter counting half revolutions one count would represent a distance traveled of 4.19 ft. If it is desired to lay out a pole line having thirty poles to the mile, it is only necessary to run the distance required to register forty-two counts between pole locations. If for any reason it is necessary to space any of the poles more or less than the average 176 ft., it is necessary only to note the number of counts more or less than forty-two and multiply by 4.19 to know the exact amount of variation. Ordinarily, multiplication by 4 is sufficiently accurate, since the error is effective only in the number of counts variation, which in most cases would not be more than five counts (20 ft.) more or less than the average of forty-two. Similarly thirty-five poles to the mile (150-ft. spans) average thirty-six counts per span. Variations in air pressure in the tire within limits not injurious to the tire do not introduce an error large enough to be considered. As the tread of the tire wears down its rolling circumference gradually becomes smaller. This error is also small enough to be neglected except for very accurate work. The distance represented by one count is easily checked by running a known distance with the counter on. Ordinarily half a mile is sufficient, but a very accurate check may be obtained by increasing the distance run to 2 miles or 3 miles.

The device might be used for other engineering work, such as preliminary surveys of highway improvement projects, or of water-pipe or gas-pipe line extensions, or surveys for appraisals, etc. In all such work it should save time and labor.

N. L. DOLPH,
Distribution Engineering Department.
Detroit Edison Company,
Detroit, Mich.

Lessons Learned from Forty Electrical Fatalities

WRITING under the above heading in the *Safety Bulletin* issued by the Bureau of Safety, Chicago, E. S. Whiting, assistant chief engineer of the Liberty Mutual Insurance Company, dwells on the too frequent occurrence of fatal shocks with the low voltages ordinarily considered safe. It is undoubtedly, he says, the amount of current sent through the body and the time it flows that cause the death, but there is no way of tying the voltage and the current together quantitatively in shock cases, because the resistance of the shock circuit is widely variable, contacts ranging from a light finger contact where the shoes are perfectly dry to a heavy grip on a switch blade with the feet in water.

The remedy for such hazards lies, Mr. Whiting holds, in complete inclosure of all current-carrying or live parts of the wiring and equipment to at least 7 ft. above floor level. All fuse cut-outs should be boxed in; bare motor terminals should be boxed in or thoroughly insulated with compound and tape; inclosed or "dead-front" switches should be substituted for open-knife switches; all open wiring should be out of reach; drop cords should be avoided; only porcelain or weatherproof lamp sockets, without keys and controlled by wall switches, should be used; the live base on each lamp should be completely covered by its socket, and if extension cords have to be used, the highest grade of reinforced cords with lamps mounted on wooden handles with cages and porcelain sockets should be provided. Finally, all dead metal parts of low-tension equipment should be permanently grounded, including conduit, cable sheaths, switch boxes, compensator and transformer cases, motor frames and switchboard frames. The National Electrical Code, Mr. Whiting thinks, is too lenient in this respect, as it makes only the grounding of conduit compulsory, other dead metal parts being left to the option of the wiring contractor.

Coming to high-voltage shock hazards, Mr. Whiting thinks that the engineers who design the layout of high-tension stations sometimes give too much weight to the fact that only expert operators will be exposed to the equipment. He recalls cases where the designer omitted guards from 11,000-volt bus compartments, although the bare wiring reached down to floor level and within a few inches of the aisle in which the operator had to walk; where switch blades when open stuck out beyond the barrier walls; where a grounding terminal was placed at the back of a compartment containing live wires; where charging cords for arresters were placed close to live choke coils, and where the switches were crowded into such a narrow aisle that the operator pulling one of them might thrust his elbow into live parts behind him. No possible justification for creating these hazards can, in Mr. Whiting's opinion, be found. They are major, not minor ones—a matter of life or death—and, however skillful and careful the operators may be, no man is immune from slipping or losing his balance.

Connecting Overhead Circuits to Underground Cables

A DISCUSSION of reinforcing the insulation on cable where it is joined to an overhead high-voltage line was embodied in an article by A. A. Meyer in the ELECTRICAL WORLD for May 21, 1921, page 1151. In this connection the writer has just received some interesting information on the same problem from Vienna.

Mr. Meyer in his article pointed out that at points where a high-voltage overhead line joins an underground lead-covered cable punctures due to lightning disturbances occur frequently. This is due to the fact that such disturbances, which are usually of a very much higher frequency than the normal frequency of the line, find the capacity of a lead-covered cable so high that they can penetrate it only for a short length (about 200 ft.), after which they obtain relief by puncturing the cable. The author suggested and actually built such a cable line with reinforced ends—that is, he spliced to the regular (three-conductor) cable at the ends three single-conductor cables having a very much heavier insulation than the triple-conductor cable. No lightning arresters were installed, and for the short period of about five months no troubles occurred.

The writer has just received a communication from Vienna, dated Oct. 21, 1921, from the Felten & Guilleaume Company, stating that this concern has built since 1908 several cable lines with a protection as described by Mr. Meyer for voltages as high as 35,000. This cable protection is covered by German patent 222,-843 of Jan. 30, 1908; by Austrian patent 42,111 of May 10, 1910, and by Hungarian patent 51,093 of March 5, 1910.

Mr. Meyer says in his article that he determined the necessary amount of increased insulation in a "somewhat experimental" way, but the Austrian patent mentioned contains the exact mathematical procedure to select the proper thickness of insulation on the reinforced cable ends. The Austrian inventors also advocate that the reinforcement be graded so as to join the main cable to two, three or more differently graded, more heavily insulated cable sections at the two ends, and to ground dependably the lead sheath and all the metallic junction boxes. It is interesting to note that the inventors increase the capacity of the ends of the reinforced cable sections by increasing the diameter of the conductor. To avoid increasing the cross-section at the same time they employ hollow conductors in the end cables, resulting in a uniform copper cross-section for the whole cable. The claim covers single-conductor cables as well as concentric cables of two and more conductors. A. PALME.

Pittsfield, Mass.

Conductor Sizes Determined by Modified Kelvin's Law

BY KELVIN'S law there is a definite size of wire which must be installed in a given circuit if the maximum economy is to be realized. A larger wire will entail too great interest and depreciation charges, while a smaller size will raise the total cost per annum on account of the greater amount of power lost. This law has served as a basis for calculating economical size of conductors for transmission and distribution systems for many years, but modifications are required for its practical application. Two phases of the problem are discussed in this paper—(1) the determination of average power loss from a study of the load characteristics and (2) the selection of the correct constants to be used with various insulated wires.

There is a simple relation between the value of energy, the annual fixed charges on copper and the mean current in amperes which determines the economic size for any given case. This problem of economic size is quite apart from questions of regulation, mechanical strength or safe carrying capacity, but it deserves equal consideration. Kelvin's law states that the size of wire which is most economical is that on which the fixed charges per annum are equal in amount to the value of the power lost per annum. If the expressions for annual fixed charges (dollars) and for value of annual power loss are equated the formula for economic size results. In this the only variables are the current assumed, the value of power, the cost of copper and the fixed charges on investment.

In a three-phase circuit the power loss in kilowatts is $3RI^2/1,000$. To get the annual loss we must find the current corresponding to an average loss throughout the year. Since loss varies as the square of the current the average loss depends on the average square and may be found by squaring values of current at stated time intervals, averaging the squares and extracting the square root, a process too tedious to be of practical use. With a given type of load there is, however, a fairly constant relation between the loss at average load and the actual loss. A check of a number of load curves for residence lighting in Seattle gave a ratio of actual loss to loss at average load varying from 1.30 to 1.49, averaging 1.39. These curves had load factors from 14 to 27 per cent. Curves for system load, showing 50 per cent to 62 per cent load factor, gave a ratio from 1.17 to 1.33, averagnig 1.23. This "loss factor" should be investigated for unusual load curves. For distributing circuits the factor 1.39 will probably be as close as the estimation of average load.

Average loss in kilowatts, then, is $3RI^2l/1,000$, where I is average current, amperes; l is loss factor, as above, and yearly loss, in kilowatt-hours, is

$$(8,760 \times 3RI^2l)/1,000 = 26.28RI^2l.$$

The value of this power at p cents per kilowatt-hour is, in dollars,

$$26.28RI^2lp/100 = 0.2628RI^2lp \qquad (1)$$

where p is the value of energy (cents per kilowatt-hour) delivered to the circuit.

Yearly fixed charges in dollars are:

$$3w(f/100)(c/100) = 0.0003wfc, \qquad (2)$$

where w is weight of each wire in pounds, f is yearly fixed charges, interest plus depreciation expressed in per cent, and c is cost of wire in cents per pound.

To reduce this expression to terms of resistance rather than weight, note that the weight of a copper wire $(w) = 2,856R(\text{C.M.}^2)/10^{10}$, where R is resistance and C.M. circular mils of the wire.

Substituting in formula (2), yearly fixed charges, dollars:

$$\frac{0.0003 \times 2,856R\ (\text{C.M.}^2)\ fc}{10^{10}} = \frac{0.857R\ (\text{C.M.}^2)\ fc}{10^{10}} \qquad (3)$$

Equating (1) to (3), for a minimum,

$$0.2628\ RI^2lp = \frac{0.857R\ (\text{C. M.}^2)\ fc}{10^{10}},$$

whence

$$\text{C.M.} = 55,400\ I\sqrt{\frac{lp}{fc}} \qquad (4)$$

where C.M. is economic size wire, circular mils;

I is mean annual current carried;

l is loss factor, ratio of actual loss to loss at mean current;

p is value of power delivered to circuit, cents per kilowatt-hour;

f is annual fixed charges on wire, per cent;

c is cost of wire, cents per pound.

This formula applies to any circuit, single-phase, polyphase or direct-current. It may be noted that economic size is independent of voltage and length of line, except as the current is influenced by these factors.

For insulated wires the ratio of weight to resistance is higher, and the constant 55,400 will be lowered accordingly. Approximate constants for several standard insulations are given in the table following:

Wire	Constant
Bare copper, any size	55,400
Triple-braid weatherproof, No. 8 to No. 4/0	48,700
Triple-braid weatherproof, 250,000 circ.mil to 1,000,000 circ.mil	50,000
Double-braid rubber-covered, 0-600 volts, solid, No. 14 to No. 10	34,000
Double-braid rubber-covered, 0-600 volts, solid, No. 8 to No. 2	42,000
Double-braid rubber-covered, 0-600 volts, stranded, No. 4 to No. 00	44,400
Double-braid rubber-covered, 0-600 volts, stranded, No. 3/0 to 1,000,000 circ.mil	48,800

For insulated wires cost C will be actual price per pound of insulated wire.

FINDING ECONOMICAL SIZE OF DISTRIBUTION WIRES

1. As an example of the use of this formula consider a service for residence lighting using on an average 40 kw.-hr. per month at 120 volts, two-wire. The yearly consumption is 480 kw.-hr. and the average current is $480,000/(120 \times 8,760)$, or 0.46 amp.

The economic size, using loss factor of 1.39 and constant for small weatherproof wire of 48,700, with wire at 25 cents, energy at 4½ cents and fixed charges 10 per cent, is

$$\text{C. M.} = 48,000 \times 0.46 \sqrt{\frac{1.39 \times 4.5}{10 \times 25}} = 3,542\ \text{C. M.},$$

which is No. 15 wire.

2. Considering one of the branch circuits in the above residence, where No. 14 rubber-covered wire is ordinarily used, assuming the branch circuit to carry one-third the total, or 0.15 amp. average, energy at 5½ cents, wire at 30 cents and constant of 34,000 for small rubber-covered wire, one gets:

$$\text{C.M.} = 34,000 \times 0.15 \sqrt{\frac{1.39 \times 5.5}{10 \times 30}} = 814\ \text{C.M.},$$

which is near a No. 20 wire.

3. Considering a power feeder for 3,000 hp. of motor load at 26,000 volts three-phase, with an average load of 1,200 kva., or 26.7 amp., with energy at 1½ cents, wire at 25 cents, loss factor 1.39 and fixed charges 10 per cent, one gets:

$$\text{C.M.} = 55,400 \times 26.7 \sqrt{\frac{1.39 \times 1.5}{10 \times 25}} = 135,000\ \text{C.M.},$$

or a No. 2/0 wire.

While economy is not always the deciding factor in choosing a wire size, it is wise to determine the economic size at least for important circuits, and this formula should be of considerable use.

GLEN SMITH,
Engineer of Outside Construction.
Seattle Municipal Light and Power System,
Seattle, Wash.

Attractive Primary-Meter House

AN ATTRACTIVE primary-meter house for a private estate is shown here which illustrates how the power company and the consumer can work together to their mutual advantage. The house is 6 ft. x 8 ft., of hollow tile and stucco finish, with a patent-shingle roof. Wood trim and door are painted a dark green, causing the whole to harmonize with its surroundings.

A 2,300-volt service line runs through the woods on poles and from the last pole underground to the meter house. The door is the only opening in the building, and this is locked by the power company making the installation. The consumer erected the house at his own expense from specifications furnished by the company.

METER HOUSE WHICH HARMONIZES WITH BEAUTIFUL GROUNDS OF ESTATE

Management and Policy

Embracing Central Station Commercial Organization and Management, Customer and Trade Relationships, Public and Financial Policies, Advertising, Selling and Service Methods

Desirability of Employee Salesmen in Customer Ownership Campaigns

Security Selling Broadens the Viewpoint of the Employee and Increases His Sense of Loyalty to the Company

IN DEVELOPING a program for security selling to customers the question arises as to whether it would be best to utilize the company's existing sales department, include all employees, or go outside of the company entirely and secure regular stock and bond salesmen. Where a company is large enough to support a security department continuously it appears to be desirable to establish such a department, which shall operate independently of other departments and solely for the purpose of selling securities.

There are many companies, however, where this would be impracticable for various reasons. The issue of stock available for sale might be comparatively small, the size of the company would not warrant a special department, or the company's financial needs may not call for the continuous sale of securities. The experiences from companies where stock has been sold are interesting.

Pointing out that a better understanding has resulted between customers and the company which has led to improved service and proper returns on invested capital, George W. Lawrence, vice-president of the Greenfield (Mass.) Electric Light & Power Company, says:

"For the larger utilities the use of the employees as a sales organization, captained by an experienced security salesman, will produce the desired results. For the smaller companies, having a capitalization of two millions or less, I believe results should be obtained by proper co-operation with the local banks, the utility company organizations aiding the banks in obtaining security purchasers. This has been the policy of this company, and at the present moment 50 per cent. of our outstanding securities are held locally."

The sale of the securities in local territory exclusively by the employees of the company itself is advocated by J. A. Hunnewell, manager of the Lowell (Mass.) Electric Light Corporation, as follows:

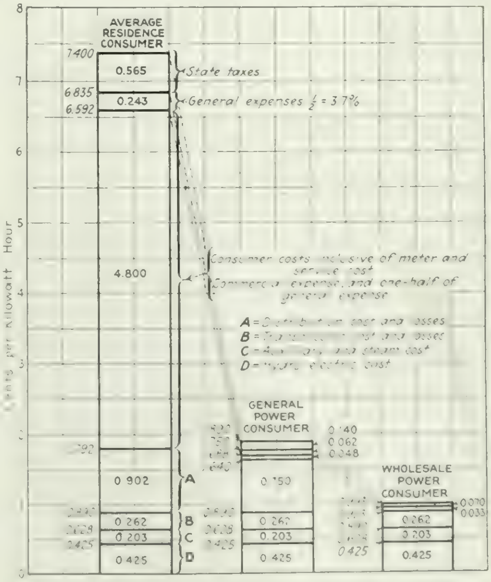
"There is no good result to be obtained by bringing in trained security salesmen, while, on the other hand, should the regular employees of the corporation take up the sale of these securities, they would obtain a very broad and strengthening knowledge otherwise difficult to secure, and would come in contact with prospective purchasers in an effective and potentially helpful manner."

C. W. Kellogg, who has supervised fourteen local campaigns on the Stone & Webster properties throughout the country during the past two years, believes that every employee should be made a salesman. "In all cases," says Mr. Kellogg, "we have endeavored to make every employee a salesman, by having him understand the value to the company of getting these securities distributed locally and of helping out in doing this as a matter of loyalty to the company. There is great value to the organization, to the public and to the employees themselves in having each employee understand the security situation of the company and in having him able to explain it to others. We have never employed any stock or bond salesmen for local sales and have never paid any commissions to employees for selling the company's securities.

"All of our local campaigns have been fairly intensive, of not over three weeks' duration, and have been strongly reinforced by advertising, changing the copy each day. Also, on account of money market conditions during the last two years in which these campaigns have been carried on, we have sold almost entirely short-term notes, rather than stock, so that our experience in local selling may for this reason not be fairly comparable with the experience of other companies."

A Graphic Explanation of Rate Differences

AN ANALYSIS by engineers of the California Railroad Commission of the cost of the Southern California Edison Company's electric service in 1921 shows some interesting and valuable comparisons of the variation in the cost of service to the average residence consumer, to the general power consumer and to the wholesale power consumer.

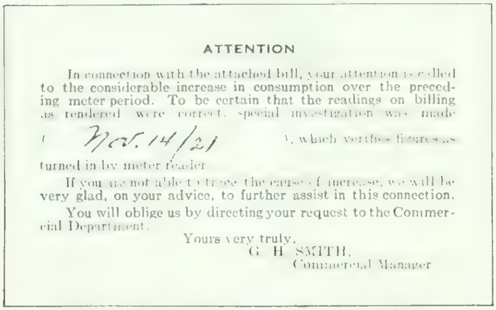


COMPARISON OF COST OF SERVICE TO DIFFERENT CONSUMERS

As shown in the diagram, the cost of hydro-electric energy plus the cost of steam-station energy used as standby and the cost of transmission is equal for the three classes of consumers. Added to this base cost is the distribution cost and losses, consumer expense, general expense and taxes. This method of comparison shows clearly that it is the large number of small accounts which cause the higher rate per kilowatt-hour for the smaller consumer. It should prove a useful means of demonstrating why kilowatt-hours cannot be sold like merchandise or potatoes at the same price to all regardless of time, place or quantity of use.

Personal Contact with Customers Reduces Complaints of High Bills

BY USING the slip shown here the Virginia Railway & Power Company, Richmond, Va., has almost eliminated complaints of high bills and added a closer personal touch to its service. "It is virtually impossible to establish a personal contact with customers," says John E. Harvell, general manager, "unless something occurs out of the usual routine. We have found one of the chief causes of complaint to be from errors in meter reading. Our method of handling this problem is as follows:



ATTENTION

In connection with the attached bill, your attention is called to the considerable increase in consumption over the preceding meter period. To be certain that the readings on billing as rendered were correct, special investigation was made

(Nov. 14/21), which verifies figures as turned in by meter reader

If you are not able to trace the cause of increase, we will be very glad, on your advice, to further assist in this connection.

You will oblige us by directing your request to the Commercial Department.

Yours very truly,
G. H. SMITH,
Commercial Manager

NOTICE ATTACHED TO BILLS SHOWING UNUSUALLY HIGH CONSUMPTION

"Each meter reader is required, after reading a customer's meter, to subtract the figures of the previous reading before leaving the customer's premises. On any reading showing 50 per cent increase or decrease in consumption, if the previous consumption was 50 kw.-hr. or more, the meter must again be read as a check.

"Readings which show a 50 per cent difference in consumption are turned in to the installation department for investigation. An inspector is sent out to ascertain, if possible, the reason for the increase or decrease. He first informs the customer of the readings showing the consumption and asks if he can account for the difference. Approximately one-half of the customers can name the cause, and thus many complaints are forestalled. In the event that the customer does not know the cause the inspector makes a test of the installation to locate any ground or other trouble, and if anything is found the customer is informed just how to have it corrected.

"Whenever these investigations are made the auditing department turns the bill over to the commercial department for handling. This department then delivers the bill to the customer with the notice calling his attention to the investigation. Under this system we have been able to reduce our high-bill complaints 95 per cent."

Life Extension Institute Advocates Electric Fans in Winter

MEDICAL authorities have dropped a valuable hint to the electrical trade for pushing the sale of electric fans during the off season. Dr. Eugene Lyman Fisk, medical director of the Life Extension Institute, takes the position that electric fans are often needed even more in winter than in summer. In a current bulletin of the Institute issued to all members taking periodic health tests he says:

"The business man should have his office properly ventilated and heated, and not a poor imitation of a Turkish bath. He should not let the temperature run above 70 deg., and if there is any deficiency in the provisions for automatic ventilation, as there usually is, he should start an electric fan to keep the air moving. I think it is often more needed in winter than in summer, since in winter closed doors and windows often result in humid or stagnant air.

"Confining the use of electric fans to the hot days of summer is largely a matter of sheer custom. The public should be educated to use them in winter as well. Still air, like a still pool, is always stagnant, regardless of the temperature or the season."

What Other Companies Are Doing

Philadelphia, Pa.—More than 1,200 contracts were signed for electrical installations by the Philadelphia Electric Company during the month of September, and it is estimated that October contracts are at least 5 per cent greater.

East Hampton, Conn.—In the past six months, says L. P. Perry, manager Central Connecticut Power & Light Company, the number of stockholders in this utility has doubled. There is now a stockholder for every ten meters on the system. Illustrated publicity, including picture post cards of the principal plant, and a friendly willingness to discuss policies openly with the people have aided customer ownership development by this company.

Cleveland, Ohio.—Statistics show that more than 130,000 people in Ohio now own securities of electric light and power, gas, telephone and electric railway companies. Considering families and dependents of the investors, this means that about one-tenth of the people of the state are financially interested in the public utilities. Life insurance companies and savings banks are among the heaviest investors in these securities. Every individual therefore who has an insurance policy or a deposit in a bank is vitally interested in the progress and development of the utility companies.

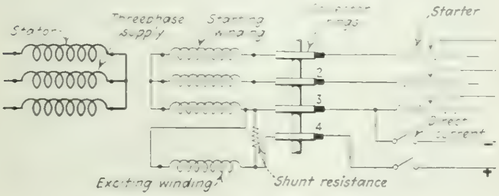
Illinois.—The Public Service Company of Northern Illinois is co-operating with more than 200 electrical contractors in pushing an extensive house-wiring campaign throughout its territory. This campaign was undertaken as a result of figures compiled by the company's commercial department showing that a large number of houses adjacent to the company's lines were unwired. The Public Service Company is taking over the electrical dealers' wiring contracts, thereby saving the time and energy spent worrying over accounts. The advertising is handled by the Public Service Company, although the contractors' names and addresses appear in the advertisements.

Digest of Electrical Literature

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

Synchronous Motor for Asynchronous Start with High Torque.—J. GEWECKE.—To combine the great starting torque of an induction motor with the running characteristics of a synchronous motor the author has built a synchronous motor with starting winding on its armature similar to that of an induction motor with wound armature. The author has built a three-phase, 20-kw., 500-volt, 100-r.p.m. motor of the second type, and he describes the interesting characteristics of this machine with the help of a great many curves and oscillograms. The armature has six direct-current poles and an almost continuous alternating-current winding, placed in slots in the pole pieces, resulting in four collector rings, three for the alternating current and one of these and a fourth for the direct current. Both stator and rotor are laminated with highly saturated iron so as to operate with unity power factor over a large range of load. The motor is started by placing the stator on the line and the gradual short-circuiting of the asynchronous winding over a rheostat. When the maximum speed, corresponding to the load, has been reached, the exciting direct current is impressed upon the poles of the rotor, which accelerates the machine to synchronous speed. The asynchronous winding stays short-circuited during normal operation, to prevent swinging and hunting. At the instant of connecting the stator to the line a very high voltage is induced in the field winding. To avoid any danger from this a permanent shunt resistor, connected across the two direct-current collector rings, is built into the rotor. The twelve oscillograms reproduced with the article give a very clear picture of the operation of such a machine under different conditions.—*Elektrotechnische Zeitschrift*, Oct. 27, 1921.



CONNECTIONS OF SYNCHRONOUS MOTOR WITH HIGH-TORQUE STARTING WINDING

Cutting No-Load Transformer Losses in Rural Systems.—T. HOLMGREN.—Iron losses in farm transformers may during idle periods amount to sums comparable with the yearly capital cost of the installation, and thus have caused much discontent among rural consumers in Scandinavia. The author shows that these losses may be reduced to four-tenths by opening one phase on the high-tension side of a three-phase transformer, as proposed by Professor W. Rung in Copenhagen. A necessary condition is that the transformer be connected in delta on the high-tension side and in star on the low side. Furthermore, all such lighting service as is needed for everyday use must be connected between one of the secondary phases and the neutral. A relay arrangement is suggested whereby two secondary phases may be brought under full voltage when one phase is open on the primary. By providing switches according to the Rung method it is estimated that energy worth 500,000 crowns a year could be saved in Sweden.—*Teknisk Tidskrift, Elektroteknik,* Aug. 3, 1921.

Generation, Transmission and Distribution

Hydro-Electric Developments in Foreign Countries.—F. ROWLINSON.—The third part of a series of articles dealing with the hydro-electric developments of the world. The present article includes France, Austria, the United States, Sweden and Formosa. The developed water powers and the possible future developments are listed and the power of each is given, together with the difficulties which will be involved in developing them.—*Beama* (British Electrical and Allied Manufacturers' Association), November, 1921.

Abnormal Pressure Rise in Transformers and Its Remedy.—R. TORIKAI.—In a high-tension transformer abnormal potential gradients likely to cause a breakdown appear usually at the foot of the bushing and at the end coils. The author describes a theory applicable to both these cases, from which he concludes that these dangers may be due to the incorrect arrangement of electrostatic capacities. Following this theory, he shows that by properly grading the capacities it is possible to avoid to a great extent the dangers in the bushing and end coils. The correct gradation of the capacities is shown to be as follows: (1) The shunt capacity must be graded so as to increase with the distance from the grounded end of the coil or from the top of the bushing; (2) the capacity to ground or to the high-tension conductor should be graded so as to decrease with the distance; (3) the proportion of the shunt capacity to the capacity to ground or to the high-tension conductor should be as great as possible, and (4) it is preferable to use a resistance in series with the capacity.—*Journal of Institute of Electrical Engineers*, Vol. 59, No. 303.

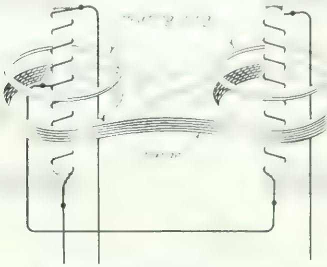
Relation of Auxiliary Drives to Heat Balance.—J. R. McDERMET.—A comparison of direct steam drive, motor drive, house turbine and combination drives for obtaining heat balance. A method is described of heating feed water by means of bleeder condensers.—*Power*, Dec. 6, 1921.

Traction

Railway Electrification in England.—A scheme formulated for the electrification of the suburban lines of the Southeastern & Chatham Railway is described. These are lines of about 91 and 141 miles respectively. It is thought that the scheme will soon be proceeded with. A sum of £10,000,000 will be involved.—London *Electrical Times*, Nov. 3, 1921.

Installations, Systems and Appliances

Electric Brass Furnace.—H. HEIN.—An induction furnace for brass melting developed during the war is described. The Röchling Rodenhauser construction was used, with changes necessitated by the high conductivity of copper alloys, the considerable diminishing in the electrical resistance of such alloys when cooling off and the excessive pinch effect. A careful design of the shape of the heating trough, forming a horizontal figure eight, and the addition of two heating rings of wrought iron, closed in themselves and embedded into the oven lining above the charge, gave good results. Furnaces of this type for three-phase and two-phase current and charges of 500 kg. to 1,000 kg. have been in operation for several years, consuming 100 kw. and 150 kw., at a power factor of 0.4 to 0.6 at 50 cycles. The oven lining is good for half a year and 800 charges. Depending on the material used, the current consumption varies between 250 kw.-hr. and 400 kw.-hr. per ton. An interesting claim is made as to the higher hygienic qualities of an induction furnace as against one of arc type due to the smaller amount of injurious zinc fumes.—*Siemens Zeitschrift*, October, 1921.



SCHEMATIC ARRANGEMENT OF TWO-PHASE INDUCTION FURNACE WITH HEATING RINGS

Electrophysics and Magnetism

Revision of Electromagnetitc Laws.—CARL HERING.—A summary is given of a number of experiments in which the results are either contrary to or differ from those required by the usual electromagnetic laws, and suggestions are offered as to how these laws might be revised to cover the exceptions. It is shown that a distinction, which is sometimes of critical importance, must be made between the conductor, the circuit and the current. Other experiments are described in which there are very evident and decided forces in the direction of the axis of the conductors, though the existence of such forces is denied by physicists. It is maintained by the author that a generally accepted fundamental law in mechanics should also apply to electric circuits, and if it does, it would explain all the observed forces, including some denied by physicists, and would open the doors to fields which had been closed by the acceptance of the older laws. — *Journal Franklin Institute*, November, 1921.

Mathematical Theory of Ferro-Magnetism. — JOSEF KELEN.—It is assumed that the greater part of ferromagnetic induction results from molecular magnets, placed vertically to the exciting field, in pairs of two, and so that the two magnets in each pair mutually counteract each other as regards external field. Under the impression of an exciting field the magnets are supposed to rotate to an angle whose sine is proportional to the ratio of the exciting field to a certain molecular constant, B_s. Thus each pair will form an X and give rise to an external field proportional to the exciting magnetomotive force. .It is further assumed that the motion of the elementary magnets is opposed by a certain force of friction, which, together with B_s and the factor of proportionality for the angular motion, constitutes the three characteristic magnetic constants. The friction forces are not supposed to be equal for all elementary pairs but to vary according to the equation of probability. By summing up the effects of all elementary pairs the author obtains analytical expressions for the magnetization curve and for the hysteresis curve which give a remarkably good representation of experimental data. For certain values of average molecular friction constant the theoretical equations also give a very satisfactory check with the Steinmetz formula for loss per cycle.—*Teknisk Tidskrift, Elektroteknik*, Aug. 3, 1921.

Telegraphy, Telephony and Signals

Radio Equipment of the "Goliath" Airplane. — The French Compagnie des Grands Express, maintaining a regular airplane route between Paris and London, has installed on one of its "Goliath" planes a mixed radio telephone and telegraph station of 35 watts antenna output, with a sending range of 300 km. at 900 m. wave length. The complete radio equipment weighs only 55 kg. An air-propeller-driven generator for 6 volts and 700 volts and a 6-volt storage battery supply the necessary current. A three-bulb amplifier is used as receiver for all wave lengths between 300 m. and 1,000 m.—*Radioelectricité*, October, 1921.

Organization and Equipment of a New French School for Radio Work.—This article contains a technical description of a model radio school just opened in Paris for the training of military, naval and commercial operators, with an outline of the teaching program.—*Radioelectricité*, October, 1921.

Auxiliary Features of Automatic Telephone System.—W. AITKEN.—A discussion on the relay devices used to repeat sender impulses to switches. A diagram shows a method of increasing permissible range of speed and insuring certainty of action of the switching apparatus by means which render its operation independent to a large extent of any adverse conditions of the line.—London *Electrician*, Nov. 4, 1921.

Note on a Four-Electrode Thermionic Vacuum Tube.—H. J. VAN DER BIJL.—A discussion of the four-electrode thermionic vacuum tube, which the author states he did not find to be so satisfactory a detector as the audion, but which might be used with satisfaction as an alternating-current ammeter and for indicating small differences of potential in bridges. The similarity between the four-electrode tube and the audion operating with a blocking condenser in the grid circuit is admitted, but certain differences are pointed out.—*Radio Review*, November, 1921.

Carborundum and Its Rectification Effect. — H. M. DOWSET.—A study of the chemical and physical nature of carborundum, with a special view to the conditions which must be satisfied for a detector. The results of a number of experiments designed to elucidate the nature of the rectification effects and suggestions of the theory are given. Voltage-ampere curves for carborundum crystals are included.—*Radio Review*, November, 1921.

Scientific and Industrial Research

(PRINTED IN THE THIRD ISSUE OF EACH MONTH)

A Department Devoted to Reports of Investigations Contemplated or Completed, Research Facilities Available, and Suggestions for Co-operative Work.

Conducted by PROF. VLADIMIR KARAPETOFF
Cornell University, Ithaca, N. Y.

Research in Progress and Completed

[When investigations which have been completed are, in the opinion of the editors, of wide enough interest to the field we serve, details thereof will be presented in other parts of this paper. Contemplated research or that which appears to have limited appeal will be only briefly reported in this section, but details may be had by communicating with the investigator or institution named in the report. Readers are referred to the department "Digest of Electrical Literature" for investigations reported in other journals. The news and engineering sections should also be followed for research reported before technical societies.]

TRANSMISSION LINE, ARTIFICIAL, WITH DISTRIBUTED CONSTANTS.

A line has been constructed whose sections consist of multilayer coils containing sheets of tinfoil between layers of wire. The constants of the coil can be adjusted to simulate various types of transmission lines. The present line consists of 130 coils corresponding to 1,000 miles of 110-kv. line, and its cost is about $0.65 per equivalent mile. The line constants are being checked by measuring direct-current transients, after which a study of alternating-current transients will be made. By means of a three-electrode vacuum tube oscillograms have been taken of the potential at various points without disturbing the natural voltage distribution.—*Massachusetts Institute of Technology, Cambridge, Mass.*

PORCELAIN, HIGH-FIRE GLAZES FOR.

An investigation has been made of high-fire porcelain glazes of the Seger cone formula type, from the standpoint of fusibility and of commercial acceptability as glazes. Tests were made on small cones, maintaining RO constant with variations in the SiO_2 and Al_2O_3. The temperature was raised at the rate of 50 deg. C. an hour above 1,100 deg. C. The deformation temperatures were from 1,100 deg. C. to 1,400 deg. C. The fusibility of the entire field was shown graphically by isotherms, plotted both by empirical formulas and by batch weights. It was found that glazing occurs when the alumina content of the glazes is low.—*H. H. Sortwell, Bureau of Standards, Washington, D. C.*

RADIO WAVEMETER, STANDARD.

An accurate standard wavemeter has been recently designed, capable of measuring wave lengths from 65 m. to 85,000 m. Particular attention has been given to the electrical and mechanical features which make for a rigidity of construction and precision of set and reading.—*Bureau of Standards, Washington, D. C.*

BEARINGS, FRICTION AND CARRYING CAPACITY OF.

Experiments have been made to determine the maximum safe load and the static friction under load of ball and flexible roller bearings. Balls were tested in grooved straight races; rollers were tested in flat and cylindrical races. The scleroscope hardness of the material tested was also determined. In compression tests deformations of 0.00001 in. could be measured. Numerical data and conclusions are available.—*Bureau of Standards, Washington, D. C.*

FIRE TESTS OF BRICK PANELS.

Tests are being made of heat penetration through, and deflection of, hollow wall panels and comparable solid walls.—*Bureau of Standards, Washington, D C.*

WELDING MACHINE FOR SEAMS.

An automatic electric welding machine has been recently developed in Europe (*Elektrotechnik und Maschinenbau*, Vol. 38, page 571) in which a roller electrode is caused to rotate along the weld in steps, the current being "on" when the roller is stationary. Several important advantages are claimed for this process and further experiments are desirable.

RECTIFICATION, ELECTROLYTIC.

An investigation is being carried out on the use of electrolytic rectification for low-power high-voltage work.—*E. J. Berg, Union College, Schenectady, N. Y.*

MINE GASES, IGNITION OF, BY INCANDESCENT LAMPS.

Numerous tests have been made to determine the possibility of ignition of gas-filled atmosphere by an incandescent filament when the bulb is broken. Tests were conducted on 125 types of lamps operated throughout a wide range of voltages. —*Bureau of Mines, Washington, D. C.*

ILLUMINATION, DAYLIGHT.

An "artificial-daylight" reflector was exhibited at a recent meeting of the Illuminating Engineering Society in London, England. Light from a gas-filled lamp is reflected off the inner surface of a large reflector placed above the lamp, which is painted emerald green and ultramarine, with a small percentage of red.

ELEVATOR INTERLOCKS AND ACCIDENTS.

A field survey has been made of several thousand elevator landings equipped with various types of mechanical and electromechanical interlocks and contact devices. Statistics of elevator accidents have been collected as reported by the press and by the coroners' offices of elevator inspection departments of large cities. A study of non-shaft-door and shaft-door accidents shows that 73.8 per cent of all fatal accidents would probably be eliminated by the use of well-designed interlocks.—*C. E. Oakes and J. A. Dickinson, Bureau of Standards, Washington, D. C.*

TELEPHONY, CARRIER-WAVE, ON ENERGIZED ALTERNATING-CURRENT LIGHTING CIRCUITS.

Investigation of the possibility of carrying on telephonic conversation over energized lighting circuits by means of carrier-wave telephony were undertaken using carrier frequencies of the order of 1,000,000 cycles per second. By proper tuning the hum due to the power frequency could be almost entirely eliminated and excellent conversation carried on. When the receiving and transmitting stations were located on secondaries of different transformers it was found necessary to provide high-frequency paths between primary and secondary by interconnecting the two windings by means of low-capacity condensers. —*Radio Laboratory, School of Electrical Enginering, Cornell University, Ithaca, N. Y.*

ALLOYS, CRYSTALLINE STRUCTURE OF.

By examination of the X-ray diffraction pattern produced by illuminating the powdered material with a beam of monochromatic X-rays the crystalline structure of several series of alloys has been determined. The results agree well with the data for these alloys obtained by metallographic methods. In addition, the X-ray pictures make the determination of the form and axial ratios of the different crystalline species more exact. When X-rays apparatus of the proper sort becomes available generally, this method should be very useful in the examination of metals and alloys and of other crystalline materials.—*Mary R. Andrews, Schenectady, N. Y.*

METALS, SOFT, INTERCRYSTALLINE BRITTLENESS OF.

It is known that soft metals, such as aluminum, tin, lead and zinc, which are much used in the electrical industry, and in particular lead, are subject to a form of corrosion known as intercrystalline brittleness. The metal crumbles to a coarse powder in which the individual grains retain their intrinsic properties, but the bond between the grains has been destroyed. A series of corrosion tests have been carried out to determine the characteristics of this corrosion. It has been found that pure metals suffer scarcely at all, and that the simultaneous application of tensile stresses upon the metal hastens the corrosion to a large extent.—*Bureau of Standards, Washington, D. C.*

Suggestions for Research

CIRCUIT BREAKERS, DIMENSIONS OF THE OIL CONTAINER.

So far the dimensions of circuit-breaker oil containers have been determined empirically, but with more and more severe service required, it becomes desirable to develop at least rough methods of computations. The factors involved are the quantity and the pressure of the developed gases, the energy of the ruptured arc, the speed of separation of the contacts and the dimensions of the container. For a beginning in this direction see *Revue Générale de l'Electricité*, Vol. 9, 1921, p. 687.

CLUTCH, ELECTROMAGNETIC, ALTERNATING-CURRENT.

With the increasing use of synchronous motors and of Diesel engines in various industries, the demand for electromagnetic clutches has been steadily increasing because of the necessity of starting at no load. The present-type clutches are excited with direct current, which has considerable advantages in so far as the magnetic circuit of the clutch is concerned. There is, however, some demand for clutches excited with alternating currents, single-phase or three-phase, and an investigation is desired of the possible construction and the relative weights and proportions as compared with direct-current clutches.

CONTROL, TIME-LIMIT, SUBSTITUTE FOR DASHPOTS.

In automatic controllers for industrial drives there is some reaction against "lock-out" switches operating on the current-limit principle, in favor of switches controlled by some time-limit arrangement. The simplest device of this kind is a dashpot, but it has serious limitations in the gumming of oil, clogging of holes, variations of viscosity with the temperature, etc. An improved device is desired for closing contact at predetermined instants which would have all the simplicity and flexibility of adjustment of a dashpot, without its disadvantages.

REACTANCE, NEGATIVE.

The development of a negative reactance is suggested; that is, a reactance which would produce an increasing current with a sudden decrease in the voltage across it. A reactance of this type could probably be developed by a suitable arrangement of self-induction and capacity. The negative reactance, if found, would be a means for accelerating starting currents and producing undamped waves at any frequency whatever. A device of this kind has so far not been elaborated, although a limited negative resistance is the cause of oscillations produced in a Poulsen arc generator and in the dynatron oscillator. —*August Hund, Berkeley, Cal.*

HYSTERESIS.

The invention of a machine something like a planimeter or Henrici's armonic analyzer would be desirable, which when run over a hysteresis loop would determine the amplitude of all the harmonics in the magnetizing current, with a sinusoidal applied voltage, or vice versa.—*R. E. Bitner, Cornell University, Ithaca, N. Y.*

PIEZO-ELECTRIC RESONATOR.

A plate or rod suitably prepared from a piezo-electric crystal, and provided with metallic coatings, can be brought into a state of vigorous resonant vibration when the coatings are connected to a source of alternating emf. of the right frequency. The plate reacts upon the circuit in a manner somewhat analogous to the reactions of a telephone receiver. The current and the equivalent resistance and capacity of the plate pass through marked characteristic changes as the frequency is varied through resonance. Another piece of solid material can also be set into vibration by a piezo-electric plate. Such resonators offer possibilities as standards of high frequency. By a graphical solution of the fundamental equations it is also possible to calculate the viscosity of the material.—*W. G. Cady, Wesleyan University, Middletown, Conn.*

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

Bureau of Standards Seeks Appropriations for Electrical Work

FOR the investigation of the standards of practice and methods of measurements of public utilities, such as gas, electric light, electric power, water, telephone, central-station heating and electric railway service, the Bureau of Standards is requesting a continuance during the next fiscal year of the appropriation of $85,000 with which it has been carrying forward this work.

For the investigation of methods and instruments employed in radio communication the bureau requests $30,000. For the investigation of the principles of sound and their application to military and industrial purposes $5,000 is requested. For the establishment of standards, methods of testing and inspection of electrical and mechanical devices used in industries and by the government $100,000 is asked.

War Department to Keep a Record of Nation's Power Facilities

A CONTINUING inventory of the available easily developed electric power resources of the nation is being planned as a war-preparedness measure by means of a co-operative agreement between the National Electric Light Association through its electrical resources committee and the engineering division of the War Department.

This action has come about as a result of a request of the chief engineer of the War Department that a plan be devised so that the district engineers of his office in the larger industrial centers of the country could obtain information of power resources to aid them in case of war.

The committee has had several conferences with the engineering division of the War Department which have resulted in a circular signed by the chief engineer to his district officers directing them to institute a study of the power situation within their districts. It is stated that the study cannot be made in the form of a costly field investigation, but that its success must depend upon the co-operation given by the electrical industry. The objects of the study as stated in the circular are:

1. To obtain in each district office a knowledge of United States power-producing plants, of primary distribution interests, of the power uses and the needs of the large power consumers in the district. (This information will include the maximum power output which can be maintained by each of the power establishments, giving regulation and capacity of the principal generating plants and the seasonal variation (if any) in this capacity, the maximum loads, the additional loads that could be carried, the spare or reserve capacity, including breakdown units available in each state to meet war conditions and buildings of what size and where this capacity can be delivered.)
2. To cultivate the acquaintance of the principal persons engaged in the business of power production and distribution, and in businesses which are large consumers of power. (An indexed list of the personnel of each power production company is to be built up in each district office, each card of this list to state forth briefly the position and duties of each individual.)
3. To obtain the co-operation of the power producers in furnishing the above knowledge and in planning their extensions and new developments in such manner as will meet the needs of the locality in case of war.
4. To ascertain whether or not the district is surveyed for development of increased power resources, by combining river navigation improvement with power generation, by combining flood regulation with power regulation, or by any other means.
5. To ascertain the best plan for the government to adopt for developing the power resources of the country and administering the distribution of power in the district in case of war. (The circular indicates that the plan used by the government during the last war in determining and fixing priority of use and advancing money for increases of plant extensions and interconnections not necessarily needed in these times undoubtedly will be followed should another war occur.)

The circular indicates that in the event of another war the personnel for handling the power situation would undoubtedly be built up from men familiar with power production in their own districts. It is suggested and it may be found desirable to begin at once to build up a paper organization and assign a personnel to it as reserve officers.

United States Chamber of Commerce Suggests Tariff Policy

A SUGGESTED tariff policy for the United States which, if accepted, would mean a radical departure in some instances from past principles and practices was early last week put to a referendum vote of the 1,400 commercial organizations making up the membership of the Chamber of Commerce of the United States. This policy contains seven recommendations and one question, as follows:

Legislation should permit, in the event of changes of economic factors, adjustment of tariff rates by administrative authorities within limits prescribed by Congress for the purpose of maintaining a consistent tariff policy.

Creation of a tariff adjustment board to administer adjustable rates.

Reasonable protection for American industries subject to destructive competition from abroad and of benefit to any considerable section of the country.

The anti-dumping legislation of May, 1921, should be maintained in principle.

The principle of maintenance and encouragment of our export trade should be observed in tariff legislation so far as consistent with protection of American industries of benefit to any considerable section of the country and subject to destructive competition from abroad.

Tariff legislation should be framed and administered with a view to meeting discriminations, direct or indirect, by other countries against American trade.

The present system of valuation for levy of ad valorem duties should be maintained and the so-called "American valuation" should not be adopted.

Do you favor a postponement of general tariff revision until conditions in international trade and finance are sufficiently stabilized to form a basis for legislation possessing permanent value?

The seven recommendations were adopted unanimously by a committee of twelve representative business leaders, with the exception of the recommendation against the "American valuation" plan, one member of the committee favoring this device. The committee has issued its reasons for advocating each of the proposed principles. These reasons, together with arguments in the negative, have been sent to the membership of the chamber. The committee also, on its own part, answers in the affirmative the question appended to the recommendations, saying:

> Surely it would seem that a general revision of the customs tariff at this time based on such data as are now available could not meet the needs of American commerce and industry through any considerable period. Certainly in the absence of a flexible scheme of rate adjustment we must express a doubt as to the wisdom of such a revision at this time.

Vanderlip Proposes Plan for American Rebuilding of European Industries

BEFORE the Economic Club of New York on Monday evening of last week, Frank A. Vanderlip proposed a new method of settling the Allied debt to this country which would create a revolving fund from the interest money paid to us by the Allies, from which loans could be made to the impoverished governments of Europe for production purposes. Mr. Vanderlip has recently completed a tour of Europe made for the study of economic conditions. While he maintains that the Allies should pay their obligations, he would temporarily devote all payments to the creation of credit. This credit he would have used for the improvement of transportation, the revival of essential industries, the production of adequate food supplies and the resumption of education and scientific research.

In commenting on the rebuilding of European industries Mr. Vanderlip said:

> Europe needs better transportation. We could help provide it. Europe needs a great development of its ample hydro-electric power in order that it may have cheaper motive power and may economize its far too small fuel supply. We could aid in initiating such projects.
>
> If time permitted, I would emphasize what might be done for Italy and Austria in developing great hydro-electric possibilities. If we took only six months' interest, $250,000,000, and put it into hydro-electric development, taking in exchange a mortgage on that development, we should have provided in those two countries for a saving in coal imports which would materially help them balance their foreign trade, and we would obtain for ourselves a sound security which would ultimately be repaid.
>
> If we would devote the income for a few months toward equipping eastern Europe with a modern grain elevator system, we would confer a material blessing on Eastern peasants and Western consumers alike, stimulating production and helping to turn stagnant trade into a swift stream of commerce.
>
> The debts are just debts and should be paid. The expenditure of the money we received would be made where and how we willed. Its expenditure would be our affair, not the affair of the debtors. Some part of what we received, however, would probably be spent without possibility of direct return. If such expenditures were wisely made, the indirect return would be enormous.
>
> I would not plan to take from England, France and Italy the last dollar that could be forced from them to pay their debt to us, and then spend it all in eastern Europe—great as the indirect recompense of such an expenditure would be in benefiting those Western nations. I would let a portion of the money that they paid us be expended within their own borders.
>
> I would propose to England the establishment of great scientific laboratories. With her genius for sound scientific research she would, through a stimulation of technical education and scientific investigation, give to the world new knowledge of incalculable value.
>
> I would give Italy, if she agreed to have it, the means for establishing great schools of applied art, so that the tremendous genius for handicraft which the Italian possesses may be turned into channels which will produce goods to enrich the world.

Heat-Balance Methods Interest A. S. M. E. Members

METHODS of maintaining a heat balance, or making the most economical use of heat, were, from the viewpoint of power-station engineers, the most interesting subject discussed at the forty-second annual meeting of the American Society of Mechanical Engineers, held in New York last week. Four papers on the subject were presented, each dealing with a different method. One referred to the Philadelphia Electric Company's Delaware station, where combination motor and steam drive is used, the electric power being supplied from the main bus. Another paper related to the Colfax station of the Duquesne Light Company, which has a combination auxiliary system of steam and motor units supplied from house alternators. The third paper presented data on the Connors Creek station of the Detroit Edison Company, where the auxiliaries are motor-driven and supplied with power from house alternators. The last paper gave a brief description of the system at the new Hell Gate station of the United Electric Light & Power Company, New York, which employs electric drive almost exclusively for auxiliaries, one-half of the power being obtained from the main generators and the rest from the house alternators with no provisions for interconnecting the two sources. The papers were presented by E. L. Hopping, C. W. E. Clarke, D. H. Berry and J. H. Lawrence, respectively.

Next in interest created were the papers on boiler-plant efficiency and economy and fuel saving in relation to the investment which is necessary. These were presented by Victor J. Azbe, Dr. D. S. Jacobus and Joseph Harrington, respectively.

In the discussion of heat balance J. A. Stevens, J. P. McDermott, John Andersen, N. E. Funk, Francis Hodgkinson, Charles Penrose, R. J. S. Pigott, Prof. L. P. Breckenridge, T. E. Keating, L. J. Pope, G. H. Gibson, G. A. Orrok and other engineers took part.

American engineers were criticised by Mr. Stevens for being behind European engineers in the use of the higher pressures and superheats. He recommended 350 lb. pressure and 250 deg. Fahr. superheat at least.

Mr. McDermott expressed the opinion that the Philadelphia auxiliary system is the most reliable and flexible, and that these factors are more important than economy, although the latter should be maintained as high as possible. While the house turbine system is now in favor, the extraction heater systems permit the highest efficiency. Mr. McDermott also pointed out that the high superheat in auxiliary exhaust cannot be used economically and that the disadvantage of electric drive supplied from the main generators is their susceptibility to system disturbances. The air extractor has the advantage of reducing vent losses and increasing boiler efficiency through allowing economizer action.

N. E. Funk differed with Mr. Stevens regarding the advisability of using higher steam pressures and temperatures, saying that this should be determined by the over-all operating expense, which includes fixed charges.

The idea that the water rate of auxiliaries is not important was ridiculed by Mr. Hodgkinson. He advocated stage bleeding and operation of main auxiliaries from the main bus to obtain the greatest economy.

Mr. Pigott emphasized the necessity of studying heat balance at various loads and advocated the preparation of input-output curves when comparing different systems of heat balance.

Heat balancing is not the important subject, said Mr. Orrok. It is how to use the heat most efficiently. This can be done by modifying the Rankine cycle of prime movers in such a way that it will approach the Carnot cycle. Taking steam from the expansion side of the diagram and applying it to the opposite side will help. This can be done by bleeding turbines, use of multistage feedwater heaters, etc.

At the special session on Tuesday evening Dexter S. Kimball, dean of the College of Engineering, Cornell University, was presented as the new president of the A. S. M. E.

West Penn Power Company and Monongahela Power & Railway to Interconnect

THROUGH the purchase of the West Virginia & Maryland Power Company of Kingwood, W. Va., by the West Penn Railway Company, interconnection with the Monongahela Power & Railway Company has been facilitated. The West Virginia & Maryland Power Company will supply electric service from Grafton, W. Va., eastward through Taylor and Preston Counties in West Virginia and Garrett County, Md., into the coal fields along the upper Potomac. The plant at Grafton was recently purchased by the incorporators of the West Virginia & Maryland Power Company, and the sale to the West Penn carries with it the transfer of the Grafton plant.

Work has already been started on a power transmission line connecting with the present system of the West Penn Power Company and extending south through the Cheat River Basin to Tunnelton, Rowlesburg and Newburg, on the main line of the Baltimore & Ohio Railroad. Arrangements have also been made whereby a direct power transmission line will be built from Grafton to Rivesville, on the Monongahela River, just below Fairmont, at which point there is a large power plant of the Monongahela Power & Railway Company. Service for Grafton will be purchased from this latter company, and it is expected that at an early date transmission lines from the West Penn system will connect with the line from Rivesville, thus making a substantial tie-in connection between the plant of the Fairmont company and the West Penn system.

Distribution of World's Water-Power Resources

THE distribution of the world's developed and undeveloped water-power resources will be set forth in Part 2 of the United States Geological Survey's "Commercial Atlas," which is to be issued Jan. 1.

Colorado River Development Resolutions Fail of Adoption by League

THROUGH fear that resolutions inimical to government or municipal construction of projects on the Colorado River would be passed or proposed at the convention of the League of the Southwest, which was held in Riverside, Cal., last week, the convention was hurriedly closed by motion of a member of the Public Power League of Los Angeles, which is an organization fostering political ownership of hydro-electric power in California. At the moment the convention closed a set of resolutions drawn up by representatives of the States of Arizona, Nevada, Utah, Colorado, Wyoming and New Mexico was ready for presentation holding to the theory that all permits for the use of interstate water should be subject to the rights of the several states for an equitable division of the waters.

Early in the course of the three-day meeting it was apparent that the adherents of municipal ownership were present in sufficient numbers to prevent an expression of the true opinion of the majority of the states represented. Although the meeting was attended by more than a thousand delegates and visitors and addressed by notable speakers, the entire aim of the convention was thwarted. The purpose of the meeting was to gather the opinion of the states of the Southwest in regard to the mode of procedure for the development of the entire Colorado River and to present this to the Secretary of the Interior at the subsequent San Diego meeting.

A program of over two dozen addresses was presented which covered every phase of the development of the Colorado River basin. Each state in the basin was represented by one or more speakers. O. C. Merrill presented a paper on the attitude of the Federal Power Commission, of which he is the executive secretary. Mr. Merrill stressed the point that the development should not be made by an agency that was restricted by state lines, and that, while this did not mean government operation, it did mean that the development should be by a single interconnected system which could take advantage of the improved load factor of such a large territory.

The attitude of the Southern California Edison Company, which has made filings for power on the Colorado aggregating more than 2,000,000 hp., was stated by R. H. Ballard, who read a statement by President Miller to the effect that the company was ready immediately upon the issuance of permits by the Federal Power Commission vigorously to proceed with this work and that it was in a position to procure from $30,000,000 to $40,000,000 per year for the construction of works which would remove the flood menace and provide power in units sufficient to meet all demands.

Director A. P. Davis of the United States Reclamation Service said that no plan of development should be undertaken until the Colorado River Commission, which has been constituted by the several states concerned and one federal representative, has completed its work and allocated the water and benefits to the several states. It is reported that President Harding has appointed Secretary Hoover to be the federal representative on this commission.

Secretary Fall said that the government was the only agency that could properly protect the interests of all and that in his opinion the government alone should undertake this work.

C. C. Chesney 1921 Edison Medalist

THE Edison medal for the year 1921 has been awarded by the Edison medal committee of the American Institute of Electrical Engineers to Cummings C. Chesney, manager and chief engineer of the Pittsfield works of the General Electric Company, for "early developments in alternating-current transmission." The Edison medal was founded by the Edison Medal Association, composed of associates and friends of Thomas A. Edison, and is awarded annually by a committee consisting of twenty-four members of the A. I. E. E. for "meritorious achievement in electrical science, electrical engineering or the allied arts." Previous awards of the medal have been made to Elihu Thomson, Frank J. Sprague, George Westinghouse, William Stanley, Charles F. Brush, Alexander Graham Bell, Nikola Tesla, John J. Carty, Benjamin G. Lamme, W. L. R. Emmet and Michael I. Pupin.

Congress to Make Effort to Limit Issuance of Tax Free Securities

A VERY determined effort will be made at the present session of Congress to obtain legislation to limit or prevent the issuance of tax-free securities by states and their subdivisions. Representative Foster of Ohio has introduced a constitutional amendment which provides that Congress "shall have power to lay and collect taxes on incomes derived from obligations issued or created by a state or any political subdivision thereof after the ratification of this article, without apportionment among the several states and without regard to any census or enumeration."

The difficulty with any constitutional amendment is the probability that its ratification by the states cannot be secured. A suggestion which is receiving serious consideration is the placing of a heavier inheritance tax on tax-free securities. Any such legislation would be reflected immediately in the sales value of such bonds and would act as an automatic check on their sale. There is a very general feeling in Congress that some way will be found to limit the issuance of such securities.

Electrical Contractor-Dealers to Try Out Labor Cost Record System

WITH a view to adopting a standard manual of cost estimating for electrical contractors the National Association of Electrical Contractors and Dealers has issued a bulletin consisting of instruction and data sheets for a labor cost system. It is proposed that every contractor shall apply the system occasionally to one job in order to obtain accurate data upon which to base labor estimates. Twenty-one members in the principal cities throughout the country have agreed to give the system a trial on the first representative piece of work which they do in order to facilitate the collection of data.

The system has been prepared by the association's cost data committee, of which Arthur L. Abbott is now chairman, and is the result of more than two years' work on the part of this committee. It is the outgrowth of methods which have been used by the Chicago Electrical Estimators' Association, the Minnesota State Association and the Electrical Estimators' Association of Greater New York.

While the proposed labor cost record system is of a tentative nature, it is expected to form the basis for a uniform method of estimating. "Specifically," says Mr. Abbott, "it is proposed that the so-called manual which has been discussed be adopted by the national association on a tentative basis as the beginning of a complete manual of estimating to be revised and added to as experience and further study may determine."

Secretary Fall Conducts Colorado River Hearing at San Diego

AN ALMOST unanimous agreement by the delegates present was given to the policy of government construction and control of a dam on the Colorado River at Boulder Canyon as expressed by Secretary of the Interior Fall and Director of the Reclamation Service Davis at the hearing conducted at San Diego, Cal., on Monday by Secretary Fall for the purpose of hearing any objections to the plans of Director Davis as reported by him to Secretary Fall last July under the provisions of the Kincaid act. The hearing was extended in scope to cover any general phases of the development of the Colorado River basin, but no general discussion resulted. The only objections were entered by the states in the upper part of the basin, which maintained that their water rights must not be jeopardized by any prior appropriations made in the lower basin or because of any dams constructed below the Utah state line.

Statements that the work could well be done by private interests were made by H. H. Craig of the Southern Sierras Power Company and R. H. Ballard of the Southern California Edison Company.

Foch Made Honorary Member of National Engineering Societies

MARSHAL FOCH was made an honorary member of the four national engineering societies on Tuesday of this week at an imposing ceremony at the Engineering Societies Building in New York. The four societies are the American Institute of Electrical Engineers, the American Society of Mechanical Engineers, the American Society of Civil Engineers and the American Institute of Mining and Metallurgical Engineers. The certificate of honorary membership was presented by Col. William Barclay Parsons, who commanded the Eleventh Engineers, the first engineering regiment to go abroad, which gained fame by rushing to the aid of Haig with picks and shovels when the Germans made their drive for the channel ports. Col. Parsons said:

> Marshal: The art of engineering was defined a long time ago as "the art of directing the great sources of power in nature for the use and convenience of man." No better definition can be found today. Of all the sources of power in nature, the greatest, the most valuable, and at the same time the most difficult to direct, is the energy of man himself. He who can direct human energy and turn it to the service of mankind is a great engineer.
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> You, Marshal, have directed a greater mass of human energy than any other man has ever done; and you have successfully directed this mass for the highest uses of mankind, in that you by its aid have preserved for him one of the most precious of human possessions—liberty, liberty not only for your own illustrious country, but for all the nations of the world.
>
> The four national engineering societies of the United States now desire to make record of their appreciation of this fact and to convey to you an expression of their most profound admiration for the great leader of men by conferring on you honorary membership in all the societies, the

> highest honor in their gift and one hitherto never conferred on a single individual.
>
> Four thousand members of these societies were enrolled in the armed service of the United States, the greater part of whom had the glorious distinction to serve the common cause in France under your orders. They heard the voice and they saw the hand of the master as he led them through battle to victory. Now we desire that you will still continue to lead us, but in peace, by permitting us to inscribe your name at the head of our roll of honor, where it will be, as your deeds have been, an example to us to do better work, and where it will remain forever a noble inspiration for all future generations.
>
> Marshal, in the name of those members of the societies who served under your orders and particularly in the name of those who fell on the field of honor in France, I salute you!

In responding Marshal Foch said:

> It was due largely to the engineers and the engineering industries that the war was brought to a successful conclusion. The armies could not have accomplished much without the effort of the engineer. Success was made possible to a great extent by the industry of the people at home, but when decisive moments arrived the engineer stood out as an essential factor in attaining success.
>
> What would have become of the armies without the engineering industries and without the professional knowledge which you exercised and which enabled us to lead our armies in the field, to feed them, to protect them and to facilitate their forward movement.

A statement issued by the engineering societies emphasized the character of Marshal Foch as an engineer. The statement said:

> Unanimously the governing bodies of the four national engineering societies have voted to confer this signal honor, the only one of its kind, in expression of the appreciation of American engineers for the services of this master of engineering principles, the unique commander of commanders of the defenders of civilizations.
>
> The Marshal's visit and tour as guest of the American Legion have not only been timely with the conference on reduction of armament, but have also most opportunely revived and enhanced our appreciation of the Marshal's incomparable service and of the victories of the soldiers of the united nations typified by the American Legion.
>
> The fundamentals of engineering achievement are co-operation and co-ordination. It was the ability of Foch to supplement his military genius with the effective co-operation of the commanders of the armies of five nations and the co-ordination of their operations that won the great victory.
>
> Ferdinand Foch studied engineering in the Ecole Polytechnique and the Ecole d'Application d'Artillerie. He served on the technical section of the Ministry of War early in life and in later years was a full professor in the Ecole de Guerre.
>
> No man can attain eminence as a commander of modern armies without mastery of the principles and practices of several branches of engineering. Ferdinand Foch was not only trained in the applications of engineering to military purposes, but also taught some of these branches in France's notable war schools and practiced them in the field.

Geological Survey to Report on Developed Water Powers in February

THE Geological Survey's report on the developed water power of the United States will be issued early in February. This report covers only the developed projects generating 100 or more horsepower; it will not be comparable with the report on developed water power issued by the Bureau of the Census in 1908. That report covered 31,600 plants. Of this number, however, only 600 were generating more than 1,000 hp. The remaining 31,000 plants had an average capacity of only 47 hp.

The "Electrical World" Street-Lighting Tables for 1922

FOLLOWING its practice for thirty-four consecutive years the ELECTRICAL WORLD has prepared tables showing the proper time for lighting and extinguishing street lamps. The 1922 tables will be ready in a few days, and a copy will be sent free to any subscriber upon request to ELECTRICAL WORLD, Tenth Avenue and Thirty-sixth Street, New York. For more than one copy a charge of 25 cents each is made to cover a portion of the postage, printing and compilation costs.

United States Amateurs Send Radio Messages to Scotland

AMATEUR operators sent radio messages from this country to Scotland during the last ten days which were reported as strong and steady by the representative of the Amateur Radio Relay League, who was in Scotland to receive the signals. The transmitting sets were limited to a rating of 1 kw. maximum and to a wave length of 200 m. This is in contrast with the commercial transmitters rated at 100 kw. to 1,000 kw. or over, using long wave lengths. According to reports received up to Dec. 13 by the Radio Corporation of America, all of the successful senders employed vacuum-tube transmitters. The receiving apparatus was adapted to very fine tuning. Nearly all of the messages received were sent from New England and New York State.

Utilities Seek Millions in Savings Banks for Investment

PRESIDENT BUMP of the National Electric Light Association has appointed representatives of that body to serve upon a joint committee with the National Conference of Mutual Savings Banks which will study state laws for the purpose of suggesting legislation, where needed, to make sound electric light and power company securities a legal form of investment for the funds held by savings banks and trust companies. The following will represent the bankers' organization: V. A. Lersner (chairman), comptroller Williamsburg Savings Bank, Brooklyn, N. Y.; J. M. Wilcox, vice-president Philadelphia Savings Fund Society, Philadelphia; George E. Brook, president Home Savings Bank, Boston; W. E. Knox, vice-president Bowery Savings Bank, New York City, and Milton W. Harrison, secretary National Conference of Mutual Savings Banks, New York City. The N. E. L. A. representatives will be M. S. Sloan (chairman), president Brooklyn Edison Company, Brooklyn, N. Y.; S. A. Farrar, vice-president Electric Bond & Share Company, New York City; L. F. Musil, treasurer Henry L. Doherty & Company and Cities Service Company, New York City; H. M. Addinsell, Harris, Forbes & Company, New York City, and C. L. Edgar, president Edison Electric Illuminating Company of Boston.

After a thorough study by this committee the N. E. L. A. Public Relations Section Committee on Relations with Bankers will carry the work on through local members and representatives in each state, who will co-operate with local savings banks' representatives in each state. If this work be successful, it is anticipated that at least $150,000,000 will be almost immediately available for investment in central station securities

State Power Maps Available

MAPS of Massachusetts, Connecticut, Rhode Island, New York and Pennsylvania showing location of power stations and transmission lines and names of the power companies have recently been published by the United States Geological Survey. It was originally planned to publish these maps in the water-supply papers, which were to contain tabular information in regard to the equipment of these stations and the chief characteristics of the transmission lines; but to avoid expense and the delay incident to that form of publication they will be issued separately and sold by the survey for 50 cents each. Similar maps of New Hampshire, Vermont, Maine, New Jersey, Maryland, Delaware and the District of Columbia are in the course of preparation.

Motor Specifications for Steel-Mill Main-Roll Drive

AFTER two years' discussion on the subject of standardization of rating of large rolling-mill motors, general specifications for alternating-current machines for this purpose have been issued, as revised, by the Association of Iron and Steel Electrical Engineers. These specifications, it is stated, represent the consensus of opinion of not only a large majority of users, but also of the designers of such motors.

Unless otherwise specified, motors are to be designed on the 50-deg. temperature-rise basis or on what is known as the single-rating basis. It is emphasized that the rating of the motor must include all overload capacity.

For comparative purposes it is recommended that mill operators ask the manufacturers to give them the approximate 50-deg. rating of their various motors now installed, in order that future installations may be compared with this rating rather than with the old 35-deg. or 40-deg. rating.

It was stated at the annual convention of the association in Chicago last September that "a few detail changes were made in the text as printed last year, but in general the specification is now finished and will not require revision until further development takes place in the art."

Georgia Electrical Men Discuss State Licensing of Contractors

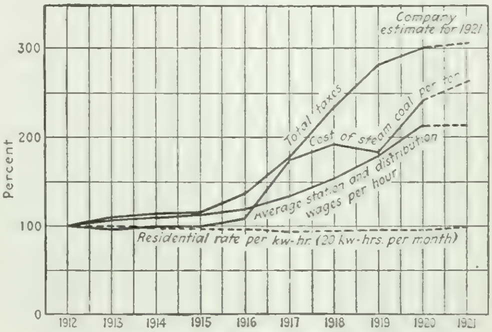
AT THE second semi-annual meeting of the Georgia Electrical Association, held in Columbus, Ga., on Dec. 8 and 9, the principal point brought up for discussion was state licensing of electrical contractors, the proposed bill on the subject being presented by R. M. Walker of the Walker Electric & Plumbing Company of Atlanta. It was the general opinion of the meeting that the subject should be approached with great care in order to avoid embarrassing complications. The matter was referred back to a committee for more thorough investigation.

W. R. Collier, general sales manager of the Georgia Railway & Power Company, outlined a plan for the comprehensive education of the building contractors and architects to the value and necessity of additional convenience outlets in the home. Acting upon his suggestion, a special committee to handle this line of activity was created and instructed to start active work at once.

Following a dinner at the Ralston Hotel, C. M. Young, for many years chief engineer of the Columbus Power Company but now an engineer in the textile business, sketched briefly the hydro-electric developments in and around Columbus, saying that with proper encouragement it would be a question of a very short time until 150,000 hp. in hydro-electric developments on the Chattanooga River around Columbus would be complete.

How Nearly Electric Rates Kept Pace with Taxes, Coal and Wages

AN INTERESTING study of the relation of the trend of residential electric rates to the trend of the three principal items in the cost of operating an electric light and power company—coal, taxes and wages—has just been made by the Empire State Gas and Electric Association. The results, which were obtained from data furnished by seven large New York State properties, are shown in the accompanying diagram. While the three items of cost have soared, rates are even less than they were in 1912. The rate line was obtained by averaging the bills that a domestic consumer would pay if he were to use 20 kw.-hr. a month.



RELATION BETWEEN TAXES, WAGES, COAL COST AND RATES

Lackawanna Again Asks for Electrification Bids

THE Delaware, Lackawanna & Western Railroad has requested the General Electric Company and the Westinghouse Electric & Manufacturing Company to prepare estimates for the electrification of about 40 miles of track in the anthracite region near Scranton, Pa. Officials of the railroad are reported to have said that the cost would total between $5,000,000 and $6,000,000. This is the second time that bids have been asked for. Estimates were received by Gibbs & Hill, consulting engineers for the road, in July, but were found unsatisfactory. It is felt that more satisfactory estimates can be secured now that prices are lower. It will probably be some months before these estimate figures can be prepared.

St. Lawrence Commission Will Soon Make Recommendations

THE International Joint Commission is holding daily sessions in Washington at which all aspects of the St. Lawrence project are being considered. The commission expects soon to arrive at definite conclusions in regard to this project and to submit recommendations.

Action Asked on New York Electrical Code

THE Board of Aldermen of New York City has been asked by Mayor Hylan to take prompt and favorable action on an amendment to the electrical code of New York City submitted by Commissioner Hayes of the Department of Water Supply, Gas and Electricity. The amendment was submitted to the board in July, 1920, and one of its purposes is to bring the code up to date with the national code in force at present. The proposed amendment also provides the commissioner with the power to appoint members of the electricians' license board annually. Under the present law a member of the board once appointed may not be removed except for misconduct in office. A third provision gives the department power to collect fees for inspection of all wiring jobs. This feature of the amendment has aroused considerable antagonism among various business interests.

Kansas Utilities Discuss Future Growth and Public Policy

THE place of the public utilities in the future growth of Kansas and matters of public policy were the principal subjects of discussion at the annual meeting of the Kansas Public Service Section of the National Electric Light Association at Hutchinson on Thursday and Friday of last week. Prof. George C. Shaad of Kansas University presented the paper on "The Future Kansas—the Public Utility a Factor in Growth," by Dean Walker of the Engineering School of the university, Dean Walker being unable to be present. The author of the paper warned the utility men that future industrial growth in Kansas was dependent on the proper development of power resources. While Kansas' manufactured products exceed the value of agricultural products, Dean Walker told the utility men that future growth of industry must not be expected to come as a matter of course. It may be retarded or diverted to other localities if a short-sighted policy in power supply development is followed.

Horace M. Davis, secretary of the Middle West Section of the N. E. L. A.; Keith Klevenger, R. H. Timmons and Director Bell of the Missouri Committee on Public Utility Information discussed the formation in Kansas of a similar committee. Steps were taken toward the establishment of such a committee.

A new movement in extending electric service in Nebraska was described by W. B. Roberts, president of the Nebraska Section of the N. E. L. A. A development company that includes in its relationships most if not all the construction contractors in the state has been formed. Municipalities are asked to issue bonds for the purpose of building transmission lines to tie into the nearest central station. Contracts for wholesale power at the respective city limits and for the maintenance of the line for a period of twenty years are entered into with the central-station company by the municipalities. The maintenance contract is on a cost-plus basis. The development company undertakes to furnish all plans and specifications and also plans the ordinances, bond issues and all other details in connection with the project. A number of municipal plants have been superseded by this method of obtaining energy.

The danger involved in using iron wire in situations where future extensions of service or growth of load is at all possible was emphasized by E. W. Rice, superintendent of distribution and electrical engineer of the Garden City Power Company, who placed the maximum current capacity of such conductors at 5 amp. to 6 amp. In situations where iron wire has been used and must be changed on account of load growth he asserted that now is the time to make the change on account of the low cost of copper.

Viewing the farm as an industrial establishment different only in form from the factory, J. C. Martin, Western editor of the ELECTRICAL WORLD, interpreted the demand for rural service as a call on the electrical industry to extend the benefits of electric service to industrial establishments and homes that are only now realizing their need of the service from an economic standpoint. Rural lines are not different in essentials from any other lines and the utility men were urged to look at them in this light. Courage to face and carefully analyze the problem and ask for adequate rates for the service was urged.

At the banquet on Thursday evening F. W. Herbert, from N. E. L. A. headquarters, and Vice-president Davidson of the N. E. L. A. told of the association activities, and Chester Leasure, managing editor of the Hutchinson *Gazette*, entertained the utility men with clever and witty take-offs of utility and newspaper affairs.

The officers elected for the coming year were: President, W. W. Austin, Cottonwood Falls; first vice-president, C. A. Fees, Concordia; second vice-president, W. A. Scothorn, Junction City; secretary and treasurer, T. T. Parker, Emporia.

Valuation of New York Telephone Property Under Way

HEARINGS are being conducted at Albany by the Public Service Commission of New York and the New York Telephone Company in accordance with the commission's recent ruling that the only way to establish a rate basis is to have a statewide valuation of the company's properties. The next hearing is set down for Dec. 12. Both the commission and the company are proceeding as expeditiously as possible and it is thought that a final determination of values will be had by the middle of January. Whether the values so determined will have the effect of raising or lowering telephone rates is a matter that can be determined only after the valuations are fixed.

Service Charge on Gas Sustained by Rhode Island Supreme Court

THE Rhode Island Supreme Court has issued a decision declaring legal a service charge made for gas by the Providence Gas Company and dismissing the appeal of the City Council of Cranston against an order of the Public Utilities Commission allowing the company to institute its present schedule of rates and a service charge of 50 cents a month.

The opinion by Judge Sweeney says: "The service charge is an equal distribution of those burdens incidental to the manufacture and distribution of gas which should be borne by all consumers, irrespective of the quantity used. The consumer of gas pays his equalized cost of the service, and neither the small consumer nor the large one is compelled to carry a load that should be shared by both."

Tentative Program of Western Inspectors' Chicago Meeting

FOR the seventeenth annual meeting of the Western Association of Electrical Inspectors, which will be held at the Hotel Sherman, Chicago, on Jan. 17, 18 and 19, the following tentative program has been adopted:

TUESDAY, JAN. 17

Morning.—President's address; reports of executive committee, secretary and treasurer; "Army Signaling," by Major J. C. Maugorgne; "Installation and Uses of Radio Equipment," by L. E. Whittemore, Bureau of Standards.

Afternoon. — "Reduction of Life and Fire Hazard at Meter Installations," by Joseph C. Langdell, Hodenpyl, Hardy & Company, Jackson, Mich.; "Safety First," by H. J. Burton, Consumers' Power Company, Jackson, Mich.; "The Uses of Armored Conductors," by J. M. Collins, secretary Electrical Contractors' Association of Chicago; "Power Requirements of a Physician Using Electricity for Therapeutic Purposes," by Dr. J. Walter Wigelsworth, Chicago; "Identification of Grounded Circuit Wires," by A. R. Small, vice-president Underwriters' Laboratories, Chicago; general subject, "The Unity of the Electrical Industry": (a) "The Electrical Manufacturer's Co-operation," by a representative of the Associated Manufacturers of Electrical Supplies; (b) "The Electrical Contractor and Dealer's Co-operation," by a representative of the National Association of Electrical Contractors and Dealers; (c) "The Central Station's Co-operation," by a representative of the National Electric Light Association.

WEDNESDAY, JAN. 18

Morning.—Discussion of inspectors' problems. (Members are requested to present these to the secretary in writing as far in advance of the meeting as possible.

Afternoon.—Tests of Electrical fittings and materials at the Underwriters' Laboratories.

THURSDAY, JAN. 19

Discussions of inspectors' problems (continued), reports of special committees and election of officers.

Inspection tours are scheduled for Friday, Jan. 20.

Indiana Electric Corporation Asks for Rehearing of Merger Plan

THE Indiana Electric Corporation has filed a petition with the Public Service Commission asking for a rehearing of the proposal to issue a large amount of securities for the purchase of the properties of seven electric utilities of the state. The Joseph H. Brewer interests, which are back of the corporation, proposed in the original petition to issue approximately $21,000,000 of securities to be used in effecting the merger. This petition was denied by the commission, after an extended investigation and hearing, on the ground that the value of the properties, estimated at approximately $19,000,000 by the corporation, is not sufficient to warrant the large issue of securities.

The petition for rehearing indicates that the amended petition would ask for authority to issue securities of smaller amount. The amount of securities to be proposed, however, is not disclosed.

The companies which the corporation proposes to purchase are the Merchants' Heat & Light Company, Indianapolis; the Indiana Railways & Light Company, Kokomo; the Elkhart Gas & Fuel Company, the Valparaiso Lighting Company, the Wabash Valley Electric Company, the Putnam Electric Company and the Cayuga Electric Company.

A number of the cities affected by the proposed merger vigorously opposed the project when it originally came before the commission. At the hearing it developed that the value of the properties as appraised for taxation purposes is several million dollars below the valuations made by the corporation. This point was strongly urged by the attorneys opposing the plan. The order of the commission said: "The commission is of the opinion that there is not enough fair value in the properties sought to be purchased by the petitioner to warrant the assuming and the issuing of that amount of securities bearing fixed charges which the petitioner says are necessary to consummate the purchase thereof, to say nothing of other capital obligations."

Federal Power Commission Issues First Annual Report

A COMPREHENSIVE view of the organization and work accomplished by the Federal Power Commission to Nov. 1 of this year is contained in its first annual report, just issued. The report is divided into several parts, dealing with the detail organization of the commission, the results accomplished, special investigations made by the commission engineers, the passage and a summary of the federal water-power act, and the jurisdiction of the commission.

By Nov. 1, 1921, 260 applications had been filed with the commission, of which 185 were for preliminary permits and 75 for licenses. After deducting conflicting applications and applications rejected or withdrawn, the applications on file aggregated 11,060,000 primary horsepower and 16,826,000 hp. of estimated installation. Of these applications, 81 affect navigable rivers, 100 public lands, 26 Indian reservations and 153 national forests. The projects are situated in thirty-three states, the District of Columbia and the territory of Alaska.

Up to Nov. 1 final action had been taken on eighty-nine applications, of which thirty-one were acted on unfavorably. The fifty-eight projects authorized aggregate 1,415,600 primary and 2,327,000 installed horsepower.

Of the projects, not including transmission lines, for which licenses have been approved up to Nov. 1, construction is now under way on the following:

	Primary Hp.
Henry Ford & Son Co., Hudson River, N. Y.	3,640
Niagara Falls Power Co., Niagara River, N. Y.	341,500
Southern California Edison Co., Big Creek, Cal.	165,000
Alabama Power Co., Coosa River, Ala.	21,760
Snow Mountain Power & Water Co., Eel River, Cal.	9,500
Western States Gas & Electric Co., American River, Cal.	6,400
Wisconsin-Minnesota Light & Power Co., Chippewa River, Wis.	10,000
Total	557,800

On several streams the power developments proposed are so involved with other uses, particularly with irrigation and navigation, that special investigations are necessary. This is particularly true of the St. Lawrence, the Columbia, the Deschutes and the Colorado Rivers, and is likely to prove true of the Kings and certain other streams in California. The Deschutes River investigation has been completed, and the Columbia investigation is now under way. The studies of the St. Lawrence will not be made until the International Joint Commission has reached its conclusions. The investigation of the Colorado River also has not been taken up by the commission engineers as yet, with the exception of a consideration of the Boulder Canyon project.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Burning Corn as Fuel.—The O'Neill (Neb.) electric light plant recently decided to try using corn for fuel in its generating plant and is said to be satisfied with the experiment, finding its heating qualities satisfactory and that a financial saving can be made.

Prosperity at Evansville, Ind.—The Southern Indiana Gas & Electric Company reports an output in one day recently at its North Side plant in Evansville of 9,000 kw. This exceptionally high figure indicates an improvement in industrial conditions. At no time during November was the daily output less than 8,000 kw. and the average was 8,700 kw.

San Francisco Electric League Sells Utility Stock.—A four weeks' stock-selling campaign in four of the electric utilities of northern California has just been closed by the San Francisco Electrical Development League. Twenty-one teams of eight men each made a thorough canvass of the members of the league and others who might be interested, the idea being to get as widespread holding of this stock as possible. The winning team in the contest took thirty-three orders, the second team taking twenty-nine. A similar contest was recently completed in Los Angeles by the Los Angeles Electric Club and was very successful.

Indiana Law Affecting Sale of Securities to Be Tested.—A suit appealing from a decision of the Indiana Securities Commission not to permit the North American Light & Power Company of Chicago to sell $200,000 worth of its preferred stock in Indiana, because of the commission's ruling that preferred stock exceeding double the value of common stock in a company may not be placed on sale in the state, was filed recently by the Chicago company. The plaintiff alleges that the Securities Commission is without authority to make an arbitrary rule such as that on the preferred-stock sale question, the company holding that a permit for sale of stock should be based only on the merit of the stock.

Latest Figures on Hydro-Electrical Development in Italy.—According to official figures just published by the Ministry of Public Works at Rome, there existed in Italy in 1915 altogether 329 hydro-electric plants with an individual capacity of more than 300 hp. and a combined capacity of about 933,000 hp. During the years from 1916 to 1920 the number of plants increased to 383 with a combined capacity of 1,152,120 hp. In construction at the present time there are fifty-four plants with a combined capacity of 359,210 hp., so that Italy will in the near future have 1,511,330 hp. developed water power for the generation of electricity. Adding to these larger installations the smaller ones with about 300,000 hp., there are available altogether power stations of a capacity of 1,811,330 hp.

New Alabama Power Project.—During the week ended Dec. 3 only one application was received by the Federal Power Commission. A. E. Killebreu of Newton, Ala., requested a preliminary permit to cover a power project estimated to furnish 1,200 hp. of primary power. It is the intention to install equipment with a capacity of 5,000 hp. and to build a dam 80 ft. high in the Choctawatchee River just above the town of Newton. The power is to be used for public utility purposes.

New Generating Station for Waukegan, Ill.—Plans are nearly completed for the construction by the Public Service Company of Northern Illinois of its new generating station at Waukegan, which will have an ultimate capacity of 220,000 kw. Construction is expected to begin early next year, when two units of 20,000 kw. each will be erected. Plans also call for the construction of transmission lines to connect the Waukegan station with the Northwestern station of the Commonwealth Edison Company in Chicago to provide for an interchange of energy in case of emergency.

France's Hydro-Electric Project.—The carrying out of hydro-electrical schemes in the Savoy provinces of France is providing some interesting technical problems which, according to the Paris correspondent of *Engineering*, are being satisfactorily solved. A characteristic example is the work undertaken by the Société de la Haute-Isère, which has driven a tunnel about 21,500 ft. long through Mont-Pourri in order to make available at Sainte-Foy-en-Tarentaise a 1,350-ft. head of water. The tunnel and the dam, which is at an altitude of 6,700 ft., are nearly completed, and it is expected that the power plant will be installed by the end of the present year and put into operation next spring. The power station at Sainte-Foy-en-Tarentaise will produce an average of 40,000 hp., of which two-thirds will be supplied to Lyons and the rest to Saint-Etienne. The current will be distributed under a tension of 120,000 volts over a distance of 140 miles. This is considered the most important electrical distribution scheme yet carried out in France.

Iowa and Wisconsin Universities Will Give Meter Courses in January.—The fourth short course for electric metermen, it is announced by the engineering extension department of Iowa State College, will be held at Ames, Iowa, on Jan. 3-6, 1922. The course will cover the fundamental principles on which meters operate, the electrical and mechanical features in the construction of meters and the installation, wiring, testing and adjusting of meters for single and polyphase service. There are no fees. The second session of the school for electric metermen in connection with the University of Wisconsin will be held at Madison during the week beginning Jan. 23. Last year's school was highly successful, and it is planned to conduct the work in much the same manner as it was conducted then, with such modifications as experience has shown desirable. One of these modifications, if the attendance justifies it, will be the division of those taking the work into two groups, one group including those who attended last year. These will be expected to do more thorough and advanced work. A fee of $10 to cover expenses is charged for this course.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

New York Electrical Society. — At the meeting of this society held last Wednesday, Dec. 14, Alfred O. Tate lectured on "The New Art of Electrolytic Waterproofing."

Material Handling in Its Relation to Port Development.—This will be the general topic of a meeting at the Philadelphia Engineers' Club on Tuesday, Dec. 20, held under the joint auspices of civic and engineering bodies, including the local section of the A. I. E. E. One of the papers will be by D. M. Petty, chief electrical engineer, Bethlehem Steel Company, who will discuss "Yard Electrification of Industrial Plant Railways." At a subscription dinner Dr. Julius Klein, director Bureau of Foreign and Domestic Commerce, will speak on "Our Plans for a Greater Foreign Commerce."

Edison Pioneers Amend Their Constitution.—In order to perpetuate their organization and thereby keep alive for future generations the activities and contributions to science of Thomas Alva Edison, the Edison Pioneers, who up to the present time have consisted exclusively of men who were intimately associated with Mr. Edison in the early days of his career, have revised their constitution to provide for a class of members to be known as "descendant members." This class will consist of the sons or daughters of actual members, only one such descendant being eligible for membership at a time. The Edison Pioneers are now sharing the rooms of the Association of Edison Illuminating Companies in the Engineering Societies Building, New York City, where it is the purpose of the society to gather together, if possible, models of early apparatus and other articles of historical and educational value in the conception and ultimate practical utilization of which the genius of Edison played a part.

Coming Meetings of Electrical and Other Technical Societies

A. I. and S. E. E.—Pittsburgh Section, Dec. 19; Philadelphia Section, Dec. [illegible]; Chicago Section, Jan. 27.

American Physical Society—Toronto, Dec. 27-30.

American Association for the Advancement of Science—Toronto, Dec. 27-31.

A. I. E. E. Section Meetings—Atlanta, Dec. 29; Lehigh Valley, Jan. 12; Baltimore, Jan. [illegible]; New York, Jan. [illegible].

Massachusetts State Association of Electrical Contractors and Dealers—Springfield, Jan. 5.

American Engineering Council—Washington, Jan. 5-6.

Western Association of Electrical Inspectors—Chicago, Jan. 17-19.

American Society of Civil Engineers—New York, Jan. [illegible].

Association of Municipal Electrical Utilities of Ontario—Toronto, Jan. 26-27.

Lighting Fixture Dealers' Society of America—Milwaukee, Jan. 30-Feb. 2.

New Mexico Electrical Association—Albuquerque, Feb. 13-14.

American Institute of Electrical Engineers—Midwinter convention, New York City, Feb. 15-17.

National Meter Committee, N. E. L. A.—Springfield, Ill., Feb. 15.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies

State Must Not Tax Capital Stock Representing Property Outside Its Limits.—The Montana Supreme Court, in General Electric Company vs. Stewart, has held void a provision of the state law whereby it was sought to levy a tax on the entire capital stock of companies conducting a part of their business in the state. The court points out that such an exercise of taxing power has repeatedly been declared illegal by the United States Supreme Court as in violation of the Fourteenth Amendment to the United States Constitution.

Filing of New Suit by Utility Does Not Affect Consumers' Right to Rebate.—Refusing a petition for rehearing in re Lincoln (Neb.) Gas & Electric Light Company, whose attack on an ordinance rate as being confiscatory the United States Supreme Court had refused to sustain, that court declared that the trial court's jurisdiction to order a refund to consumers of charges in excess of the ordinance rate was not affected by the utility's bringing a new suit against the city again attacking the ordinance rate, nor by a restraining order issued therein, as such new suit could properly have effect only as to the then future operation of the ordinance and could not affect the period covered by the former suit; nor was the obligation to reimburse consumers affected by the sufficiency or insufficiency of the supersedeas bond filed by the company to cover such a necessity. (42 S. C. R. 2.)*

Effect of Nullifying Statutory Rate.—The New York Public Service Commission may approve a schedule of rates when the legislative maximum has been declared confiscatory, since there then exists no lawful maximum rate. This is the holding of the New York Court of Appeals in Morrell vs. Brooklyn Borough Gas Company, which thus reverses the judgment of the Appellate Division of the Supreme Court. (See ELECTRICAL WORLD, Feb. 26, page 508.) In the latter judgment an order for an injunction against the company was upheld and the action of the Supreme Court, Special Term, in itself fixing a rate of $1.15 was sustained. The Court of Appeals says: "We find nothing in the laws or in authorities to justify such action. The Public Service Commissions law covers the whole question. The company may file its own schedule of rates and change of rates. The Public Service Commission on complaint or of its own motion may modify the charges. Here, on application of this company, the commission fixed the rate at $1.40. It is only where a rate has been fixed by statute that the commission cannot increase it. The only law was that of 1916, which had been declared null and void, so that there was not this limitation upon the commission."

"Passion and Prejudice" Affect Seattle's Municipal Plant.—A great divergence in the estimate of land values appeared when the City of Seattle brought suit against the Bingham Investment Company in eminent domain proceedings to condemn land for its hydro-electric light and power plant. A plot valued by the city at $3,000 was held by the company at from $17,000 to $50,000, and a jury returned a verdict for $27,500. The court found this amount "excessive in the sum of $13,750" and held the verdict to be "the result of passion and prejudice against the petitioner," ordering a new trial. This decision has been upheld by the Supreme Court of Washington, despite the fact that both sides appealed from it, the investment company on the ground that the jury's finding was of a binding nature and the city because the court did not "include in its order for a new trial an affirmation of legal points which it desired to have sustained." (201 Pac. 300.)

Exemption of City-Owned Utilities from Control of Illinois Commission Upheld by Supreme Court. — The Supreme Court of the United States has upheld the Supreme Court of Illinois in its decision that the public utilities act of that state does not apply to city-owned utilities, they being exempted under a section of the public utilities act as well as under the municipal ownership act (Springfield Gas & Electric Company vs. City of Springfield). The United States Supreme Court says: "The plaintiff's argument shortly stated is that in selling electricity the city stands like any other party engaged in a commercial enterprise and that to leave it free in the matter of charges while the plaintiff is subject to the public utilities board is to deny to the plaintiff the equal protection of the laws. But we agree with the Supreme Court of the state that the difference between the two types of corporation warrants the different treatment that they have received. The private corporation whatever its public duties, is organized for private ends and may be presumed to intend to make whatever profit the business will allow. The municipal corporation is allowed to go into the business only on the theory that thereby the public welfare will be subserved. So far as gain is an object it is a gain to a public body and must be used for public ends. Those who manage the work cannot lawfully make private profit their aim, as the plaintiff's directors not only may but must. The Supreme Court seems to interpret the municipal ownership act as limiting the charges allowed to what will be sufficient to meet outlays and expenses of every kind, thus emphasizing the purely public nature of the interests concerned and excluding the latitude for wrong that the plaintiff fears. . . . The trouble with the plaintiff's argument is that it attempts to go behind the interpretation that the Supreme Court has given to the acts concerned and to overwork the delicate distinction between the private and public capacities of municipal corporations. It is unnecessary to refer to the numerous cases upon classification by state laws in order to show that the distinction here is very far from being so arbitrary that we can pronounce it bad." (42 S.C.R. 24.)

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities

Reasonableness of Company Rules.—Passing upon various regulations of the Luzerne County Gas & Electric Company to which objection had been made, the Pennsylvania Public Service Commission upheld a rule reserving to the company the right to reject any application and also the rules in regard to deposits and guarantees. A rule giving the company the right to discontinue service without notice and to remove its equipment in case of failure to pay bills was modified to cover only bills directly related to the service rendered, and the commission asserted that the right of shut-off should be exercised subject to reasonable notice to the consumer. An objection to a clause making the customer liable for damage to the company's property as a result of misuse or neglect was overruled.

Off-Peak Power Rate Approved.—An increase in the power rate to the East Providence Water Company and the establishment of a new power rate for the East Greenwich Water Company are included in tariffs filed by the Narragansett Electric Lighting Company with the Public Utilities Commission of Rhode Island and approved by that body. The rate to the East Providence company is increased from 4 to 4½ cents per kilowatt-hour for the first 25,000 kw.-hr. per year. The minimum charge of $1,000 per year still remains. The rate established for the East Greenwich company is 4½ cents per kilowatt-hour per year for the first 20,000 kw.-hr., and existing power rates in the regular tariff are to govern the excess power used. The minimum charge per year is $1,000. The rate is made by the Narragansett company upon the condition that the water concern does not use power during the peak load of the power company.

Working Capital and Issues of Stock.—In permitting the Haverhill Gas Light Company to issue additional capital stock of which the proceeds are to be applied to the payment of floating debt, the Massachusetts Department of Public Utilities quoted a former decision in which it said: "In established and prosperous companies, with an unquestioned surplus, the board has been of the opinion that working capital should be provided out of surplus or temporary debt rather than by the issue of new stock because under such conditions the necessity for such issue is not apparent. For these reasons no provision for this item is made in this decision, but if experience shall later prove that such reasonable necessity exists, the request for the same can then be renewed." Adhering to this position, the Massachusetts body criticises the inclusion in the contemplated stock issue of a sum to make up a deficit in working capital, especially in view of the present market conditions, which should make new issues of stock as small as exigencies permit.

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*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel—Responsibilities and Association Appointments of Men Engaged in Professional, Executive, Operating and Commercial Branches of the Industry

Dexter S. Kimball, dean of the College of Engineering, Cornell University, has been elected president of the American Society of Mechanical Engineers for the year 1922. Dean Kimball was born in New River, New Brunswick, Canada, in 1865. He was graduated from Leland Stanford, Jr., University in 1896 with the degree of A.B. In 1913 he received the degree of mechanical engineer from the same university. He served his apprenticeship with Pope & Talbot, Port Gamble, Wash., and in the shops and engineering department of the Union Iron Works, San Francisco. In 1898 he became designing engineer for the Anaconda Mining Company. For three years he served as assistant professor of machine design at Sibley College, Cornell University, after which he became works manager of the Stanley Electric Manufacturing Company, Pittsfield, Mass. In 1904 he returned to Cornell University as professor of machine design and construction, and since 1915 he has occupied the chair of industrial engineering. He became dean of the College of Engineering of Cornell in 1920. Since 1911 Dean Kimball has been a member of the Council on Industrial Engineering, New York State Department of Education. He is also a member of the Society for the Promotion of Engineering Education and the Society of Industrial Engineers. He is vice-president of the Federated American Engineering Societies. Dean Kimball is the co-author with John H. Barr of "Elements of Machine Design" and the author of "Industrial Education," "Principles of Industrial Organization," "Elements of Cost Finding" and "Plant Management," as well as of many contributions to the technical press.

D. S. KIMBALL

Prof. Harold J. Lockwood has been appointed professor of electrical engineering in the Thayer School of Engineering, which is connected with Dartmouth College, Hanover, N. H., to fill the vacancy caused by the resignation of Prof. F. E. Austin.

James B. Brokaw has been recently appointed manager of the Grand Ronde division of the Eastern Oregon Light & Power Company, with headquarters at La Grande, Ore. Mr. Brokaw brings to this company a wide experience of the electrical industry, since he had served prior to 1921 as manager of the Minot (N. D.) division of the Northern States Power Company and for more than eight years as local manager of the Idaho Power Company at Blackfoot, Idaho.

Allan D. Colvin has been appointed general manager of the Hartford (Conn.) Electric Light Company, succeeding E. F. Lawton, who has resigned his post on account of continued ill health. Mr. Lawton still retains his connection with the company. Mr. Colvin was born at Troy, N. Y., in 1883 and was graduated in 1906 from the Rensselaer Polytechnic Institute. From 1906 to 1907 he was personal assistant to Dr. W. L. Robb, consulting engineer, Troy, and from 1907 to 1909 he was assistant superintendent of the electrical department of the Troy Gas Company. He then served two years as assistant in physics and electrical engineering at the Rensselaer Institute. Mr. Colvin was called to the Hartford Electric Light Company in 1911 to become assistant to the general manager and a year later was made assistant general manager. During the absence of Mr. Lawton in 1919 and 1920 he was acting general manager. Mr. Colvin is well known in New England central-station circles, is active in the New England Division of the N. E. L. A., and is a member of the committee on inductive interference.

A. D. COLVIN

Dr. B. E. Eldred of New York has recently been awarded the Elliott Cresson gold medal by the Franklin Institute, Philadelphia, for his development of the low-expansion leading-in wire for incandescent electric lamps.

F. R. Winders, who becomes a member of the engineering force of the National Electric Light Association at the New York headquarters this week, is a graduate of the University of Illinois, which conferred the degree of electrical engineer upon him in 1905. He spent five years with the Arnold Company on construction work and from 1910 to 1914 was with C. W. Humphrey in his consulting and construction work dealing with utility and other problems. From 1914 to 1919 Mr. Winders was with the L. E. Meyers Company, engaged in construction and operation of utility properties in the Lake Geneva territory in Wisconsin and later at Ashland and Ironwood, Mich. In 1919 he went to the engineering department of the Railroad Commission of Wisconsin, with which he remained until Sept. 1, 1921, when he undertook some work in Ohio in connection with the formulation of rules which a joint committee of the Ohio utilities are working out for recommendation to the commission. Mr. Winders' new activities will consist primarily of field work in the study of the inductive-interference problem, which is now being actively discussed in a very large number of states.

F. R. WINDERS

Walter S. Dickson has been appointed to the staff of the Society for Electrical Development. Mr. Dickson's work for the society will consist in part in gathering and interpreting statistics and other information of value to members. Mr. Dickson brings to the society a broad experience in engineering and research work. He has made extensive business trips in this country and throughout South America in the interest of large engineering projects. He has given a great deal of time to further the work of the several national technical societies of which he is a member. His activities have been associated with electrical manufacturing interests, public utility properties and prominent consulting electrical engineers. During the present period of reconstruction Mr. Dickson has done active work on engineering committees dealing with large engineering problems.

C. F. Gottschalk, for the past twelve years assistant manager of the George Worthington Company, has been appointed sales manager of the Frankelite Company, lighting fixture manufacturer, Cleveland, Ohio.

A. A. Albaugh, formerly general superintendent of the Jacobson Manufacturing Company, has been appointed vice-president and general manager of the Barnhart-Davis Company, Warren, Pa., manufacturer of specialties.

L. S. MONTGOMERY

L. S. Montgomery, who has joined the New York sales organization of the Garland Manufacturing Company, successor to the Safety-Armorite Conduit Company of Pittsburgh, has been associated with the electrical industry for about fifteen years with electrical jobbers, central-station companies and electrical manufacturers. Mr. Montgomery was the first sales representative of the National Metal Molding Company in the South. He entered that field in 1909 and later established and managed the district sales offices of the company in Atlanta, Pittsburgh and Buffalo. While in Buffalo he was also sales representative for the Dominion of Canada. In June, 1916, after the National Guard had been mobilized for the Mexican border disturbance, Mr. Montgomery enlisted as a private with Troop I, First Cavalry, and was in active service at McAllen, Tex., with that unit for more than ten months. After returning from the Mexican border he joined the organization of the American Conduit Manufacturing Company in charge of its sales and warehouse organization in New York City. This position he resigned a few months later to re-enter the army for the World War, enlisting as a recruit at Fort Slocum in December, 1917. He was assigned to the Corps of Engineers and when discharged in December, 1918, was a captain of engineers in command of Company F, Seventh Engineer Training Regiment, and regimental director of athletics of the Seventh Engineer Training Regiment, Camp A. A. Humphreys, Va. After being discharged Mr. Montgomery joined the organization of the Fairbanks Company as manager of its electrical division and during that connection was in charge of electrical merchandising activities of that company, installing industrial electrical supply departments in its branches at Baltimore, Birmingham, New Orleans and St. Louis. Mr. Montgomery was born in Concord, N. C., Feb. 26, 1887. He is a member of the Army and Navy Club, New York, and the Cavalry Post of the American Legion.

E. M. Herr, president of the Westinghouse Electric & Manufacturing Company, and Gen. Guy E. Tripp, chairman of the board, have been elected directors of the Radio Corporation of America.

R. W. Everson, formerly manager of the merchandising department of the Westinghouse Electric International Company, has left for Mexico City, where he has been assigned to the Mexican office of the company. Mr. Everson has been connected with Westinghouse interests for the past twenty-five years. For several years he had charge of the export activities in the supply department, and in 1906 he was transferred to the Chicago district office of the Westinghouse Electric & Manufacturing Company, where he specialized on syndicates. In 1919 he was made manager of the merchandising department of the International Company.

Obituary

Martin H. Stellman, general manager of the Westerly (R. I.) Light & Power Company and the Mystic Power Company, died on Nov. 17, after a long illness. Mr. Stellman was born in Providence Dec. 21, 1875. From earliest boyhood his interest was held by things electrical, and it was along the line of practical electrical work and electrical engineering that the greater part of his active years was spent. Besides being general manager of the Westerly Light & Power Company and the Mystic Power Company he had a number of other business interests.

M. H. STELLMAN

Frank Chittenden Peck, for fourteen years an electrical engineer with the Electric Service Supplies Company, died on Nov. 12. Mr. Peck was born in Scranton, Pa., in 1877.

H. R. Frost, formerly treasurer and general auditor of the Northern States Power Company, died Nov. 23 at his home in Wichita, Kan. Mr. Frost, who had been a member of the Byllesby organization for many years, serving as local auditor, traveling auditor and member of the auditing department at Chicago, was forced to retire from active work in 1919 because of ill health.

Sir Charles Douglas Fox, an eminent British civil engineer, who was also a member of the Institution of Electrical Engineers and who was among those instrumental in bringing into being the British Engineering Standards Committee, died in London last month at the age of eighty-one.

R. N. Hodgson, of the W. E. Moore Company, Pittsburgh, was instantly killed on Nov. 30 by being run over by a train. Mr. Hodgson had been in the central station business for the past eighteen years and was widely known throughout the Eastern States. He began his service in the industry with the West Penn Electric Company in the power sales department, finally becoming power sales engineer. He was later connected with the Westinghouse Electric & Manufacturing Company as special motor application engineer and with the General Electric Company as engineer of motor application. His last work in the electrical industry was as general manager of the Binghamton (N. Y.) Light & Power Company.

Frederick A. Keyes, well known to the electrical industry as the sales manager of the electrical and wire-rope department of the New York office of the American Steel & Wire Company, died on Saturday, Nov. 26. Mr. Keyes was born in West Boylston, Mass., in 1864. He entered the service of the Washburn & Moen Manufacturing Company at Worcester, Mass., at the age of sixteen and continued his service with that company and its successor during his entire lifetime. In 1892 he was placed in charge of the Philadelphia office of the Washburn & Moen company. In 1899, when that company was absorbed by the American Steel & Wire Company, he was given charge of the electrical and wire rope department in New York City, covering the Atlantic Coast States, and he conducted that important department with marked success until his death. He was a man of very high ideals and fine character.

F. A. KEYES

Trade and Market Conditions

Business Reviews, Together with Market Letters
from Important Trade Centers, on the Supply, Demand and Prevailing Prices of
Electrical Apparatus and Supplies

Southeastern Collections Better, but Credits Remain Tight

ALL electrical firms in the Southeast report their collections as materially improved, though a large number of outstanding accounts remain to be liquidated. The tendency of the rural population to put the proceeds from agricultural products in their pockets rather than to liquidate their old debts is causing an undesirable situation in the smaller towns, which of course is reflected in jobbers' accounts with clients in such centers. Creditors hesitate to push such individuals as hard as conditions warrant for fear that bankruptcy would result in a large number of cases, thus causing the creditor to lose more heavily than if collections are handled on a less drastic basis. The increase in cash business and in the payment by debtors in the larger communities is going far toward the liquidation of outstanding accounts in the cities. Little credit is being extended by the jobbers, except to thoroughly reputable and well-established firms, and this is usually on the sixty-day basis.

Cedar Poles Denied Free Entry

THE collector's assessment of duty at the rate of 10 per cent ad valorem on merchandise imported from Canada and described as cedar piling or peeled cedar poles is affirmed in a ruling by the Board of United States General Appraisers. This decision overrules protests of the United Railway Customs Bureau. The goods, the subject of this controversy, were entered at Pembina, N. D., and classified under Section 170 of the existing tariff law. Claims were made for free entry under paragraph 647 of the tariff.

Foreign Export, Rail Electrification and Water-Power Figures Being Compiled

DETAILED figures as to the current exports from the fifteen countries which engage extensively in the manufacture of electrical goods are being compiled by the electrical division of the Bureau of Foreign and Domestic Commerce. An effort also is being made to procure figures as to the production of the more important foreign manufacturing concerns. A compilation is being made of all water powers in the world whose early development is likely. This survey is well under way. A similar survey with regard to railroad electrification is about to be begun. In the gathering of these data the department has had the advice of a special committee of the Electrical Manufacturers' Council.

Farm-Lighting Sets and Central-Station Service

THAT farm-lighting sets pioneer the way for later service by central-station companies was vigorously affirmed recently by a prominent distributer of this class of equipment who was discussing the trade outlook with a representative of the ELECTRICAL WORLD. It was pointed out that the use of these sets generally involves either regular 110-volt wiring or heavier copper for a 32-volt or other low-potential utilization of energy in farm buildings, and that the standards of insulation adopted often enable service from the local utility to be provided with little additional outlay. Where the farm-lighting unit is purchased and installed for service along a highway or branch road having no central-station service, it tends, in the opinion of this distributer, to stimulate other purchases in the neighborhood and ultimately to bring about a community state of mind favorable to meeting the extra costs of central-station line extensions, where these costs are a limiting factor. In territory just beyond existing lines, it was stated, these small sets provide an interim service of value. Sales of such sets by actual demonstration in the evening from a light gasoline motor car or truck from which a duplex cable can be run into the farm buildings and the "sales talk" backed up by modern lighting and power apparatus are advocated.

November Building Overtops Last Year

BUILDING contracts awarded during November in twenty-seven Northeastern states, according to the F. W. Dodge Company, amounted to $192,311,000. This is 45 per cent greater than in November, 1920, and 14 per cent under October of this year, although the average per business day last month was only a little under October. Normal decline from October to November is 24 per cent. The fact that construction activity is holding up at such a high level during the winter gives promise of unusual construction in 1922. The greatest fear now is that the supply of building material will be unable to keep up with actual construction.

Metal Market Situation

A VERY important factor in the copper market has been the rise in foreign exchange. The mark has doubled in value and German demand, which has been good all along, may be expected to improve accordingly. The pound sterling has established a new high record for the last two years, and although copper is quoted at London £1 lower, it is actually selling at higher equivalent prices than last week.

Domestic demand is varied, inquiries coming from electrical manufacturers, wire mills, brass manufacturers, etc. The price drift is steadily upward. Large producers ask 14 cents per pound for electrolytic for January and first-quarter delivery. Predictions of 15-cent copper before Jan. 1 seem to be coming true.

NEW YORK METAL MARKET PRICES

	Dec. 5, 1921	Dec. 12, 1921
Copper:	£ s d	£ s d
London, standard spot	67 5 0	66 17 6
	Cents per Pound	Cents per Pound
Prime Lake	13.75	13.75
Electrolytic	13.62½	13.62½
Casting	13.00	12.87½
Wire bars	15.00—15.25	15.00—15.25
Lead, Am. S. & R. Co. price	4.70	4.70
Antimony	4.55	4.50
Nickel, ingot	41.[illegible]	4[illegible]
Sheet zinc, f.o.b. smelter	9.00	9.[illegible]
Zinc, spot	5.40	5.15—5.20
Tin, Straits	31.75	33.50
Aluminum, 98 to 99 per cent	19.00	19.[illegible]

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	10.50—11.37½	11.50—11.75
Brass, heavy	5.00—5.50	5.00—5.25
Brass, light	4.75—5.25	5.00—5.12½
Lead, heavy	3.75—4.12½	3.75—4.12½
Zinc, old scrap	2.50—2.75	2.50—2.75

THE WEEK

IN TRADE

Prices When Quoted Are Those Prevailing at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

SEASONAL business during the past week has developed well, but the general business of both manufacturers and jobbers has been restricted by the fear of enlarging inventories. Contractor-dealers have found a large volume of business in the residence construction permitted by generally mild weather and are reported to be buying in good quantities from jobbers.

Chicago reports a good call for vacuum cleaners, washing machines and wiring materials. Meters are selling well in St. Louis, where the central-station company has gained an average of 1,000 customers per month for the last year. Boston reports meters down 10 per cent, and New York jobbers have received notice of a 5 per cent cut from manufacturers of rigid iron conduit.

NEW YORK

Holiday trade is increasing in volume and jobbers report that this business is picking up rapidly. Individual orders, however, are not as large as last year, and dealers in this section state that this is because of a certain amount of stock carried over from last year. Jobbers appear to feel that the Christmas business this year will show up somewhat better than was at first expected.

The demand for wiring material holds up steadily, except for the fact that orders are for small quantities. This is explained, of course, by the desire of the contractors to keep their stocks as low as possible until the first-of-the-year inventories have been made. Jobbers, generally, state that they expect business to continue at about the present level until after the middle of January, when another step forward in the improvement of conditions is looked for.

One important price change was noted this week. Leading manufacturers of iron conduit have reduced the price on this material 5 per cent off the previous quotations. A new card has not as yet been issued.

Conduit.—An additional discount of 5 per cent on rigid iron conduit went into effect this week. Jobbers have not issued a revised list of prices to conform with the new discount, but are quoting 5 per cent off on the following: For ½-in. black pipe in 2,500-ft. lots, $48.29 to $48.90; ¾-in., $62.06 to $62.70, and 1-in., $88.21 to $89.32 per 1,000 ft. The same discount applies to galvanized pipe, which for the same sizes is quoted at $53.19 to $53.97, $68.61 to $69.58 and $98.19 to $99.47 per 1,000 ft. Demand is fair with most orders for small quantities. Jobbers' stocks are ample to meet the demand.

Rubber-Covered Wire.—Little change has been noted in conditions in the wire market. Demand is moderate and few large orders are being placed. Jobbers are quoting $6.50 to $6.60 per 1,000 ft. for No. 14 rubber-covered in 5,000-ft. lots. It is understood that in some cases where large stocks are on hand these prices have been shaded slightly on orders for over 5,000 ft.

Flexible Armored Conductor.—Demand for this material continues active and jobbers' stocks are moderate. No change in price has been reported. No. 14, two-wire, single-strip, was quoted at $44.50 to $46 per 1,000 ft., and double-strip at $46.50 to $48 per 1,000 ft. in that quantity.

Metal Molding.—Price on this material has remained unchanged. The three-wire size is quoted at $5.60 per 100 ft. Demand is light and jobbers' stocks are small.

Loom.—Because of the small demand stocks of this material are kept as low as possible. Both the $\frac{7}{32}$-in. and the ¼-in. sizes are quoted at $18 per 1,000 ft. in lots of that quantity.

Appliances.—Jobbers report an active demand for the smaller devices, and the holiday trade is developing rapidly. Christmas-tree sets are moving well, and present indications are that the holiday business may exceed estimates made a month ago.

CHICAGO

Another week has passed with steady business in electrical lines. Dealers in general report an active trade in wiring materials and a growing call for washers, vacuum cleaners and silk lamp cord. Since the public is showing keen interest in price lists, dealers are busy increasing sales efforts to obtain orders.

Christmas tree lights are also moving strongly, and stocks in most cases are conservative since dealers are not risking any such carry-over as occurrred last year. Dealers are optimistic as to total Christmas trade and feel that the volume for 1921 will closely equal that of 1920.

Wire.—Rubber-covered No. 14 is still selling at $6.60 to $6.75 per 1,000 ft., in 5,000-ft. lots, although weatherproof has advanced from 16½ cents a pound in 1,000-lb. lots to 16¾ cents in a few cases. Bare wire has also strengthened, the base being 16¾ to 16⅞ cents. In general, wiring materials are selling well and no shortage of wire has been reported.

Conduit.—No change in price has been recorded in this material, ½-in. black pipe still selling for about $47 per 1,000 ft. in 5,000-ft. lots. Dealers report a steady movement and their stocks are ample.

Flexible Armored Conductor.—Demand for this also has been active but no reduction in price has been announced. No. 14 two-wire, double-strip, still sells between $45 and $48 per 1,000 ft. in 5,000-ft. lots. Stocks on hand are sufficient to supply the trade.

Lamp Cord.—Silk cord seems to be the best-moving article because of the activity in portable appliances and lamps, while cotton, twisted, is going fairly well also. Silk No. 18, $\frac{1}{32}$-in. insulation, sells around $33 to $35 per 1,000 ft., while the same cord with cotton insulation costs about $28 to $30. The cheaper grade of cotton, twisted, $\frac{1}{64}$-in. insulation, is available at about $13 per 1,000 ft.

Cleaners and Washers.—Intense sales efforts by a large number of dealers are producing results. Many dealers are reporting good sales with deliveries scheduled just in time for Christmas.

Flashlights.—The fall trade is steady and the three-cell flashlight is selling the best. Replacements of batteries are drawing excellent trade and jobbers report their stock ample.

High-Tension Equipment.—Numerous inquiries for 33,000-volt equipment for extending feeder circuits by public utilities for farm lighting were reported this week by one high-tension manufacturer. Another inquiry for a 100,000-volt extension for supplying power to coal mines was also reported. Another manufacturer has received an order for 400 25,000-volt fuses from Australia and also for fifty disconnecting switches and fuse mountings of the same voltage from Texas.

Christmas-Tree Outfits.—Dealers report activity and prices vary from $1.75 to $2.50 for an eight-light carbon-lamp outfit to $2.75 to $4.75 for a tungsten-lamp outfit for the same number of lights. Stocks are ample for the trade.

BOSTON

Little change is evident in the volume of trade this week. The desire to limit inventories is undoubtedly holding back some orders, for stocks are well liquidated in most lines and ordering is confined mainly to current requirements. Operations are about 75 per cent of capacity in the cotton industry; the woolen and worsted mills are running at 97 and 92 per cent of rating, respectively, and rubber plants are busy. Conditions are spotty in paper mills, and the shoe industry is being hampered by labor difficulties. Building contracts in New England, Dow Service reports, totaled

$178,933,000 from Jan. 1 to Dec. 1, or 17 per cent below the corresponding five-year average, while the November contract total of $18,404,000 was only 1 per cent below November, 1920. It is reported that a million-dollar car order has been placed with the Laconia (N. H.) Car Company by the Boston & Maine Railroad. Prices stiffened Monday on insulated wire, while switchboard meters are off about 10 per cent. Optimism is widespread in viewing prospects for 1922 business.

Lamps.—The excellent trade of the last five months continues. Stocks are satisfactory, prices firm and demand well distributed. Sign lighting is fairly active.

Meters.—Meters for switchboard service are down about 10 per cent in price in at least one prominent make. Residence meters are firm and trade only moderately good. Deliveries are very easily made.

Appliances.—Distributers are not very enthusiastic over sales in the first half of this month, but last-minute orders of the lighter devices for table and boudoir service are expected to swell the total for December. Washing machines are moving slowly and cleaners are a little more active. Air heaters are making a reasonably good showing, but unprecedentedly mild weather has hurt this class of trade. Retail trade in socket devices is accelerating seasonably.

Wire.—The long-expected advance on rubber-covered wire appeared on Monday's price sheets, No. 14 in 25,000-ft. lots mounting to $6.50 per 1,000 ft. For 5,000-ft. lots, $6.75 per 1,000 ft. was the new figure. Trade is spotty, some jobbers reporting fairly good sales. Weatherproof wire is also firmer, the new base being 16½ cents. Prospective buying by storm-hit utilities to replace wire drawn from emergency stocks is not far off.

Insulators.—High-tension equipment is in light demand, but buying of insulators for distribution lines is fair. Enormous quantities of telephone-line material are being consumed in post-storm repair work. Freight shipments are getting somewhat slower on insulators.

Linemen's Tools.—The demand has flattened out, leaving low or exhausted stocks. Early buying by distributers is forecast.

Loom and Flexible Armored Conductor.—The market is dull in loom, but much better business is anticipated with the turn of the year. Prices are steady. Flexible armored conductor is moving well, and No. 14 single-strip sold at Boston this week at $45 per 1,000 ft., in 1,000-ft. lots.

ATLANTA

The preinventory period has somewhat reduced the volume of business, the orders received being of sufficient size only to carry over to the first of the year, while restocking for Christmas specialties has not begun to make itself felt. One of the largest jobbers reports that his volume of business for the entire year to date is satisfactory, being somewhat below that of 1920 but on parity with that of 1919. Keen competition has served to reduce the margin of profit in nearly all lines, and in some specialties the tendency to unload overstocked articles is taking away all profit in this line. Orders from central stations are being received in very satisfactory volume, replacements and expansions long deferred being responsible for this condition. Orders from smaller contractors continue to hold up fairly well, and purchases by the larger contracting firms are on the increase. Indications are that by early spring a very material stability will be in evidence throughout the jobbing line. Engineering firms report considerably increased interest on the part of industrial plants, both present and proposed, but little definite business is being closed up, as there seems to be a tendency to hold over final decisions until after the first of the year. This is not true in the activities of the ice industry, there being considerable new construction under way, together with changes in old plants to the raw-water type.

Turbo-Generator Sets.—A number of satisfactory sales are reported recently, while inquiries from central-station companies and large industrial concerns are the heaviest in many months. Most of the sets are for sizes of 1,500 kw. and up, the largest being for 20,000 kw. Shipments are satisfactory.

High-Tension Circuit Breakers.—There has been considerable activity in this line for the past few weeks, several large orders having been received while others are pending. This is in keeping with expansions to be noted in the central-station field.

Conduit.—Orders continue to hold up very nicely, particularly in the more popular sizes of 2-in. and smaller, with the demand about evenly divided between the black and galvanized. There has been no change in price since September and jobbers' stocks are in good shape.

Schedule Material.—A general sluggishness is to be noted, due probably to the recent falling off in the small industrial business. Jobbers' stocks are heavy with a resultant instability in prices.

Portable Lamps.—The expected movement in this line has failed to materialize to date, though prices are low. It is probable that there will be further price cuts in certain lines in which dealers find themselves overstocked, unless some sales materialize shortly.

Printing-Press Equipment.—Orders and inquiries throughout the section are uniformly good, the single-phase apparatus of 10 hp. and under being particularly active. Local stocks are in fair to good shape.

Electric Hoists.—A revival in demand is to be noted, several satisfactory orders being received, while construction and dock work is stimulating inquiries for delivery shortly after the first of the year.

Wire.—The recent slight increase in price seems to have stabilized the market, especially for small quantities. Competition on carload lots, however, is very keen. Both weatherproof and rubber-covered are moving quite satisfactorily in the smaller sizes, but there is little demand for No. 2 of larger sizes.

ST. LOUIS

Holiday buying is becoming brisker but has not yet reached the proportions that retail dealers expected for this period. However, warm weather has held back the holiday buying spirit and substantial improvement is anticipated from now on. Jobbers report that there are few replacement orders of holiday goods. The early buying depleted stocks in a number of appliance lines, but these have been refilled. The carry-over in all lines will be light, yet sufficient to enable jobbers to give proper service.

Improved buying from the industrials, especially the railroads and the steel mills, was felt last week. Utilities were heavier buyers of meters, transformers and pole-line hardware. The recent reductions in poles have slightly stimulated sales, but no large orders are expected before spring. Glass and porcelain insulators are moving better. An increase in the prices of rubber-covered wire is announced, but the change has not been in effect long enough to show its results in the demand. The improved buying in these items resulted in a better volume of business for the week

A representative jobber reports that business to date has been about 30 per cent less than last year, but that 20 per cent of this is due to decreased prices. Profits, however, have not been satisfactory, and this is attributed to the highly competitive status of the electrical goods market.

Wire.—An increase in price of rubber-covered wire of about 7½ per cent has just been announced, but prices have not yet been established. Though this has been expected for some time, there has not been much tendency on the part of contractor-dealers to stock up. Jobbers' stocks are also on a moderate basis. No. 14 has virtually the entire demand in rubber-covered. Fairly good movement continues in bare and weatherproof, the base prices of which are 15 cents per pound and 15½ cents per pound respectively.

Poles.—The following prices have been established for Northern white cedar poles in carload lots, f.o.b. St. Louis: 6-in., 30-ft., $5.85; 7-in., 30-ft., $8.75; 7-in., 35-ft., $14.35; 7-in., 40-ft., $18.30; 7-in., 45-ft., $21.30. Since these lower prices were made effective there has been some improvement in demand, though there are no orders for large amounts.

Utilities are buying only for small extensions and stock replacements.

Cross-Arms.—Sales show some improvement and there are a number of attractive inquiries. Representative prices on fir arms, size 3¼-in. x 4¼-in., are: 3-ft., $40.43 per 100; 4-ft., $53.90; 6-ft., $80.86; 10-ft., $135, all f.o.b. St. Louis.

Pole-Line Hardware.—Improved sales have been noted since the reduction around November 1. Stocks are sufficient to take care of all small orders, but factory shipment would have to be made for any order of magnitude.

Insulators.—Better demand is experienced for both glass and porcelain. Local stocks are complete in all standard sizes up to 6,600 volts, and immediate factory shipment can be made in any standard size of higher voltage.

Meters.—Utilities throughout the entire territory are making substantial purchases. The St. Louis central-station company for the past year has gained more than 1,000 customers per month, necessitating large orders, principally of the residential and commercial lighting type. Industrials are buying recording meters in good volume, especially demand meters, for more economical factory operation. Jobbers' stocks are well in line with the requirements. Buying is done on a very conservative basis.

SAN FRANCISCO

As the holidays draw nearer business conditions seem better, although much business is of seasonable character. In making their estimates of 1922 business local jobbers and dealers are figuring on anywhere from 75 per cent to 100 per cent of that of the present year.

Rubber-Covered Wire.—For the past few days salesmen have been eagerly seeking rubber-covered wire business, on the rumor of an advance. This advance is about 5 per cent and brings No. 14 single-braid solid in 5,000-ft. lots to an approximate price of $7.40 per 1,000 ft. There is a 5 per cent higher price in coil lots. Local stocks are working down nicely from the overstocks prevalent during midyear. Several good dealer orders, in some cases amounting to 100,000 ft. have been reported.

Medical Apparatus.—Such electrical devices as violet-ray machines are in demand, there being prevalent much sickness caused by the long dry spell. The best seller is the twenty-five-dollar type of machine equipped with a general applicator. There is a steady call also for vibrators, although this call is usually for a few machines at a time, probably because of the small inducement of only 50 cents per vibrator offered for dozen lots.

Christmas-Tree Outfits.—Jobbers' stocks have been received and generally distributed on orders dating back to spring. There is a much better call this year than last, probably because of the stimulating effect of new styles. A new outfit composed entirely of fancy lamps retailing complete for $17 is being widely displayed. Standard outfits are listing at $5 for eight-light series sets. Complete, costing the dealer $3 in single lots and $2.50 each in ten lots, and with special prices quoted on orders of 500, which, however, are very scarce. The fifty-lot requirement has been discontinued in line with the determination to give maximum prices on comparatively small amounts.

Holiday Goods.—All things considered, the electrical gifts for the holidays will be sold in a much higher proportion this year than previously. The recent industrial show held in San Francisco, in which about twenty dealers maintained booths, displaying socket appliances, gave satisfactory evidence that the buying public will pay more attention to the gift possibilities of electrical appliances this year. Furthermore, the Christmas campaign was not started too soon this year, but has been allowed to accumulate its own impetus, and many dealers reported better business on Dec. 1 than they had during holiday week last year. However, this business is nearly all for outfits and small heating and cooking appliances, and business on the larger appliances is reported slow. Nearly all prospective customers say that they will defer their purchases until after the first of the year.

SALT LAKE CITY—DENVER

In an effort to get the Interstate Commerce Commission to revert to the freight rates that prevailed in 1917, five governors of Intermountain states are preparing data to show that the present rates are stifling progress and discouraging reclamation work. The sum of $1,500,000 will soon be distributed by the Sugar Beet Finance Corporation. This will be a boon particularly to country banks and will enable growers to square up many of their debts. There is less demand for loans than has prevailed for some time, and it is expected that there will be a slight easing of the money market. Holiday buying is proceeding at a good rate, with every conceivable kind of merchandise being urged as appropriate for gift giving. Electrical merchants are vigorously pushing their wares, under the slogan "Make this an electrical Christmas." There is a fair demand for hollow ware, flashlights and vacuum cleaners. A mild, open December is permitting considerable residence construction, making business fair, at least, for energetic contractor-dealers. Jobbers are able to appraise the year 1921 with fair accuracy. That the jobbing business in electrical supplies has fallen off more than 30 per cent seems quite certain.

Pole-Line Material.—No department of the electrical jobbing industry here has suffered a greater shrinkage. There has been scarcely a construction project of any size and the demand for materials has been very small.

Switchboards.—Manufacturers of switchboards report a quiet period. At no time during the year have they run to production capacity. High cost of materials and labor keep the price well up.

SEATTLE—PORTLAND—SPOKANE

Evidence of the permanent character of the business revival which set in during the late summer and fall is reported from all sections of the Northwest. Shipping at the ports of Seattle and Portland has increased so rapidly this fall that it has been found necessary to increase terminal and drydock facilities. Building is active throughout the Northwest, and several large projects have been announced lately, one of them being a ground fill at Portland for a large Union freight terminal. The port of Portland plans extensive harbor improvements in connection with the terminal project. The employment situation shows improvement. Lumber production is about 18 per cent below normal.

Electrical jobbers report business good with the Christmas trade holding the center of the stage. However, porcelain, wiring supplies and other electrical goods which go into residence construction are selling very well. Portland jobbers report the demand for hollow ware better than last year. There seems to be a slight tendency on the part of retailers to let the jobbers carry their holiday stocks, although this tendency is not marked. Contractor-dealers report business good, but holiday business is not so active as it should be and it is not probable that it will equal that of last year. Spokane has just staged its first electrical show, which was attended by fully 15,000 persons. The educational results in the use and possibilities of electrical appliances and equipment, it is felt, will more than justify the expense of staging the exhibit. Jobbers' stocks in Spokane are good, with the exception of high-tension insulators.

Lamps.—The demand for lamps continues to be very active. The 40, 50, 75 and 100-watt sizes in "Mazda B" and "Mazda C" lamps move in greatest volume, although there is a marked tendency toward greater use of bowl-frosted lamps in than in the past.

Heaters.—This class of goods has been quite active for the past two months and continues to move well. The small reflector type heaters are the most popular. Heaters rated at from 1 kw. to 5 kw. are very active sellers in Tacoma where the house-heating customers have doubled in number each year for the past three years on account of the very low rate offered to this class of load. Portland reports stocks of single-coil radiant heaters almost depleted.

Manufacturers' Activities

Devoted to the Business Side of Manufacturing, Distribution and Sales, News from Jobbers and Foreign Fields and a Record of New Devices and Trade Literature

Allis-Chalmers Business Better in October and November

An encouraging increase in both October and November business has been announced by the Allis-Chalmers Manufacturing Company, and from present indications the current month will be equally good. Incoming business in the two months past exceeded billings for the first time in months, the corner apparently having been turned in November. October bookings of new business were approximately $200,000 in advance of billings, which were $1,520,000. November bookings equaled those of the preceding month.

Mueller Company Disposes of Sales Agencies

The growth of the manufacturing end of the Mueller Electric Company, Cleveland, makers of battery clips and other attachments, has been so rapid, according to the announcement of the company, that it has been necessary to dispose of several manufacturer's agencies and devote all the attention to manufacturing. The companies represented included the Philadelphia Insulated Wire Company, the Anchor Webbing Company and the Scranton Button Company. The good will of this department of the company was turned over to J. E. Black, a former employee, the new arrangement going into effect on December 1.

Chicago Pneumatic Announces Improvement

The Chicago Pneumatic Tool Company, Chicago, has announced that November sales were the best of any month this year and that December is expected to be still better. Sales are now running between 35 per cent and 40 per cent of normal. Business is dependent to a large extent on railroad and equipment shop buying. The manufacturers have been buying in good quantities lately, but the railroads have been slow. Although the roads are in need of tools, they have not the money to buy them.

Confidence Growing in Loom Market

"Facing 1922 business, I believe that the outlook is far better for loom sales than it was a year ago," said D. H. Murphy, president American Wiremold Company, Hartford, Conn., last week to a representative of the Electrical World. Mr. Murphy holds that the "housecleaning" period of this branch of the industry is practically over, and that while present orders are chiefly for current requirements owing to the disinclination of jobbers to purchase to any marked extent for stock, a better feeling is evident throughout the trade. Stocks, he stated, are now well liquidated by manufacturers, jobbers and contractors. Repair work absorbs a good deal of non-metallic flexible conduit from month to month, and even a slight increase in purchases for stock would help the situation materially. Mr. Murphy said that his own company anticipates an improvement in demand soon after the inventory period is over.

Mutual Electric Now Making Safety Switches

The Mutual Electric & Machine Company, Detroit, manufacturer of open-knife switches and other electrical products, will soon place on the market a line of safety-type switches, an entirely new product for the company. They will be sold under the trade name of "Bulldog" switches.

Walla Walla Company's Receivership Ended

The Electric Equipment Company, Walla Walla, Wash., which has been in the hands of B. E. McCain of the Western Electric Company as receiver, has been purchased by A. W. Morey and A. H. Cash, who have been identified with the old company for some time.

G. E. to Pay Supplementary Compensation

The General Electric Company has announced that the 5 per cent supplementary compensation for employees in the service of the company for five years or more would be paid for six months ending Dec. 31, 1921. The 5 per cent supplementary compensation for six months ending June 30, 1921, amounted to $1,067,899 and benefited 24,773 employees.

U. S. Light & Heat Not Involved in Willys Receivership

A statement has just been issued by the U. S. Light & Heat Corporation, Niagara Falls, maufacturer of farm light plants and other apparatus, that the company is not affected by the recent receivership of the Willys Corporation. The statement has been issued, according to C. O. Miniger, president of the company, because of an impression that the company is one of the component parts of the Willys Corporation, this idea having been strengthened by the appointment of Mr. Miniger as receiver of the bankrupt company. The statement declares that the only connection betwen the two companies is that of preferred-stock ownership by the Willys Corporation in the U. S. Light & Heat Corporation, and the latter company will continue to operate as before. Mr. Miniger is also president of the Electric Auto Lite Company, one of the divisions of the Willys Corporation.

Sieben Company Gets Production Under Way

The Sieben Manufacturing Company, Kansas City, Mo., is now in its new location at 914 Genesee Street, Kansas City, and production of its Sieben "All-in-One" electric washing machine, drier and ironer has been started. The new building is three stories high and has ample room for manufacturing, assembling and storing. Henry Sieben is president of the company, and H. F. Walker is sales and advertising manager. The general offices are in the Gumbel Building, Kansas City.

Sees Approaching Business Revival in More Advertising

The infallible sign of a business revival, more advertising, is at hand, according to the *Electrical Trade*, the house organ of the Electric Appliance Company, Chicago. There has been a drop in business, the publication states, and finances have been poor, but within the last month there has been displayed a sure sign of better times.

"We refer to the condition of the paper business," the article continues. "For the past twenty years it has been found that when the demand for paper increases the whole trend of business receives a decided upward trend within three months. Today we understand that the large paper corporations are selling more of their products than they have at any time in the past year. What does this mean?

"Simply this—that the industries are starting to spend money for advertising—that they are ready to go ahead with a drive for better business—that the present condition is not a 'castle in the air' sort of optimism, but that a concrete proof of a revival of business is at hand. Advertising should show its effect to some degree at least in three months. Good effects mean good business."

Foreign Installation Contracts Announced

Some interesting large foreign orders for American electrical equipment have been announced during the past two weeks. They include a Spanish railroad electrification project and units for plants in South America, Japan and Mexico.

The contract for the electrification of 40 miles of the Spanish Northern Railway was obtained by the International General Electric Company and its associated company, the Sociedad Iberica de Constructiones Electricas. This initial order covers the most recent and one of the largest European railway electrification projects now under development. The high-voltage, direct-current system will be employed. The equipment will consist of six 78-metric-ton, six-motor locomotives, two complete substations, each comprising two 1,500-kw., three-unit motor generator sets, transformers and switchgear and the material necessary for line construction. The project comprises about 40 miles of the Leon-Gijon branch of the railway, running through the mountains between Ujo and Busdongo. The traffic is very heavy and the grades are heavy. The locomotives are to be of the freight type and will be arranged for regenerative braking. They will operate at 3,000 volts. The order is said to involve over $1,000,000.

Orders for plant equipment include one received by the Westinghouse Electric International Company through its Japanese agents, Takata & Company, from the Daido Denrioku K. K. (the Daido Electric Power Company), Japan, for electrical apparatus for two large hydro-electric plants. The total value of this order is about $2,000,000. These plants are to form a part of a "super-power" system for the Tokio district. The current for the Japanese system is to be transmitted at 154,000 volts. This is the second large order that this company has received from Japan within the last few weeks, the other being for switching equipment for the Tokio Electric Company and amounting to approximately $1,000,000.

Two other important plant equipment contracts have been closed by the International General Electric Company. The larger of the two, for both of which German interests were bidding, is for the new Tepexic development for the Mexican Light & Power Company. This project calls for 55,000 additional horsepower, using two 14,400-kw. generators. The other contract is for an additional 7,000-kw. steam-turbine unit for Montevideo. In connection with this order bids were advertised and rejected three times over a period of six months, resulting in the final award to the International General Electric Company. German prices on this installation were about 30 per cent lower than the American quotations, but German delivery was long and uncertain. This fact largely influenced the awarding of the contract.

Apex Branch to Have Own Building

A two-story-and-basement building, 50 ft. x 115 ft., to cost about $60,000, is to be erected for the Kansas City branch of the Apex Electrical Distributing Company. The branch has had a phenomenal growth, having been started less than two years ago in a small second-floor location. At that time the force consisted of a stenographer and twenty field men. It has now been enlarged to fifty office employees and 600 field men. The new building will be at 1405-07 Walnut Street.

Chapman Valve Resumes Full Time

The Chapman Valve Manufacturing Company, Springfield, Mass., announces that its plant there has resumed full-time working operations. The full working force numbers between 700 and 800 men. The step is ascribed to better business conditions. Until lately the plant operated on a basis of five days a week.

Empire Company Acquires "Elektro" Rights

Rights to the manufacture and sales of "Elektro" appliances have been secured by the Empire Transformer Company, Chicago. This includes flat-irons, percolators, toasters and a toy range. Some changes have been made in these products by the Empire company and production has already been started. According to William Seckinger, vice-president of the company, each product has to pass an engineer's test before it is allowed to be put on the market.

"Yale" Electric Tractors Win Over Foreign Competitors

An installation of eight "Yale" electric industrial tractors, each with a haulage capacity of 20,000 lb. to 30,000 lb. in trailer units, has been made at Rotterdam, Holland, in the face of sharp competition by European manufacturers.

The installation, for N. V. Thomsen's Havenbedruf, is used for pier service, and it is noteworthy that each tractor with trailer equipment replaces seven men. James C. Morgan, manager material handling equipment sales, Yale & Towne Manufacturing Company, Stamford, Conn., recently informed a representative of the ELECTRICAL WORLD that this fleet of electric industrial tractors is expected to pay for itself inside of a year, owing largely to the decrease in turn-around time effected in the case of vessels subject to wharfage expenses. It is interesting to American manufacturers that although German quotations on this fleet were about 50 per cent of those made by the successful bidder, the contract was awarded to the American producer on the basis of demonstrated quality of equipment.

AMERICAN TRACTOR FLEET RECENTLY INSTALLED AT HOLLAND SEAPORT

New Company to Manufacture Insulating Materials

The L. Robinson Corporation, with headquarters at 8-10 Bridge Street, New York City, has been formed to manufacture insulating materials. The main laboratories of the company will be maintained in New York, while factories will be located in Newark, N. J., and in St. Louis. Arrangements have been made for representation in Canada.

The company will be headed by L. Robinson. Mr. Robinson has had a long experience in the production and marketing of insulating materials, having been in charge of the insulating department of the Standard Varnish Works for the past fifteen years. Before that he was connected with various electric railway companies in the United States, Canada and France. W. D. Crumpton is vice-president and treasurer of the new organization. For the last fourteen years he has been purchasing agent and storekeeper of the British Westinghouse Electric & Manufacturing Company, Ltd. Before that he was connected with the bureau of purchases of the parent company.

The Dry-Kold Refrigerator Company, Niles, Mich., manufacturer of electric refrigerators, is erecting an addition to its plant, which will increase the floor space of the machine department by 2,000 ft.

The U. S. Ball Bearing Manufacturing Company, 4535 Palmer Street, Chicago, is adding a one-story brick forge shop to its present plant which will be used for manufacturing ball-bearing rings.

The Blaw-Knox Company, Pittsburgh, Pa., manufacturer of steel transmission towers, has announced the removal of its New York office from the City Investing Building to the Carbide and Carbon Building, Forty-second Street and Madison Avenue.

The Carter Electric Company, Kokomo, Ind., wholesale and retail dealer in electrical supplies, is erecting a new two-story building to house its retail, wholesale and motor-winding departments.

The Metropolitan Electric Appliance Company, 246 Third Avenue, New York City, electrical jobber, has changed its name to the Metropolitan Electrical Distributors.

The Packard Electric Company, Warren, Ohio, has appointed White & Converse, Metropolitan Life Building, St. Paul, sales engineers, as its representatives for that territory.

The Paramount Electric Supply & Fixture Company, Philadelphia, electrical supply jobber, has acquired the entire building at 251 Market Street, where it will carry a full line of electrical supplies, fixtures and appliances. The company is prepared to supply the stores, small jobbers and electrical contractors.

The Lewis Electric Company, Minerva, Ohio, is erecting a new plant, consisting of a main building, 62 ft. x 162 ft., two stories; a one-story building, 20 ft. x 40 ft., and a power plant, 20 ft. x 25 ft. J. C. Lewis is president of the company.

The Bestove Appliance Company, Seattle, Wash., has recently filed articles of incorporation for the purpose of engaging in the manufacture and sale of various electrical appliances on patents issued to William Barker. J. A. Dougan, New York Block, Seattle, is president of the company.

The Automatic Electrical Machine Company of San Francisco has recently perfected a line of automatic time clocks, dating machines and automatic canceling machines and is preparing to erect a factory in Oakland, Cal., for the manufacture of its products. H. G. Lundgren is the inventor of the devices and president of the company.

The Baker-Joslyn Company, manufacturer's agent on the Pacific Coast, has recently purchased the office and warehouse building of the Northwest Trading Company, Seattle, as a permanent home for its Pacific Northwest business. The building is a one-story-and-basement structure, 60 ft. x 100 ft., and is built for both warehouse and office purposes.

Foreign Trade Notes

THE VICTORIA ELECTRICITY COMMISSION RECOMMENDS THE PURCHASE OF COAL BRIQUETTING PLANT FROM GERMAN COMPANY.—The Victoria Electricity Commission, according to *Electrical Industries*, is reported to have recommended the purchase of a coal briquetting plant from the Zeitz Company of Halle, Germany. The chairman explains that after exhaustive inquiries extending over many months it was found that only in Germany could the special knowledge and efficient machinery required be found. An initial plant capable of turning out 96,000 tons of brown-coal briquettes will be installed, for which the Zeitz Company will supply special parts which are to act as models, at a cost of £86,000. The cost of the plant is estimated at £350,000, and subsequent expansions are expected to increase this amount to £750,000. The commission will also acquire boilers, buildings, electric plant and other material, the cost of which is estimated at £264,000.

AMALGAMATION OF ELECTRIC COMPANIES IN JAPAN.—During the past year, according to *Electrical Industries*, a large number of amalgamations of electric companies have taken place in Japan. The Minister of Communications is said to be in favor of a proposal for bringing under one management all the electric companies in Japan. As a preliminary step a great many minor mergers of companies operating in different districts have already taken place. The following amalgamations were mentioned in a recent article in the *Japan Times*: The Associated Electric Power Company, capitalized at 100,000,000 yen, is composed of three leading companies and will absorb three more, thus giving it control of central Japan. The Tokio Electric Company is planning to acquire four or five more companies and will increase its capital to nearly 200,000,000 yen. In the Hokkaido the Fuji Electric Company has absorbed five other companies. An amalgamation of all the large and small companies operating in Kynshiu is under consideration.

IMPORTATION OF ELECTRICAL MACHINERY IN JAPAN.—The importation of electrical machinery in Japan, in spite of increase in production, continues to grow, according to *Electrical Industries*, and it is probable that the more her industries develop the more machinery will be required from abroad, as it will be a long time before production will meet all requirements. In 1914 Great Britain supplied about 50 per cent of the machinery and Germany and the United States most of the rest. The water-turbine machinery for the various plants delivered and on order since January, 1920, up to the end of June, 1921, totals 260,000 hp. in machinery ordered abroad and 150,000 hp. in machinery made in Japan. In addition to this, another 250,000 hp. will be ordered during this year, including the 190,000-hp. plant of the Formosan Hydro-Electric Company, a project which is of a semi-government nature and which will supply power to the whole of Formosa.

ELECTRICAL CONSTRUCTION IN JAPAN.—According to reports from the American consulate at Nagoya, Japan, the Japanese electrical companies are actively pushing both hydro-electric and electric railway construction. The Nippon Electric Power Company, Ltd., the consul states, has been supplied with energy by the Ibigawa Company (the new water-power company supplying Osaka) since June 24, starting with 5,000 kw., this to be increased to 19,000 kw. during the year. The principal transmission line will pass Seto, Kosaka, Kuno, Mase, Kawataka and Itogawa. It is planned to increase the supply so that 40,000 kw. will be available for transmission in 1923, 75,000 kw. in 1924, 100,000 kw. in 1925 and 105,000 kw. in 1926. In the electric railway field the Aichi Electric Railway Company of Nagoya has been granted rights for an extension of its line to Okazaki, and it is expected that construction work will begin soon. This company has also applied for permission to construct two other lines, one of more than 10 miles branching from Ota, on the present Tokoname line, to Handa, and another 3 miles long from Tokoname to Handa via Narawa. Official sanction has been given for the construction of a railway between Ota and Tsukechi in Gifu Prefecture. A company has been organized with a capital stock of 2,000,000 yen ($997,000) to carry out the construction and operation of this line. Fifty per cent of its stock has been taken by the Daido Electric Power Company. A franchise has been granted to the Nagoya Tetsudo Kabushiki Kaisha (Nagoya Railway Company, Ltd.), a newly organized company, capitalized at 12,000,000 yen ($5,982,000), which is to take over the suburban lines of the Nagoya Electric Railway Company. The directors of the new company, it is reported, are all members of the Nagoya Electric Railway Company directorate, and it is understood that the above action is preliminary to municipal ownership of the Nagoya street railway, a matter which has been pending many months.

BRITISH ELECTRICAL STANDARDS IN SOUTH AFRICA.—The South African branch of the British Engineering Standards Association, according to the *South African Mining and Engineering Journal* of Oct. 8, has issued a copy of the "British Standard Electrical Pressures for New Systems of Installations," as published by the British Engineering Standard Association. These standards, as well as the frequency of 50 cycles per second for all alternating-current systems, have been recommended for adoption by the electrical section of the South African branch of the association.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

A merchant in India (No. 405) desires to secure an agency for the sale of electrical appliances, such as lamps, wires, switches, lamp holders, etc.

A firm of importers in Sweden (No. 408) desires to secure the representation of manufacturers or wholesalers of electrolytic copper wire, metal goods, etc.

A merchant in Italy (No. 412) desires to purchase or secure an agency for the sale of electrical supplies.

The agency and purchase is desired by a mercantile firm in Norway (No. 416) of electrical apparatus and supplies, electrical household utensils, cables, wire, etc.

A mining company in Wales (No. 421) desires to purchase electrical equipment for its works, with a view of substituting electricity for steam and to replace obsolete machinery.

ELECTRIC EQUIPMENT FOR THE PROPOSED WAIKATO (NEW ZEALAND) POWER SCHEME.—Bids will be received by the Public Works Department of New Zealand, addressed to the Secretary Public Works Tender Board, Wellington, New Zealand, until March, 1922, according to the *Electrical Times*, for two 2,500-kva., three-phase, 50-cycle alternators, two 3,100-hp. water turbines (Francis type), and two exciter sets, each consisting of one 200-kw., direct-current generator and one 350-hp. synchronous motor, together with a Tirrill regulator.

New Apparatus and Publications

ADJUSTABLE LAMPS.—S. Robert Schwartz & Brother, 729 Broadway, are distributing catalog No. 19, describing the "Esrobert" adjustable desk portables and floor lamps.

MOTOR-GENERATOR SETS.—The Ideal Electric & Manufacturing Company, Mansfield, Ohio, is distributing bulletin 106, covering its different types of "Ideal" motor-generator sets.

ELECTROPLATING APPARATUS.—Bulletin 107 issued by the Ideal Electric & Manufacturing Company, Mansfield, Ohio, describes its different types of motor-driven electro-plater sets.

BRASS TUBING.—"Tube Facts" is the title of a booklet published by the Scovill Manufacturing Company, Waterbury, Conn., in which it gives scientific data regarding the brasses and other metals used in the production of seamless tubing and also describes and illustrates the different processes involved in the manufacture of tubing.

HEATER.—An electric heater for heating rooms and keeping food and drinks warm has been placed on the market by the Overland Electric Company, 4236 Ogden Avenue, Chicago.

RANGE.—The H. G. Weeks Manufacturing Company, Hamilton, Ohio, has brought out an electric range with an oven, broiler-toaster and two surface burners.

BATTERY AND JAR HOLDER.—A device for holding batteries and jars while removing elements has been placed on the market by the Service Station Supply Company, 30-32 East Larned Street, Detroit, under the name of the "Hydrate" battery and jar stripper.

LIGHTING PLANT.—The [illegible] Utilities Corporation, 260 Madison Avenue, New York City, is marketing an electric light and power plant of 1½ kw. capacity.

KITCHEN APPLIANCE.—The [illegible]-Lite Company, Front and Warren Streets, [illegible] appliance, "Moto-Maid," for beating eggs, grinding knives, etc.

TOY TRANSFORMER.—[illegible]ner, 422 First Avenue, Pittsburgh, manufacturers' representatives (electrical), has placed on the market a toy and bell ringing transformer, under the name of "Little Ball."

AIR CONDENSER.—The General Radio Company, Massachusetts Avenue and Windsor Street, Cambridge 39, Mass., manufacturer of radio and electrical laboratory apparatus, has recently brought out a new variable air condenser.

WHITE CEDAR POLES.—The Northern White Cedar Association, Lumber Exchange, Minneapolis, is distributing a booklet covering its Northern white cedar poles.

RED CEDAR POLES.—"The Story of Pentrex" is the title of a booklet published by the Western Red Cedar Association, Peyton Building, Spokane, Wash., describing a new method of butt treating of the "Pentrex" poles.

CLEANING SOLUTION.—The Oakite Chemical Company, 22 Thames Street, New York City, is distributing a small booklet entitled "Oakite" for Cleaning Waste and Wiping Cloths in machine shop, metal-working factories, power houses, etc.

THAWING SET.—The Auto Engine Works, University Avenue and Griggs Street, St. Paul, has developed a gaso-electric thawing ("Capital") set for thawing frozen underground pipes.

ELECTRICAL ACCESSORIES.—"Electrical Accessories for Laboratory and Commercial Use" is the title of bulletin No. 18 distributed by the Standard Scientific Company, corner West Fourth and Barrow Streets, New York City, covering its carbon compression rheostats, direct-current meter-loading units, thumbar terminals, binding posts and connectors, etc.

PORTABLE LAMP.—The Waterbury Metal Wares Company, Waterbury, Conn., has placed on the market an adjustable lamp, known as "Practi-Lite."

—New Incorporations

New Companies

THE SANDBERG-SHEPPARD COMPANY, Worcester, Mass., has been incorporated by Herbert V. Sheppard, Charles E. Sandberg, Gustaf Erickson and James E. Sheppard. The company is capitalized at $100,000 and proposes to manufacture electrical appliances.

THE COLUMBUS ELECTRICAL SUPPLY COMPANY, New York, N. Y., has been incorporated with a capital stock of $20,000 by H. and M. Ferber, and S. W. Levine, 261 Broadway. The company proposes to manufacture and deal in electrical equipment.

THE MURRAY-GARR ELECTRIC STALL STARTING COMPANY, Wilmington, Del., has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $100,000 to manufacture electrical equipment. The company is represented by the Delaware Charter Company, 904 Market Street, Wilmington.

THE McINTOSH ELECTRICAL CORPORATION has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $250,000 to manufacture instruments for use of electricity. T. L. Croteau, M. A. Bruce and C. H. Blaske, Wilmington, are attorneys.

THE CITIZENS' LIGHT & POWER COMPANY, Fredericksburg, Tex., has been incorporated with a capital stock of $40,000 by J. Stein, Louis Kott and Hugh Basse.

THE ELECTRIC DRAFT HEATER CORPORATION, [illegible] South Michigan Avenue, Chicago, Ill., has been incorporated with a capital stock of [illegible] to manufacture heating devices, etc. The incorporators are R. E. Leopold, G. W. Axelson and E. A. Zimmerman.

THE TRIAD ELECTRIC COMPANY, Boston, Mass., has been incorporated with a capital stock of [illegible] electrical equipment. The officers of the company are [illegible], president, and [illegible], Bedford, Mass., treasurer.

THE LITOMETER COMPANY, INC., has been incorporated under the laws of the State of R[illegible] deal in electrical [illegible] specialties. The incorporators are Justin Henderson, [illegible] and E. W[illegible]. Headquarters will be established in Providence.

Record of Electrical Patents

Notes on United States Patents

(Issued Nov. 15, 1921.)

1,397,239. ELECTROLYTIC PRODUCTION OF HYPOCHLORITE SOLUTIONS; Henry B. Slater, Riverside, Cal. App. filed Nov. 9, 1920.

1,397,247. STORAGE-BATTERY-TESTING INSTRUMENT; John W. FitzGerald, Detroit, Mich. App. filed March 26, 1920. Electrical meter to record condition of charge.

1,397,249. HOUSEHOLD ARTICLE; Peter F. Glenn, Philadelphia, Pa. App. filed March 3, 1920. Portable rotating device for polishing, sharpening knives, etc.

1,397,276. PROTECTIVE DEVICE; Henry G. French, Schenectady, N. Y. App. filed Oct. 24, 1919. Relay of induction type.

1,397,278. SPEED-REGULATING APPARATUS; Valere A. Fynn, St. Louis, Mo. App. filed July 5, 1919. Electromagnetically governing speed of prime movers.

1,397,298. STATIONARY INDUCTION APPARATUS; John A. Seede, Schenectady, N. Y. App. filed Feb. 15, 1921. Welding transformer.

1,397,353. ELECTRIC DRIVE FOR VEHICLES; Fred Berger, New York, N. Y. App. filed Dec. 21, 1920. Gasoline motor drives generator which supplies main driving motor.

1,397,361. PRESSURE VARIABLE RESISTANCE; Alexander Churchward, New York, N. Y. App. filed May 7, 1920. Well-cooled carbon pile.

1,397,363. INSULATING END PLATE; Lovell B. Cole, St. Louis, Mo. App. filed Dec. 4, 1920. To protect windings at edge of slot.

1,397,396. PLANER AND SYSTEM OF MOTOR CONTROL THEREFOR; Harold L. Blood, Plainfield, N. J. App. filed Jan. 7, 1918.

1,397,421. ELECTRIC SIGNAL; Richard M. Hopkins, Rutherford, N. J. App. filed Oct. 25, 1918. Operated by comparatively weak current.

1,397,432. SIGNALING SYSTEM; Charles V. Logwood, New York, N. Y. App. filed June 16, 1917. Wireless.

1,397,441. ELECTRICAL MEASURING INSTRUMENT; Carl D. Miller, Rockville, Mass. App filed April 5, 1919. Static voltmeter.

1,397,449. ELECTRICALLY OPERATING MECHANISM FROM A DISTANCE; Alexander Patshin, London, England. App. filed Nov. 20, 1918. Suppressing sparking.

(Issued Nov. 22, 1921.)

1,397,514. PROCESS FOR DEPOSITING A METALLIC COATING ON VARIOUS METAL ARTICLES OR OBJECTS; Frederick W. Haines, township of Sandwich East, Ontario, Can. App. filed Sept. 28, 1918.

1,397,562. OXIDATION AND REDUCTION PROCESS AND APPARATUS THEREFOR; Charles J. Thatcher, New York, N. Y. App. filed Jan. 24, 1920. For electrolytically oxidizing substances such as anthracene.

1,397,575. SELECTIVE AUDION AMPLIFIER; Lee de Forest, New York, N. Y. App. filed April 9, 1915. Will amplify high-frequency currents more than low frequency currents.

1,397,576. TELEGRAPHY; Thomas B. Dixon, New York, N. Y. App. filed Nov. 1, 1917. Imperfect balance between main and artificial lines neutralized.

1,397,582. ELECTRIC SIGNAL; Edgar W. Hazazer, New York, N. Y. App. filed July 14, 1916. Vibrating-diaphragm horn.

1,397,610. COMBINED CIGARETTE OR LIKE CASE AND ELECTRIC TORCH; Samuel A. Appell, New Haven, Conn. App. filed Feb. 25, 1920.

1,397,620. MULTIPLE-URN CONSTRUCTION; Warren F. Clark, Cleveland, Ohio. App. filed Dec. 24, 1919. Single source for heating.

1,397,633. REEL FOR ELECTRIC-WIRE CONNECTIONS; Alva L. Hite, Pomeroy, Ohio. App. filed May 23, 1919. Self-reeling for extension cords.

1,397,641. MEANS FOR DETECTING CHANGES OF RESISTANCE IN ELECTRIC CIRCUITS; Petrus Van Santen Kolff, Philadelphia, Pa. App. filed Dec. 9, 1916.

1,397,646. BATTERY HANDLAMP; Lorenz Maisel, Madison, Wis. App. filed May 14, 1920. Lamp protected from shock.

1,397,647. PROCESS OF ELECTROLYSIS OF COPPER-BEARING SOLUTIONS; Percy R. Middleton, Los Angeles, Cal. App. filed Feb. 16, 1920.

1,397,687. TRANSMITTER AND CIRCUITS THEREFOR; Newman H. Holland, West Orange, N. J. App. filed Sept. 26, 1917. Microphone transmitters.

1,397,694. MEANS FOR CONTROLLING TEMPERATURES; Tiodolf Lidberg, Chicago, Ill. App. filed May 21, 1919. For bateriological work.

1,397,705. PORTABLE ELECTRIC LAMP; Louis E. Shaw, East Orange, N. J. App. filed Jan. 17, 1918. For field service.

1,397,735. PROCESS OF RECOVERING COAL, HELD IN SUSPENSION, FROM COAL-BEARING WATER AND STREAMS; Charles E. Holland, Brooklyn, N. Y. App. filed Nov. 13, 1920. Particles precipitated by electrolytic action.

1,397,766. CONSTANT-TEMPERATURE WATER BATH; Tiodolf Lidberg, Chicago, Ill. App. filed Feb. 23, 1918. For therapeutic purposes.

1,397,785. ELECTROTYPE MATERIAL AND METHOD OF FORMING SAME; George U. Rose, Jr., Washington, D. C. App. filed March 2, 1921. Electro-depositing process of forming printing plates.

1,397,799. ELECTROLYTIC CELL; Elisha B. Cutten, Minneapolis, Minn. App. filed June 25, 1920. Decomposition of sodium chloride solution.

1,397,862. TRANSMISSION SYSTEM; Albert L. Fitch, East Orange, N. J. App. filed Nov. 26, 1917. For connecting transmitter to electron-discharge device.

1,397,872. ELECTRIC HEATER; Joseph Lavoie, Montreal, Quebec, Cann. App. filed Nov. 26, 1919. Readily converted from room warmer to cooker.

1,397,888. BELL-RINGER RESISTANCE UNIT; Jacob Chodrow, Buffalo, N. Y. App. filed Feb. 4, 1921. Connected in series with service lines and a doorbell.

1,397,975. ELECTRICAL TESTING SYSTEM; George W. Kuhn, Brooklyn, N. Y. App. filed Feb. 19, 1920. For telephone toll office.

1,397,991. MESSAGE-REGISTERING SYSTEM; George K. Thompson, Maplewood, N. J. App. filed Oct. 9, 1919. Registering device locked in circuit by subscriber.

1,398,005. TROLLEY-WIRE PROTECTOR; Francesco Colabrese, Albert, W. Va. App. filed March 12, 1920. For preventing workmen from touching wires.

1,398,006. PRODUCTION OF ZINC; Cornelius E. Cornelius, Stockholm, Sweden. App. filed March 17, 1921. Continuous process.

1,398,028. PROCESS AND APPARATUS FOR WORKING METALS; Frank P. Kobert, Amityville, N. Y. App. filed Sept. 29, 1917. Heating, reheating, riveting and welding.

1,398,029. TELEPHONE ATTACHMENT; John P. Lee, Pleasantville, N. Y. App. filed April 20, 1921. To prevent conversation from being overheard.

1,398,032. INCANDESCENT LAMP AND METHOD OF MAKING THE SAME; Oscar V. Maurer, East Cleveland, Ohio. App. filed March 10, 1919. Tipless incandescent lamp.

1,398,033. METHOD OF MAKING INCANDESCENT LAMPS; Oscar V. Maurer, East Cleveland, Ohio. App. April 23, 1919. For headlights.

1,398,0[illegible]. PROCESS FOR THE MAGNETIC SEPARATION OF ORES; Clarence Thom, Ralph W. Diamond and Selwyn G. Blaylock, Trail, B. C. App. filed April 30, 1920. Four consecutive steps.

1,398,056. SYSTEM AND APPARATUS FOR CONTROLLING MOTORS; Albert K. Allison, Tappan, N. Y. App. filed Oct. 6, 1920. Movements of motor definitely controlled.

1,398,058. PORTABLE ELECTRIC PLANT; Edward L. Aurand, Detroit, Mich. App. filed May 1, 1918. For use in isolated homes.

1,398,065. METHOD OF PREPARING STORAGE-BATTERY SEPARATORS; Campbell C. Carpenter, Niagara Falls, N. Y. App. filed Feb. 14, 1921. Removing harmful constituents from wood.

1,398,077. SWIVEL ATTACHMENT PLUG; Philip S. McLean, Bloomfield, N. J. App. filed April [illegible], 191[illegible].

1,398,167. ELECTRIC HEATER; Johan R. [illegible], Chicago, Ill. App. filed Oct. 7, 1920. For heating railway cars.

1,398,192. ELECTRODE FOR ANNEALING AND HEATING [illegible]; Walter [illegible] Hurlbert, Chicago, Ill. App. filed Feb. [illegible], 191[illegible]. Evenly distributed heat.

Construction News

Projects, Plans, Bids and Contracts Contemplated or Under Way

New England States

SOUTH WINDHAM, ME.—The Windham Manufacturing Company is having plans prepared for the construction of a hydro-electric power plant. Arthur P. Safford, 66 Broadway, Lowell, Mass., is engineer.

WILLIMANSETT, MASS.—The Hampden Motor Truck Company, Holyoke, recently organized, is planning the construction of a power house in connection with its new plant at Willimansett. R. D. Bloom is president.

BURRVILLE, CONN.—The Connecticut Power Company, New London, is contemplating changes at its Burrville generating plant, in connection with proposed plans to purchase electrical energy from the Winstead (Conn.) Gas Company for the operation of the Torrington-Winchester trolley lines of the Connecticut company.

NEW HAVEN, CONN.—The New York, New Haven & Hartford Railroad Company, it is understood, is considering the construction of a large power plant near its yards at Cedar Hill. Edward J. Pearson, New Haven, is president.

WINDSOR, CONN.—Plans are being prepared by the Farmington River Power Company, New Britain, for the construction of a new hydro-electric power plant to have an initial capacity of about 12,000 hp. I. W. Jones, Milton, N. H., is engineer.

Middle Atlantic States

EAST GREENBUSH, N. Y.—The Hamilton Industrial Corporation, Hamilton Street, Albany, is planning the construction of a one-story power house at its new factory, 50 ft. x 240 ft., at East Greenbush.

VESTAL, N. Y.—The Binghamton Light, Heat & Power Company has geen granted a franchise to furnish electricity in Vestal.

WILLARD, N. Y.—Bids will be received by the State Hospital Commission, Capitol, Albany, until Dec. 21, for construction, including heating, sanitary and electric work, in connection with additional accommodations at the Willard State Hospital.

EGG HARBOR, N. J.—Plans are under consideration by the Ingram Motor Company, 2 Rector Street, New York City, for the construction of a one-story power house in connection with its proposed automobile manufacturing plant at Norfolk and Atlantic Avenues, Egg Harbor. Joseph A. Ingram is president.

GLASSBORO, N. J.—The Board of Education, Trenton, has plans under consideration for the construction of a one-story power house in connection with the three-story State Norman School, 138 ft. x 300 ft., on Mullican Hill Road, Glassboro. Guilbert & Betelle, [illegible] Broad Street, Newark, are architects.

JERSEY CITY, N. J.—The Weehawken (N. J.) Dry Dock Company, foot of Baldwin Street, is considering the construction of a shipbuilding and repair plant and a power house in the South Cove district, near Henderson Street, Jersey City. The cost is estimated at $[illegible].

LINDEN, N. J.—The Warner-Quinlan Company, 79 Wall Street, New York City, is having plans prepared for the reconstruction of its works and power plant in Linden, recently destroyed by fire. The loss is estimated at $[illegible]. George Gifford, 227 Fulton Street, New York City, is engineer.

CONFLUENCE, PA.—The Hagerstown & Frederick Railway Company, Hagerstown, Md., is considering the construction of a 40,000-kw. power plant at Confluence, Pa. Surveys have been made for the erection of a transmission line to connect the proposed unit with its present system.

PHILADELPHIA, PA.—The Board of Education has decided to substitute electric lamps for the gas lamps now in use in the local schools. The sum of $100,000 has been appropriated for the work.

PHILADELPHIA, PA.—Plans have been filed by the A. Theodore Abbott Company, [illegible] Avenue, for the construction of a power house in connection with the upholstery goods manufacturing plant, now under construction at Twenty-third Street and Allegheny Avenue. W. E. S. Dyer, Land Title Building, is engineer.

WASHINGTON, PA.—Plans have been prepared by the Tyler Pipe & Tube Company for the construction of a one-story power house, 25 ft. x 50 ft., and a producer plant, 50 ft. x 50 ft., to cost, including machinery, about $50,000. The Simplex Engineering Company, Washington Trust Building, is engineer.

BALTIMORE, MD.—The Canton Company, Commerce and Water Streets, is considering the construction of a one-story power house, 40 ft. x 70 ft., at Third and Sixteenth Streets.

BALTIMORE, MD.—Bids will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until Dec. 27 for a lighting plant for the post office at Baltimore.

HAGERSTOWN, MD. — The Board of Street Commissioners has directed A. B. Grubmeyer, superintendent of the municipal electric light plant, to prepare plans for the construction of a new light plant in the vicinity of Marsh Run.

PETERSBURG, W. VA.—The construction of a dam and hydro-electric power plant across the south branch of the Potomac River is under consideration by the Community Power Company. The company is represented by A. J. Welton.

WELLSBURG, W. VA.—The American Gas & Electric Company, 30 Church Street, New York City, is considering the establishment of a power plant in Wellsburg, W. Va. Sargent & Lundy, 72 West Adams Street, Chicago, Ill., are architects. R. E. Breed is president.

North Central States

ERIE, MICH.—The Toledo (Ohio) Edison Company contemplates the construction of a substation on its Toledo Beach line and the extension of electric transmission lines to Erie.

LANSING, MICH.—The date of bids to be received by the Board of Water and Electric Light Commissioners, Lansing, for the construction and equipment of a new municipal power plant has been extended from Dec. 15 to Jan. 10, 1922.

ALLIANCE, OHIO.—The consolidation of the Alliance Gas & Power Company, Lorain County Electric Company, Massillon Electric & Gas Company and Trumbull Public Service Company under the name of the Ohio Public Service Company, with a capital stock of $6,500,000, has been affected. The present plans of the new company provide for the construction of a large generating station along the Ohio River with high-tension interconnecting transmission lines between Warren, Ashland, Alliance and Massillon.

CALDWELL, OHIO.—At a special election to be held Dec. 23 the proposal to issue $15,000 in bonds for the installation of new machinery in the municipal electric light plant will be submitted to the voters. Twenty-four-hour service will be established.

DAYTON, OHIO.—The City Commission is considering the installation of a new ornamental lighting system, maintained by underground conduits, on West Third Street between Olive Street and the Pennsylvania Railroad. Plans are reported under way for an ornamental lighting system on East Third Street between Bell Street and Harshman Street. Street-lighting service is furnished by the Dayton Power & Light Company.

HUNTINGTON, IND.—The Bippus Utilities Company, Huntington, recently organized, has been authorized by the Indiana Public Service Commission to issue $150,000 in stocks and bonds, the proceeds to be used for taking over the electric plant of the Browne-Mills Electric Company at North Manchester and for the construction of a new plant, etc.

INDIANAPOLIS, IND. — The Indiana Electric Corporation has filed an amended petition with the Indiana Public Service Company for the consolidation of seven public utility companies, including the Merchants' Heat & Light Company of Indianapolis, the Elkhart Gas & Fuel Company and the Valparaiso Lighting Company, all of which are now owned by the corporation, and the Indiana Railways & Light Company of Kokomo, Wabash Valley Electric Company, Putnam Electric Company and Cayuga Electric Company.

WINCHESTER, IND.—The construction of a one-story power house is planned by the Storms Novelty Works, in connection with the two-story plant, 59 ft. x 100 ft., now under construction.

GRANITE CITY, ILL. — The Madison County Light & Power Company, Granite City, is having plans prepared for improvements to its transmission lines and its power plants at Venice and Edwardsville. The cost is estimated at $65,000.

SHELBYVILLE, ILL.—The construction of a municipal electric power plant, to cost about $75,000, will be held in abeyance by the Council. Bids, it is understood, will be asked next spring. Fuller & Beard, Railway Exchange Building, St. Louis, Mo., are engineers.

SPRINGFIELD, ILL.—The Illinois Power Company, recently organized, has filed a petition with the Illinois Commerce Commission for permission to take over the properties of the Springfield Consolidated Railway Company, Springfield Gas & Electric Company of Springfield and the De Kalb-Sycamore Electric Company, operating in De Kalb and Sycamore. Permission is also asked to issue $5,000,000 in bonds and $5,025,000 in stock. A. D. Mackie is vice-president and general manager of the Springfield Consolidated Railway Company.

WAUKEGAN, ILL.—The Public Service Company of Northern Illinois, Chicago, it is reported, has plans under way for the construction of a generating station at Waukegan to have an ultimate capacity of 220,000 kw. It is proposed to begin construction of the plant early next year, when the initial installation of two units of 20,000 kw. each will be made. The present plans also include the erection of transmission lines connecting the Waukegan station with the Northwestern station of the Commonwealth Edison Company of Chicago, to provide for an interchange of electrical energy in case of emergency.

EAGLE RIVER, WIS.—An issue of $20,000 in bonds has been authorized for the purchase of additional generating equipment for the municipal hydro-electric generating plant.

KANSAS CITY, MO.—The Kansas City Power & Light Company is reported to be negotiating with the city officials of Lawrence, Topeka and several other Kansas towns to furnish electricity to the distributing plants in these places.

MEXICO, MO. — The Missouri Utilities Company contemplates enlarging its plant to enable it to furnish electricity in additional territory, including Montgomery City where the electric light plant was recently destroyed by fire. The cost of the new equipment is estimated at $25,000.

ST. CHARLES, MO.—The question of installing an electric light and power plant in St. Charles, to cost about $235,700, is under consideration by the City Council. Benham & Mullergren, Firestone Building, Kansas City, Mo., are consulting engineers.

Southern States

AUGUSTA, GA.—The city officials and J. P. Wood, it is reported, are interested in the establishment of a hydro-electric plant on the canal, to generate electricity at a point about 2 miles from Augusta to operate industrial works, including cotton mills. The project provides for the development of 12,000 hp. and will cost $1,500,000.

LAKE CITY, FLA.—Bids, it is reported, will be received by the city of Lake City for the following: One poppet-valve automatic uniflow engine of approximately 300 hp. when operating at 125 lb. steam pressure, to be arranged for direct connection to a 240-kva., 2,300 volt, three-phase, 60-cycle, alternating current electric generator and to be provided with belted exciter of ample capacity and other necessary fittings. One six-panel switchboard consisting of three combined generator and exciter panels, two feeder panels and one regulator and totalizing wattmeter panel; the three generator panels are to control generators and three exciters, one of 70-kw. capacity and two of 240-kw. capacity; the two feeder panels are to be of 150-kw. capacity and 400-kw. capacity and to have watt-hour meters; each panel is to be equipped with necessary instruments, switches, wiring, busbars and supports. An automatic voltage regulator for control of generators. One jet or barometric condenser having a capacity of 6,000 lb. of exhaust steam per hour with 26-in. vacuum, complete with steam-driven air pump and motor-driven circulating pump, temperature of circulating water of 90 deg. Fahr. C. E. Hurst is city manager.

DOTHAN, ALA.—Plans are under way by the Houston Power Company for the construction of a hydro-electric generating plant on the Choctawhatchee River, Dale County. The plans provide for an initial installation of 2,000 hp.

COLUMBIA, LA.—The installation of a municipal electric light plant to be operated [illegible] for which $30,000 in bonds have been issued.

NEW ORLEANS, LA.—Bids, it is reported, are being received by the New Orleans Railway & Light Company for one 20,000-kw. turbine complete, including installation, $540,000; relaying and switching apparatus at central station, $100,000; additional switchboards, $25,000; new building for Bourbon substations, $30,000; new rotary for Edison system, $50,000; new rotary for railway system, $50,000; two 6,600-volt underground feeders, $28,000 each; one 6,600-volt tie line from Magazine to Bourbon substation, $12,000; one 6,600-volt tie line from Edison to Consumers substation, $10,000; underground ducts, $50,000; reroute half of 6,600-volt feeders to Canal and Valence substations, $25,000; extend Shrewbury feeder into Canal substation, $8,000; new feeders for distribution system and rearrangement of existing feeders, $44,000. A. Kempster is general manager of the company.

PAWHUSKA, OKLA.—Contracts, it is reported, will be awarded by the City Commissioners on Dec. 21 and 22 for extensions to the municipal electric power plant and construction of a sewage-disposal plant. New equipment, including two additional engines, will be installed. Bonds to the amount of $113,000 have been issued for power plant and $51,000 for sewage disposal plant.

CURRIE, TEX.—The Currie Light & Power Company is considering the construction of a new plant in Currie, for which a site has been acquired.

MEXIA, TEX.—The Central Texas Ice Light, Water & Sewerage Company is contemplating the installation of new equipment at its local power house, to cost about $50,000.

SAN ANTONIO, TEX.—Bids, it is understood, will be received by the San Antonio Water Supply Company early in January for a 15,000,000-gal. steam-turbine centrifugal pumping outfit and a 5,000,000-gal. electrically driven centrifugal pumping outfit.

WELLINGTON, TEX.—The City Council has called an election for the purpose of submitting to the voters a proposal to issue $50,000 in bonds for the establishment of a municipal light and power plant.

YORKTOWN, TEX.—Local manufacturing concerns are considering the construction of an independent electric power plant According to present plans the power plant will be erected near the Yorktown Cotton Oil & Manufacturing Company's plant.

Pacific and Mountain States

PORTLAND, ORE.—[illegible] of Portland has filed with Percy Cupper, State Engineer, application for authority to construct two reservoirs to be known as the Marion Lake reservoir and the Santiam River Reservoir for the storage of water for power development in Linn County.

CHICO, CAL.—Arrangements have been made by the Shell Oil Company with the Pacific Gas & Electric Company, Chico, for the erection of a transmission line to the site of the proposed distributing plant of the oil company, on the Thomasson Ranch near Chico.

SAN DIEGO, CAL.—Bids will be received at the office of the Chief of the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Dec. 28, Specification 4559, for gas, sewer, water and underground electric systems at the naval hospital, San Diego. Bids will also be received until Jan. 4, 1922, Specification 4526, for street-lighting and fire-alarm system at San Diego.

SAN LEANDRO, CAL.—Bids, it is understood, will be received by the Alameda County officials, Oakland, about Jan. 1, 1922, for a one-story laundry and one-story power house, refrigerating plant, ice plant, incinerator, shops, etc., on the County Infirmary grounds in San Leandro. H. H. Meyers, Kohl Building, San Francisco, is architect.

Canada

FULLARTON, ONT. — The township authorities are considering the installation of an electric lighting and power distribution system, to cost about $48,000. For further information address R. H. Pomeroy, Fullarton.

LONDON, ONT.—Plans are under way by the London & Port Stanley Railroad for the installation of additional power units, enlarging terminals and the construction of additional sidings. The cost is estimated at $1[illegible]

Electrical World

New York, Saturday, December 24, 1921

A Demonstration That Points the Way

OUT of the disarmament conference is clearly coming the greatest single achievement which the world has ever seen in the cause of peace. What then? This readjustment of naval armament, this ten-year truce in world competition, means more to humanity than even this. It has brought at last a demonstration that governments possess the power to prevent as well as to cause war. And the people want still further measures of such beneficent protection.

This relief from the back-breaking burden of naval expenditures has been made possible, of course, because within our recent memory war has brought all nations close upon the brink of bankruptcy. America, it is said, will save $200,000,000 a year by this one economy. Other nations will save proportionately. And all the nations must save, because no one of the great countries in the world today is operating on a balanced budget. All are spending more than they receive. And it is a fact of tremendous import that the amount of money being spent today by European peoples on land armaments is practically the same figure by which their budgets are unbalanced.

Under this economic stress, the nations of the world have met in Washington, not just to talk about their national or continental problems, but to make arrangements for the safety of all people through the prevention of more wars and the protection of the world's prosperity. They have met once and applied some common sense to naval programs. It is the first great step. And they can meet again and deal as sensibly and as effectively with armies and with other evils that affect the world.

We—the people—have seen this demonstration, and we want more of our traditional troubles settled now in this same way. For there is more than one kind of war from which we suffer. We must seek out a way to peace in our industrial warfare, no less than in international conflicts. And in the future conferences it would be well to see not alone the representatives of governments, but also men who can broadly think and speak and influence for business, finance, agriculture and labor.

Europe is slowly, surely getting back upon its feet industrially, socially and politically, but financially is almost in a state of ruin. There is but one way out—to spend less and produce more wealth. While four or five million men are still held in great armies, there is a drain upon the entire economic world. We must not stop with the fulfillment of the Washington conference. We must go on. For we have seen the way.

Cummings Coligny Chesney

Pioneer in long-distance high-tension transmission and one of the originators of the S. K. C. system, who is this year's Edison medalist.

JUST as new records are being made in long-distance high-tension transmission both commercially and in the laboratory, it is gratifying to report that C. C. Chesney, chief engineer and manager of the Pittsfield (Mass.) works of the General Electric Company, has been chosen by the American Institute of Electrical Engineers as this year's Edison medalist "for early developments in alternating-current transmission." In fact Mr. Chesney might almost be called the original long-distance high-tension transmission engineer. Prior to the experiments in the early nineties at Pittsfield of Mr. Chesney and his associates, the late William Stanley and John F. Kelly, the highest voltage in use was 2,000 and the longest transmission line was only a few miles in extent.

An experimental line was erected and Mr. Chesney at first tried out 10,000 volts, then 15,000 volts and finally 25,000 volts. The results were so successful that high line pressures and long-distance transmission were boldly advocated, this responsibility, according to a statement by Mr. Stanley a few years before his death, being taken by Messrs. Chesney and Kelly, who "always made good." More recently the Pittsfield works of the General Electric Company, which are under Mr. Chesney's supervision, have made notable progress in the development of apparatus for commercial service up to 220,000 volts, and they have just completed successful tests of 1,000,000 volts for transmission purposes.

Mr. Chesney was born in Selinsgrove, Pa., on Oct. 28, 1863. He was graduated from Pennsylvania State College in 1885. In 1888 he joined Mr. Stanley's laboratory force at Great Barrington, Mass., where he devoted himself particularly to experimental chemistry and electrodynamics. The following year he went with the United States Electric Lighting Company in Newark, N. J., a Westinghouse subsidiary. In 1890 he moved to Pittsfield, where he was one of the original incorporators of the Stanley Electric Manufacturing Company, which developed the well-known S. K. C. system (Stanley, Kelly, Chesney), the company being started with an original capital of $25,000. Mr. Chesney was vice-president and chief engineer from 1904 to 1906. On the latter date he took up the duties of chief engineer and manager of the Pittsfield works of the General Electric Company, which company had acquired the Stanley Electric Manufacturing Company.

The Stanley Electric Manufacturing Company was organized in 1890 to develop the patents of Stanley, Kelly and Chesney in the alternating-current field. The company's work was primarily of a pioneer character with little and in many cases no past experience or practices to guide it. As chief engineer it was Mr. Chesney's work not only to supervise personally the calculations and design of its equipment but also to make practical the ideas of his associates. This company built the first revolving-field types of alternators used in America. They were extensively used in hydraulic stations, notable among which were the Bay Counties and Standard companies' lines in California, at that time the longest high-voltage lines in the world, using 40,000 to 60,000 volts.

The first polyphase transmission plant equipped with the S. K. C. system to be put into successful operation and the first in America was installed in 1893 and is supplying power and light today for use in the towns of Housatonic and Great Barrington, Mass. In 1895 a 12,000-volt plant was installed for service between Lowell and Grand Rapids, Mich. The operating success of these alternators was due to a special design in which the high-tension currents were generated in the stator element by the revolving rotor, these being the first alternators to produce a true sine wave. As early as 1896 alternating-current generators of 6,000 volts with control equipment were put into successful operation on the transmission line of the Montmorency Electric Power Company, Quebec. In 1898 generators up to 12,000 volts were placed in service. During the early period two-phase alternating-current induction motors, electrostatic condensers at 500 volts and electric transformers of 100-light capacity were developed. In developing the transformer all spaces in the coils were filled with "Gilsenite" to provide better heat dissipation and insulation. This occurred as early as 1892, as did the development of cloth treated with oxidized linseed oil. In 1893 belt-driven alternators were put into successful operation, and in 1899 alternators of this design directly connected to steam engines went into use in the power house of the Staten Island Electric Company. These were the first alternators to be operated in parallel and in regular commercial service.

Mr. Chesney has always been a tireless worker, keeping in close contact with all phases of his organization and taking an active part in the civic work as well as associated work. He is a fellow of the A. I. E. E., of which he was a manager from 1905 to 1908 and vice-president from 1908 to 1910. Presentation of the medal will take place at a session of the midwinter convention of the Institute, Feb. 15-17.

Electrical World

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Customer Ownership and the News

CUSTOMER ownership of utility securities demands a new mental attitude on the part of the utility executive in his relations with the press. The day is past when the central-station-company manager can refuse to have anything to do with the newspapers. The idea that news given out should be good propaganda for the company must be abandoned. For the people are beginning to realize that they not only regulate, but own, the public service companies and therefore have a right to know what is going on.

It was fear of the radical politician that put a muzzle on the employees of railroads and other utilities and built up the negative policy of telling nothing. A positive policy of telling all would have disarmed the agitator and won the confidence and sympathy of the people, because straightforward, open honesty has a winning appeal. With public ownership through popular investment in the company the fear of political persecution dies. The people maintain the institution of the press so that they may know the news. It is the simple duty of executives to give the press full, frank and free access and tell it everything.

The people want to know about the public service company and all it does. Who is the official of the electric light and power company that he should hide things —good or bad—from those who own his corporation and, in fact, employ him? There are some men who do not yet see this thing clearly.

Ear Corn Used as Fuel in Middle Western States

SINCE the selling price of ear corn is less than one-third of a cent per pound in the corn-producing states, while coal costs twice that amount, several central-station companies are burning corn instead of coal under boilers, and the Board of Supervisors of Pocahontas, Iowa, has ordered the buying of ear corn for fuel to heat the court house and county home. This is striking evidence of the working of the economic law which halts the flow of raw materials to factories of production, and the corresponding demand for manufactured products in exchange, when the spread between the selling price of the raw material and the cost of the finished product becomes too great. The situation in Iowa is blamed upon propagandists who, it is claimed, have urged the farmers to increase production until surplus farm products are selling for about one-third the cost of production. Whether or not this is the cause, it is perfectly plain that more attention than ever before must be given to the economic needs of all industries and the production program adjusted thereto on the basis of actual requirements. The law of supply and demand is fundamental in the production of farm materials, and their conversion into beef on the hoof is in no sense different from the conversion of iron and copper into motors or other products of industry. This fundamental law of supply and demand that economists have laid down as the great leveler of prices seems to be a difficult one for most of us to comprehend and apply. In these days of falling prices it is a good subject for intensive study.

Five Hundred Cases of Undervaluation Monthly

LAST year at the custom house in New York City alone there were 5,400 cases of undervaluation of importations. This year they have been running at the rate of 500 cases every month, or about twenty a day. Why do foreigners who export to this country or American people who import from foreign countries undervalue? Because they pay less duty. Because they make more profit if they can enter a dollar of value at fifty cents. The Fordney tariff bill, therefore, proposes the American valuation plan, which will assess all ad valorem dutiable goods on the basis of the domestic value, which we can ascertain, instead of a foreign value for which we have to accept some stranger's word. It is just plain common sense.

And it must not be thought that this is a new and untried theory. Some of our greatest public men for many years, including Henry Clay, have labored earnestly to bring about this needed change. The British colonies compare the value at the source and in their own market and assess for import on the higher value. Great Britain herself at present, under the "safeguarding of British industry act," places a special additional duty of 33⅓ per cent on any foreign importation that threatens a home industry. It is the value in the British home market that governs every case that comes up.

If the electrical industry is to be saved from the blighting competition of the cheap Japanese and German goods now being sold here at prices less than our factory costs, we must have a protective tariff. And it must be made secure by the American valuation plan, so that the duty will be alike on like goods no matter whence they are imported.

Good Will as Important as Good Service

SERVICE like charity may cover a multitude of sins, but the covering may be too narrow at times for a public utility to wrap itself in. Good service without good will hardly suffices, and the company which gives the former and does not enjoy the latter is not to be envied. It may be likened to a house built upon the sand, for the spirit shown in the conference of mayors of New York State held this week indicates that its ultimate doom is merely a question of time. When the public becomes vindictive the finest service in the world avails nothing. The Toronto Railway Company carried passengers for a nickel and less and paid the city in taxes and other emoluments $1,600,000 a year. The city took over the lines, thereby sacrificing this yearly income of $1,600,000, and immediately increased the fare to 7 cents without improving the service. This is certainly piling Pelion on Ossa and the sad part is that the people rejoice to have it so. Therefore, while we are perfecting our service, let us also cultivate good will.

The Bearing of Automatic Operation on Power Development

THERE are many streams in the United States which do not present available head enough at any one site to rise to much importance as sources of power, although the aggregate head which can be rendered available by a series of co-operating stations may be considerable. If one attempts to utilize powers of such sort in the ordinary conventional way, he is driven in an attempt to unify the system, either to very extended and costly hydraulic works or to several stations each requiring about the same operating staff that would be needed for a single station utilizing the full power of the stream.

Just at this point is where the automatic station can be utilized to the best economic advantage. One has only to develop a single site for an ordinary plant with provision for the generation of power above or below on the stream as convenience may dictate. He can then set up very simple, easily controlled and efficient little plants, which can be thrown into operation as required in the judgment of the local dispatcher quite as readily as if it had been necessary to call for help over the telephone. Whether the generators should be synchronous or asynchronous is a detail of the general design which has no particular relation to the practical situation. The point is that in any case a simple plant, used in co-operation with one directly under the control of the load dispatcher, can be thrown into or out of operation with the utmost ease and can, moreover, be provided with virtually the same automatic safety appliances that would be used in a manually operated station. Just how the requisite sequence of operations can be most easily controlled is a matter to be dictated by the actual conditions under which the plant is to operate.

The number of instances in which the general policy of automatic auxiliary stations can be carried out will prove to be surprisingly great, and it is not easy to set a limit to their usefulness. As to reliability, the plants thus far installed have shown a good record, and there is no reason why this should not be continued since the work to be done is of a very simple character and the safety precautions involve nothing unusual. There is no reason why much larger plants than the one which we have just described should not be organized in a similar manner. The control system, so long as only a single unit is installed, is substantially the same whether it is used for a hundred kilowatts or for several thousand. If the station capacity exceeds that which can be worked in this simple way, the conditions may very often make it cheaper to have an attendant than considerably to increase the complication of the automatic gear. An operator working on a single shift and being on hand merely at times when quick changes in the operation of several units might become necessary would often suffice.

Administrative Engineering, Human Relations and the Technical Schools

A RECENT article in the *Sibley Journal of Engineering* by Dean Kimball of the College of Engineering, Cornell University, which asks what the universities and technical schools are doing and can do to train their undergraduates in industrial relations deals with a subject fully worthy of the thoughful consideration the author accords it. By the very necessities of the case, the Cornell educator avers, the engineer, originally only the technical adviser of industry, has been gradually drawn over into the administrative field. Today great industries of every kind are demanding technically trained men to fill executive posts and control the human forces from whose efforts production springs. Such men the technical schools are asked to furnish in increasing numbers, and from such men it is fondly hoped will come a final solution of the problem of human relations in industry which so many self-confident administrators have attacked in vain and because of which so many promising enterprises have suffered disaster.

It is, as Dean Kimball implies, rather by the successful nurture of the engineering mind that victory in this field can be won than by the inclusion in the undergraduate curriculum of elaborate studies of administration or by protracted excursions into the field of social science and similar domains. The time at the faculty's disposal is all too scant for proper grounding in the rudiments of technology and their practical application. To attempt to train certain students for the end desired by narrow specialization in studies of the type to which allusion has been made at the expense of fundamental engineering knowledge would not produce administrative engineers, for if these executives of a new type are to be clearly distinguishable from other types, their administrative ability must be derived from, and not merely tinctured by, engineering training. Moreover, are there not grave objections to placing pseudoscientific studies of any kind on an equal basis with those founded on the unshakable verities of mathematics? There is great reason to hope that industrial administrative and labor problems will shrink in magnitude when approached by minds in which natural ability to lead, engineering talent and broad human sympathies mingle; but here as elsewhere individual experience will prove the most important teacher. To approach these problems equipped mainly with half-digested theories incapable of scientific proof would only bring discredit on the graduate in "human relations." It is easy to step from empiricism to charlatanry, and to charlatanry engineering must ever remain the implacable foe.

Reduce the Number of Insulating Oils

NEARLY a dozen insulating oils for use with transformers, oil switches, lightning arresters and other apparatus are now on the market. In the opinion of operating engineers the number is far too great. The handling of such oils is at best a difficult matter, and when, owing to the special requirements of the different manufacturers, it becomes necessary, in order to be protected under the guarantees, to have on hand and use several different grades or makes of oil the trouble grows. Operating engineers do not assert that the same grade of oil will be found suitable for both water-cooled transformers and heavy-duty oil switches, but they do feel that if a certain oil is suited to the oil switches of one manufacturer it should in all reasonableness be equally suited to the oil switches of another. A similar reasoning applies in the case of transformer oil. Therefore an agreement by which the total number of insulating oils would be reduced to two, or at most three, would be heartily welcomed by purchasers generally. There seems, indeed, no inherent reason why the advantages of standardization should be unattainable in this particular.

A Well-Planned Industrial Distribution System

FLEXIBILITY and safety are combined to an unusual degree in the wiring of the Pacific Coast industrial plant described by I. A. Oliver in the issue of Dec. 17. Comprehensive provision for future growth, convenience of service and safe construction are attained without losing sight of economical investment in equipment. The case cited is typical of plants whose growth is so rapid that almost continual relocation of motors is essential. Changes had to be made with minimum interruption to production, and an inflexible and far from modern installation was here transformed into a thoroughly improved layout. Fifty-eight motors with a total connected load of 600 hp., distributed throughout a plant covering four acres, presented an interesting problem in wiring and control for best results, and the flexibility attained is creditable to those in charge of the work.

The provision of switchboards with "dead" fronts and backs and the extensive use of safety switches are noteworthy features of this installation. Concentration of these switches in groups at various centers of distribution illustrates a subdivision of control which facilitates economical departmental service and which might well be followed in many plants at present depending upon one centralized assembly of switch equipment. The use of laminated flat, bare busbars in a protected compartment with the copper cross-section tapered in proportion to the electrical loading illustrates careful attention to the investment. Symmetrical location of switching and control apparatus conduces toward economy of outlay, and in this plant irregular and haphazard applications of control equipment were not permitted. It is of interest to find here a dry safety switch of unusually high rating for instantaneous control of the entire power service, showing that the designers of the plant did not make a fetish of switch segregation, but applied the same standards of construction at the entrance of power to the plant as in the remote subdivisions of control.

Other features marking the installation's advance over ordinary practice are the attention given to the spacing of conductors to avoid disturbing magnetic circuits, eddy currents and accidental contacts; the general use of overload relays and undervoltage releases on motor starters, the complete marking of control apparatus, the use of pipe framing to reduce mechanical costs, the provision of special terminal boxes to fit each type of motor, and the use of considerable old equipment which was made safe for further service without undue expense. Work of this kind is of wide suggestiveness and deserves the consideration of plant engineers responsible for revamping installations to meet the heavy duties of the future.

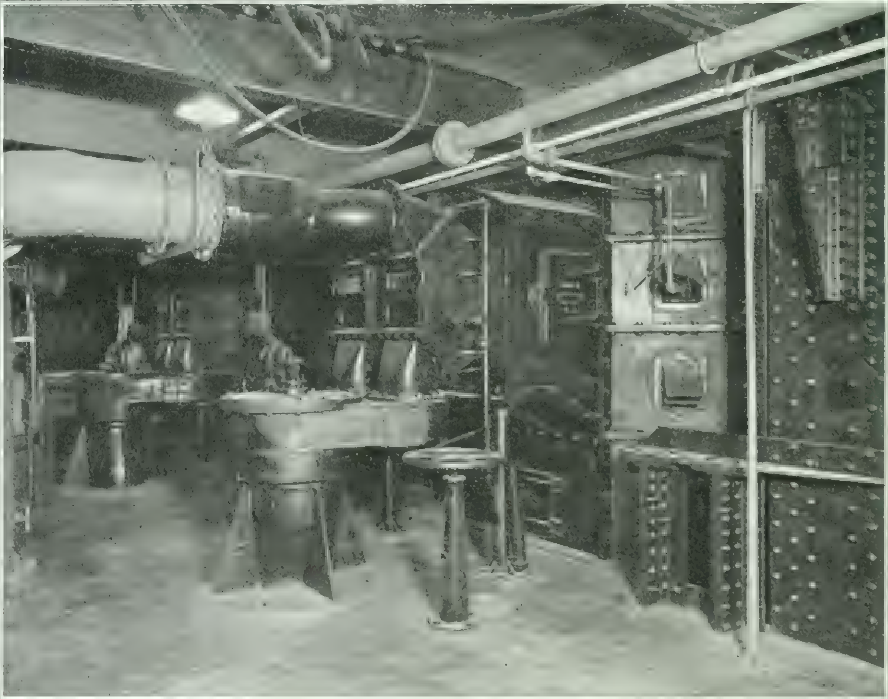
Carbon Electrode Has Undergone Astounding Evolution

SELDOM have we published a more interesting bit of technical history than that furnished by A. T. Hinckley of the National Carbon Company regarding the development of electric furnace electrodes. It is hard to realize how soon after the beginnings of the voltaic cell the heating power of the arc was brought into play for chemical purposes and the electric furnace had its origin. Sir Humphry Davy struck the first electric arc in the year 1800. Eight years later in the first electric furnace he produced potassium carbide, and in 1815 the first electric steel was made by a process which now seems curiously and unnecessarily troublesome, but which was the beginning of the great art. It was not until more than a quarter of a century later that the electric furnace had a real beginning in the hands of Hare and Despretz. This was in that singular period of electrical evolution when, with nothing besides batteries as a source of current, the ingenuity of inventors seems to have been unlimited in forecasting the engineering work done half a century later. Many an inventor working soon after the invention of the dynamo stubbed his toe on the patents taken out by the skillful and patient men who had nothing better than a few battery cells as a source of their energy. So it was that Despretz, trying various forms of carbon, fell upon the gas retort species and not only appreciated its advantages but discovered some of the troubles later found. It was still in this battery period that the first patent on a fabricated carbon was granted in 1858.

It was not until the dynamo had become somewhat familiar in the Graumme and Siemens machines, making electric light a possibility, that Carré settled seriously to the manufacture of carbons, followed very quickly by our own Charles F. Brush, who molded his carbons from petroleum coke. The art owes not a little to Brush's persistence and ingenuity, and these simple pressed carbons such as were used for electric lights did sterling service in the beginning of electric furnace work. A little later came the squirted carbon, but when the call came for serious work with furnaces, as in the aluminum process and similar metallurgical processes, big electrodes had to be made. It was less than a quarter of a century ago, however, that the squirted carbons were brought up to a diameter of as much as three inches. Later came the heavy furnaces requiring huge electrodes capable of standing enormous changes of temperature. The squirting process broke down, and the tamping process, with the carbon mixture driven by hand or mechanical rammers into molds from which the formed electrode was subsequently removed and baked, took its place. Finally recourse was again had to retort carbon and to high grades of anthracite as the best material for the carbon mix. As the art of blending materials developed so did the process of making the electrodes, until more than ten years ago squirted electrodes up to sixteen inches in diameter and one-half ton in weight were produced with good results. From that time on, and especially through the war, the evolution of the electrode has proceeded with astounding rapidity. The weight just mentioned has been more than doubled, and these big electrodes stand up with astonishing success against the terrific temperature strains to which they are exposed. They have grown with the ramifications of electric furnace work until now it is hard to set a limit to the evolution of electrodes.

Furnaces of Ford Plant Burn Gaseous, Liquid or Powdered Fuel

FOUR remarkably large (2,640 nominal hp.) boilers equipped to burn blast-furnace gas, coal tar and powdered coal simultaneously or separately have been in operation for several months at the River Rouge plant of the Ford Motor Company. The installation shows in a striking manner the flexibility possible with powdered-fuel firing. Blast-furnace gas is used as the basic fuel, but the fluctuations of supply make it necessary to make up for deficiencies with powdered fuel and occasionally tar. Not only does the powdered-fuel equipment have to meet this requirement but it must work at odd times on fuels ranging from 100 per cent West Virginia bituminous coal down to 100 per cent coke breeze. Sometimes the latter contains as much as 14 per cent moisture. No trouble has been experienced in burning even this very wet coal, according to the Combustion Engineering Corporation, although it is to be expected that the efficiency probably decreases considerably with this extreme moisture.



Electric Furnace Electrode Has Undergone Marked Development

A Review of the Uses of Carbon Electrodes, from Sir Humphry Davy's Production of the Electric Arc in 1800 to Present Day Applications in the Electric Furnace and the Important Steps in Electrode Production

By A. T. HINCKLEY
Engineer National Carbon Company, Inc.

DEVELOPMENT of the electric furnace and its major accessory, the electrode. have progressed simultaneously since early in the nineteenth century. Without the electric furnace the large electrode would never have been called into being, and without the large electrode the mammoth electric furnace of today could not operate. No one who has followed the development of high-temperature chemistry thus far in the twentieth century can fail to realize that it has an important place in the foundation upon which our industrial fabric rests and that the electric furnace has made commercial high-temperature chemistry possible.

USES OF CARBON ELECTRODES 120 YEARS AGO

Carbon electrodes have been used as conductors for the electric current since the time of its discovery. Volta had no sooner discovered the electric battery and thus produced the first continuous flow of electrical energy than Sir Humphry Davy in 1800 used the battery with carbon electrodes attached to each pole to produce an electric arc. This invention constituted the nucleus of the electric furnace, and subsequent work has been principally enlargement and adaptation. Large steam and water-driven generators with their switches and transformers have been substituted for the Volta battery, refractory walls have been built around the electrode tips to conserve the heat, the energy developed within such walls has been multiplied a millionfold, and the electrodes have grown from tiny points of carbon to great masses weighing many tons.

These developments have stretched out over a period of 120 years. At first the progress was very slow. The energy that the Volta battery was capable of delivering was small, and the methods by which the heat, which Sir Humphry Davy's arc furnished, could be controlled so as to produce chemical change in matter adjacent to it had to be worked out. In spite of these handicaps a considerable number of electric furnace products were discovered within a few years. Probably the first substance to be produced in the electric furnace was the carbide of potassium made by Sir Humphry Davy in 1808. Electric steel was made in 1815, when W. H. Pepys made an electric resistance furnace out of a slotted iron wire and, heating this by current from a bank of batteries, caused it to absorb carbon from diamond dust and become steel. Important electric furnace products—viz., graphite, calcium and phosphorus—were made by Robert Hare in 1839, but only in tiny amounts, just sufficient for identification. Many forms of furnaces were proposed and some, such as the charcoal tube furnace of Despretz, were built, but no marked progress was made until the invention of the electric generator. All through the first half of the nineteenth century a search was made for suitable electrode material. The metals were found to be unsuited for most furnace work as they could only be used in channels to hold them when molten.

The result of all these investigations was that carbon electrodes became standard accessories to the electric furnace. Of the various forms of carbon available, little blocks of retort carbon sawed from the deposits formed in gas retorts were best, as they possessed the highest strength and lowest electrical resistivity. This material possessed several properties, however, which caused trouble, and as early as 1849 Despretz complained that after the electrodes had been used for some time the tips swelled irregularly and cracked off owing to conversion to graphite. Furthermore, it was impossible to secure a piece of this material of adequate size to carry the current in the large furnaces on account of the laminated structure.

The invention of the dynamo in 1867 overcame the limitation as to quantity of electrical energy available. This gave a fresh impetus to electric furnace investigations, and there was an almost immediate demand for larger electrodes. It was evident from the earlier investigations that such electrodes must be of carbon and must be a fabricated article as no natural carbon of the required uniformity, conductivity and strength existed.

THE FIRST FABRICATED CARBON

There is some question as to who made the first piece of fabricated carbon, but as early as 1858 a patent was granted in the United States to De Grasses B. Fowler of New York for a method of making carbon plates by mixing pulverized coke with tar, forming the mixture under pressure in molds, packing the piece in lime and heating slowly in an air-tight box to drive off the volatile matter. It is improbable that this patent was commercialized for other than battery plates as the experimental arc light shown at Yale in 1871 used electrodes cut from blocks of retort carbon. There is little doubt that a Frenchman, Carré, gave to the world the first real commercial process for manufacturing carbon electrodes. In 1877 he described the various steps in the process. He was the first to use carbon dust as a protective material for holding the electrodes during the baking process, and he succeeded in producing satisfactory carbon electrodes up to 0.5 in. (1.25 cm.) in diameter. In 1878 Sir W. Siemens used such carbon electrodes in his experimental work, melting metals in radiation arc furnaces of the crucible type.

In America Charles F. Brush, who gave the first public demonstration of arc lighting in Cleveland in 1876, began in 1877 to experiment in the manufacture of carbon electrodes, using petroleum coke. At first he used the coke raw and molded it into electrodes 0.5 in. square by 12 in. (30.4 cm.) long in a hand press. Such electrodes shrank so much in baking that he invented the calcination process for removing the volatile matter from the coke prior to its fabrication into an electrode. As the pressures given by the hand press were too low to impart the requisite density to the molded carbon mass, he designed a hydraulic press.

By the year 1878 Mr. Brush was manufacturing these carbon electrodes on a commercial scale and gradually developed the method used for molding round electrodes 0.5 in. in diameter by 12 in. long. It was electrodes such as these that were used by Hall in 1886 in his experiments for the production of metallic aluminum.

As the small molded electrode was an expensive article to form, the extrusion process was developed. In this process the plastic carbon mix was molded into short, thick cylinders, which were placed in a heavy steel cylinder tapering at one end to a small opening or die. Through this opening the mix was extruded by hydraulic pressure applied from the rear end of the cylinder. Many different kinds of extrusion apparatus were tried for this work, including adaptations of the pug mills used commonly in brick work. None of the existing extrusion machines, however, proved capable of handling the carbon mix, and a new type of extrusion machine designed especially for carbon work had to be developed. Such extrusion machines capable of forming carbons up to 1-in. or 1½-in. (2.5-cm. or 3.8-cm.) diameter were in operation by 1895.

EARLY NEEDS FOR LARGE ELECTRODES

The demand for the first large electrodes came from the Pittsburgh Reduction Company, operating the Hall metallic aluminum process. For its commercial furnace the company wanted an electrode 3 in. (7.6 cm.) in diameter by 18 in. (45.7 cm.) long. At first it was considered impossible to make so large an electrode as no presses then made had carbon cylinders of sufficient diameter. The machine designers, however, proved equal to the task, and a new extrusion press was built with a steel cylinder 1½ ft. (45.7 cm.) in diameter to hold the carbon mix. By 1898 so many of the 3-in. electrodes had been made that the large-electrode industry can be said to have become established.

From 1898 on the growth of the industry was very rapid. The development of great quantities of hydroelectric power at Niagara Falls gave an impetus to the electric furnace art second only to the invention of the dynamo itself. Scattered through the closing years of the nineteenth century there were many discoveries of electric furnace products. By 1900 calcium carbide, carborundum and graphite were being produced commercially and electrodes up to 8 in. (20.3 cm.) in diameter had been made to lead the current into the furnace necessary for such manufacture. The decade which had just closed had seen electric furnaces grow from less than 100 hp. to more than 1,000 hp. in single units, and the electrodes for such furnaces had grown from pencils weighing less than ½ lb. (0.23 kg.) to cylinders weighing over 100 lb. (45 kg.).

The first decade of the twentieth century, while perhaps less fruitful in fundamental discoveries in high-temperature chemistry, was marked by a striking commercialization of electric furnace products. This increased demand led to larger and larger furnaces, requiring larger and larger electrodes. Many attempts were made to meet these demands by building up large electrodes from small slabs of baked carbon. The patent literature during this period is replete with examples of ingenious proposals for accomplishing such fabrication. None of them gave really satisfactory results. There are several reasons why this should have been so. If no bonding material was used to unite the individual slabs, expensive machining was required to fit them together and dowel them in place. Even if this was so well done that the mass possessed adequate mechanical strength, the contacts offered variable resistance, which resulted in local hot spots with subsequent burning and breakage. If a bond was used to unite the slabs, the shrinkage of such material in baking set up stresses which caused breakage of the individual members later on. Furthermore, the contacts between the individual members were still of variable resistance, and it was seldom that the mass as a whole possessed adequate mechanical strength.

ATTEMPTS TO PRODUCE MONOLITHIC ELECTRODES

It was obvious from these experiments that such large electrodes to be satisfactory must be monolithic. Larger extrusion presses were built capable of forming electrodes up to 12 in. in diameter. Such electrodes, however, gave a great deal of trouble in use on account of a tendency to crack when subjected to rapid temperature changes. Some manufacturers believed that this difficulty could be overcome if the internal defects incident to forming the electrode by the extrusion process were eliminated. This led to experiments both in Europe and America with what is known as the "tamping process."

In the tamping process the carbon mix is rammed into molds of the desired size, the molds being subsequently opened and the formed electrode removed for baking. At first this ramming of the mix was done by hand, but the pressure developed in this way proved inadequate to impart the required strength to the mass. Later on mechanical rammers were built capable of striking heavier blows. Although there was some improvement in the electrode due to the reduction of the internal defects known as "cones," the tamping process did not produce satisfactory electrodes from the fine-grain petroleum coke mix in use at that time.

In order to overcome the breakage which was common to such electrodes, attempts were made to reinforce the carbon mass with rods of baked carbon or rods of metal or even woven-wire screens, but none of these reinforcements accomplished the desired result. The difference in expansion between the metal and the carbon caused cracking. Furthermore, the shrinkage of the carbon bond in baking caused it to draw away from the reinforcement so that there was really no union between the two.

The first real improvement was made with retort carbon. This material when used in the so-called "concrete mixes" gave large electrodes which were able to withstand the stresses caused by rapid temperature changes without breakage. Experience showed, however, that retort carbon was extremely variable in composition, some kinds being very dense while other kinds occurring in the same retort were light and porous with no higher strength than is possessed by petroleum coke. The search for stronger carbon materials was continued. Finally certain forms of dense, low-ash anthracite were selected as most promising. This material required quite different dressing from petroleum coke, but after satisfactory methods of calcination, crushing and sizing had been worked out it gave as good electrodes as had been made with retort carbon.

ELECTRODE REQUIREMENTS OF THE ELECTRIC FURNACE

During this ten-year period a number of other electric furnace industries had become well established, as ferro-alloys, aluminous abrasives, carbon bisulphide and phosphorus, and lastly electric steel.

The use of the electric steel furnace for melting down cold scrap imposed more difficult conditions on the electrodes than they had ever been called upon to meet. Not only were larger electrodes demanded for open-arc service than before, but the varying short-circuit conditions incident to melting down a cold charge caused the arc to be concentrated first on one spot on the electrode tip, heating it rapidly to incandescence, and then the arc jumped to a new spot, thus causing uneven expansion in the section, with resulting breaking stresses. As such stresses increase as the diameter of the electrode increases, attempts were made to get the required current-carrying capacity in an electrode by using several small graphite electrodes in a clover-leaf bundle instead of the single large electrode. The mechanical weakness of such an arrangement, together with its rapid oxidation, caused spindling and breakage of the component pieces. These results confirmed the earlier view that electrodes to be successful must be as nearly as possible monolithic. The manufacturers of hydraulic presses in both Europe and America built new machines combining the tamping and extrusion principles in an attempt to overcome the internal defects which had hitherto caused trouble in extruded electrodes. In some of these machines the mix, instead of being made up in a relatively small cylinder before extrusion, was poured loose into the extrusion chamber and compressed in it hydraulically. Other press manufacturers provided for molding of cylinders of mix of the full size of the extrusion cylinder. To these cartridges a low temperature heat treatment was given, and they were then shoved into the extrusion cylinder and formed into electrodes. All of these improvements in forming methods made improvements in the internal structure of the electrode, so that by 1910 fairly reliable electrodes were made up to 16 in. (40.6 cm.) in diameter, weighing over 1,000 lb. (450 kg.)

The second decade of the twentieth century was marked by the Great War, which caused an unprecedented demand for electric furnace products. The manufacturing capacities in all lines were stretched to the utmost. Larger and larger furnaces were built, mammoths consuming 20,000 hp. apiece, or as much as the connected load of many a fair-sized city. For such furnaces electrodes weighing over a ton apiece and many tons in the assembly have been made. Much has already been written to show the fundamental character of electric furnace products in the manufacture of munitions, calcium carbide for the miners, the host of ferro alloys for the steel makers, fixed nitrogen for explosives, abrasives for finishing shells and machine guns, aluminum, magnesium and phosphorus, all requiring electrodes for their production.

For the manufacture of such electrodes retorts glowing incandescent with the burden of carbon in the purifying fire have been devised—retorts requiring for their success the very electrodes in whose production they have played a part. Mills whose manganese steel parts came from the electric furnace crunch and rumble as they crush the crude carbon to finest dust. Towering presses, throbbing as if from the effort, squeeze the steaming masses into shape. Cavernous furnaces in which tides of heat ebb and flow in never-ending cycle drive out the oils from the plastic mass, leaving it hard as stone and able to carry its load when all other substances are molten.

Now we are at peace, the abnormal industrial requirements of the war are over, and we can quietly take stock of our dependence upon electric furnace products for the comforts of our daily life. Call with me for a moment at the modern home at breakfast time. As the door to the kitchen opens you catch a glimpse of the electric range with spun-aluminum pans and cast-aluminum griddles, electric furnace products. The heating units in the range are of the cast-in type, with resistance wire made in the electric furnace from metals which were themselves reduced in the electric furnace. The resistance wire running at brilliant heat is insulated from the iron casting by a snow-white powder whose purity is guaranteed beyond question by its production in the electric furnace. The gleaming white of the enameled sink may well be due to the oxides of titanium or zirconium, electric furnace products. That steel knife was ground to shape with silicon carbide, and the stainless metal with which you cut your orange was not silver but an alloy made in the electric furnace.

DIVERSITY OF PRODUCTS MADE IN THE MODERN ELECTRIC FURNACE

As you bid the family good-by you note the beautifully formed brass fittings on the door, castings from the electric brass furnace. With a whir the motor starts —the pistons of aluminum, the axles of chrome-vanadium steel, the machine parts turned first with high-speed steel and finished by grinding with aluminous abrasives, even the tires made with the aid of carbide bisulphide, all electric furnace products. You reach your office and light a cigarette. The phosphorus on the match came from the electric furnace.

We will not follow all through the day the points where electric furnace products play an important part, but remember that when you ordered that new band saw you specified electric steel. Those new punches were made from molybdenum steel. That bolt of cloth was woven from cotton grown on fields fertilized by potash and phosphate, wrested from the native rock in the electric furnace, and by the nitrates which the electric furnace fixed from the air. When the miners tore that carload of coal from the bosom of old Mother Earth their way was lighted by gas from calcium carbide, an electric furnace product, and the same kind of gas was used by the man who welded that break in the fender of your machine to stop the rattle which irritated you.

Night comes and your home is brilliant with tungsten lights, the filament of electric furnace metal. Even the flashlamp on the table at your bedside derives its energy in part from carbon prepared in the electric furnace, and for the operation of all of these electric furnaces electrodes were required.

The arc was of little practical use without the dynamo, and it in turn could do only a little work until the great waterfalls had been harnessed; but with these the electric furnace, with the aid of the electrode to link them together, has become an important factor in the production of the comforts and more and more of the necessities of life.

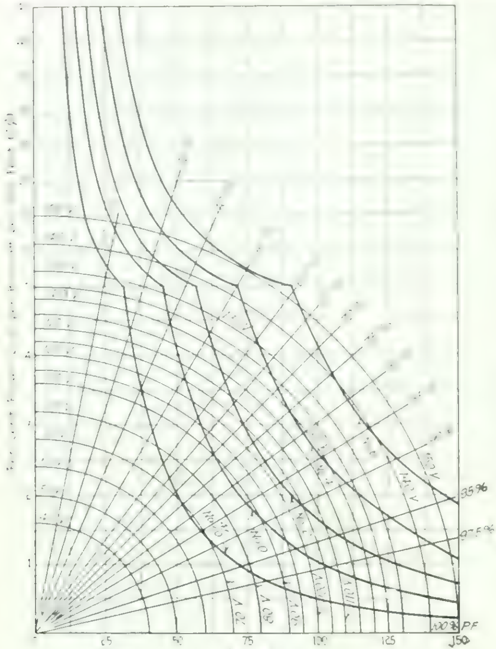


Fig. 1

Curves for Quick Solution of Power Loss and Voltage Drop Problems

FIG. 1—POWER LOSS IN PERCENTAGE OF DELIVERED POWER

[illegible]

To Use Chart: 1. [illegible] voltage within the limits of the chart (0—150 volts) by [illegible]

2. Locate intersection of voltage arc with power factor [illegible]

3. Intersection of this ordinate with curve for given wire size gives per cent power loss on scale at left.

4. Divide scale reading by the square of ratio used in 1, and multiply by distance in thousands of feet and load in kilowatts.

Result is total per cent power loss on line.

FIG. 2—PERCENTAGE OF DELIVERED POWER LOST PER KILOWATT PER 1,000 FT.

This applies to 4,600-volt three-phase line only. For single-phase line multiply figure given by curve by two. To obtain per cent voltage drop use these curves in conjunction with quantity B given in Fig. 4.

FIG. 3—PERCENTAGE (OF DELIVERED VOLTAGE) DROP PER 1,000 FT.

These curves apply to three-phase 4,600-volt lines with 27-in. spacing and 80 per cent power factor.

FIGS. 4A AND 4B—VOLTAGE DROP IS READILY DETERMINED AFTER POWER LOSS HAS BEEN FOUND

B, given by the curves, is the ratio *V*/*P*, where *V* = voltage in per cent of delivered volts and *P* = power loss in per cent of delivered power. Fig. 4a gives values of *B* for power factors 50, 60, 70, 80 and 90 per cent and 4b for 90, 95 and 100 per cent.

To Use Chart: 1. Determine value of x/r for size and spacing of wire used, from curves on right.

2. Determine value of *B* for this value of x/r from proper curve on left.

3. Multiply by per cent power loss (from other curves) for per cent volts drop, $V (= PB)$.

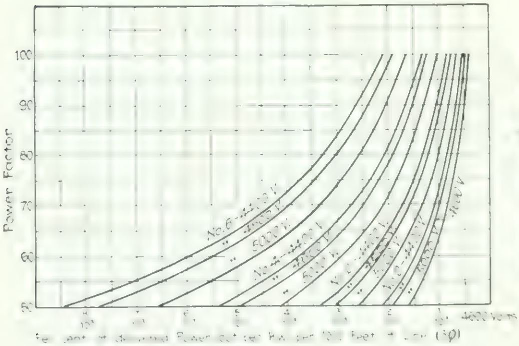


Fig. 2

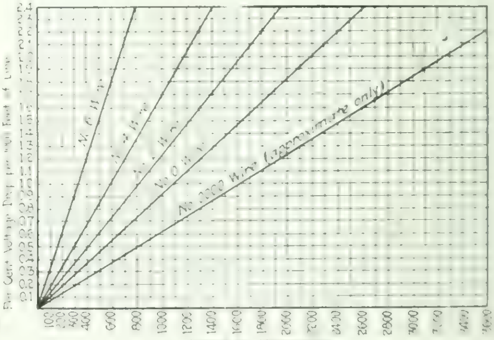


Fig. 3

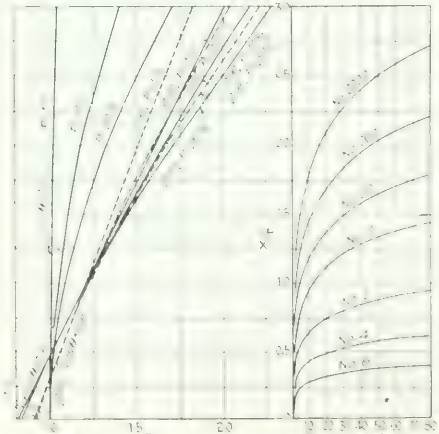


Fig. 4A

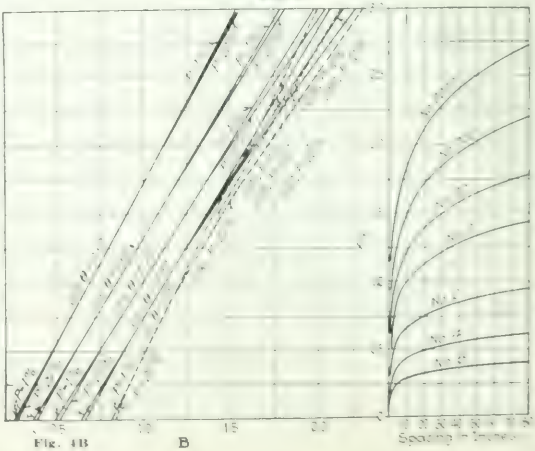


Fig. 4B

Simplifying Line Loss and Drop Problems

Power Loss Is Determined from Charts with Minimum Computation and Voltage Drop Is Readily Derived from This—Charts Do Not Cover Charging Current and Corona Problems

By H. P. SEELYE
Distribution Engineer's Department, Detroit Edison Company

PROBABLY the two quantities most often computed in the design of lines for electrical transmission and distribution are the power loss and the voltage drop. The former is always important in determining the economy of a design. Upon the latter depends the quality of service rendered. The most usual case of power loss is that due to the resistance of the conductor, *i.e.*, the I^2R loss. In high-tension transmission lines leakage losses and corona losses become important. Charging current also has an effect or I^2R loss. Such problems, however, are comparatively rare in the work of most engineers and warrant special treatment when encountered. In the majority of problems I^2R loss is all that need be considered.

If D = length of line in feet,
W = the load at the receiver end in watts (kilowatts × 1,000),
E = the receiver voltage,
A = cross-sectional area of conductor in circular mils,
ρ = resistivity of conductor material in ohms per mil-foot,
$\cos\theta$ = the power factor of the load W.

$$I^2R \text{ loss} = \left(\frac{W}{E\cos\theta}\right)^2 \frac{\rho D}{A} \times 2 \text{ watts (for single-phase)},$$

$$I^2R \text{ loss} = \left(\frac{W}{\sqrt{3}\,E\cos\theta}\right)^2 \frac{\rho D}{A} \times 3 \text{ watts (for three-phase)}.$$

If P = per cent power loss in terms of power delivered,

$$\frac{P}{100} = \frac{2W^2\rho D}{(E\cos\theta)^2 A} \times \frac{1}{W},\quad P = \frac{200W\rho D}{(E\cos\theta)^2 A}$$

(for single-phase);

$$\frac{P}{100} = \frac{W^2\rho D}{(E\cos\theta)^2 A} \cdot \frac{1}{W},\quad P = \frac{100W\rho D}{(E\cos\theta)^2 A}$$

(for three-phase).

For the same load, same voltage between conductors and the same conductor size, the loss with single-phase is twice that with three-phase.

If it is desired to consider the load, voltage and power factor at the source instead of at the receiver, if

W' = load at source in watts,
E' = voltage at source,
$\cos\theta'$ = power factor at source.

The line loss in percentage of load at source

$$P' = \frac{200\,W'\rho D}{(E'\cos\theta')^2 A} \text{ (for single-phase)},$$

$$P' = \frac{100\,W'\rho D}{(E'\cos\theta')^2 A} \text{ (for three phase)}.$$

For copper conductor ρ = 10.8 approximately. If load is expressed in kilowatts (kw.), the formula becomes

$$P = \frac{2.16 \times 10^6 \times \text{kw. } D}{(E\cos\theta)^2 A} \text{ (for single-phase)},$$

$$P = \frac{1.08 \times 10^6 \times \text{kw. } D}{(E\cos\theta)^2 A} \text{ (for three-phase)}.$$

These formulas are comparatively easy to use. However, it is believed the work may be somewhat simplified, especially where a large number of such computations are to be made, by use of the accompanying chart (Fig. 1). The use of this chart reduces the computation to a simple multiplication of round numbers.

HOW TO USE THE POWER-LOSS CHART

A series of circular arcs (with the center at O, O) are drawn, each representing a given voltage. Voltages range from 0 to 150, but as will be shown below, the same arcs may be used for any voltage. Diagonal straight lines are drawn through O, O at various slopes, each representing a given power factor. It is evident that the abscissa of the intersection of any arc with any diagonal gives the corresponding value of $E\cos\theta$.

For each standard wire size considered, a curve is now plotted between $P \div$ (kw. D/1,000) and $E\cos\theta$, giving for any voltage, power factor and wire size the per cent power loss per kilowatt per 1,000 ft. Curves for other sizes of wire can be easily added if desired. The upper part of these curves was drawn to a condensed scale to give a greater range of values in the more unusual cases. The curves here shown are for three-phase. The power loss for single-phase would be twice the values shown for three-phase.

These curves are used according to the following rules:

1. Reduce the voltage considered to any equivalent secondary voltage within the scale of the chart (less than 150) by dividing by some convenient transformation ratio such as 2, 4, 10, 20, 200, 400, 1,000, etc.
2. Locate intersection of voltage arc and power-factor diagonal.
3. The intersection of the vertical through this point with the curve for the proper wire size gives the value of P on scale at left.
4. Divide this scale, reading by the square of the transformation ratio used, to give per cent power loss per kilowatt per 1,000 ft. for the given voltage. Multiply by the number of kilowatts and by the length of line in thousands of feet for total per cent power loss in terms of power delivered. (If line is single-phase multiply this quantity by 2.)

Take for example the following problem:

Load, 1,200 kw.; power factor, 75 per cent; voltage at receiver, 4,400; wire size, No. 3/0 (three-phase); distance, 8,000 ft.

4,400/40 = 110 (transformation ratio = 40).
Power loss = (1.51 × 1,200 × 8) ÷ (40 × 40) = 9.06, or 108.7 kw.

VOLTAGE DROP READILY DETERMINED FROM POWER-LOSS DATA

The drop in voltage from source to receiver involves more complicated equations. When relating to high-tension lines the problem involves line capacity, etc., and warrants special consideration. For medium-voltage and low-voltage problems, however, it is sufficient to consider inductive reactance only, and the equation becomes the well-known

$$\frac{V}{100} = \frac{\sqrt{(E\cos\theta + \sqrt{3}\,RID)^2 + (E\sin\theta + \sqrt{3}\,XID)^2} - E}{E}$$

(for three-phase lines)

$$= \sqrt{\left(\cos\theta + \frac{\sqrt{3}\,RID}{E}\right)^2 + \left(\sin\theta + \frac{\sqrt{3}\,XID}{E}\right)^2} - 1$$

Where V = per cent voltage drop in terms of receiver voltage,

R = resistance in ohms per foot,

X = inductive reactance in ohms per foot,

D = distance from source to receiver in feet,

I = current per wire.

But

$$P = \text{per cent power loss} = \frac{100\,WD}{(E\cos\theta)^2 A} = \frac{100\sqrt{3}\,RID}{E\cos\theta} \text{ (see above).}$$

Substituting

$$\frac{V}{100} = \sqrt{(\cos\theta + \frac{P}{100}\cos\theta)^2 + (\sin\theta + \frac{P}{100}\frac{X}{R}\cos\theta)} - 1$$

$$= \cos\theta\sqrt{\left(1 + \frac{P}{100}\right)^2 + \left(\tan\theta + \frac{P}{100}\frac{X}{R}\right)^2} - 1$$

$$\frac{V}{P} = B =$$

$$\frac{100\cos\theta}{P}\sqrt{\left(1 + \frac{P}{100}\right)^2 + \left(\tan\theta + \frac{P}{100}\frac{X}{R}\right)^2} - \frac{100}{P}.$$

(The above computation is for three-phase, but the resulting expression for B is the same for single-phase.)

B, then, is a quantity expressing the relation between per cent voltage drop and per cent power loss. It depends on the power factor ($\cos\theta$), size and spacing of conductors (X/R) and per cent power loss (P), but is independent of load or voltage. It is evident that if B is known the per cent voltage drop may be easily obtained from the per cent power loss by the simple relation $V = BP$.

B may be plotted as shown in the accompanying curves (Figs. 4a and b). Since the variation of B with P is not great excepting for high power factor and large conductors, three fixed values of P were chosen which cover the usual range of problems, *i.e.*, 1 per cent, 10 per cent and 20 per cent. For each power factor a curve between B and X/R is plotted for each of these values of P. Other values of P may be interpolated if necessary. The value of X/R is shown directly by the curves on the right for standard sizes of conductor and any spacing.

The use of the curves is as follows: Locate the point on the X/R curve for the given wire size and spacing. (For three-phase, unequal spacing, use the equivalent spacing, $S = \sqrt{S_1 S_2 S_3}$). Pass across the sheet to the left on the horizontal through this point until it intersects the curve for the given power factor and value of P. The corresponding value of B is found on the scale at the bottom. If this is multiplied by the value of P computed from Fig. 1, the desired value of V (per cent voltage drop) is obtained.

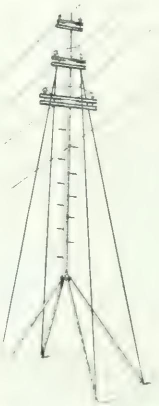
Example.—In the example given above for the determination of P, let the spacing between the wires be 28 in., 28 in., 56 in. The equivalent spacing $= \sqrt{28 \times 28 \times 56} = 35$ in. Interpolating between the 70 per cent and 80 per cent power factor curves, $B = 1.18$, $V = 1.18 \times 9.06 = 10.7$ per cent, or 470 volts.

The curves given here are general and may be used for any voltage, load, length of line and spacing between conductors. The range of wire sizes and power factor is more limited, but the curves could be easily extended to cover any desired value. For every-day use on the problems arising on any given system less general curves may be derived from these which will still further simplify computations. As an example, Fig. 2 shows a set of curves plotted for work on 4,600-volt lines. Three curves are shown for each wire size giving a range from 4,400 volts to 5,000 volts. For any power factor (lower scale) the scale on the left gives the per cent power loss per kilowatt per 1,000 ft.

Fig. 3 shows another special curve giving per cent voltage drop per 1,000 ft. of line for 4,600 volts, three-phase, 80 per cent power factor, 27-in. spacing. It is a comparatively simple matter to derive any such special curves desired by use of the general curves.

A Flexible Type of Transmission Tower

A NEW type of transmission-line power is described in the *Commonwealth Engineer* (Australia). The tower is a four-sided structure and consists of struts of weldless steel tubes and ties of steel-wire ropes braced together, making it exceedingly light and self-contained. It is unaffected by any settling of foundation, and any variation in temperature, whatever the range, will not set up internal strains. The connection between the upper strut and the lower struts is a simple casting with projections into the tubes to keep them in position. The casting is held in position by the weight of the structure above it, consequently bolting, riveting or screwing are unnecessary. The galvanized-wire rope stays are attached to the upper strut by a clamp or by incorporating the clamp in a cross-arm firmly fastened to the strut. Connection to the lower struts is affected either by the rope being passed around the strut and a malleable cast bearer bolted on or by fitting a clamp. The rope end is finished off by a thimble and wire rope clamps. The cross-arms are of channel iron. Should increased spacing be required, as in the case of very high voltages, two tubes instead of one are used for the upper strut. This maintains the strength of the tower and at the same time preserves its flexibility and simplicity. The ground reaction, owing to the wide base of the tower, is small; it is dealt with by means of buckled plates bolted to the ends of the tubes. No concrete is required for the foundations. The longest span thus far erected is 1,800 ft. (550 m.), but it is said that a span of 3,000 ft. (900 m.) is now in the course of erection.



FLEXIBLE TOWER USED IN AUSTRALIA

Voltage, 22,000; height, 42 ft. (for span of 1,432 ft.); conductor, 0.1 sq.in. copper. Ground wire is below line wires.

Station Electrical Layout for Supplying Local and Regional Service

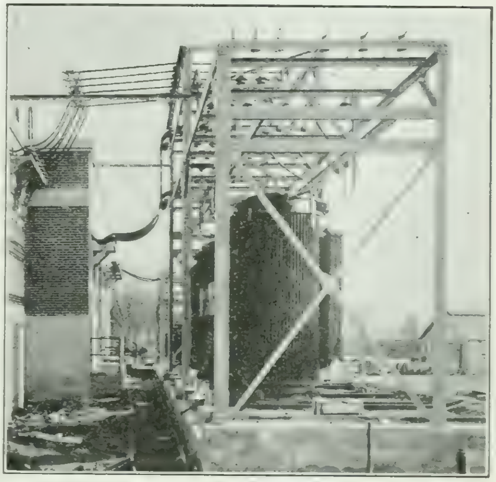
Flexibility and Simplicity of Design Effectively Combined in the South Meadow Station of the Hartford Electric Light Company—Symmetrical Development by Sections to Meet Dual Service

TYPIFYING plants which must meet the requirements of more than local service, the new South Meadow station of the Hartford (Conn.) Electric Light Company is of interest from both the mechanical and the electrical viewpoint. This plant is intended to operate as a key plant for giving both regional and local service so that particular attention had to be given to insuring continuity and flexibility of service. Some of the salient features of the mechanical part of the plant were discussed in the Dec. 10 issue of the ELECTRICAL WORLD, and those of the electrical layout will be considered in the current issue. Among the features of particular interest in this discussion are the arrangement of the electrical bay, the precautions taken to prevent short circuits, the supporting of buses and circuits to resist mechanical stresses set up by short circuits, the segregation of oil circuit breakers and instrument transformers, the arrangements of reactors, the placing of virtually all transformers outdoors, and the use of truck-type switchboards for station service control.

As illustrated in the Dec. 10 issue, the electrical bay has four floors with a basement under part of it. Of electrical interest on the top floor are the operating room and load dispatcher's quarters. Below is the oil circuit-breaker room, with equipment mounted directly above the bus room to minimize length of connections and prevent fires and gases in the switch room communicating to the bus room. In the bus room there is a longitudinal wall which divides it into two main sections. On the floor below are compartments for existing and future reactors and instrument transformers, and beneath these is the station-service room. Adjoining the electrical bay on the outside is a cable house of two stories providing for convenient connection of the station circuits with the outgoing underground circuits.

With minor exceptions, all transformers, including those for station service, are outdoors. For the time being distribution from the South Meadow station will be largely at 11,000 volts, but construction of an outdoor transformer and switching station connecting with the 66,000-volt lines of the Connecticut Power Company has been begun. This will supersede equipment now serving this purpose near the Dutch Point station of the Hartford company. At present two 7,500-kva., three-phase, self-cooled, 11,000-volt delta/66,000-volt Y-connected transformers are installed with their neutrals grounded. This rating may be increased by adding a cooling system.

Features of the main electrical circuits and switching arrangements for providing this dual local and regional service are indicated in the accompanying line drawing. As shown, there will ultimately be two 11,000-volt buses, to either of which any 11,000-volt circuits may be connected through selector oil switches. Only one is provided now, however. Among other features which this diagram shows are the positions of reactors and the use of oxide-film static dischargers on the buses. So far protective reactors are installed only in the Dutch Point tie lines, although space is provided for such equipment in each of the 11,000-volt circuits, including the generator leads. The tie-line reactors are designed to give 15 per cent voltage drop at the rated circuit current and the power-feeder reactors 3 per cent.

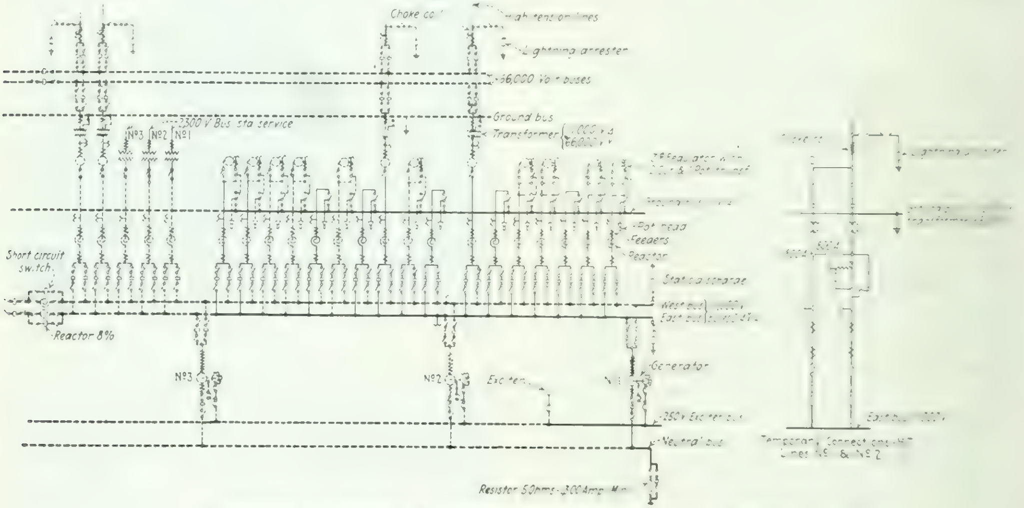

THE 11,000/2,300-VOLT STATION-SERVICE TRANSFORMERS ARE OUTDOORS

The 11,000-volt, 25,000-kva. generators, one of which is now installed, will be arranged in a single row with their longitudinal axes running the length of the turbine hall. These units will be protected by differential relays. The neutral from each generator will be brought through the air-duct wall into a chamber below the generator platform where current transformers are inserted and connections made through oil circuit breakers with a neutral grounding bus running the length of the turbine hall. Normally only one generator will be connected to the ground bus, which has a 5-ohm, 1,300-amp. resistor between it and the ground. This can be short-circuited when it is necessary to burn out a grounded cable. In these chambers are also the generator and exciter field rheostats and switches, which are remotely controlled.

The closed system of generator air cooling is used, the chamber for continuous recirculation and water spraying being under the generator end of the turbine foundation. Two sets of sprays are provided, one in the uptake to each end of the generator. Compact yet ample space, reduced air velocity and a flexible damper control are permitted with this arrangement. Turbine-room air can be recirculated if desired or, in cold weather, generator air can be used for warming the turbine room and reducing roof condensation. In case of interrupted water supply a quick change to the open system of ventilation can be accomplished by means of interlocked dampers.

Each generator will have a direct-connected exciter, but two reserve steam-driven exciters will be provided. One of these is installed now. Parallel operation of the exciters is not contemplated, although the generator field circuits can be readily transferred from their individual to the reserve exciters without interrupting generator operations.

The generator circuits are equipped with H-9 oil circuit breakers and all other 11,000-volt circuits with H-6 breakers. As mentioned before, these switches are on the floor above the bus room, with their disconnecting switches in subcompartments immediately below them. This arrangement not only enables the operator to see both simultaneously and reduces length of circuits, but minimizes the possibility of communicating to the bus room any flames or gases arising from the circuit breakers or accidental opening of disconnecting switches in loaded circuits. Passage of conducting gases from one switch cell to another is minimized by vertical barriers separating individual tanks and vertical ribs on these barriers separating adjacent cell doors. The spreading of gases is further prevented by artificial ventilation.



ULTIMATE AND TEMPORARY CONNECTIONS OF MAIN ELECTRICAL CIRCUITS

In the ceiling directly over each circuit breaker inserts are provided for eyebolts to be used in dismounting circuit breakers. At one end of the room is a tap and drain connected directly with an oil tank and filter in another part of the station so that circuit-breaker tanks may be filled without leaving the room.

The 11,000-volt buses are supported on special glazed insulators so attached to a concrete wall forming the back of the bus compartment as to be in compression under short-circuit stresses. Between the buses are precast concrete slabs which carry nothing more than their own assembled weights. The main supporting wall also serves as a barrier to the passage of any gases between the bus compartment and circuit connections. Access to the buses is afforded only from the passageway through openings covered with asbestos doors. All insulators supporting 11,000-volt circuits outside of the main buses are of the post type with a smooth white porcelain finish that minimizes the collection of dust and makes it conspicuous if it does accumulate.

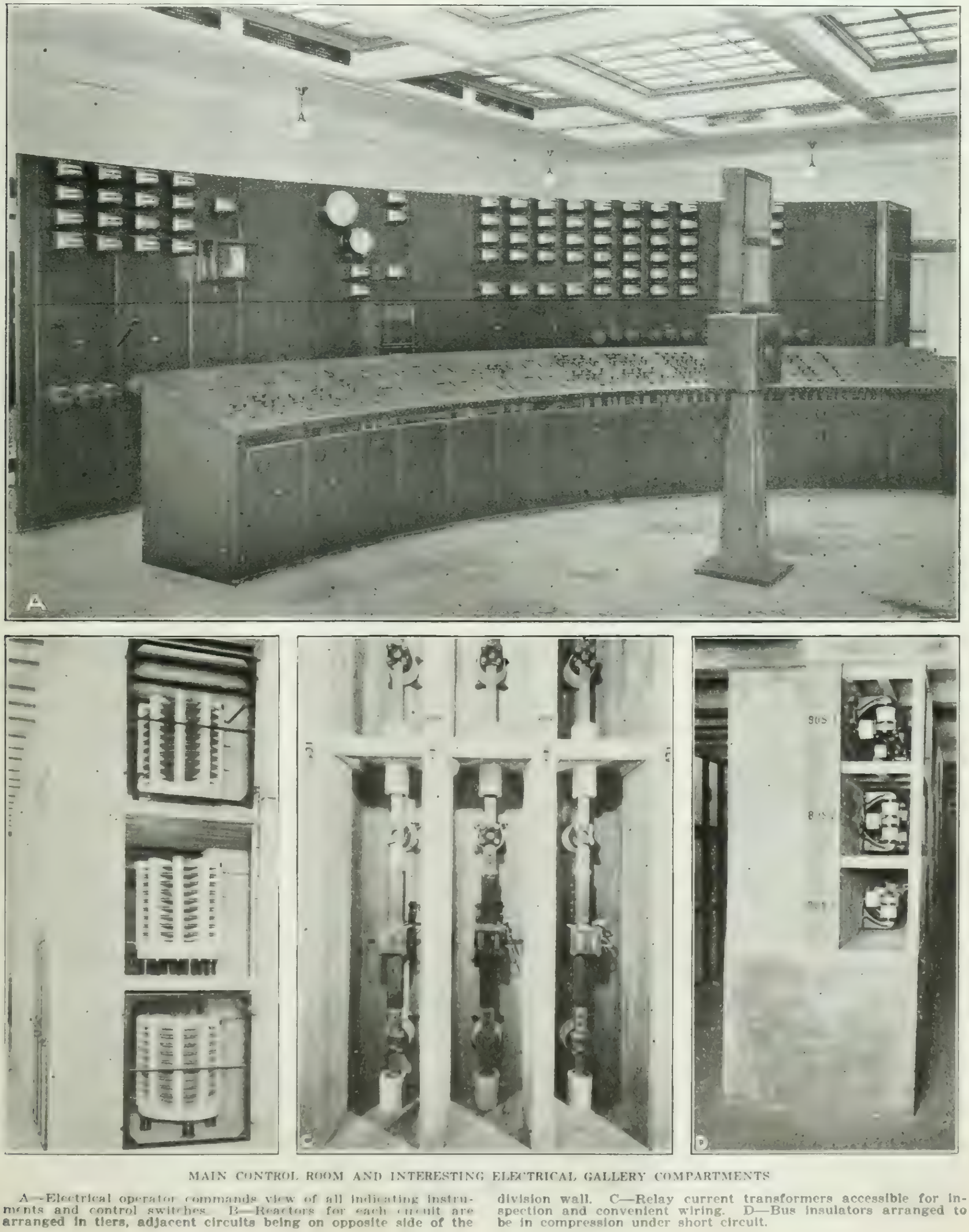
To facilitate ventilation, inspection and cleaning of the reactors on the floor below, the three units for each circuit will be arranged in tiers, one above the other, those for adjacent circuits being on opposite sides of a central division wall. The reactor compartments are made of concrete brick with concrete shelves.

Along the outer station wall in the reactor room are all feeder potential transformer compartments. There are two transformers per circuit. Each one is supplied with two fuses having series protective resistors designed to limit the current and consequently the gases resulting from fuse explosion.

From the electrical bay the 11,000-volt outgoing circuits run into the cable house, where they connect with potheads directly above the corresponding underground ducts. Above the potheads are double-throw switches which make it possible to connect them either to ground or to a circuit from the electrical bay. If it is necessary to provide additional circuit breakers in the outgoing circuits, they may be placed directly above the cable house. Arrangements are such that within a feeder section any feeder may be connected with any underground cable at any time, thus eliminating cable crosses in manholes.

In line with the most modern accepted practice, the control of the main generators, electrical circuits and switches is centered in a benchboard back of which is a vertical panelboard bearing the principal instruments required in operating these switches. The relays are also mounted thereon. Parallel and back of this board is another vertical panelboard carrying the watt-hour meters and curve-drawing instruments. Between the boards in the floor is a pull box approximately 1 ft. deep into which all instrument and control circuits are brought. All wiring in this box is encased in flexible metal conduit, the panel wires being brought up through the metal floor plates to terminal boards at the base of the panel on which test links are provided for the calibration of instruments and meters. The 11,000-volt side of the station-service transformers is also controlled from the main operating room.

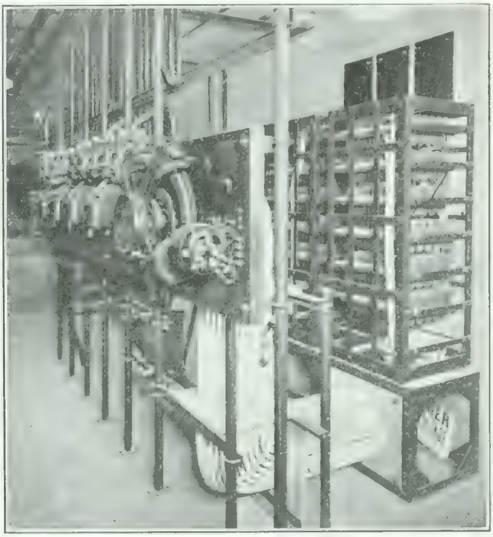
In addition to the usual instruments provided, each generator circuit is equipped with a wattless component indicator, a temperature indicator, an ammeter in the



MAIN CONTROL ROOM AND INTERESTING ELECTRICAL GALLERY COMPARTMENTS

A—Electrical operator commands view of all indicating instruments and control switches. B—Reactors for each circuit are arranged in tiers, adjacent circuits being on opposite side of the division wall. C—Relay current transformers accessible for inspection and convenient wiring. D—Bus insulators arranged to be in compression under short circuit.

neutral ground circuit, and provision for a printometer demand indicator. The 11,000-volt feeder panels also have wattless-component indicators and provision for graphic wattmeters and demand printometers. All graphic-instrument mechanisms are operated by small synchronous motors controlled from a master-frequency source.


GENERATOR AND EXCITER FIELD RHEOSTATS ARE BELOW GENERATOR PLATFORM AND REMOTELY CONTROLLED

Convenient to the control bench is a signal stand for exchanging signals with the boiler room and turbine hall. Signs indicate the signals sent and received. The load bulletin boards in the boiler room and turbine room are also controlled from this stand. Another feature which helps the chief operator is an annunciator board on which all signals are received, such as opening of circuit breakers, excessive temperatures in apparatus and similar conditions.

THOROUGH RELAY PROTECTION

Each generator circuit is protected by differential relays operated from current transformers in both ends of each phase winding. These relays trip the two main oil circuit breakers, the neutral oil circuit breaker, the generator field switch, and the turbine throttle in case of trouble inside the unit. Each 11,000-volt feeder circuit is protected by induction overload relays. Four tie lines connect with Dutch Point station. These are protected at each end by balanced relays which will open the circuit breakers only in case of trouble in the tie lines themselves. The station transformers have differential relay protection.

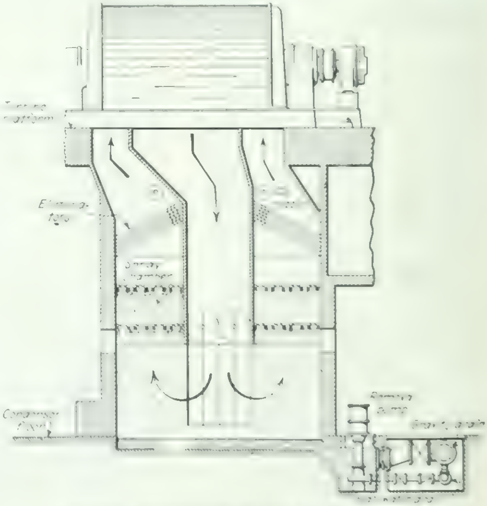
All relays are connected to current transformers having primaries of the bar type to withstand short-circuit stresses. These current transformers are located between the protective reactors and the buses. All instruments are operated from a separate set of current transformers, which in the case of circuits of less than 1,000-amp. capacity are not of the bar type. The instrument transformers are so located in the circuit that the protective reactors are between them and the buses.

In general all station service motors rated at 50 hp. or more are designed for 2,300-volt operation. Smaller units are designed for 220-volt operation. With the exception of a few motors rated at 2½ hp. or less, all the motors are protected by automatic control. The small units are provided with fuses connected in such a way that rupture of a fuse in any phase will open the other phases and thus prevent single-phase operation.

The transformers to serve the 2,300-volt auxiliaries are installed outdoors. Ultimately there will be three banks of station-power transformers, any two of which will be sufficient to carry all station auxiliaries, each bank consisting of three 1,000-kva., single-phase, self-cooled, 11,000/2,300-volt transformers connected delta-delta. Only four of these transformers are installed now. They are connected in two open-delta banks, either bank being sufficient to care for the existing equipment. These transformers are connected to a 2,300-volt ring bus, divided ultimately into three sections. All important 2,300-volt circuits may be supplied from any one of the bus sections, any two of which are sufficient to carry the entire load.

The 220-volt auxiliaries are served by 2,300/230-volt transformers. For the auxiliaries in the turbine room and the electrical bay two banks will ultimately be provided. The boiler-house auxiliaries will have two similar banks. Only one-half of these units are installed, each bank consisting of three 150-kva. units.

Truck-type switchboards installed beneath the electrical bay on a level with the condenser floor control the 2,300-volt side of the station-service transformers and 2,300-volt auxiliaries. This type of board is used because the men who will operate it are not especially familiar with electrical apparatus. A switchboard of the usual type, also in the station-service room, controls the 220-volt auxiliary circuits. A second auxiliary-power room is provided in the basement of the turbine room.



RECIRCULATION OF GENERATOR VENTILATING AIR PERMITTED BY SPRAY COOLING

The firing aisle in the boiler house, the main turbine room, the switchboard operating room and the load dispatcher's room all obtain natural lighting through skylights in the roof. Artificial lighting is so provided in the boiler house that the firing aisle and space over and back of the boilers is amply illuminated, special lighting being added directly over the stokers, at the water columns, instruments, valves and other points where light is of particular importance. All fixtures in the boiler house have cast-iron outlet boxes with cast-iron hoods and steel reflectors. The sockets are arranged so that smoke and fumes cannot reach the interior. In the ash cellar and similar locations vapor-proof fittings are used and heavy guards are provided wherever necessary.

LIGHTING AND VENTILATION

The turbine room is lighted from industrial-type fixtures suspended from the overhead trusses arranged so that general illumination is provided on the condenser floor as well as on the turbine platform. Local lighting around the condensers and auxiliaries is also provided in addition. All of the lighting is supplied normally from lighting transformers with automatic regulators, but in case of trouble on the alternating-current circuits a part of the lamps are automatically connected to the control battery.

The reactors and bus rooms depend entirely on artificial illumination, the circuits being supplied from panels installed in the south end of each room, adjacent to the main operating stairway. Outside these rooms in the adjacent hallways are emergency circuit switches, and in the doors are wired-glass panels covered by a metal slide so that an operator can view the conditions existing in the room before entering. The main switchboard control room is artificially lighted by lamps placed above a glazed ceiling directly under the skylight, thus affording well-diffused light on the switchboard, day or night. Emergency lights are also provided in this room, which are always connected directly to the station battery.

The electrical bay is provided with a ventilating system for all floors, which will prevent the accumulation of heat in such locations as the reactor room and will also quickly remove smoke and gas in case of circuit-breaker trouble. Provision is made so that in cold weather the incoming air can be heated to some extent. Such additional local heating as may be necessary for working comfortably in these rooms during extreme weather will be furnished by electric heaters connected through plug outlets to circuits carried in the walls of the electrical bay.

In general all circuits of 2,300 volts or higher are carried in varnished-cambric cables, and all cables of 750,000 circ.mils or above are provided with rope cores. All control and signal circuits have 30 per cent Para rubber insulation, and all circuits in the boiler house, whether for light or power, are insulated with varnished cambric. All other lighting circuits have the usual type of National Electrical Code insulation.

The information on which the foregoing discussion is based was obtained from T. H. Soren, vice-president of the Hartford Electric Light Company, and engineers of Stone & Webster, Inc.

DETAILS OF PRINCIPAL ELECTRICAL EQUIPMENT IN SOUTH MEADOW STATION

Station Service Transformers.—Four 1,000-kva., 11,000/2,300-volt outdoor self-cooled units; six 150-kva., 2,300/230-115-volt; one 100-kva.; one 50-kva.; one 17½-kva., 2,300-230-volt automatic lighting regulator (all General Electric).

Protective Reactors.—Fifteen 250-amp., 15 per cent drop, single-phase reactors with shunt resistors (General Electric).

Ground Resistor.—One 5-ohm, 1,300-amp. (one minute) cast grid resistor (General Electric).

Switching Equipment (11,000-Volt Circuits).—H-9 and H-6 oil circuit breakers, disconnecting switches, switchboards, instruments and instrument transformers (General Electric).

Switching Equipment (2,300-Volt and 220-Volt Circuits).—Truck-type switchboard with K-32A oil circuit breakers and panelboards with K-35 circuit breakers (General Electric).

Storage Battery.—One 60-cell, E-15 154 amp.-hr. battery (Electric Storage Battery Company).

Turbine Signals and Load Bulletins.—Operating pedestal with miniature signs and load bulletins in turbine and boiler room (Q-F Signal Company).

Lighting Cabinets.—Double-door, dead-front type with tumbler switches and cartridge fuse (Benjamin Electric Company and Wetmore Savage Company).

Bus and Cable Supports.—Post and bracket type heavy-duty insulators (General Electric).

Wire and Cable.—Varnished cambric and 30 per cent para rubber insulation (General Electric).

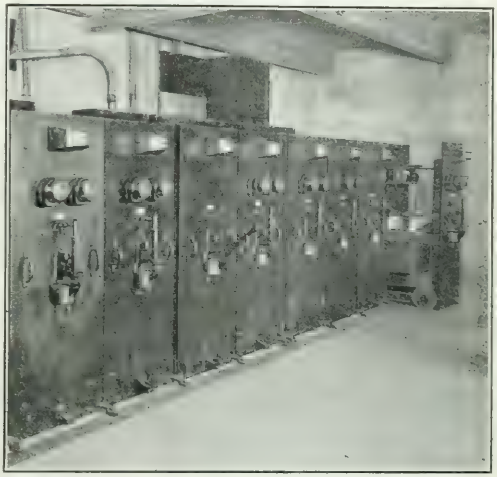
Porcelain Bushings.—11,000-volt floor and wall tubes (Ohio Brass Company and Locke Insulator Manufacturing Company).

Interior Lighting Fixtures.—Pettingell-Andrews Company, Benjamin Electric Manufacturing Company, Holophane Glass Company, Hart & Hegeman Manufacturing Company, National Company.

Yard-Lighting Fixtures.—Floodlamps (General Electric).

Safety Switches.—Inclosed knife switches (Trumbull Electric Manufacturing Company).

Terminals.—Cast copper (Electric Power Equipment Corporation).



TRUCK-TYPE SWITCHES CONTROL THE 2,300-VOLT STATION-SERVICE AUXILIARIES

Important Accomplishments of the Geological Survey

IN HIS annual report, submitted to Congress on Dec. 7, the Secretary of the Interior lists the following among the important achievements of the Geological Survey during the last fiscal year:

Made surveys in five states for the purpose of classifying lands with relation to their value in connection with the development of water power.

Made reports increasing the power-site reserves from 2,500,000 acres to more than 3,700,000 acres.

Prepared statistical reports on the production of electricity and the consumption of fuel by public utility power plants and continued mapping of transmission lines and power stations.

Prepared and published maps showing power stations and transmission lines in Maine, New Hampshire, Vermont, Massachusetts, Connecticut, Rhode Island, New Jersey, Delaware and Maryland and assembled data for similar maps of other states.

Conducted an engineering investigation and prepared an exhaustive report on a proposed "Superpower System"—a comprehensive system for the generation and distribution of electricity for the operation of railroads and manufacturing industries in the region between Boston and Washington.

A Review of Some Rural-Line Fundamentals*

A Practical Presentation of the Reasons Why Rural Service Must Now Be Considered by Most Central Station Companies and the Course to Follow

By **J. C. MARTIN**
Western Editor ELECTRICAL WORLD

WHY is it, what is it, how shall it be handled, and what are the pitfalls to be avoided, are questions that every business man must answer in some sort of a reasonable way before he can attack any problem with a reasonable hope of finding a successful answer. In a brief way I would like to consider the rural-service problem from the several angles the questions indicate.

WHY IS RURAL SERVICE?

Five years ago the average utility operator east of the Missouri River and a large majority of those between the Rocky Mountains and the Missouri River would have unanimously chorused, "A farmer's fad." The utility men in the semi-arid territory of the mountain and coast states knew that to the farmers in their territory at least rural service was a vital factor in watering the land and making agriculture and the development of the territory possible. In spite of the difficulties involved and the new trails that must be broken an economic need lay back of the demand that would brook no refusal to attempt the solution. The issue in the Middle West and the East has been less clear-cut because the service did not bear so intimate a relation to the development of the territory, which, in fact, had already developed agriculturally without such service. With the war and its aftermath of high cost and scarce labor the farmers in these sections have been brought face to face with a necessity for reducing the cost and the drudgery of farm labor. The development of American farm machinery has accomplished much in this direction in the past fifty years, but those accomplishments are insufficient and economic need is relentlessly forcing the farmer to untried fields in his search for a solution.

The necessity of electric service in the modern home is just as important from an economic standpoint as is its need in the modern factory. It is hardly conceivable that those benefits can be barred to the rural home when, slowly but surely, the benefits of running water, sanitary equipment, home-heating plants and other conveniences have been brought to the farm. Inevitably the farmer has turned to the agency that has been so great an influence in the city home and the industrial life of the nation for help in meeting his problem. The American farm is an industrial establishment different only in form from the factory, and the rural home is simply an average American home.

WHAT IS RURAL SERVICE?

It is nothing more nor less, from a central-station distribution viewpoint, than the city or town distribution system carried into the country. There has been entirely too much discussion of rural distribution lines based on an assumption that they are a new and possibly a fearfully and wonderfully constructed animal that must be handled gingerly for fear it might turn out to be a bull in a china shop or something equally undesirable. The simple fact is that the lines differ from the city lines only in the fact that they are seldom built to carry more than two circuits and in many cases only one. The general weight of the construction may be lighter than the corresponding city lines.

From the viewpoint of load characteristics, available information is meager. The most important fact known is that under the present conditions line and transformer losses at least equal, if they do not exceed, the energy sold to the consumer. There are some indications that the power-factor conditions are such that more plant capacity is required to handle the farm load than would be required if the load were in the city.

The maintenance problems are more difficult and more expense is involved than in city work. The investment per customer is several times greater, but a pertinent fact that must be kept in mind in connection with both these matters is, that in giving the service you are virtually transporting the farm to the city. Of the two the taking of the service to the farm is an infinitely more practical and less expensive measure to the community than taking the farm family to town.

These are some of the principal facts. Our knowledge of their value is all too small. The remedy is comparatively easy to find if utility men will only take the trouble to select specific cases on their own systems and carefully study the results year by year for a few years. By this is meant not merely taking the total investment, maintenance and consumption figures the bookkeeper hands out but two or three typical cases on every system having such service should be taken and detail accounts set up to cover the various items of investment, operation and maintenance. Meters should be installed on the lines and other measures taken to obtain data.

HOW SHALL IT BE HANDLED?

This quesion has been the subject of more dodging and "buck-passing" than almost any other question before the Middle Western utility interests. It is a business proposition and not one of charity. A cardinal business principle is that every business must be profitable to the principals if it is to be continued. Each participant has something that the other can use to better advantage than he can. In this particular problem the cost factors are little known as yet, because utility men have not taken the trouble to find out what they are. The first step in handling business under such conditions is to sit down with each extension as it comes up and analyze it as you would if Jim Jones had asked you to supply power at a factory several miles away You are entitled to consider all the items of investment, fixed charges, maintenance and operating charges, return on the property involved in the service and the insurance against losses in the business. When you have evaluated all these items and estimated your consumption, you will find that you have no rates to cover. At this point the most serious blunders have been made. Men have not had the courage to ask, as a matter of business common sense, for a remunerative rate. Too many times it has been a case of plain cold feet caused by inability or unwillingness to analyze the problem thoroughly and an additional lack of sales ability to tell the would-be customer what it all means in terms that he can understand.

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*A paper presented before the Kansas Public Service Section of the N. E. L. A. at Hutchinson, Kan., Dec. 9, 1921.

The problem of financing is a difficult one, not merely because the rural service problem is new, but because just now almost any financing problem is difficult and a producer of gray hair for the unfortunate individual who must solve it. In some of the Eastern States the companies are financing the lines. In one case a rate of 20 per cent per year of the cost per customer is added to the rates covering the same service in the city territory as an excess cost charge. In Wisconsin, under the rules filed by several companies and approved by the commission, the farmer finances the extension and in addition to the regular city rates pays 10 per cent per annum plus the transformer-core losses at a fixed rate per kilowatt-hour as a rural charge for which he receives no energy. With allowances for interest on the investment this is approximately the same figure that the Eastern company referred to uses. Conditions have made this plan a necessity, but there are movements on foot that may subject it to serious attack. Permanent financing methods must be developed, but at the present time each utility must be governed by conditions.

An important factor in this service is the education of the farmer in the use of electricity. The manufacturer, the jobber and the dealer in electrical equipment must have a share in this, but the central-station company must be a leader because it is the first and last point of contact with the farmer. Take time to discuss the problem with the other members of the electrical industry in your territory and get them thinking straight, and then take it up with your farm equipment manufacturers and dealers. Get them interested in finding out how electric power may be best used on the farm and what adjustments in their present equipment must be made. Interest such farm papers as you can get to. You have information that they will be glad to get. If it comes from you, you will be in a strong position with them. Co-operate with your agricultural schools and through them reach their students.

PITFALLS TO BE AVOIDED

The first pitfall to be avoided is ownership and maintenance by the farmer. He does not and should not be expected to know the utility business. In most states, if forced to own and operate lines, mutual or actual utility companies, subject to the commission, must be formed. The growth of such companies would be parallel to the growth of the rural telephone companies. These companies form one of the most acute of our regulatory problems, and duplication of the problem in the electric service field, with the physical hazard due to the presence of the distribution voltages to be contended with, would be a calamity for the industry, not to mention the utility that might have such lines connected to its system. Utility ownership and responsibility for the lines involve difficulties, but they are of a moral character that can be solved. Regardless of the financing plan, the control of the lines must be in the hands of the utilities.

A most common error has been to build the lines and apply the city rate schedules. This is fatal. Some utilities in financing have forced the farmers to take company securities. In later customer-ownership campaigns it has been discovered that the farmers have looked on these securities as so much paper and on the money paid as the price of obtaining the service. In a market created by a real customer-ownership campaign these securities have been dumped with disastrous results.

Other companies have required the customer to advance money which is refunded later. If this is done without any strings as to revenue produced before the refunds are made, the utility is carrying the investment and must take account of the fact in its rate. Some have entirely overlooked the precaution. In general it is poor policy to mix rate schedules and financing.

THE RATE PROBLEM

In the present state of knowledge of the business it is unwise to attempt the establishment of a uniform system of rates over an entire system unless you are prepared to go into a long-drawn-out and extremely thorough study of the subject, and even then the results may not be worth the cost. It is well for the time being to take some set of rules, like that in use in Wisconsin, in which the fundamentals of costs are well covered and work out each case on its merits. This course involves more work, but the educational value of the plan is worth all that it costs and in the end will serve to prevent costly mistakes. Uniform rates on this business are probably not a safe thing to attempt, but a uniform method of computing rates for the individual extension is desirable and necessary if discrimination is to be avoided. For the present the Wisconsin method of adding the excess costs to the rate in the nearest town is desirable because it is anchored to a known quantity and is easiest to explain to the prospective customer. In the future I expect to see a rate with a fairly high fixed charge or rural-service charge, as it is more commonly called, with a very low energy rate, developed. Such a rate is psychologically correct because it brings home to the user the fact that he is buying a service. The low energy rate encourages him to use the service extensively because it is already paid for and the additional use is at small cost. This result will not be reached rapidly. There are too many things in the way, and established rates might be involved in an upset through a misunderstanding of the low rate as applied to rural service. The tendency would be to talk about the low energy rate and forget the fixed charges that actually bring the average rate to a much higher figure.

In the selection of line voltages do not make the mistake of selecting too low a voltage. Use lower voltages if you must to start with, but give yourself the utmost possible leeway in future increases with the minimum amount of reconstruction costs.

Above all, remember that you are selling service and not kilowatt-hours. Kilowatt-hours are a measure of that service. The price should no more be the same for all classes of service than the price of gold and lead should be assumed to be uniform because the weight of both is measured in pounds.

Letters from Our Readers

This is a readers' forum. Comments on questions before the electrical industry presenting economic, financial, engineering or commercial aspects and new or supplementary viewpoints on published articles are cordially invited

Attenuation of Line Current Essential for Radiation

To the Editors of the ELECTRICAL WORLD:

The proper interpretation of the declared potentials of Lorentz is so very important that any contribution to the subject should be welcomed. It is not clear, however, that Dr. Carson has clarified the problem of how radiation takes place by attacking the views of Dr. C. P. Steinmetz. (See *Proceedings A. I. E. E.*, October, 1921.)

It would seem that the former had proved his case by referring to the writings of Maxwell, Mie, etc., though Abraham of Göttingen and his ellipsoidal oscillator might also have been mentioned. If, then, "sauce for the goose is sauce for the gander," how does the mere fact that Lorentz expresses his "fundamental equations" in terms of a deferred system of potentials help matters along? At best, so far as Steinmetz is concerned, the question is wholly one of degree and not kind. Then what becomes of Maxwell himself in the light of the newer twist that is being given to Maxwell's theory?

The fact of the matter is that though the solution of the equation

$$\triangle \psi - \frac{1}{c^2}\frac{\delta^2 \psi}{\delta t^2} = 0$$

(see Lorentz, "The Theory of Electrons," Leipzig, 1916, page 6, equation 6), is typical "for a disturbance of the state of equilibrium, traveling onward with the speed c," another type of solution is also typical of a stationary wave disturbance which necessarily is not of itself to be considered as traveling *outward* in the same sense. The truth is that Maxwell's theory leads both to stationary waves (Maxwell's instantaneous potentials) and the progressive waves that Lorentz has in mind, which latter call for the Lorentzian deferred potentials. The two types are coexistential and not necessarily exclusive as the text has led some to believe.

In a yet unpublished contribution on the subject I have shown that on the basis of the Heaviside-Hertz fundamental equations attenuation of the line current is absolutely essential for radiation to take place. This is contrary to the view of Dr. Carson, yet it is a little difficult to understand why he should have imposed the condition that attenuation takes place suddenly and completely at the end of the line, when in fact at the end of the physical line it is open-ended. Surely it is a known fact that radiation takes place laterally along an open-ended Squier transmission line.

In the above paper, having set up a progressive wave of potential ("voltaic" effect) and of current ("galvanic" effect), attenuating to zero at the open end of the line, radial radiation perpendicular to the line is found to be set up. It is this effect that the older theorists with their four line constants, R, L, C, g, which alone cannot represent a physical line, have been looking for. The overlooked constants are those of my paper before the (British) Institution of Electrical Engineers, which appeared in April last. The treatment was along the lines indicated in my December, 1920, paper before the Institute of Radio Engineers, but based upon the mathematical and physical conceptions of the I. E. E. paper.

So far as the Poynting condition is concerned the condenser effect ("voltaic") of the one part of the circuit was assumed to be perpendicular to the wire and therefore at right angles to the magnetic ("galvanic") effect H due to the current flowing in the rest of the antenna, or transmission-line circuit. In the latter writing the basis of the assumed phase angle ψ of the I. R. E. paper was given.

A. PRESS.

Washington, D. C.

Better Illumination Cuts Production Costs

To the Editors of the ELECTRICAL WORLD:

A question has been brought up regarding the article entitled "Better Illumination Cuts Production Costs," printed on page 763, ELECTRICAL WORLD, Oct. 15, 1921, bearing on the fact that four of the twenty operations indicated decrease in production under the higher levels of illumination. This question is indeed pertinent, although we had endeavored to bring out in the article the reasons which, from our close study during the test period, seemed fully to account for these apparent decreases.

The four operations which indicated losses in production are confined either to the drilling or the tapping class. However, it will be seen from the table in the article that of a total of five drilling operations only two indicated losses, and that of four tapping operations again only two indicated losses. Considering that if all of the drilling operations are grouped together and if all of the tapping operations are grouped together, as in the following table, the gains in production more than offset the apparent losses, it does not appear logical to assume that the indicated decreases were due to too much light. Especially does this become evident when it is considered that all of the drilling and all of the tapping operations were of the same class, and only varied in the size of hole or size of iron, and were in some cases even performed on the same machines. The following tables indicate the average change in production for all of the drilling and tapping operations:

Factory Operation Number	Factory Operation	Change in Production, per Cent
1 21	Drilling	23
6-G-43	Drilling	−12
62-3	Drilling	24
72-3	Drilling	
622-4	Drilling	−13
Average		4.4
1-33	Tapping	−12
6-G-44	Tapping	32
62-4	Tapping	24
922-4	Tapping	−11
Average		8.3

As the article emphasizes, the precision with which the data could be recorded and the variation in the run of material worked upon were such that it is dangerous to place too much weight on the exact percentage of gain or loss indicated for any one operation. For example, in the case of recording time, the time per operation in hours does not always refer to a continuous period, but rather in some cases it refers to a summation of somewhat short intervals of time, that is intervals of three or four hours. It was only possible to record the time to the nearest half hour, and while it is obvious that a total period of operation built up from a number of short periods will tend to eliminate inaccuracies due to the mental and physical state of the operator, it is also true that conclusions as to the exact change in production of any one operation may easily be faulty owing to this inaccuracy in tabulating time. Of course, when all of the figures are averaged to obtain the change in production of the shop as a whole, many possible sources of error such as those due to recording time and to variations in material have a tendency to average out.

Frankly, we feel that these four operations which showed a loss strikingly bring out the point that unavoidable errors or inaccuracies are almost certain to be introduced to a greater or less degree in any investigation conducted in order to determine the effect of any one factor, such as illumination, on factory efficiency. In outlining an investigation provisions therefore should be made for following such a plan as will average out these possible discrepancies. The test should be conducted over a considerable length of time and with a comparatively large number of men working in the test area or on the test operation. A close check should be kept on the quality of material furnished the men. An accountant or efficiency engineer who is well enough acquainted with the work to check and weigh the various factors entering into such an investigation should supervise the test thoroughout the entire operating period.

O. F. HAAS,
Engineering Department.
National Lamp Works of General Electric Company,
Nela Park, Cleveland, Ohio.

Possible Errors Through Use of Line Data

To the Editors of the ELECTRICAL WORLD:

In the issue of Nov. 19 an article by W. S. Guthrie of the Anaconda Copper Mining Company dealt with the possible errors through use of line data. Inasmuch as this article might be interpreted by some as a warning against the use of some transmission-line calculation charts of mine which were published in the ELECTRICAL WORLD on May 28, I would appreciate your publishing the following remarks concerning Mr. Guthrie's statements:

The transmission-line calculation charts were developed for the purpose of allowing rapid calculations to be made of practical lines with very little labor. The text of the article with the chart says that in most cases the charts will give less than a 2 per cent error, and in very few cases is the error as great as 3 per cent.

An examination of Mr. Guthrie's calculation shows that the resistance value used is twice the resistance of one mile of No. 4/0 line; that is, the resistance of No. 4/0 per mile is approximately 0.266 ohm, instead of 0.53 ohm per mile. The calculation when carried through with the proper resistance value gives a drop of 80 volts per mile instead of 118 for the 2,200-volt line, and a drop of 85.8 volts per mile instead of 171.8 volts for the 173-volt line. By this method of calculation, then, there is a difference of 5.8 volts per mile in the drop with the two receiving voltages taken.

Even this small difference, however, would not occur in any practical case, because no engineer lays out a line with a 49.5 per cent voltage drop in one mile. To deliver the odd voltage of 173 volts over a No. 4/0 line with a load of 100 amp. at one mile distance, it is necessary to carry 258.8 volts at the generator. If we reduce the load or the distance to such a point that we get even the excessively large drop of 20 per cent, there is then a difference of 1.45 per cent between the values from Mr. Guthrie's calculation and the values from my charts. If we take a voltage drop of 10 per cent, which is the commonly accepted standard, there is a difference of 0.3 per cent between voltage as calculated by Mr. Guthrie's method and as taken from my transmission-line calculation charts.

The above examples are given simply for the purpose of showing that the charts are accurate within the limits stated and that it is safe to use them.

E. P. PECK,
General Superintendent Electrical Department.
Utica Gas & Electric Company, Utica, N. Y.

Switzerland's Hydro-Electric Plants Rated at 504,500 Kw. as of 1919

To the Editors of the ELECTRICAL WORLD:

The total energy available in 1914 in the whole of Switzerland was, according to a report of the Swiss Water Board, estimated at 4,000,000 hp., based upon an average of fifteen hours' working time at the power stations. Of this energy there was in use on Jan. 1, 1914, 500,000 hp. The new power stations erected and in course of construction from Jan. 1, 1914, up to Dec. 31, 1920, furnish about 300,000 hp., so that on Jan. 1, 1921, about 3,200,000 hp., four-fifths of the energy available, was still to be exploited. On Jan. 1, 1914, the total number of water-power stations was 6,860, of which 6,025, with an average total net capacity of 39,000 hp., had a minimum constant capacity of less than 20 hp.; 835, with an average total net capacity of 487,000 hp., a minimum constant capacity of 20 hp. and more, and only six a minimum constant capacity of 10,000 hp. and more.

The Swiss Electrotechnical Association has collected some figures regarding the situation at the end of the year 1919. The number of enterprises increased only from 1,185 to 1,285, nor has the number of places using electrical energy grown to any extent. This is due to the fact that there are scarcely any villages in Switzerland into which electricity had not already penetrated. With the exception of the population living in mountainous districts away from the road, it may be said that today electricity is at the disposal of all the inhabitants. In fact, Switzerland is declared to be the most completely electrified country in the world at the present time. The possible capacity of the hydro-electric power stations amounted in 1919 to 504,500 kw., with steam reserves of 66,500 kw. The electrical energy delivered in 1919 was 1,846,000,000 kw.-hr., of which steam plants produced 2,235,000 kw.-hr. These figures exclude the production of the Swiss Federal Railways and other producers which consume their own energy.

During the year 1921 the exports of electrical energy were as follows: To Germany, 36,610 kw.; to France, 24,296 kw., and to Italy, 46,859 kw., or a total of 107,765 kw. The total number of kilowatt-hours exported amounted in the year 1920 to 378,000,000, of which 221,000,000 were exported in the six-month period between April 1 and Sept. 30. HENRY L. GEISSEL.

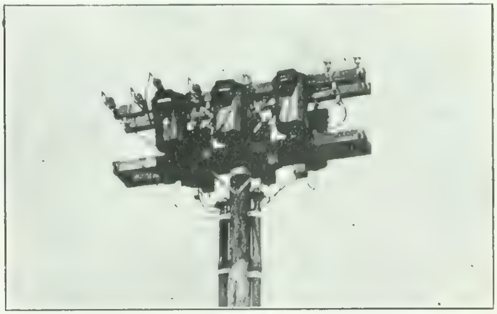
Thoune, Switzerland.

Industrial and Station Practice

Installation, Operation and Maintenance of
Generating and Distribution Equipment and Economical Utilization of Electrical Energy
in Mills and Factories, Including Testing and Repair Methods

Six Transformers Hung on One Pole Reduce Cost of Distribution

IN AN installation in southern California, where it was necessary to reduce the cost of a street-lighting installation to the minimum, it was found feasible to install six transformers on one pole, as shown in the accompanying cut. The transformers were 4-kva., type SL, 6.6-amp. to 6.6-amp., and were insulated for 10,000 volts. A saving of approximately 50 per cent was effected over installing these transformers on two separate poles. The reason they were all installed on one pole, other than the saving in cost, was that they feed six underground circuits. If the transformers had been on two poles, it would have been necessary to extend half the underground circuits one span.



CONCENTRATED TRANSFORMER INSTALLATION REDUCES STREET-LIGHTING COSTS

Southern California Edison Co., N. B. HINSON,
Los Angeles, Cal. Engineer of Distribution.

Radio Communication Between Power Stations and Substations

CONSIDERABLE attention is being directed to the utilization of radio communication between power stations and substations in Germany, according to a lecture recently delivered before the German Institution of Electrical Engineers at Hanover by Count Arco. Since with free radiation the power required increases approximately with the seventh power of the distance, more attention is being given to so-called "wired wireless." The transmission loss is less, and the atmospheric disturbance is practically nil compared with free radiation. Some trouble was experienced with line choke coils obstructing communication, but this difficulty has been overcome to a great extent.

Several radio installations for public utility service have been made by the German Company for Wireless Telegraphy, the most important being that at Golpa-Rummelsburg, with a transmitting radius of 135 km., and another at the Schichau works at Elbing rated at 50 km.

For supplying power to the cathode-tube generators a small battery is used to impress 10 volts across the incandescent filament, and another source of power, generally a rotary converter, impresses about 600 volts direct current on the anode. The cathode tube is connected up on Meissner's principle and delivers a constant amount of energy at a known amplitude and frequency. From this oscillating circuit the power is transmitted to the line, preferably on the Lecher system. This consists of two wires, about 100 m. long, which are mounted on the transmission line supports, and run parallel to the lines for a few meters. Both wires are coupled through a coil to the oscillating circuit of the generator. The efficiency of this kind of transmission is high when two wires are more closely coupled to two of the transmitting lines than to the rest. With the ordinary system of transmission lines this is easily possible. Thus there is very little free radiation, and most of the energy is communicated to the two transmission lines. A similar arrangement is used at the receiving end. The direct current is, if necessary, intensified by a low-frequency cathode tube and then transmitted to the telephone. It is specially necessary to see that at the receiving end there are no high harmonics superimposed on the direct current, as frequently happens with dynamos, commutators and brushes, and special arrangements must be made with this object in view. By using different transmitting wave lengths at the two ends it is possible for both persons to speak at the same time, and this has undoubted advantages. The difference in wave length must be fairly considerable. Any disturbance due to such a cause can be obviated by the use of a tuned choke-coil circuit. The wave lengths cause certain complications if there are a number of substations; but it is possible to deal with this by automatic apparatus. Modern cathode tubes have a very high vacuum and give constant results if the auxiliary apparatus is kept in good order. Slight changes may be due to alterations in the dielectric, but the factor of safety is so high that this produces very little result. With this directional telephony the intensity at the receiving end is very high; therefore, if a simple rectifier is used, it is possible to employ an ordinary moving-coil instrument or a polarized relay of high sensitiveness to operate the local bell circuit

Special apparatus has been developed for communicating when the lines are completely severed. This apparatus may be obtained in portable form and is small enough to be carried by hand or in a motor car. It involves an emergency antenna like that ordinarily employed for free radiation.

Apparatus has usually been designed for stations of a given size, so that in passing from one size to the next there is generally a considerable difference in cost. In the cost of maintenance the expense of new tubes is the greatest item. The main thing is only to use the tubes when they are wanted and to get tubes that have the longest possible life. The lives of tubes have been much improved of late, and further improvements are likely. If they are kept at a low temperature, the life is correspondingly improved. No doubt the tubes are then less efficient, but the cost of a little extra energy is not so great as the cost of the new tube. Usually the cost of radio is prohibitive, compared with wired telephony, when the distance between stations is less than 20 km., owing to the investment required in apparatus.

Central-Station Service Halves Hotel's Power Costs

IT IS coming to be a well-recognized fact that in the vast majority of cases the cost of purchasing central-station energy is considerably less than the cost of generating power in a small individual plant. An interesting example giving concrete figures in proof of this statement is that of the change-over from an isolated power plant to the use of central-station energy by the Hotel Stenton, Philadelphia. In this hotel the expenses for heat and power have been reduced practically 50 per cent by shutting down the power plant and adopting the various equipment to the use of purchased electricity.

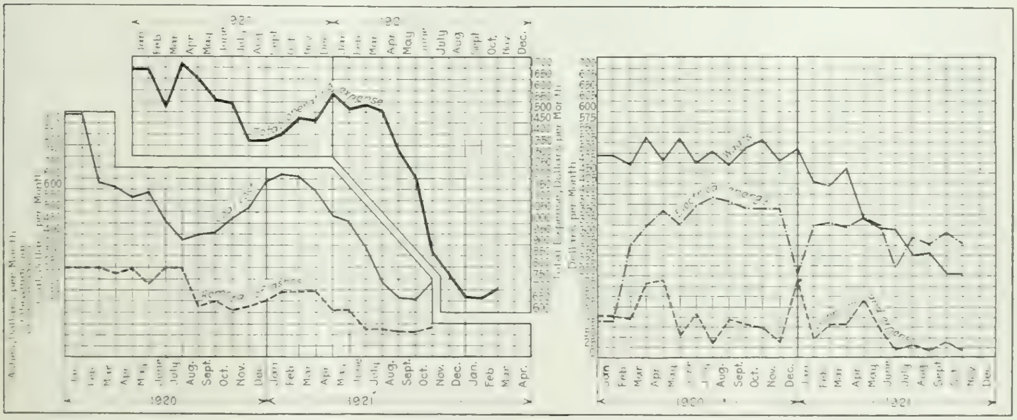
Concretely stated, the total operating cost averaged $1,525 per month during August, September ond October, 1920. During the same three months of the year 1921 it was $712 less per month. This saving was made at a total cost of $6,251.38 for all the improvements to light, heat and power equipment.

Among the most important changes are the substitution of an electric elevator for the old-type hydraulic one and the substitution of centrifugal pumps for house water service, boiler feed, heating return, etc.

In the new installation the electric elevator requires 7½-hp. motor, the ice machine requires 12 hp., and the motors for driving the centrifugal pumps are rated one at 5 hp., two at 2 hp. and one at ½ hp. The plant formerly had two 80-hp. boilers operated at 90 lb. to 100 lb. pressure. The only boiler required now is for low-pressure steam used in heating. This is an 80-hp. boiler operating at about 20 lb. pressure.

In examining the curves showing the costs of various items it should be borne in mind that these changes were not started until March and April of this year and were not fully completed until August, at which time the labor cost was brought down to the final minimum. Except in the month of January, 1920, this plant was making use of purchased energy for its lighting requirements, at the same time running various pumps, elevators, etc., by means of high-pressure steam. Savings in this case are therefore due largely to the fact that high-pressure steam was done away with in such a manner as to insure all of the economies possible through the low-pressure steam and purchased electricity system.

Special attention should be called to the fact that the new system of operation precludes much of the waste incurred in private-plant operation. The reduction in operating costs is self-guarded, being in many cases under automatic mechanical control, free from errors of human attendance. With two men the plant is now operated at higher efficiency than formerly when it required four or five men to maintain the high-pressure steam. These men were also furnished meals, the expense for which has not been included in the figures submitted.



OPERATING EXPENSES HAVE DROPPED TO HALF SINCE CENTRAL-STATION POWER WAS ADOPTED

It will be noticed that the cost of purchased electricity has not shown a material increase. The reason for this is that the rate under which the energy is being purchased at the present time has been changed so that, although more energy is required, the total cost is no greater than it was previously. This is due to the fact that the previous service was in the nature of a breakdown service, and the rate was very much higher in proportion to the energy used. Thus under present conditions, where the rate is properly chosen to meet the demands of the hotel in the most economical manner, the total cost is not materially increased.

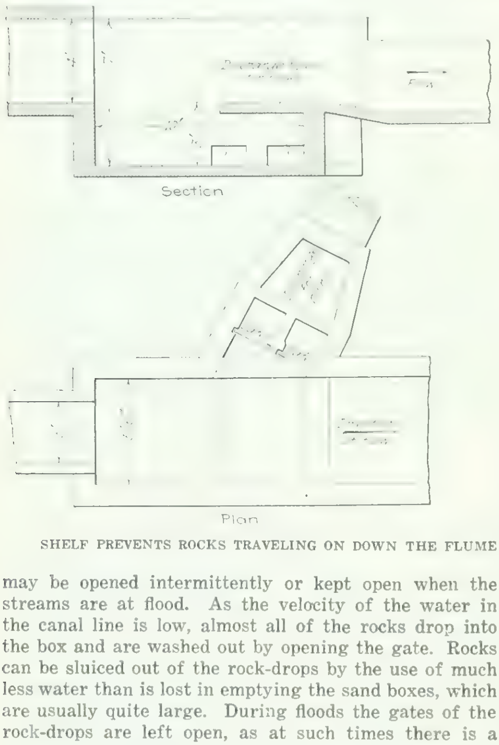
Credit must be given to Arthur F. Heeb, manager of the Hotel Stenton, for the completeness of the operating data which are available. Moreover, it is the thorough and efficient manner of operation of the equipment which is largely responsible for the excellent economies shown.

J. KEARSLEY M. HARRISON,
Harrison & Company, Engineer.
Philadelphia, Pa.

Rock-Drop Prevents Rocks and Gravel Entering Flume Line

As sand boxes have not always proved effective, the Southern California Edison Company has designed a rock-drop which is installed between the intakes and the sand boxes of its smaller hydro-electric stations to catch the great quantities of small rocks and sand entering the intakes of the plants taking their water from mountain streams subject to floods and flowing at high velocities.

At a suitable point in the canal line the rock-drop is placed so that water may be discharged from it without danger of causing washes. As shown in the illustration, these rock-drops are simply boxes built into a concrete section of the canal line and equipped with gates which may be opened intermittently or kept open when the streams are at flood. As the velocity of the water in the canal line is low, almost all of the rocks drop into the box and are washed out by opening the gate. Rocks can be sluiced out of the rock-drops by the use of much less water than is lost in emptying the sand boxes, which are usually quite large. During floods the gates of the rock-drops are left open, as at such times there is a surplus of water.



SHELF PREVENTS ROCKS TRAVELING ON DOWN THE FLUME

J. W. ANDREE,
Assistant Superintendent of Generation.
Southern California Edison Company,
Los Angeles, Cal.

Iowa Utilities Developing Old Mill Sites

The utilization of old mill dams by power companies is an interesting electrical development of Iowa. In the fifties, sixties and seventies, when Iowa was frontier territory and there were few railroads in the state, every river and stream had its grist and flour mills. Most of these long ago closed their doors; some are still running as feed mills; a few are still real flour mills, though without the prestige of bygone days. Within the last fifteen years power companies have been giving more and more attention to these old-time power plants and in many instances have taken them over. A good illustration is the Northeastern Iowa Power Company of Clermont, Iowa. By the installation of modern machinery this company has been successful in developing and improving such water powers so that maximum power is obtained from a minimum amount of water. As it has added more power it has gradually extended its lines, until now it has more than 200 miles of transmission lines and is serving towns and villages and many farms in five different Iowa counties. Some of the farms are the same ones which in early days used to depend on the mills to grind their grist for them. The Northeastern Iowa Power Company has an interchange connection with the Citizens' Gas & Electric Company of Waterloo, Iowa.

Special Types of Lamps Improved During Last Year

Marked advances in the application of lighting equipment to commercial purposes, coupled with a wider recognition of the importance of individual treatment of illumination problems and development of special types of lamps, were emphasized as the chief signs of progress by the committee on progress, which presented its report at the recent Rochester (N. Y.) convention of the Illuminating Engineering Society. In seventy-three closely printed pages the year's developments are chronicled succinctly and with breadth of vision. General progress, followed by developments in street lighting, exterior and interior illumination, fixtures, physics and other aspects of the subject of modern lighting, are treated with skill and discrimination. A résumé of the more important general and street-lighting matters discussed is given below.

Developments in light sources have not been marked, but notable advances have been made in lamps for special purposes, including projection, automobile and sign lamps, motion-picture apparatus and miners' lamps. For stereopticon work a 300-watt, 28-32-volt gas-filled lamp in a short tubular bulb has been listed. It is announced that in Germany a new high-current arc lamp for motion-picture projection has been successfully produced, in which the upper carbon is horizontal and the lower is inclined at about 60 deg. from the horizontal. Formerly it was difficult to keep the arc steady above 30 amp., but the new lamp is reported to work satisfactorily up to 80 amp. on both direct and alternating current, through magnetic control of the arc. Simplified mechanism is a feature, and only two hand adjustments are required on this development as now introduced into America.

An improvement in the Beck type of high-intensity arc lamp for projection work is obtained by using greater currents with smaller carbons of the cored type, in which the metal fluorides are replaced by oxides. The area of the carbons is reduced to about 20 per cent of that of the ordinary type, with a resultant electrode brightness of 1,260 candles per square millimeter. By using a magnetic field the current density in United States Army searchlamps was increased from 0.15 amps. per square millimeter to 0.35 amps., with an increase of 50 per cent in the total luminous flux. An improved French stereopticon lamp is also reported for opaque projection, this outfit having reflectors behind the source of light and short-focus lenses for concentration. In a new miner's lamp improved fittings and well-distributed weight are features.

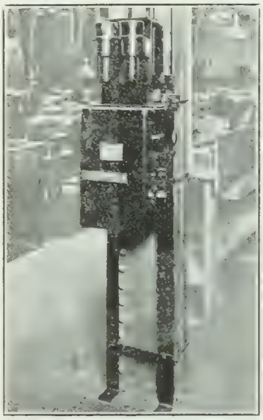
Simplification of the quartz burner has been achieved in mercury-vapor lamp design through the development of a means of connecting quartz through intermediate steps of glasses of increasing coefficients of expansion to a glass fused directly to a metal lead-in wire and forming with it a permanent vacuum-tight seal capable of withstanding high temperatures. This has made it possible to use an anode electrode of infusible tungsten instead of mercury, and the lamp does not require the former elaborate cooling devices. A neon-vapor lamp rated at ¼ cp., 110 volts and upward on alternating-current supply and 150 volts and upward on direct-current and consuming 5 watts has been introduced into England as a night light. The claimed life is over 1,000 hours. Neon lamps with automatic starting features, with a claimed energy consumption of 0.5 watt per candlepower, are being made in Germany. In addition to emergency and long-hour uses, it is suggested that these units be utilized to indicate switch positions, fuse openings, motor-service continuity, etc., through parallel connection. Researches on the production of low-voltage arcs in a mercury-vapor atmosphere indicate a linear relation between striking voltage and current through the cathode for the larger currents. With tungsten cathodes 3.2 volts was noted as a minimum striking potential compared with 4.9 volts with lime-coated platinum cathodes.

It is expected that 1921 will see the virtual elimination of the carbon-filament lamp in American manufacture. Gas-filled tungsten lamps represented 20 per cent of all tungsten lamps disposed of in 1920 as against 19 per cent in 1919 and 13.7 per cent in 1918. The use of carbon-filament lamps increased in Germany about 5 per cent from 1918 to 1920. In this country the average candlepower, watts and efficiency all show an increase due to the greater proportion of gas-filled lamps used. The effort here to standardize at 110, 115 and 125 volts is progressing, 80 per cent of the present demand being for these voltages, while of 481 central-station companies 96 per cent are using these voltages exclusively, as against 79 per cent in 1920. New lamps have been reported in the street series, stereopticon and sign classes. For the first-mentioned a 2,500-cp., 20-amp. unit has been made available, and this constitutes the highest candlepower source in this type. The current is derived from a compensator or transformer from regular alternating-current series circuits. A decided advance in the sign-lighting field is recorded in the advent by the production of 25-watt and 50-watt, 110-125-volt vacuum lamps in short pear-shaped bluish-colored bulbs with the filament in a plane perpendicular to the lamp axis. This gives maximum candlepower in the direction of the tip, and the lamps are rugged and compact. Double and three-filament lamps of the gas-filled type have also been developed for automobile headlight service within the year. For automobile lamps voltage conditions in service have been studied, and as a result changes will be made which it is expected will result in increased efficiency and brilliancy.

Instead of by the so-called "useful life" performance, lamp service is this year evaluated in terms of average total life and mean efficiency during life, or on the basis of the average total life corrected to a stipulated mean efficiency during total life. Except as a primary standard, candlepower rating has been abandoned and all light measurements are expressed in lumens. Last January the lumen and lumens per watt were adopted by the larger lamp manufacturers as the official units in which to express the light output and efficiency of their product. A movement is afoot to label street series lamps in lumens, the candlepower rating being also printed to avoid conflict. It is hoped to have contracts changed so that the lumen rating will be specified.

Standardized Compensator Mounting on Steel Columns

TO MAKE relocations of compensators easy and inexpensive and to support these equipments in minimum space, their mounting on steel columns at the factory of the American Bosch Magneto Corporation of Springfield, Mass., has been standardized by the electrical department as shown in the accompanying photograph. The compensator is mounted on two vertical pieces of 2¼-in. x ½-in. strap-iron bent at right angles at their lower ends to form floor pieces. They are clamped to the column near the floor by ⅜-in. tie rods bolted through a 1-in. x ⅜-in. horizontal strap. Behind the compensator case they are bolted to two straps, ½ in. x 2¼ in. in section. The lead wires are carried above the compensator in vertical rigid conduit. The tie rods are bent around the inner edges of the column, forming hooks of convenient shape for a secure clamping effect. The use of narrow straps in these supports, with a U-shaped 1¼-in. x ⅛-in. strap behind the compensator case for direct attachment to the horizontal pieces, results in unusual economy of space, the equipment being practically flush with the column and forming little or no obstruction to free movement through aisles. LEO KRESSER.



COMPACT AND EASILY MOVED COMPENSATOR MOUNTING

American Bosch Magneto Corporation,
Springfield, Mass.

Signal Light Indicates When Rotary Brushes Are Raised

IN ORDER to give an indication to the operator of the position of the brushes on two rotary converters recently installed in a San Francisco substation, a switch has been placed on the frame of the machine and connected to the brush-lifting arm so that the circuit is closed when the brushes are down. This switch controls a lamp placed on the switchboard. If the lamp is lighted when the machine is being started, this is an indication to the operator that the brushes are down on the commutator and that they should be lifted. The switch used is an inclosed one such as is used on elevator doors to operate the control circuit. This type of switch was selected because in case of a flash on the commutator the switch housing would protect it against damage by fire. This information was contributed by J. E. Woodbridge, engineer for Ford, Bacon & Davis. FIELD EDITOR ELECTRICAL WORLD.

San Francisco, Cal.

Management and Policy

Embracing Central Station Commercial Organization and Management, Customer and Trade Relationships, Public and Financial Policies, Advertising, Selling and Service Methods

Progress of Electric Service in the South

In a Recent Letter, W. E. Clement, Commercial Manager of the New Orleans Railway & Light Company, Tells of Electrical Development in the South

IN THE older cities of the South there has been up to recently a large percentage of unwired homes. A number of these were among the better class of residences built long before the use of electricity became general, and the owners have been reluctant to put up with the inconvenience of having the houses wired while occupied. Where the wiring had already been done there was a great lack of convenience outlets. During the past few years, however, an interesting development has occurred in that a very considerable number of these large old Southern homes have been remodeled into apartment dwellings and properly wired in connection with the remodeling work. This condition has, of course, meant much new business where the electric service lines were already established.

W. E. CLEMENT

Electric appliances also have become a vital necessity on account of the high wages of servants and the newly experienced difficulty in obtaining help. The general prosperity of the past few years has also raised the standard of living among our laboring classes, so that today virtually every family, including even the negro population and excepting only the very poor, regards electricity as a necessity and not as a luxury. Electric appliances, even washing machines, are now in general use. The summer fan load has grown by leaps and bounds. Formerly one fan in a household was a luxury to be carried around from room to room. Now the tendency is to have a fan in each room in the house and to make very liberal use of it for long-hour operation.

The principal new development in the industrial load throughout the South during the past few years has been raw-water ice plants. In New Orleans we have added six such plants to our lines, ranging in capacity from 60 tons to 300 tons of ice per day. All the new plants are operating satisfactorily, and the indications are that electrically driven raw-water ice plants will gradually supplant the old types. This business offers a new type of load that is very attractive to the central-station company as it is off-peak; moreover, the consumption is heavy in summer and light in winter and results in a very distinct improvement in the yearly station load factor.

Another interesting development has been the use of electric power in harbor work. While this applies particularly to New Orleans, it applies also in a general way to a number of the Southern ports. About eighteen years ago a survey was made of the city of New Orleans from an electrical standpoint, and the possibilities for the use of electric power for loading and unloading ships in port was pointed out. While at that time we could not visualize this idea to any extent, it has now been realized.

During the past four or five years the immense public grain elevators and cotton warehouses have been erected on the river front, an inland waterway system is nearing completion, and remarkable developments in the revival of the river traffic are taking place. Central-station energy is used exclusively in connection with this terminal work and is reaching a total beyond all expectations of only a few years ago.

One Good Reason for Investing in Public Utility Stocks

UNDER the heading "You and Your Money" a sound argument in favor of investment in public utility securities is presented by the Consumers' Power Company of Jackson, Mich. Pointing to bankers' methods of investment, the statement reads:

"The national banks of the United States invested 40 per cent more of their funds in public utility securities in 1920 than in 1919. These banks know—the facts which guide their judgment should guide you in your personal savings.

"Are you getting the most out of your money? Do you get only 3 per cent or maybe 5 per cent? A percentage of 7.37 is more than double 3 per cent and it is 47 per cent more than 5 per cent. When it earns you such small figures in a bank that money is reinvested in the very security that you yourself can buy. Fifteen hundred and forty-eight Consumers' Power employees have invested in their company's preferred stock, which returns 7.37 per cent on the investment.

"Why not get the full profit your money will earn, right at the source?"

Starting New Customers Off with Right Impressions of the Company

FIRST impressions are lasting and whenever a new application for service is accepted by the Edison Sault Electric Company of Sault Ste. Marie, Mich., the accompanying letter sent to the new customer has proved valuable in promoting friendly relations between the customer and the company. "It is our aim," says Edward Horry, vice-president and general manager, "to impress upon the customer the fact that we want him to come to us at any time for advice or with any complaint that he might have rather than go to somebody else and tell his troubles, which might be exaggerated as they were passed along."

DEAR SIR: It is with a great deal of pleasure that your application for electric service has been accepted by this company. It is our desire to go beyond the definite terms of our contract with you in the matter of service. We view our business relations with a new customer as only just beginning when meter and service installations have been made, and they do not end with the payment of bills as we are eager that the service we may have the privilege of rendering be real and lasting.

We have in connection with our office a salesroom, where we carry a complete stock of bureau tested lamps and household labor saving devices such as irons, toasters, percolators, washing and ironing machines, which we will be only too glad to demonstrate to you and tell you how cheaply they can be operated and the vast amount of real drudgery they take off the shoulders of the housewife.

We hope to deserve your further patronage and good will, and trust you will immediately notify us of any failure on our part to render you excellent service.

EDISON SAULT ELECTRIC COMPANY.

The Utility's Opportunity in Observing National Holidays

HOW a public utility can use its display windows in the observance of great national holidays is shown here in the two pictures of the windows of the Utica (N. Y.) Gas & Electric Company during the week of Nov. 7, the display being in keeping with the spirit of Armistice Day. In this impressive exhibit the company's honor roll, the Statue of Liberty and a bronze statue of the "Doughboy" were featured in one window, and in the other a photograph of the President of the United States together with photographs of Generals Pershing, Foch and Diaz were grouped and draped with the national colors.

"The local Armistice Day celebration," says Commercial Manager W. J. Reagan, "was accentuated, especially among the foreign-born population, by a visit from General Diaz, the noted Italian patriot. Appreciative comment on the windows was made by his former countrymen as well as by many prominent citizens who have interested themselves in the local Americanization work.

"Quantities of ferns, flags and tulle in red, white and blue added greatly to the attractiveness of the windows. By virtue of their appropriate nature and unusual merit the displays were greatly admired and many complimentary remarks were heard.

"The windows of the office building of a public utility may thus be used to promulgate the patriotic idea perhaps to greater advantage than any other commercial agency. Previously, the banks have reminded us of the advent of the holiday or patriotic occasion, but a much stronger appeal can be made through a constructive and well-arranged window demonstration."

What Other Companies Are Doing

Lebanon, N. H.—Thirty electric ranges have been sold this year in the territory served by the Grafton County Light & Power Company of this town. A rural population aggregating about 9,000 is scattered along the company's lines. H. M. Tucker is manager of the company.

Chicago, Ill.—The Commonwealth Edison Company is offering new stock to stockholders of record Dec. 17 to the extent of 8 per cent of their holdings at par, payable in four instalments of 25 per cent each. Commonwealth Edison has around 27,000 stockholders, compared with 5,700 when the armistice was signed. Since the customer ownership campaign started the stock has advanced from 103 to 115. Most new stockholders were secured by solicitation of employees.

Worcester, Mass.—The New England Power Company is completing a one-story power house of brick and concrete fireproof construction on the Deerfield River at Searsburg, Vt. The company is also having an earthen dam and penstock constructed. The Aberthaw Construction Company, Boston, Mass., is the contractor.

Portland, Ore.—The electrical contractors and dealers of this city in co-operation with the light and power companies serving Portland and vicinity, launched an active electric range campaign early in November. A price slightly above cost was agreed upon on all types of ranges and a flat price to cover the inside wiring was made and prices quoted on ranges installed either with or without inside wiring. A feature of the campaign is the sale of the ranges installed complete, including inside wiring on a deferred-payment plan. The underlying scheme of the campaign is that the power companies buy the ranges in large quantities, the dealers receiving them on consignment and being paid a commission on each sale. Co-operative advertising is carried on in the local newspapers.

AN EXCELLENT EXAMPLE OF THE TIMELY OBSERVANCE OF A NATIONAL HOLIDAY

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
of the World

Generators, Motors and Transformers

"Double-Step" Motor.—A. STOMMEL.—The author suggests a new type of induction motor which would permit a great many useful variations as motor, generator, regulator and frequency changer. For example, a three-phase induction motor with wound armature may be connected to the line so as to feed both stator and rotor from the line at the same time. The result will be a motor with a speed equal to the difference of the speeds of the two rotating magnetic fields. Stator and rotor winding may then be designed so as to divide their load either equally or so as to give one winding the total power output and the other winding only the second field. As in the case of the direct-current motor, such a "double-step" motor can be connected as a series, shunt or compound machine. Combining two such machines mechanically on one shaft results in a frequency-changer set, or, as the author calls it, a frequency splitter. As the mechanical couplings may permit a change of the relative position between the two armatures, all frequencies from zero to line frequency may be obtained stepless.—*Elektrotechnische Zeitschrift,* Nov. 10, 1921.

A Simple Method of Finding Steam Consumption of Small Turbines.—Small turbines using superheated steam frequently have a superheated exhaust. This paper shows that in such a case the water rate of the turbine may be determined by simple temperature and pressure measurements at inlet and exhaust.—*Power,* Dec. 6, 1921.

General Specification of Alternating-Current Motors for Main-Roll Drive.—These specifications are intended to cover as far as possible the general requirements for main-roll motors in steel mills and are issued by the American Iron and Steel Electrical Engineers, to be furnished to electrical manufacturers. They represent the consensus of opinion of a large majority of users and designers of such motors. They are for use when mills are to be electrified.—*Bulletin of the Association of Iron and Steel Electrical Engineers.*

Generation, Transmission and Distribution

Asynchronous and Synchronous Generating Plants for Small Watersheds.—H. KYSER.—From an economical standpoint it is very desirable to have a number of small hydro-electric plants tie in with a large steam plant. In such a case it is best to have the hydro-electric plants supply the average load while the steam station covers the peaks. It has recently been a much-discussed question whether these small plants should be equipped with asynchronous or with synchronous generators. The respective features of the two systems may be briefly described as follows: (1) The asynchronous generator is operative only with impressed voltage from the main plant. Frequency, load and voltage are regulated from the main plant, so that no turbine regulator is necessary. To avoid run-away at no load, a speed limit must be installed. The generator may be operated with minimum of attention. Efficiency, floor space, weight and cost are lower than with a synchronous generator. Power factor, while the same at full load, falls rapidly with load. (2) The synchronous generator operates only with independent direct current supply (exciter). The driving of the exciter by belt from the main generator is dangerous. Very exact turbine regulation is needed. High and elastic power factor is obtained. To make a definitive decision for one or the other system, the following points require careful investigation: (1) Reaction on the main plant; (2) load conditions in the tie-in plant; (3) economy; (4) independence of the tie-in plant. The very elaborate article discusses all these points in general and by means of concrete examples, coming to the conclusion that, except in very rare cases, the asynchronous generator does not give technical or economical advantages over the synchronous type.—*Elektrotechnik und Maschinenbau,* Oct. 30 and Nov. 6, 1921.

Electrical Supply in Sheffield, England.—Details of the new Blackburn Meadows station, including the boiler room, the turbine room, switchboard, cooling plant, etc. —London *Electrician,* Nov. 4, 1921.

Burning Pulverized Anthracite Mine Waste.—O. M. RAU.—Results of tests obtained by burning pulverized anthracite coal in the Philadelphia Rapid Transit Company's power plant, where pulverizing equipment is installed for ten boilers though only one boiler has been in operation to date. An efficiency of 62.2 per cent for boiler and furnace was obtained, and it is expected that this will be raised to 76 per cent when improvements and changes suggested by the preliminary operation have been made.—*Electric Railway Journal,* Nov. 26, 1921.

Developments in Power-Station Design.—A continuation of a series on recent progress made in developing equipment used in power stations. The present article deals with stokers and various methods of removing ashes. One ash remover mentioned maintains an air-sealed combustion chamber, quenches the ashes as they fall from the furnace, prevents dust, fumes and heat from reaching the ash tunnels and does not necessitate building the boilers above the ground level. Another scheme makes use of a stream of continuously flowing water for delivering the ashes into a sump.—London *Engineer,* Nov. 18, 1921.

Electrolytic Protection of Steam Boilers Against Scale and Corrosion.—W. PHILIPPI.—A description of a method said to be successful in protecting steam boilers against their two greatest enemies, corrosion and boiler scale. Careful investigations of corrosion on boiler bottoms, water tubes and condensers proved, the author says, that electrolytic action was the cause of these damages. As a remedy a metal of higher emf., like zinc, has been connected electrically to the boiler to create a counter-emf. to compensate for the corrosive current. But this method did not always give complete satisfaction, as it was impossible to regulate the current. An externally generated direct current, applied through electrodes into the boiler, was found to be a perfect remedy. In fact, by doing this the small but constant generation of hydrogen along the boiler walls will also effectively prevent the formation of boiler scale. A direct-current voltage of from 10 to 20, at a current density of about 2 milliamperes per square foot, was found to be most effective. A small motor-generator of 6 kw. may supply a battery of thirteen boilers, each of which may have four protective electrodes. A small resistor in series with each electrode circuit permits of suitable regulation of the voltage. Ordinary wrought-iron gas pipes are used as electrodes. Experience with this protection, extending now over several years, surpassed all expectations. On boats using sea water in the condensers no corrosion of any kind was observed after months of operation, while before installing the electrolytic protection it was necessary to clean them every few weeks.—*Siemens Zeitschrift*, October, 1921.

Essential Qualities of Oil for Steam Turbine Lubrication.—J. Y. DAHLSTRAND.—This article states that the price of lubricant is the least important of all considerations as savings may be lost many times in repairs to machinery. Flash test and specific gravity are considered of little value. Recommendations by machinery manufacturers for lubricants are given.—*Electrical Review*, Nov. 19, 1921.

Hydro-Electric Works in New Zealand.—This article speaks of the allocation by the government of New Zealand of the sum of seven million pounds for the development of the colony's hitherto little-exploited but admittedly valuable hydro-electric power. The project includes the construction of a number of dams, the acquisition of latest types of plants and machinery, substations and secondary lines.—*Electrical Industries*, Nov. 9, 1921.

Lamps and Lighting

Day and Night Lighting in Textile Mills.—SAMUEL G. HIBBEN.—Intensities of lighting desired, arrangements of units and suggestions for proper maintenance are given in this paper. The variation of daylight throughout the day is shown by curves. — *Electric Journal*, November, 1921.

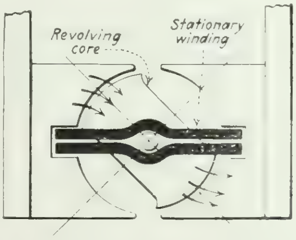
Traction

Trackless Trolleys Instead of Street Railways.—M. SCHIEMANN.—The trend in every large city has long been to establish a quick and modern transit system from the business center to the residential sections. In the majority of cases it would be possible to install a trackless trolley system over existing well-kept-up roads with a minimum of invested capital and a maintenance cost about equal to that of a street railway. For ten years such a system had been in operation between Hamburg and Marienhöhe, but it had to be abandoned in 1917 on account of the conditions brought about by the war. The run was 2½ km. each way, and the cars weighed 3,150 kg. and could carry twelve seated and ten standing passengers. The wheels had solid rubber tires and were driven by one 15-hp. motor with a silent worm drive. The trolley was pivoted on the roof of the car in such a manner as to give a free sway through a full circle, permitting the car to deviate as much as 3 m. from its route. A "pay-as-you-enter" fare-collecting system was in use. For the trackless trolley system in general the author makes the following claims: (1) Operating cost, including interest, depreciation and renewals, per transported passenger is the same as for rail traction; (2) the building cost is at least three times higher for a street railway; (3) the wear and tear on the road is less with the trackless system; (4) the traffic obstruction is far less.—*Elektrische Kraftbetriebe und Bahnen*, Nov. 10, 1921.

Ten Years Operation of the Hamburg Elevated Railway.—DR. ING. WILHELM MATTERSDORFF.—An account of the many changes of an economic nature which have occurred to this property since it was put in operation in 1912. General statistics are given, together with a list of improvements which have been made.—*Electric Railway Journal*, Dec. 3, 1921.

Installations, Systems and Appliances

Magneto and Alternator Type "Stella."—H. TOURNAYRE.—A magneto is described in which the magnet and the winding are stationary. Pulsating magnetic flux is established within the winding by a swinging or rotating soft-iron piece, shaped like the familiar Siemens double-T armature. A complete flux reversal takes place after each quarter revolution. Such a magneto, weighing only about 10 ounces, can produce 4 watts at 6,000 r.p.m. with 75 per cent efficiency. The same principle could be used advantageously on large machines, and especially on high-frequency generators. —*Revue Générale de l'Electricité*, Nov. 12, 1921.



WINDING OF MAGNETO REMAINS STILL WHILE CORE REVOLVES

The Future of Electrically Driven Rolling Mills.—L. ROTHERA.—This paper states that motor drive continues to grow in favor for rolling mills and that no instance is known of a motor having been replaced by another form of drive for such work. Practice has shown that the claims made for electric drive on the score of economy, efficiency, low upkeep, flexibility and reliability are fully justified.—London *Electrician*, Nov. 18, 1921.

Electric Furnace in Melting and Refining.—JOHN B. C. KERSHAW.—A discussion of the poor progress made in England during the last year in adopting the electric furnace for melting and refining and of the modern tendencies in the design of electric furnaces. Tilting and rocking arrangements, electrode operating gears and electrode economizers are also described.—London *Electrician*, Nov. 18, 1921.

Electrochemistry and Batteries

Electrolytic Solution and Deposition of Copper.—T. R. BRIGGS.—The author modifies the theory formulated by Luther and concludes that the electrolytic behavior of copper in solutions containing copper ions may be accounted for by two electrochemical reactions or their reverse. The theory advanced is applicable in general to metals other than copper.—Paper presented before Electrochemical Society, Oct. 1, 1921.

Telegraphy, Telephony and Signals

Carrier-Wave Multiple Telegraphy and Telephony.—K. W. WAGNER.—The author gives a review of the fundamentals of carrier-wave multiplex, illustrated with diagrams and photos showing the latest developments of this art in Germany. The Germans have devoted a good deal of energy to the application of carriers to rapid telegraphy and have succeeded in bringing the multiplexing of machine telegraphy to a fair degree of reliability. On a 600-km. telephone line from Berlin to Frankfurt six telegraph channels have been superimposed and are used for six Siemens printers, the total capacity of the line, besides ordinary telephony, being 3,000 letters a minute, or about 3,600 ten-word dispatches an hour. The carrier impulses are sent by a grid relay, and the received signals are amplified in four double-grid tubes. Two rectifying double-grid tubes operate a double-pole relay which controls the printer. Carrier-wave telephony over high-tension transmission lines is briefly mentioned.—*Teknisk Tidskrift, Elektroteknik,* September, October and November, 1921.

Large Radio-Telegraphy Stations in the Dutch East Indies.—A description of the large radio station in Java which has nearing completion an arc-lamp transmitter rated at 2,400 kw. to 3,600 kw. The aërial is suspended across a valley between two mountain peaks. The transmitting station is from three and a half to four times as powerful as the largest European stations such as that at Bordeaux, etc. This station is being constructed for the purpose of transmitting messages from Java to Holland, a distance of 1,200 km.—*Radio Review,* November, 1921.

Operation of the Modulator Tube in Radio-Telephone Sets.—E. S. PURINGTON.—In radio-telephone transmitter circuits using electron tubes the radiated power is caused to vary at speech frequencies usually by one of the three following methods: First, by variable absorption of the output power of a radio generator, as by a microphone in the antenna circuit; or, second, by varying at speech frequencies the operating grid voltage of a radio generator, as in grid modulation; or, third, by varying at speech frequencies the input plate voltage of a radio generator, as in plate modulation. The third method is used in practically all commercial and military types of apparatus. It is superior to the others with respect to the intensity of signal conveyed for a given total input power, and with respect to inherent reliability and tone quality. This paper deals with phenomena in transmitters of this third type.—*Scientific Paper of Bureau of Standards, No.* 423.

Miscellaneous

Electric Arc Welding for Boiler Repairs.—A report of the best methods of reconditioning boilers by means of electric welding. For a good weld the operator must have a certain skill and experience, the electrodes must be of proper material and the work must be correctly prepared. Details of methods for treating various parts of boilers are given, and these are explained fully with numerous illustrations. Among the topics covered are fire boxes, patching side and door sheet, fire-box sheet-knuckle patches, preparing small portions of side sheets, welding patches on front of crown sheets, welding seams, broken mud ring, door-collar patch, flues, etc. A tabulation shows that the cost of labor for applying electric welding to a three-piece Micado fire box is about $106, against $120 for riveting a firebox.—*Railway Electrical Engineer,* November, 1921.

Survey of Elevator Interlocks and an Analysis of Elevator Accidents.—C. E. OAKES and J. A. DICKINSON.—This report gives the results of a field survey of several thousand elevator landings equipped with different types of interlocks. The survey was conducted in connection with the preparation of an elevator safety code, in which work the Bureau of Standards has co-operated with the American Society of Mechanical Engineers. Statistics show that 73.8 per cent of all fatal accidents might be prevented by well-designed interlocks.—*Technologic Papers of the Bureau of Standards,* No. 202.

Use of Electric Power on the Western Front.—MAJOR T. RICH.—A lecture dealing with the work of the American, French and German forces in the recent war. With the exception perhaps of Germany, all the nations began by using direct current, but as the war progressed the advantages of the three-phase system became so apparent that it was being used exclusively at the end, the French employing it for units rated as low as 20 kw. The great problem was the supply of energy for mobile and semi-mobile workshops, casualty clearing stations and other consuming points in the forward area. The French, Americans and Germans linked up the main power stations with trunk lines of 30,000 volts or more. The French put up over 1,000 miles, the British 80 miles and the Germans more than 2,000 miles of high-tension lines.—*Royal Engineers' Journal,* September, 1921.

Electricity in Swedish Towns.—B. TRANEUS.—A statistical survey of electrical installations in Swedish towns, which shows that the average specific installation for electric lighting during the period 1906-1919 has increased from 44.8 kw. to 81.3 kw. per 1,000 inhabitants. At present the specific installation ranges from 56.5 kw. to 125.5 kw. for ordinary towns and up to 399 for residential towns in the neighborhood of Stockholm. The electric motor installation during the period 1906-1918 increased from 89 kw. to 1.087 kw. per 1,000 workmen, with a minimum at present of 250 and a maximum of 3,020. The saturation values are estimated at 140 kw. per 1,000 inhabitants for lighting and 1,070 kw. per 1,000 workmen for motors, which values should be reached in 1927.—*Teknisk Tidskrift, Elektroteknik,* July 6, 1921.

Researches on Wave Erosion.—W. FELLENIUS.—To ascertain whether there are any reasons to fear excessive erosion along the shores of a lake artificially maintained at constant level a series of experiments were carried out in the hydraulic laboratory of the Royal Institute of Technology in Stockholm. In a big rectangular wooden box a shore profile was made up of sand, the box was filled with water, and waves were set up by means of a motor-driven shovel wheel, while the water surface was regulated (1) according to the unregulated level curve of the lake for the period 1901-1909, and (2) according to the level curve for the same period as it should have appeared after a regulation. It was found that, contrary to the common belief, the erosion in the regulated case actually came out equal to or less than in the unregulated.—*Teknisk Tidskrift, Veckoupplagan,* July 30 and Aug. 6, 1921.

Textile Industry in the South.—JOHN GELZER.—Load curves and horsepower requirements for various types of machinery used in cotton mills are described in this article.—*Electric Journal,* November, 1921.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

Better Electrical Business Campaign for 1922

"MORE business—better business" is to be the slogan for the electrical industry during 1922. A joint meeting of N. E L. A. committees—the executive committee of the Commercial Section, the wiring committee, the lamp committee and the committee on upbuilding of the industry—will be held probably early in January, when a program and plan will be worked out. Representatives of the manufacturers, jobbers and contractor-dealers who met with the last-named committee last week gave assurances that their own branches of the industry would get behind the movement.

As now proposed, the campaign will be entirely local in endeavor, but with national direction. In general the campaign will be an effort throughout the year to educate the public to a wider use of electricity through practical demonstration. It is felt that the net result will be greatly increased sales of appliances and lamps not only for the home but for the factory and store as well.

California Commission Thinks Regulation Has Saved People $100,000,000

HAD public utility rates advanced equally with commodity prices instead of being subject to regulation by the California Railroad Commission, the people of the state would have paid in the last few years $100,000,000 more for utility service than they actually did, the commission declares in its annual report for the year ended June 30, 1921, just transmitted to Governor Stephens. The commission puts the average increase in utility rates during the war and post-war periods at between 35 and 40 per cent, while retail commodity prices at the beginning of 1921 were 72 per cent higher than in 1913. A turn toward normal in market conditions last May was quickly noted by the commission, and it expresses the opinion that the peak of utility rates has been reached. Material reductions in the price of electricity and gas have already been made, the commission now views applications for increased rates with disfavor where no unusual conditions exist, and further reductions are confidently anticipated. In fact, the commission informs the Governor, a basis for rate adjustments for all the large power companies of the state will soon be established.

The assertion that regulation tends to hamper industry is declared by the commission to be a fallacy, and it points out that the public utilities under regulation are keeping pace with the rapid growth of the state. This is especially true in the development by the power companies of the hydro-electric resources of California's mountain streams. Describing this work, the commission says:

"During the year the work of harnessing the mountain streams and turning to useful purposes the state's inexhaustible supply of 'white coal' has progressed satisfactorily, while still greater projects loom in the not distant future. Hydro-electric plants of a total kilowatt capacity of 145,500 and steam plants of 47,500 kw. capacity were completed and tied into the existing distributing systems. Not including preliminary work, there are under construction new hydro-electric plants, with a capacity of 146,000 kw. Developments are being carried on by the Pacific Gas & Electric Company on Pit River and tributaries, to make available 103,500 kw.; the San Joaquin Light & Power Corporation, bringing in 10,000 kw. at Kern Canyon; the Southern California Edison Company, increasing its Big Creek production by 22,500 kw., and the Southern Sierras Power Company, preparing to produce 10,000 kw. at its Levining Creek plant."

Lower Fire Insurance Rates for Power Companies

FIRE insurance rates on electric power plants and substations are to be reduced not to exceed 25 per cent, immediately, according to a statement made last week by S. E. Wolff, chairman of the N. E. L. A. insurance committee, which has been working on this situation for nine months. It is estimated that the saving to the members of the association will exceed $400,000 annually.

The committee has made an exhaustive study of loss estimates on generating stations and substations during the last five years and held several meetings to take up various phases of the work. Conferences also were held with insurance officials. New insurance or renewed insurance will receive the benefit of this reduction as soon as certain detailed revisions are completed, and it is understood that within a comparatively short time benefits likewise will accrue to those company policy holders whose insurance policies extend over a period of years.

There are many necessary details involved which will have to be worked out, but it is expected that within the next sixty days the new rates can be put into operation.

Henry Ford and Government Engineers Still Corresponding

AFTER conferring for an hour on Dec. 19 with W. B. Mayo and J. W. Worthington, engineers for Henry Ford, the Secretary of War announced that further correspondence with Mr. Ford will be necessary. Secretary Weeks explained that the engineers had presented a letter from Mr. Ford but that they had no power to act or to make comment. For that reason Secretary Weeks finds it necessary to propound certain questions in connection with the Ford letter, which is understood to be largely an expression of opinion as to the cost of completing the Wilson Dam and building dam No. 2.

Secretary Weeks pointed out that there is great uncertainty as to the cost of dam No. 2, owing to incomplete knowledge of the foundation. He referred to the experience of the Brady interests of New York in constructing their Chattanooga project. In that case an estimate of $2,000,000 grew to $11,000,000 before the dam was completed, because of the difficulty of sealing the underlying limestone. The uncertainty as to foundation conditions at the site of dam No. 2, he said, is unusually great. This is due to the width of the river at that point.

It was the intention of Secretary Weeks to make public later in the week both the letter received from Mr. Ford and his reply to it.

Illinois Utilities to Hold Meeting in March

THE joint meeting of the Illinois State Electric Association and the Illinois Electric Railway Association will be held at the Hotel Sherman in Chicago on March 15 and 16, 1922. The morning sessions will be joint and the afternoon sessions will be in the form of separate technical sessions for each association. The annual banquet will be on the evening of March 15.

More Than Seven and One-Half Million Wired Homes

THE Society for Electrical Development has just completed a survey to ascertain the residential load of the electric light and power companies of the country, the results of which are published in the *Monthly Sales Service* for December. Following are some of the very valuable data pertaining to this survey:

Homes wired in the United States	7,636,469
Homes reached by electric service	13,000,000
Homes not reached by electric service	8,145,126
Homes reached by central-station lines but not wired	5,363,531
Homes not wired	13,508,657
Communities reached by central-station lines	14,000
Annual central-station revenue from use of electric irons	$39,000,000
Annual central-station revenue from use of vacuum cleaners	$4,750,000
Annual central-station revenue from use of washing machines	$3,500,000
Annual central-station revenue from use of electric ranges	$6,000,000

Ohio New-Business Meeting Discusses Central-Station Finance

CENTRAL-STATION finance was the topic of a full day's discussion at the recent Dayton meeting of the new-business co-operations committee of the Ohio Electric Light Association. Though the number in attendance was discouragingly small, the program was well planned and productive.

The morning session was devoted to a paper on "Public Utility Financing," by J. R. Edwards, vice-president Fifth-Third National Bank, Cincinnati, and an address on the "Relation of Public Utility Rates to the Prices of Other Commodities," by W. W. Freeman, president of the Union Gas & Electric Company, Cincinnati, and also of the Society for Electrical Development. Mr. Edwards discussed the subject from the banker's standpoint, laying stress on the merits of no-par-value stock and the importance of properly taking care of stock discounts so that the cost of financing may be written in as an item in the cost of construction and not increase the floating debt of the company.

Mr. Freeman made a clear analysis of the central-station business as compared with the ordinary commercial enterprise in its slow turnover of capital and its inability to control either its costs or its price or to finance expansions from its profits. He discussed the broad influence of these facts upon central-station financing and the necessity for informing the people fully on the commercial side of the utility business in order that they may properly recognize its commercial influence and opportunities. This more than anything else, he said, will increase the popular market for securities.

In the afternoon session Grover C. Maxwell, former secretary of the Ohio Public Utilities Commission and at present a member of the Ohio Committee on Public Information, gave an address on the work of the commission and the committee as an influence on utility financing. C. E. Yacoll, manager of the securities department, Pennsylvania-Ohio Electric Company, Youngstown, read a paper on "The Organization and Work of the Central-Station Securities Department," in which he discussed in detail this new phase of administration.

An animated discussion occupied the greater part of the time of both sessions, and out of it came a large amount of definite experience and many suggestions of practical use in meeting the local problem of selling the securities of the central-station company. Warner Jones, sales manager of the Erner Electric Company, Cleveland, brought before the meeting the opportunity offered by the present work of jobbers' salesmen in selling electrical material to farmers. This business is developing in large volume in Ohio, and Mr. Jones suggested that jobbers' salesmen be interested in selling securities of central-station companies in adjoining rural districts both to the farmers who are installing farm plants and to those who are equipping their farms for connection with central-station lines. This suggestion was considered to offer great possibilities, and a committee was appointed to investigate and report at the next meeting.

Co-operation Between New York Architects and Electrical Men

AN AGGRESSIVE policy is announced by the Architectural League of New York for bringing architects and members of the electrical industry together so that they shall mutually understand what each can produce and the advantages the designer will secure by having this knowledge. It is felt, that, in addition to the two professions, the general public will benefit. For this reason the league will hold periodical exhibitions at its headquarters, 215 West Fifty-seventh Street, New York, where electrical equipment will be displayed. These exhibitions will be open to everybody.

Funds for Study of Coal Movement Assured

PRIVATE funds in sufficient amount to make possible a comprehensive study of seasonal coal movements have been placed at the disposal of the committee on mining of the President's conference on unemployment. This is the first of a series of surveys which are to be carried out by Edward E. Hunt, secretary of the conference, in co-operation with the Department of Commerce.

Lamp Industry Falls Into Building-Material Investigation

AS A PART of the investigation into building trade and material conditions being conducted by the Lockwood committee of New York, incandescent-lamp prices and the incandescent-lamp manufacturing business are to be probed on the resumption of public hearings in January. This was ascertained on good authority by the ELECTRICAL WORLD. According to this information the committee feels that the cost of lamps to the consumer is 40 per cent too high. In its inquiry the committee will attempt to ascertain whether or not the manufacturing companies are making an unfair profit and also if there is any understanding to maintain a fixed price.

Stabilization of Foreign Exchange Necessary, Says Governor Harding

STABILIZATION of foreign exchange is needed to bring about a resumption of foreign trade on a large scale, according to W. P. G. Harding, governor of the Federal Reserve Bank. Governor Harding referred to the relation between foreign exchange and the export situation in a recent address as follows:

> Judging from our own history after the Civil War, many years will doubtless elapse before some European countries can restore the normal value of their currencies, but if the violent fluctuations in exchange which have marked the past two years can be prevented in future and a stabilization on some basis accomplished, it will be possible to engage in commercial and financial transactions with Europe on a much larger scale than at present. If we wish to sell our surplus products abroad, it is evident that we must continue to exchange commodities with foreign countries, for where we sell we must buy. A curtailment of production to meet merely American requirements would involve widespread non-employment and would invite disaster. On the other hand, because of the great depreciation in the currencies of many foreign countries their labor costs are much less than ours, and partly because of this fact and partly because of the high premium on dollar exchange they are able to undersell us in our own markets. One of the great problems of our national legislators today is to frame a tariff which will prevent the dumping upon our markets of foreign goods, without at the same time erecting a tariff wall so high that our exports will be greatly reduced because of the inability of foreign nations to trade with us.

Lower Railroad Rates Appear to Be Foregone Conclusion

THERE is very general recognition among the large number of traffic specialists who are attending the Interstate Commerce Commission hearing on railroad rates that the public sentiment in favor of rate reduction is so pronounced as to make it a foregone conclusion. Were the commission to announce a refusal to reduce rates, it is believed that there would be such a widespread resentment made manifest as to insure the railroading through of special legislation making a substantial rate-reduction mandatory. The fear expressed in some quarters that the commission may be influenced to such an extent by the overwhelming volume of the public demand for rate reduction as to go further than the best interests of all concerned require is not shared by most of those in attendance at the hearing, as it is felt that the commission will be conservative in any action that it may take.

The commission is not likely to authorize a blanket reduction. It is felt rather that on items which constitute a large proportion of railroad tonnage, such as coal, the reduction will be materially less than in the rates on some other commodities. At the same time it is recognized that the demand is keenest for reductions on basic commodities.

Lower Utility Taxes to Bring Power Rebate to Idaho Farmers

IDAHO farmers using electrical energy for pumping purposes are to be allowed rebates totaling $37,467. The 1921 session of the Idaho Legislature passed a law granting power companies operating in the state a rebate on taxes and provided that the amount of the rebate be apportioned among the various users of irrigation power. In compliance with the provisions of this statute the Idaho Power Company has filed with the Public Utilities Commission a report which shows that 18,326 hp. is used in the state annually for pumping water electrically. Sections of the law provide that the Public Utilities Commission shall calculate the amount of the total rebate to be placed to the credit of each consumer. After this is done an order will be issued by the commission authorizing the power company to credit the various power users of the state with their proportion of this rebate.

General Beach Reports on Muscle Shoals Status

AN EXPENDITURE of $7,500,000 can profitably be made at Muscle Shoals during the fiscal year of 1923, Major-General Beach, Chief of Army Engineers, says in his report to the Secretary of War, just made public. No work has been done on the project since last April because Congress would not make additional appropriations for it. At the present time a number of private and public utility interests are negotiating with Secretary Weeks for a lease of the plant.

A financial summary prepared by General Beach shows that to date a net total of $15,278,828 has been expended on the project, which, the report says, is about one-third completed, the percentages of completion for the various units being: Wilson Dam, 45 per cent; power house, 11 per cent, and locks, 10 per cent. The sum expended in the fiscal year ended last June 30 was $7,840,781, the principal items listed in the report being: Dam construction, $3,108,800; power-house construction, $1,017,000; main-line railroads, construction, maintenance and operation, $495,500; general plant, purchase, construction, operation and maintenance, $1,391,200; camp construction, maintenance and operation, $728,500; general expenses, including flood losses, labor recruiting and office expenses, $731,300, and lock construction, $143,800.

On last July 1 the money available of funds appropriated was $398,921, and it is stated that this will be expended by next August, as the expenses of guarding and maintaining the property average $30,000 a month.

"Should additional funds be provided," General Beach says, "the work to be done would be: Construction of cofferdam No. 2 and work thereon, continuation of excavation for lock, continuation of concrete work in dam, and continuation of excavation and concrete construction for power house. The amounts expended for each would depend upon the date and amount of the appropriation. The rate of expenditure should be approximately $625,000 per month."

Discussing the present state of the work, General Beach observes:

"All preparatory work in the nature of camps, roads, railroads, plants and shops is completed. Earth excavation for the lock is 90 per cent completed and rock excavation 18 per cent. About 66 per cent of the excavation and foundations for the dam are completed and about 35 per cent of the concrete placed. About 48 per cent of the excavation for the power-house section is completed and approximately 4.6 per cent of the concrete placed.

"Following suspension of construction, property has been collected and stored, rented floating property returned and construction equipment placed in condition for indefinite storage or lay-up. The navigation of the river is completely blocked by the work in its present condition."

Order on Line-Extension Policy in Oregon Expected Soon

AN ORDER on line-extension policy for Oregon light and power companies will be promulgated soon by the State Public Service Commission. The case was initiated by the commission to determine, if possible, on a more liberal policy of rural extension.

Under the present policy farmers desiring to obtain electric service are required to bear the cost of the extension and are then allowed two years' service without additional cost, provided the service rendered does not exceed their pro rata share of the extension cost. The extension then becomes the property of the utility provided the service and the customers pay for service upon the same schedule as do city customers.

Engineering Council Meeting Scheduled for Jan. 4

PLANS for the development of the work of the Federated American Engineering Societies were under discussion at a series of conferences and meetings held in New York last week. President Mortimer E. Cooley and Executive Secretary L. W. Wallace met with the American Engineering Council's committee on procedure on Dec. 16, and in the evening at the Engineers' Club with the secretaries of the national societies, when questions of finance, publication and closer relations with member societies came up.

Further details of the Washington meeting of the council were announced. On Jan. 4 the meeting will start with a session of the executive board at the Cosmos Club, where the sessions of the council also will be held. The next morning the council will convene for an all-day session, at which Dean Cooley will preside. The business of the council will include the election of two vice-presidents and a treasurer. That evening the council will give an informal dinner at the University Club, among those invited to which will be the engineers of Washington. Secretary Hoover has been asked to attend and he has accepted provisionally. In addition to Secretary Hoover other prominent speakers are expected to deliver addresses.

On Jan. 6 the council will again meet in business session at 10 a.m., and in the afternoon there will be a meeting of the new executive board, the new members of which will be elected by the delegates from the national organizations and the regional areas.

At the Washington meeting the work of the past year will be reviewed and plans for the ensuing year discussed. Among the important reports to be received will be that of the special committee on non-employment. Other leading topics will be industrial waste, a national Department of Public Works, Patent Office conditions, licensing and proposed constitutional changes.

Supreme Court Holds Open-Price Plan Illegal

THE government won its suit against the American Hardwood Manufacturers' Association on Monday, when the Supreme Court held the open-price competitive plan of the association to be in restraint of trade and therefore in violation of the Sherman anti-trust law. This decision has been awaited for some time with more or less apprehension by all trade associations engaged in statistical work. There is some doubt, however, as to how far reaching this particular decision may be because of the extent to which this association went to secure trade statistics. The court was divided in its decision, the vote being six to three.

The plan adopted by the association in securing its statistics, as brought out in the record, was for each member of the association to furnish the secretary with the following six reports:

1. A daily report of all sales actually made, with the name and address of the purchaser, the kind, grade and quality of lumber sold, and all special agreements of every kind, verbal or written, with respect thereto—"the reports to be exact copies of orders taken."
2. A daily shipping report, with exact copies of the invoices, all special agreements as to terms, grade, etc. "The classification shall be the same as with sales."
3. A monthly production report showing the production of the member reporting during the previous month, with the grades and thickness classified as prescribed in the "plan."
4. A monthly stock report by each member.
5. Price lists.
6. Inspection reports.

This material was digested and each member was supplied with the following:

1. A monthly summary showing the production of each member for the previous month, "subdivided as to grade, kind, thickness," etc.
2. A weekly report, not later than Saturday, of all sales to and including the preceding Tuesday, giving each sale and the price and the name of the purchaser.
3. On Tuesday of each week the secretary must send to each member a report of each shipment by each member, complete up to the evening of the preceding Thursday.
4. He must send a monthly report showing the individual stock on hand of each member and a summary of all stocks, green and dry, sold and unsold. This report is very apparently referred to by the managing statistician as a monthly inventory of the stock of each member.
5. Not later than the tenth of each month the secretary shall send a summary of the price lists furnished by members showing the prices asked by each, and any changes made therein must be immediately transmitted to all the members.
6. A market report letter shall be sent to each member of the association (whether participating in the plan or not) pointing out "changes in conditions both in the producing and consuming sections, giving a comparison of production and sales and in general an analysis of the market conditions."

It was further provided that there should be monthly meetings of the members.

While the plan was termed open competition, the court felt that was a new name for an "old evil in a new dress." The majority opinion held:

> Genuine competitors do not make daily, weekly and monthly reports of the minutest details of their business to their rivals as the defendant did; they do not contract, as was done here, to submit their books to the discretionary audit and their stocks to the discretionary inspection of their rivals for the purpose of successfully competing with them, and they do not submit the details of their business to the analysis of an expert jointly employed and obtain from him a "harmonized" estimate of the market as it is and as in his specially and confidentially informed judgment it promises to be.
>
> This is not the conduct of competitors but is so clearly that of men united in an agreement, expressed or implied, to act together and pursue a common purpose under a common guide that, if it did not stand confessed a combination to restrict production and increase prices in interstate commerce and as, therefore, a direct restraint upon that commerce, as we have seen that it is, that conclusion inevitably must have been inferred from the facts which were proved.
>
> To pronounce such abnormal conduct on the part of 365 natural competitors, controlling one-third of the trade of the country in an article of prime necessity, a "new form of competition" and not an old form of combination in restraint of trade, as it so plainly is, would be for this court to confess itself blinded by words and forms to realities which men in general very plainly see and understand and condemn as an old evil in a new dress and with a new name.
>
> The "plan" is, essentially, simply an expansion of the gentlemen's agreement of former days, skillfully devised to evade the law. To call it open competition because the meetings were nominally open to the public, or because some voluminous reports were transmitted to the Department of Justice, or because no specific agreement to restrict trade or fix prices is proved, cannot conceal the fact that the fundamental purpose of the "plan" was to procure "harmonious" individual action among a larger number of naturally competing dealers with respect to the volume of production and prices, without having any specific agreement with respect to them, and to rely for maintenance of concerted action in both respects not upon fines and forfeitures as in earlier days, but upon what experience has shown to be the more potent and dependable restraints of business honor and social penalties, cautiously reinforced by many and elaborate reports, which would promptly expose to his associates any disposition in any member to deviate from the tacit understanding that all were to act together under the subtle direction of a single interpreter of their common purpose, as evidenced in the minute reports of what they had done and in their expressed purposes as to what they intended to do.
>
> In the presence of this record it is futile to argue that the purpose of the "plan" was simply to furnish those engaged in this industry, with widely scattered units, the equivalent of such information as is contained in the newspaper and governmental publications with respect to the market for commodities sold on boards of trade or stock exchanges.

Plans to Extend Customer Ownership of Securities Campaign

TENTATIVE plans for extending the customer ownership of electric light and power securities movement to all member companies of the National Electric Light Association which desire to participate were drafted at a meeting in New York on Dec. 15 of the customer ownership committee. It has been decided to publish a standard manual on the sale of utilities' securities and a pamphlet devoted to facts regarding customer ownership activities already under way by member companies. A committee was appointed to study literature, advertising, sales letters, pamphlets, etc., already issued by companies that have undertaken the customer ownership program and to evolve from them standard material which might be used in the national campaign. Another committee was appointed to compile the salesmen's textbook and also a textbook on standards of practice.

The next meeting of the customer ownership committee will be held in New York City in the latter part of January.

Light and Power Systems Undamaged by Severe Eastern Storms

A STORM of unusual violence swept over the northeastern section of the country Monday, but the damage to electric light and power company systems was negligible. Communication wires were reported down in Pennsylvania and New York over extensive areas. The storm apparently reached its height in northwestern New York. The property damage around Buffalo and Niagara Falls exceeded $1,500,000. Reports received by the ELECTRICAL WORLD from power companies in this area indicated almost no damage to electric systems.

The Niagara Falls Power Company sustained no material damage. The Niagara, Lockport & Ontario Power Company reports that while there were numerous interruptions to service during the ninety-six-mile gale and sleet storm, the damage to physical property was very slight and did not exceed twenty-five dollars.

The worst effects of the storm were probably felt by the Buffalo General Electric Company. W. R. Huntley, vice-president of the company, stated that this was the most severe storm the company had ever experienced. The transmission lines into Buffalo from Niagara Falls were affected to a considerable extent, although at no time was there a total interruption to this service. The company's steam plant functioned as usual.

A number of pole lines carrying heavy industrial and domestic feeders were demolished, causing interruption to service in the north and south sections of Buffalo. Repairs had practically been completed by Tuesday night.

Minneapolis Street-Lighting Report Recommends Shorter Spacing

THE report of the committee on street lighting for Minneapolis contains some interesting recommendations for improving the lighting of that city. Since the subject of street illumination is so broad and varied, the committee felt that the city should place the control of the street-lighting system in the city engineering department under the direct management of an electrical engineer. Other projects under consideration were to adopt a system which would give fairly uniform illumination on the street surface and to grade the intensity according to the night traffic on the streets. One way of creating this uniform intensity would be the use of 30-ft. standards at intervals of 240 ft. instead of the present 15-ft. standard spaced at 100 ft. or 120 ft. Several photographs were contained in the report, showing a comparison between these two sources of illumination. Virtually all the light beams of the lamp hung from the 30-ft. standard were evenly distributed by reflectors on the surface of the ground between two standards.

The committee discussed the problem of glare at considerable length, advocating the proper use of heavy durable refractor globes for the elimination of this evil.

Licensing Law for New York Engineers Now Functioning

THE New York State enactment licensing practicing engineers, which became a law last May, has just begun to function, and at a session of the board of five engineering examiners 241 applications were considered and 171 passed. This board, which represents each of the five branches of engineering — electrical, mining, mechanical, chemical and civil—passes upon all applications.

This professionalizing of engineering has rapidly spread over the country until it has been agitated or become a law in forty of the states. An effort is being made to harmonize all of the different laws so that they will be co-operative and enable a licensee in any state to practice in any other state.

Gas-Filled Lamp Patent Upheld in Highest British Court

THE British House of Lords, court of last resort in English patent cases, has unanimously upheld the English patent covering the Langmuir gas-filled incandescent lamp, having reversed the decision of the lower court, according to word just received in the United States. The final determination of this case was in a suit for infringement brought by the British Thomson-Houston Company against the Corona Lamp Works, Ltd. This patent corresponds to the American patent No. 1,180,159, April 18, 1916, owned by the General Electric Company, which was sustained in the suit of General Electric Company vs. Nitro-Tungsten Lamp Company and in the suit of General Electric Company vs. Alexander et al.

Proposed California Power Act Denounced by Banker

DENOUNCING the proposed California "water and power act," which its advocates hope to submit to general referendum in November of next year, as a "distinct step toward socialism," and declaring that any such plan for state ownership would be an economic failure, L. H. Roseberry, vice-president of the Security Trust and Savings Bank of Los Angeles, speaking at a luncheon of directors of the Federated State Societies recently, said:

"The management of the power business is purely a private enterprise and should be left to private initiative and capital to assure efficient results and promote economy and efficient operation. While the state might in justice own its water supply, which is a natural monopoly, there is no more justification for going into the power business than into the manufacturing of clothing, farming or other food business. It is an effort to inject government into business, socialistic in its purposes and destructive to the institution of private ownership of property upon which this government and our civilization are founded. This menace is a type of radicalism which has proved disastrous to Europe and which is threatening our own business and civic institutions.

"Little or no control is placed over the expenditure of this huge sum or the administrative acts of the board which is to disburse it. There is no justification for the act, because the present California Railroad Commission is functioning above criticism in the treble interests of the utility companies, the consumers and investors in the utility's securities. This public regulation gives every benefit of public ownership without destroying initiative or assuming the liabilities of operators."

To Investigate Northern Ontario Electrification

THE Temiskaming & Northern Ontario Railway Commission has decided to make an investigation as to the feasibility of electrifying the road, with particular reference to the extension from Cochrane to Oil Can Portage, 70 miles further north. It is estimated that 500,000 hp. can be developed on the Abitibi River, between Kettle Falls, 16 miles north of Cochrane, and Oil Can Portage or New Post. The commissioners have authorized S. B. Clement, chief engineer of the Temiskaming & Northern Ontario Railway, and J. G. Kervy, consulting engineer, of Toronto, to make a report as to the power possibilities, the power required and the feasibility of the scheme, the report to be ready in three months.

The plans, profiles and all matters pertaining to the extension of the road from Cochrane have been approved by the provincial government. Contracts have been let for ties and rails for the first 40 miles of the extension.

Hoover Made Chairman of Colorado River Commission

PRESIDENT HARDING has appointed Secretary Hoover as federal chairman of the Colorado River Commission recently created jointly by Congress and the seven states traversed by the river. The appointment has been made with the approval of the governors of the states concerned—California, Arizona, Nevada, Utah, Colorado, Wyoming and Montana. It is the duty of the commission to determine a plan for the development of the immense power and irrigation possibilities of the river and to make recommendations to Congress. One of the first questions before it will be to determine whether the construction of the dams along the river should be undertaken by the federal government or whether they should be allotted to different private interests.

The Irrigation Service advocates that the first construction should be a dam about 600 ft. high at Boulder Canyon in Arizona, costing about $40,000,000, which would give an initial amount of upward of 600,000 primary horsepower. This dam would increase the irrigated acreage in Nevada, Arizona, California and Mexico by 1,300,000 acres and would give such flood control as would protect the Imperial Valley from destruction by a break in the river banks.

New Transmission System to Serve Western Kentucky Coal Mines

AN EXTENSIVE transmission system has been planned by the Kentucky Utilities Company to serve all the coal mines in western Kentucky and larger towns in that section requiring service. The company has just closed contracts with five coal mines for an aggregate of 850 kw. connected load, to yield an annual revenue of $30,000. Negotiations are in progress for several more mining contracts. Central City and Greenville, now served by the company, will soon be connected to the new transmission system, effecting a substantial saving in operation and permitting the addition of more new business.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Metric System Bill Up Again.—Hearings on Senator Ladd's bill providing for the compulsory adoption of the metric system after ten years were reopened at Washington on Dec. 14. The hearing is being conducted by a sub-committee of the manufactures committee of the Senate, of which Senator McNary of Oregon is chairman.

A Big Lifting Magnet.—Among the biggest electric lifting magnets of the world is one recently supplied to a British steel works by a Birmingham (Eng.) manufacturer. The magnet is 66 in. in diameter, weighs 5,800 lb. and is, says *Engineering*, capable of raising a load of 50 tons. It is used in a plant for handling and breaking scrap metal and delivering it to the charging box for furnace filling, and it is handled by a 25-ton overhead crane.

Boquillas Dam Called Second Largest in Storage Capacity.—A Mexican government official who recently returned from a visit of inspection to the now completed Boquillas Dam, in the State of Chihuahua, which has been built for power and irrigation purposes in the valley of the Conchos River, declares that the storage capacity of this great development will be 106,000,000,000 cu.ft. and second only to that of the Elephant Butte Dam, near El Paso, Tex.

Electrical Workmen's Earnings on Railroads.—Figures issued by the Interstate Commerce Commission indicate that for the month of July last the earnings of workmen concerned with electrical operations on the Class I railroads of the United States were: General foremen, electrical transmission, $238; assistant general foremen, electrical transmission, $215; linemen, $159; electrical inspectors, $202; electrical workers, Class A, $170; electrical workers, Class B, $167; electrical workers, Class C, $130; laborers in power plants, $94; common laborers in power plants, $82; stationary firemen and oilers (electrical plants), $130.

Simple Type of Radio Direction Finder.—An important application of the radio direction finder is to expedite the location of a wrecked ship by a rescuing ship. If the former vessel can continue to send out radio signals, a ship equipped with even a very simple type of direction finder can lay a course directly to the wreck, even in time of heavy fog. A rescuing ship not equipped with a radio direction finder may require many hours to locate a vessel in distress, even though near at hand, if there is a fog, and this delay sometimes results in a serious loss of life. A very simple type of direction finder is described in the report of the technical conference on radio regulation held in Paris a few months ago. It consists of a square wooden frame about 5 ft. on a side, wound with eight turns (spaced ½ in.) of No. 20 insulated copper wire, and it can be used with auxiliary simple receiving apparatus. This instrument can be held in the hand by a person on deck and fairly accurate bearings taken on a ship sending out distress signals. The working distance depends upon the sensitivity of the detector and amplifier used with the direction finder. The accuracy increases as the ship is approached.

Electrical Progress in El Paso.—Improvements involving the expenditure of $840,000 have, according to a dispatch in the *Manufacturers' Record*, been completed at the plant of the El Paso (Tex.) Electric Railway Company. The additions and improvements to plant and equipment were made to take care of increased demands for electric power throughout the city, and more than 200 plants of many kinds are now served in addition to power for lighting purposes and steel railway use. A 75,000-kw. turbine together with the necessary auxiliaries is part of the new equipment.

Illinois Properties To Be Merged.—Announcement has been made that a merger of the railway, gas, electric and heating properties of the Springfield (Ill.) Consolidated Railway Company and the Springfield Gas & Electric Company and the electric and heating properties in DeKalb and Syracuse, Ill., is planned, subject to the approval of the bondholders, the new company to be known as the Illinois Power Company and to have a capitalization not to exceed the combined capital of the constituent companies, which is $10,025,000. The properties concerned are controlled by the Commonwealth Power, Railway & Light Company.

Program of Northwest Electrical Service League.—The Northwest Electrical Service League has called two meeting of jobbers' salesmen. The first was held at Seattle, Wash., Nov. 19 with an attendance of forty, the second at Portland, Ore., Nov. 26 with an attendance of thirty. Auxiliaries are being planned for Spokane and Tacoma. Meetings will take place at least once every two months. Constructive work will, according to Stephen Ivan Miller, Jr., the manager-secretary, be at once undertaken along the lines of sales "round tables" in order that successful salesmen may contribute their ideas and experience to the entire group.

Harnessing the River Jordan.—The placing of a contract by the Palestine government for a hydro-electric system in connection with the River Jordan has, according to the London *Engineer*, been the subject of inquiry in the British House of Commons. It appears that the contract was awarded to a Russian, and the Colonial Secretary was asked whether tenders were obtained from other sources before reaching a decision. The reply given indicated that the contractor was acting in co-operation with the Zionist organization, and the Palestine government as well as the Colonial Office approved of the concession. The works, which will utilize the waters of the Rivers Jordan and Yarmuk and the other streams for the generation of electric power throughout the country, will, it is understood, employ local labor to a large extent. The exact terms of the concession have not been stated, and it is uncertain whether the government is assuming any financial responsibility.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

British Columbia Co-operative League Changes Name.—The advisory council of the British Columbia Electric Co-operative Association has decided to change the name of the organization to "Electrical Service League of British Columbia."

American Physical Society.—At the Toronto meeting of the American Physical Society on Dec. 27-31, Prof. J. C. McLennan will give an address on "Atomic Nuclei and Extra-Nuclear Electronic Configuration." This will be followed by a symposium on the quantum theory.

American Welding Society to Have Western Sections.—The American Welding Society, which has its headquarters in New York, will add five sections to the parent organization with the completion of preliminary steps taken on the Pacific Coast by C. A. McCune, vice-president of the society. Work in the establishment of the sections is under way in Seattle, Spokane, Portland, San Francisco and Los Angeles, and it is expected that each of the five new branches will be thoroughly organized by the first of the year.

Section Meetings of the A. I. E. E.—Future Institute section meetings scheduled include these: Dec. 29, Atlanta, "Muscle Shoals," by C. G. Adsit, chief consulting engineer Georgia Railway & Power Company; Jan. 12, Bethlehem (Lehigh Valley Section), "Electricity Aboard Ship"; Jan. 20, Baltimore, "Use of Electricity for Industrial Heating," by C. F. Hirshfield, chief of research department, Detroit Edison Company; Jan. 27, Salt Lake City, "Possibilities of Electrical Engineering in the Future Development of Utah," Lafayette Hanhett, president Utah Power & Light Company; Jan. 27, New York (jointly with A. S. M. E.), "Industrial Power Requirements."

Coming Meetings of Electrical and Other Technical Societies

American Physical Society—Toronto, Dec. 27-30.
American Association for the Advancement of Science—Toronto, Dec. 27-31.
A. I. E. E. Section Meetings—Atlanta, Dec. 29; Lehigh Valley, Jan. 12; Baltimore, Jan. 20; New York, Jan. 27; Salt Lake City, Jan. 27.
Massachusetts State Association of Electrical Contractors and Dealers—Springfield, Jan. 5.
American Engineering Council—Washington, Jan. 5-6.
A. I. and S. E. E.—Philadelphia Section, Jan. 7; Chicago Section, Jan. 27.
Western Association of Electrical Inspectors—Chicago, Jan. 17-19. (For program see issue of Dec. 17, p. 1243.)
American Society of Civil Engineers—New York, Jan. 18-19.
Association of Municipal Electrical Utilities of Ontario—Toronto, Jan. 26-27.
Lighting Fixture Dealers' Society of America—Milwaukee, Jan. 30-Feb. 2.
New Mexico Electrical Association—Albuquerque, Feb. 13-14.
American Institute of Electrical Engineers—Midwinter convention, New York City, Feb. 15-17.
National Meter Committee, N. E. L. A.—Springfield, Ill., Feb. 15.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities

Approval of "Split Inventory" Basis of Valuation.—The Wisconsin Railroad Commission has placed itself on record as favoring the "split inventory" basis of valuation. "This method of determining property value," the commission explains, "consists in applying pre-war nominal prices to property installed before the war and investment cost on all property installed since. The method is in accordance with the established policy of the commission and is used in preference to the 'present cost of reproduction' basis as being fairer in the long run to both the company and the consumers. It is also more permanent and is not affected by possible abnormal market prices at the time of the appraisal."

Should Return Be Allowed on Full Value of High-Priced Site?—The Hawaii Public Utilities Commission, dealing with the question of return on an unnecessarily expensive site, said recently: "Public utilities are a vital necessity in the affairs of every community; their sound financial standing and the confidence of the investing public in the opportunity for a limited but sure reasonable return under efficient management is vitally necessary, not only to the continued prosperity of the utilities but to the ability of those utilities to continue by their development an expansion adequately to serve the public. If utilities are ever placed on a basis where their return is limited to a fair return under the most skillful management, subject to further deduction by way of penalization to the uttermost farthing for every error in judgment, the result will necessarily be the rendering so unattractive of public utility investments that the further development and expansion of public utilities will from a business standpoint become practically impossible."

Improper Financing Condemned.—In granting permission to the Coast Valleys Gas & Electric Company to make new stock issues and cancel claims for unpaid accumulated dividends, the California Railroad Commission sharply criticised overcapitalization as practiced before the issue of the securities of public service corporations was placed under its control. Such improper financing, it said, "has resulted in some utilities depending entirely on borrowed funds or earnings for moneys to pay for additions and betterments. The result has been the payment of high interest rates for loaned capital. The inability to sell stock is not always due to low earnings on property used and useful in rendering service to the public, but frequently is caused by the fact that a large amount of stock is outstanding which does not rest upon any real equity. It is only through refinancing and the sale of stock that such conditions can be remedied. It is unfortunate that the commission has not sufficient power to take positive action in these matters. Antiquated financial structures have seriously handicapped utilities in their financing and have been a cause in rendering unsatisfactory service to the public."

Damages Awarded in Excess of Insurable Amount Are Not an Operating Expense.—Awards in judgments returned against public utilities for personal injuries not covered by insurance cannot be passed on to ratepayers, according to a decision rendered by the California Railroad Commission in passing on the electric rates of the Western States Gas & Electric Company, operating in Stockton. The rule laid down as to damage awards is that the cost of insurance is an allowable operating charge, whether a utility carries insurance or assumes the risk, but where a judgment award exceeds the insurable amount the stockholders must stand the loss. The company wished to amortize in its operating expense account over a period of three years $36,000, the remainder of a personal injury judgment after a casualty company had paid the amount of its liability. Commenting on the company's proposal to amortize this sum in operating account, the commission said: "From a study of public utility commission decisions and court decisions it appears that in general allowance is made in operating expenses for either the reasonable insurance to cover public liability or reasonable cost of carrying such insurance, and that allowance for excess damages over insurable amounts should not be made. The amount in question is in excess of insurance carried. Applicant at this time is carrying public liability insurance, and the amount included in general expenses should be eliminated."

Contract Involved in Sale of Private Generating Plant to Central-Station Company Discriminatory.—Opposing an application to the Utah Public Utilities Commission from the Utah Power & Light Company for increased rates for steam service, the Hotel Utah Company contended that in 1916 it had entered into a contract for the sale of its own plant for the generation of electricity, steam and hot-water heat and refrigeration to the Utah Power & Light Company for a certain price and at the same time entered into service contract with the latter company whereby the hotel company was to be furnished electric and steam-heating service for a stated price. It was further contended that the contracts were for such consideration as would come under the exception rule or proviso set forth in the public utilities act of Utah, and that the consideration had at the time of the said transaction was such as to prohibit the changing by the commission of the rates agreed upon in the contract. The commission, after making an inquiry into the value of the transferred property for revenue as compared with its purchase price, denied the hotel company's contention, asserting: "The record clearly indicates that the effect of preserving the contract rate under the admitted facts in this case would be either to prevent the rendition of central-station steam service, by reason of its inability to pay expenses, or to cast upon the remaining consumers of such steam service the burden of making up the deficit, over $66,000 per year, resulting from the service to the Hotel Utah Company at the contract rate. The contract rate is therefore discriminatory."

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies

Municipality Has No Right to Appeal Against Rates by Which It Is Not Affected.—In City of Oswego vs. People's Gas & Electric Company of Oswego, the city authorities sought to enjoin the utility from enforcing its rates against private consumers. The New York Supreme Court has dismissed the proceedings because the municipality is by the terms of the Public Service Commissions law exempt from the rates and has therefore, the court holds, no right to represent other consumers in such proceedings, which must be brought by a real party in interest. The power conferred on the mayors of cities under the law applies only to the institution of proceedings before the commission and provides no basis for an action in the courts. (190 N. Y. S. 39.)*

Service Charge Declared Illegal in New York.—The Appellate Division of the New York Supreme Court for the Third Department has held the service charge of 40 cents permitted the Rochester Gas & Electric Corporation by the Public Service Commission to be illegal. Three of the justices voted for the reversal of the commission's order and two dissented. Opinions filed previously by the New York Supreme Court have held that the commission is empowered to make such a charge, and that it is not a rental or meter charge within the meaning of the transportation corporations law, which prohibits a direct or indirect rental or meter charge. (See ELECTRICAL WORLD for Nov. 5, page 944.) The Rochester Gas & Electric Corporation is carrying the case to the highest court of the state, the Court of Appeals, and from it a definitive opinion is expected.

Powers of Oklahoma Commission.—In Oklahoma Gas & Electric Company vs. State Corporation Commission the Supreme Court of Oklahoma has determined (1) that the commission may prescribe a temporary schedule of rates to be effective until it has had time to evaluate the company's property, (2) that it is not necessary for the commission to fix a time limitation for a temporary rate order, (3) that in fixing a rate the commission may take into consideration former earnings and probable prospective earnings, former cost of operation and probable prospective cost of operation, with the object of so adjusting the rates as to prevent the public utility from practicing extortion on the public and yet allow it a fair and reasonable return, and (4) that the legislative power of the commission over rates is not confined to prescribing permanent rates but may be exercised as the exigencies of the times and changing conditions demand. (202 Pac. 505.)

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*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System

Men of the Industry

Changes in Personnel—Responsibilities and Association Appointments of Men Engaged in Professional, Executive, Operating and Commercial Branches of the Industry

William A. Durgin has been placed in charge of the new division of the Department of Commerce which will be concerned with furthering the elimination of waste by the simplification of commercial practices. Leave of absence was given to Mr. Durgin by the Commonwealth Edison Company of Chicago that he might direct this work. Mr. Durgin was born in Rochester, N. Y., and was graduated from the Massachusetts Institute of Technology. Immediately after his graduation he joined the engineering staff of Stone & Webster and took that firm's student course in the Boston office. He was then sent to Terre Haute in the capacity of assistant lighting superintendent of the local central-station company. From 1904 to 1914 he was engaged in the testing department of the Commonwealth Edison Company of Chicago. During this period he specialized in the location of faults in underground cables and studied the particular problems of large alternating motors. From 1914 to 1919 he served the Commonwealth Edison Company as light specialist, being promoted to the post of lighting assistant to the vice-president. In December, 1920, he was made secretary of the budget and expense committee and of the advisory committee of the company.

W. A. DURGIN

J. P. Clark, who has been associated with the securities department of the Central Maine Power Company since that department was first established, has been transferred to the operating department and will hereafter devote all his time to following up petitions for line extensions and to selling stock to finance extensions which the company undertakes to build. Mr. Clark brings into this work the new idea of soliciting stock sales from companies wishing extensions made by the Central Maine Power Company.

C. Murphy Chandler has been elected chairman of the Georgia Railroad Commission for a sixth consecutive term.

F. M. Doolittle, who has been instructor in electrical engineering at Yale for the past two years, has resigned and is devoting himself entirely to his manufacturing interests in New Haven, where he is manufacturing radio apparatus and electrical specialties.

L. B. Herrington, the newly elected president of the Kentucky Association of Public Utilities, comes to this position armed with fifteen years of experience in the problems of the utilities. Mr. Herrington was born in Albany, Ga., April 8, 1880, and is a graduate of the Central University of Kentucky and the law department of Mercer University, Macon, Ga. In 1905 he became president of the Richmond (Ky.) Electric & Power Company and built the power plant which still serves that place. Later, this company erected the power plant at Gallipolis, Ohio, and the telephone system at Orlando, Fla. These properties were sold to local syndicates, and in April, 1917, Mr. Herrington joined the Kentucky Utilities Company, Louisville, Ky. He has twice represented Madison County in the Kentucky Legislature and was presidential elector from the Eighth Congressional District in 1916. Mr. Herrington is now president of the Electric Transmission Company of Virginia, operating extensively in the coal fields of Lee and Wise Counties; president of the Kentucky Light & Power Company, which operates five utilities in western Kentucky, and also vice-president in charge of operations of the Kentucky Utilities Company, which serves thirty-seven cities and towns in Kentucky and the coal fields of the southeastern and western part of the state.

L. B. HERRINGTON

Prof. Henry Jordan has begun work as head of the department of electrical engineering in the State College of Colorado at Fort Collins. He is a graduate of Virginia Polytechnic Institute.

Walter F. Finlay, Jr., was elected a manager of the American Society of Mechanical Engineers at its annual meeting held in New York City in December. Mr. Finlay was born in Hoboken, N. J., in 1882 and was graduated from Cornell University in 1904 with the degree of mechanical engineer. Soon after graduation he entered the employ of the Interborough Rapid Transit Company, his first work with that company being in connection with the construction of the Fifty-ninth Street power station. He later assisted in experimental and research work in connection with schemes for the development of that station and the promotion of its efficiency. In 1909 Mr. Finlay left the Interborough to go into engineering work with the New England Engineering Company, and subsequently became associated with his father in commercial work, returning to the Interborough company in 1915 to take charge of the installation of turbines and of auxiliary mechanical equipment necessitated by the extensions to the subway and elevated systems. He was subsequently appointed superintendent of motor power of this company, and in addition to supervising operation of its power-generating system he had charge of the engineering and construction work coming within the scope and control of the department. In 1920 he resigned from the Interborough to become vice-president of the American Water Works & Electric Company.

W. F. FINLAY, JR.

V. C. Grant has resigned from the position of superintendent of the Enterprise (Ore.) Electric Company to accept the management of the Ilwaco (Wash.) Light & Power Company.

Lloyd P. Joubert, formerly with the Todd Dry Dock & Construction Company, is now electrical engineer with the Tacoma (Wash.) lighting department.

David P. Barrows, president of the University of California, has been appointed a member of the National Research Council for a term of three years.

Edward A. Deeds, recently elected vice-president of the American Society of Mechanical Engineers, was born near Granville, Ohio, in 1874. He was graduated from Denison University in 1897 with the degree of B.S. After studying electrical engineering at Cornell he became assistant draftsman for the Thresher Electric Company at Dayton, Ohio, and within a year was advanced to the position of chief engineer and superintendent. He resigned in 1900 to become construction and maintenance engineer for the National Cash Register Company. After two years with this company he resigned to go to Niagara Falls, where as chief engineer he designed the plant and equipment of the Shredded Wheat Company, and was for a time in charge of operation of the plant. He then returned to the National Cash Register Company, as vice-president in charge of engineering and production. At the time of his resignation from this company in 1914 he was vice-president and general manager. Working together, Colonel Deeds and C. F. Kettering developed the electric starting, lighting and ignition device for automobiles, founding the Dayton Engineering Laboratories Company. Selling this business in 1916, Mr. Deeds and Mr. Kettering devoted themselves to the Domestic Engineering Company, another industry created by them for the manufacture of isolated house-lighting outfits. Colonel Deeds is president of this organization. In April, 1917, Colonel Deeds became a member of the Munitions Standards Board, then a member of the Aircraft Production Board. He was largely responsible for the broad foundation upon which the aircraft-production program proceeded and for the development and production of the Liberty engine. He is a member of the American Institute of Electrical Engineers, the Society of Automotive Engineers, and one of the charter members of the American Electrochemical Society. He belongs to the Engineers' Club of New York and is president of the Engineers' Club of Dayton. He is vice-chairman of the board of trustees of Denison University.

E. A. DEEDS

A. H. Kohlbusch has been appointed manager of the Chicago office for Payne Dean Limited, with headquarters in the Lumber Exchange Building, 11 South La Salle Street. Previous to May 1, 1921, he had been connected with the Public Service Electric Company of New Jersey as construction superintendent. Mr. Kohlbusch was graduated from the mechanical engineering course at Columbia University in 1913.

Charles H. Bromley, formerly technical director of the Richardson-Phenix Company, Milwaukee, has been appointed manager and chief engineer of the newly formed Richardson-Phenix division of S. F. Bowser & Company, Inc. His headquarters will be at Fort Wayne, Ind.

J. D. Mooney, general manager of the Remy Electric Division of the General Motors Corporation, has been promoted to the position of operating vice-president in the East for the Motors Corporation. **I. J. Reuter** has been appointed general manager of the Remy division. Mr. Reuter is a graduate of Purdue University, in the class of 1907.

W. H. Smedley has been appointed acting manager of the Halifax office of the Northern Electric Company, Ltd. Mr. Smedley has been with that company for fifteen years, first becoming connected with it in 1906 at the manufacturing plant in Montreal. In 1910 he was transferred to the Montreal local distributing house, which had just been opened, and was put in charge of service and stock maintenance. In 1917 he was appointed district stores manager in Montreal and in 1919 held the same position in the Toronto district. A year later he was placed on the general sales manager's staff in order to make a special study of merchandising methods of his own and other companies and held that position until Nov. 1 of this year, when he received his present appointment as acting manager of the Halifax office.

Obituary

John Wheeler Duntley, fifty-five years old, founder of the Chicago Pneumatic Tool Company, was killed in Chicago on Dec. 15 by an automobile truck. Mr. Duntley was one of the first men to bring pneumatic tools into use, working with Charles M. Schwab to place them on the market. He established the Chicago Pneumatic Tool Company in 1884 and was president of the company until 1909.

Robert H. McKean, manager of the credit department of the McGraw-Hill Company, Inc., died at his home on Dec. 17, 1921. Mr. McKean's services began with the *Engineering and Mining Journal* in April, 1902, as assistant in the accounting department. Within two years he had been promoted to the position of head bookkeeper, and at the time the periodical was purchased by the Hill Publishing Company he was in charge of the accounting department. About a year later Mr. McKean was appointed manager of the *Engineering and Mining Journal*, a position he held until he was elected a director and secretary of the Hill Publishing Company. At this time he assumed the management of the credit department of the company. He was a director and secretary of the Hill Publishing Company until its consolidation with the McGraw Publishing Company. After the consolidation he became manager of the combined credit department and held this position until his death. Mr. McKean's loss to the McGraw-Hill Company, Inc., will be a serious one because of his unusual ability in his chosen work. His ready wit and keen sense of humor will be missed by his associates.

W. Caryl Ely, vice-president of Barron G. Collier, Inc., and president of the American Electric Railway Association from 1904 to 1906, died on Dec. 14 from heart failure. Mr. Ely was a man of prodigious enterprise. He was perhaps best known among the railway men as the former head of the International Railway, Buffalo, and for his work with the Collier organization, but these are only a small part of activities to which he had turned his attention from time to time. Mr. Ely's charm of manner and invariable courtesy and consideration for others endeared him to his many friends. At the same time his sound judgment and forensic ability made him a national leader among men. Mr. Ely was born in Middlefield, N. Y., in 1856 and was graduated from Cornell University. He studied law, was admitted to the bar at Ithaca, N. Y., in 1882 and practiced in East Worcester, N. Y., after which he removed to Niagara Falls. In 1899 he gave up the practice of law to become president of the International Traction Company of Buffalo and the International Railway. In 1891 he was nominated by his party for justice of the Supreme Court. Mr. Ely was one of the organizers of the Niagara Falls Power Company and was identified with the Buffalo-Niagara Falls Electric Railway, having been the first president of that company. Upon the union of the International Traction Company and the International Railway, Mr. Ely became president, serving in that capacity until March, 1905. For six years previous to 1910 Mr. Ely was president of the Ohio Valley Finance Company and engaged in the construction and operation of electric railway and electric lighting properties in the Ohio Valley between Pittsburgh and Wheeling. Among other companies in which he was interested were the East Liverpool Traction & Light Company, the Ohio River Passenger Company and the Steubenville & Liverpool Railway & Light Company.

W. C. ELY

Trade and Market Conditions

Business Reviews, Together with Market Letters from Important Trade Centers, on the Supply, Demand and Prevailing Prices of Electrical Apparatus and Supplies

Transformer Market Easier with Moderate Production

ALTHOUGH nothing spectacular is in evidence in the transformer market at this time, part-time production is being carried on by most manufacturers under conditions favorable for rapid expansion should business increase speedily. All over the country there is a constant absorption of distribution transformers for utility service, and there has been a moderate sale of the power type of transformers for foreign installation outside of Europe. Raw materials are plentiful, and a recent temporary shortage in high-grade steel has been overcome satisfactorily. At no time did this condition cause any serious hardship, but with the advent of better business in the industry as a whole orders on the mills will tend to approach volumes that mean more economical handling per unit than of late. Insulating materials are said to be in unusually good supply at this time.

Steady prices on the whole characterize this field, and buying seems to be more dependent on general business conditions than on apparatus cost to the purchaser. In other words, if a central-station company or industrial buyer of transformers sees an opportunity to utilize such equipment, he is not likely to put off ordering very long for fear that there may be price changes. Reductions have been made consistently with former price levels and new costs, and where the need for new equipment exists, purchases may be made on the assumption that prices are now reasonably stable in the opinion of representative manufacturing and distributing interests. Some manufacturing for stock is under way, and productive organizations have been kept well enough in hand to meet larger requirements on short notice. Deliveries are excellent, and the tendency toward higher voltage selections for distribution as well as for transmission gives evidence of marked interest in economic applications on the part of operating companies and industrial concerns.

Heavy Buying of Telephone Line Material in New England

UNPRECEDENTED purchases of telephone-line material were necessitated in New England by the recent record-breaking sleet storm. Both the New England Telephone & Telegraph Company and the American Telephone & Telegraph Company entered the market by the Monday morning following the beginning of the storm on Sunday, Nov. 27. Existing emergency stocks of poles and other line material were drawn upon heavily. Most of the purchases of the New England company were made through J. C. Kilday, supervisor of supplies, and by him through T. L. Holmes, manager telephone department, Western Electric Company, Inc., Boston. The warehouses and yards of the latter organization in the East were heavily drawn upon, and for about a week staffs worked literally day and night to fill emergency orders. Shipments into New England were largely made by rail and the wire factories coöperated, as did other plants in pushing material forward to the limit. Motor-truck shipments were extensively used in distributing material within the Massachusetts areas hardest hit.

Up to Dec. 12 the New England company had ordered the following major material for immediate field service: 12,000,000 ft. No. 17 twisted-pair and 1,500,000 ft. No. 14 twisted-pair for outside distributing lines for temporary toll and exchange work; 400,000 lb. of bare copper wire, chiefly No. 12, for permanent toll lines; twelve carloads of cross-arms; 100 tons pole-line hardware; 430 tons bare iron wire, and 325 sets linemen's tools and equipment. The telephone company lost approximately 10,000 poles and its total damages, General Manager W. R. Driver, Jr., stated to the ELECTRICAL WORLD, will be easily $1,500,000. About 5,000 miles of toll lines were down in New England. To replace lines destroyed about 400,000 linear feet of underground cable have been purchased, and the American company has ordered about 50 miles of sixty-circuit cable to be installed in an underground duct line between Boston and Worcester, previously constructed in anticipation of traffic expansion. Over 7,000 poles were among the earlier New England orders. Shipments at the rate of 50 tons per day left the Boston warehouse of the Western Electric Company during the first week after the storm and at the rate of 75 tons per day from other distributing stocks.

Early Improvement in Wiring Supplies Market Anticipated

ALTHOUGH a slight recession in demand has struck manufacturing plants turning out schedule material within the past two or three weeks, it is not believed by close observers of market conditions that this will last. Some of the best-known producers are making finished material for stock at this time in addition to filling routine orders from jobbers. If the demand should continue light after the middle of January, it is expected that some curtailment of output would have to be put into effect; but the feeling is widespread in the market that as soon as inventory days are past a much more healthy tone to orders will manifest itself. There is heavy pressure on building concerns to expand their activities on price bases which will permit more satisfactory investment of capital in homes and mercantile establishments, and broad general gains in the business situation are sure to be reflected next year in a better demand for wiring supplies, in the opinion of several manufacturers who discussed this matter a few days ago with a representative of the ELECTRICAL WORLD.

One of the chief obstacles to a more rapid expansion of output in schedule materials is the hesitation of the jobber to buy substantially for stock, in the opinion of leading manufacturers. The jobber, on his own account, feels that until the demand increases much more, and until prices are stabilized to a greater degree he must move with caution and hand-to-mouth buying results. The manufacturer points out that the jobber expects 24-hour deliveries on most standard products and greatly desires that distributers' stocks shall be built up somewhat more than of late, particularly as space is lacking in many plants for convenient storage of wiring supplies beyond three or four weeks' output down to the production of a few days. The storage practices of different manufacturers vary considerably, but all those interviewed were looking forward to the building up of more diversified stocks in distributers' hands as a real possibility in the coming year.

The situation is a difficult one all around, but as building operations increase—and improved credit is helping here—the demand upon the jobber is bound to grow, and with larger volumes of sales, local stocks can safely be increased if the buyer is reasonably satisfied that stable or minimum prices are with us. Within the past year not a little liquidation in wiring device prices has occurred, and while prophecy is not to be indulged in freely, it may be said that a little more purchasing for stock by distributers does not appear likely to lead to any substantial losses in view of the present tendencies of copper prices. The manufacturer's viewpoint is that the jobber may now well ask himself if schedule material prices are not sufficiently close to the latter's ideas of what is reasonable to warrant a more liberal policy in purchasing for future stock, unless the particular jobber still finds himself heavily oversupplied with this class of material.

Copper Research Association Working to Reduce Costs

At the first annual meeting of the Copper and Brass Research Association, held in New York Dec. 6, it was announced that particular attention is being paid to technical production and sales methods in a continuing effort to reduce costs of copper to the consumer. The effect of this will probably not be felt by the electrical industry for some time as the price of copper is low now. Many mines cannot be operated profitably at present copper prices, but as soon as quotations resume their proper levels—and this may be soon—the effort by producers to keep down costs will react favorably on electrical manufacturers and central stations.

That the producers realize the need to keep costs down in order to increase consumption is evidenced by a part of the convention announcement which reads as follows:

"As we view it, in the new business era at hand, we shall see a keener competition, more scientific buying and a greater scrutiny of values in relation to price than ever before. No industry can hope permanently to prosper unless it has a product which it is really economical for the public to buy."

Position of Farm-Lighting Plants Becoming More Favorable

A survey of the prospects for the sale of farm-lighting plants during the next few months indicates that, although agricultural conditions in many parts of the country are more or less bad, intensive sales methods and education of the farmer may be expected to bring good results. Sales in some territories have improved in the last few months noticeably, though it is still impossible to consider them good. The best sign of all, however, is that the farming class is showing interest in the possibilities of these units, and when the financial situation of the farmers is bettered a large demand will undoubtedly develop of itself. Conditions in the East may be summarized as fair actually and more than good potentially.

A fine outlook for 1922 business in farm-lighting sets is reported from New England. Farming districts with a few important exceptions prospered this year, and conditions are improving generally in the northern and central parts of this territory. A leading distributer's sales for 1921 exceed those of 1920 by 7½ per cent. Vigorous sales effort is yielding fruit and the territory is far from saturated. Conservatively, New England should easily absorb 20 per cent more sets next year than this.

The outlook in the Southeast is reported quite encouraging, one of the largest jobbers of this specialty reporting that, owing to advertising and sales campaigns recently undertaken, he is having unusual success in sales and is in receipt of many inquiries. This particular jobber is arranging to sell plants on twelve monthly payments, taking the purchaser's notes for this period. Business conditions in a certain section may be found good, while in a section near by where no cotton was picked they are very poor.

Expectations are that the largest volume of sales will come from southern Alabama, northern Georgia and North and South Carolina in the order named. Special efforts are to be made to boost the business in Florida. Recent price reductions should begin to make themselves felt in the Southeast within the next thirty days.

Since the financial situation in agricultural sections throughout the Middle West is not so good as was expected, dealers in farm-lighting plant units there are rather divided in opinion as to 1922 prospects. Sales for the past few months have increased only slightly over sales during the spring of the year. However, several dealers tell of an increased amount of inquiries even in territories where conditions are the worst. Such an interest shown at the present time augurs well for these units when farmers are on a better financial basis. In the majority of cases dealers are not heavily stocked, and when a few orders are obtained it is often necessary to send direct to the factory for them.

Sales in St. Louis and the Southwest for the past few months have been much better than was anticipated, but the decline in prices on farm products has held back a good many purchasers. Total sales for the year will be perhaps 25 per cent of those for last year. At the present prices of grains and meats, farming is not very profitable, and many farmers are in bad shape financially. Their losses, however, have been to some extent liquidated, and with labor prices lower they may have more buying power next year. This cannot have much effect until next summer, and as a consequence sales from now until spring will necessarily be slow and difficult. Dealers are getting out special advertising and making strenuous efforts to sell, so that a reasonable volume of business, considering existing conditions, may be expected.

In surveying the business of the present year on the Pacific Coast it appears that for about a year beginning with November, 1920, there was a decided slump in sales, though not in interest, for never before have there been so many live inquiries from prospective purchasers as during this time. Agricultural conditions have been excellent. Sales last month picked up surprisingly, going ahead of the same month last year. The average plant sold in this territory is now rated at 1¾ hp. or 1½ hp. It is noticeable that larger batteries are being demanded. One firm marketing 90-hour and 180-hour continuous-rating batteries reports more sales of the larger size. Manufacturers' stocks are very good, but dealers are buying more and more in a hand-to-mouth manner because of the uncertainty of prices.

Metal Market Situation

Consuming demand for copper has become very quiet, but producers are in a position of such great statistical strength that the lack of demand has no effect on price. Quotations of 13⅞ cents per pound rule for deliveries through December and January, but some producers say there is virtually no metal available at this price. There is authority for the statement that the copper surplus of the country is almost gone. It is true that there is still 200,000,000 lb. available for domestic delivery, but most of this is sold for the first quarter. Several of the larger agencies whose producing sources have had their mines shut down are said to be very low on unsold metal. From this it may be seen that there is a probability of a shortage and a runaway market, as it takes from three to five months between the mining of the copper and its delivery refined and most of the producers are entirely inactive.

NEW YORK METAL MARKET PRICES

	Dec. 12, 1921	Dec. 19, 1921
Copper	£ s d	£ s d
London, standard spot	66 17 6	66 12 [illegible]
	Cents per Pound	Cents per Pound
Prime Lake	13.75	13.87½
Electrolytic	13.62½	13.62½ – 13.75
Casting	12.87½	13.00
Wire bars	15.00 – 15.25	15.00 – 15.25
Lead, Am. S. & R. Co. price	4.70	4.70
Antimony	4.50	4.50
Nickel, ingot	41.00	41.00
Sheet zinc, f.o.b. smelter	9.00	9.00
Zinc, spot	5.15 – 5.20	5.20 – 5.25
Tin, Straits	33.50	33.50
Aluminum, 98 to 99 per cent	19.00	19.00

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	11.50 – 11.75	11.00 – 11.50
Brass, heavy	5.00 – 5.50	5.00 – 5.37½
Brass, light	5.00 – 5.12½	5.00 – 5.12½
Lead, heavy	3.75 – 4.12½	4.00 – 4.12½
Zinc, old scrap	2.50 – 2.75	2.50 – 2.75

THE WEEK
IN TRADE

Prices When Quoted Are Those Prevailing at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

THE last week has been a period of hand-to-mouth buying for both the jobber and the dealer, and not until the taking of inventory has banished the fear of large stocks may better business be expected. If it were not for a fairly good holiday-goods demand and unprecedented December construction, business in all branches of the trade would have been negligible.

In spite of the dull tone, there are a few high spots. Makers of small electrical specialties around Boston are busy and there have been very good sales of air heaters there. Atlanta notes a demand for electrical toys much improved over the first of the month, but there still is fear of a carry-over. Excellent sales of radio receiving sets continue in Chicago, and there is the usual activity in high-tension equipment there. There are a number of small transmission lines under way or planned near St. Louis. On the Pacific Coast around San Francisco there is reported a rather disappointing end to holiday business.

NEW YORK

In the electrical trade particular attention has been given to the holiday business during the past week. As predicted earlier in the season, most dealers have waited until the last possible moment before ordering their Christmas stocks. As a result this business has been very active within the past week, and some jobbers report that their stocks of some heating appliances are very low. In some quarters it is expected that the volume of holiday sales will equal and possibly exceed that of last year, while in others the estimates are not so sanguine. It seems certain, however, that this business will be considerably in excess of early estimates.

Demand for wiring material is steady, with, of course, a tendency on the part of contractors to hold their stocks down until after the inventory period. There is a general tendency to mark time until after the turn of the year, when renewed activity is expected with a considerable degree of confidence.

Conduit.—There has been little change in the demand for this material, the additional 5 per cent discount announced last week appearing to have no tendency to stimulate sales. Under the new discount representative jobbers' quotations are: For ½-in. black pipe in 2,500-ft. lots, $46; ¾-in., $59, and 1-in., $85 per 1,000 ft. Galvanized pipe in the same sizes is quoted at $51, $66 and $94 per 1,000 ft. Jobbers' stocks are good.

Rubber-Covered Wire.—Prices have stiffened slightly during the past week, although demand remains about the same. No. 14 rubber-covered is quoted from $6.50 up to $6.93 per 1,000 ft. in 5,000-ft. lots.

Flexible Armored Conductor.—Jobbers have been able to increase their stocks somewhat, but the demand continues very active. Prices are a little easier. No. 14, two-wire, single-strip, is quoted at $45 per 1,000 ft., and double-strip at $47 per 1,000 ft.

Lamp Cord.—No change in price has been announced as yet. No. 18, cotton, twisted, is quoted at $12.90 per 1,000 ft. and the parallel at $15.60 per 1,000 ft. in that quantity. Stocks are good to large.

Heating Appliances.—Orders have been very good for the past week, and some jobbers who ordered sparingly are finding their stocks already depleted. There has been a heavy last-minute rush of holiday business which will probably continue through the present week.

Cleaners and Washers.—Jobbers report a very satisfactory volume of vacuum cleaner sales along with the other Christmas business. Washing machines are moving slowly.

B-X Connectors.—An advance of about 10 per cent in the price of these fittings has been announced. In lots of 1,000 the net price has been advanced from $36 to $40 per 1,000.

CHICAGO

Although wiring materials are moving steadily, the outstanding feature of the week has been the start of active Christmas trade. Dealers in general are satisfied with the good start Christmas buying has made and are optimistic as to the final total sales. Heating appliances, especially ironers, toasters and percolators, are going well; but the keen appreciation of price values is still felt by the public and results in sharp competition among dealers. The interest aroused by broadcasting grand opera is still sustained and some excellent sales have been obtained on radio receiving sets. A high-tension manufacturer announces a sale of a 1,200-kw. substation for a dredge on the Mississippi River and states that the power is obtained from a transmission line running along the river banks.

Wire—No remarkable change either in activity or volume has been noticed this week in wiring materials. However, the steady movement has been sustained. No. 14 rubber-covered still is quoted at about $6.60 per 1,000 ft. in 5,000-ft. lots. Weatherproof varies from 16⅝ cents a pound in 1,000-lb. lots to 16¾ cents, according to conditions of sale. The base on bare wire is 16¾ cents.

Flexible Armored Conductor—This is also holding a steady market with ample stocks on hand to supply the trade. No. 14 two-wire double-strip sells between $45 and $47 per 1,000 ft. in 5,000-ft. lots.

Conduit—Trade in conduit remains about on the same level it held during the last few weeks—that is, a fair but steady movement. Stocks are large enough to supply the needs of consumers. Black pipe in the ½-in. size sells for about $46 per 1,000 ft. in 5,000-ft. lots.

Poles—The 10 per cent reduction on Northern white cedar had little effect on the buying market of this territory. Although a few orders for replacements have been reported, the majority of dealers feel that this equipment will not be very active again until next spring.

Radio Equipment—Dealers report marked interest and good sales on receiving equipment due to the broadcasting of grand opera. Complete sets ranging from $30 to $50 seem to be the most popular.

Lamps—Activity on lamps still continues and dealers report the gas-filled lamps to be very popular. Movements of 75-watt to 100-watt lamps for industrial purposes have been noted. Demand for the blue gas-filled bulbs has increased.

Dry Cells—The call for dry cells has not increased very materially for the Christmas season, but jobbers report a fairly steady movement on this line. In barrel lots of 100 they cost about $31 to $33.

Heating Appliances—Christmas activity on these appliances has started and the general purchases are toasters, ironers, percolators and waffle irons. Dealers report stocks sufficient to cover the trade.

BOSTON

Conservatism in buying continues to dominate the trade, pending the completion of inventories and the turn of the year. Underlying financial conditions are maintaining their improved tone, and general industry is looking forward to better business after the holidays. In the textile field, mills are extremely active, fair business is being handled by shoe factories and makers of smaller electrical specialties are busy. The paper trade is quieter and metal-working plants are reviving but slowly. Good weather permits the continuance of building operations on a considerable scale. Central-station companies are busy on service repair work, but before long a renewed activity in the installation of new services is likely to be seen, these having been greatly curtailed as a result of the November sleet storm. Hand-to-mouth ordering by jobbers and by contractor-dealers continues. The indications are that a fair holiday trade in the less expensive electrical conveniences will be recorded.

Wire—Rubber-covered No. 14 sells at $6.75 per 1,000 ft. in 5,000 ft. to 25,000 ft. lots, prices being open beyond the latter quantity. Shipments are coming in well from the factories, and even the present moderate building construction total absorbs large quantities of this material. Little bare copper wire is moving except for telephone toll service. Weatherproof is dull this week.

Fuses—Recent price fluctuations have disturbed the market not a little. Plug fuses in lots of 500 up to 30-amp. rating are selling through a range of 2¼ to 3½ cents net. Light demand is reported, with liberal stocks. With discounts running up to 70 or 80 per cent off list in some cases and wide differences among manufacturers as to quotations, conditions are very unsteady. A firmer tone is anticipated soon.

Lamps — Portable lamps are active in the retail field. General lamp business holds up well and deliveries are excellent. The temporary recession in consumption caused by interrupted service in outlying districts where central-stations were hard hit by the recent storm is not likely to make much of a "dent" in sales.

Motors—Little more than "pick-up" business is apparent in the motor field this week, but small order installations are going in constantly and helping to "sell" the motorization idea to industrial and mercantile concerns. Stocks are very representative and industrial betterment requirements are being readily met.

Rigid Conduit—Prices are steady, with spotty demand. Stocks are not very heavy, and ordering is confined chiefly to needs plainly in sight. Building operations have not yet increased to a point which strains the local supply to any extent.

Radiators—These units are being actively featured in the holiday trade, and sales are distinctly encouraging. Plentiful supply is noted.

Washers and Cleaners—A few washers are moving and cleaners still keep up a fair flow into the hands of retailers, but nothing striking characterizes this trade except very acute competition for business. Close attention to service is a factor in today's washer sales. Intensive canvassing is yielding some returns, but buying cannot be called good.

Hollow Ware—Socket appliances for the table and boudoir are in considerable demand. Jobbers are not buying much for stock and there are no general indications of a shortage of any type so far, although some makes of heating equipment were pretty well moved out of stock at the beginning of the week.

ATLANTA

As was to be expected, the volume of business in jobbing lines has fallen off during the past week on account of purchasers desiring to reduce stocks to a low figure for inventory. The retail business, however, reports considerable activity, especially in the holiday goods line. Specialties are moving better than was anticipated two weeks ago and with a little cold weather will show even better results within the next ten days. Building activities throughout the section continue to furnish a very fair volume of work for the electrical contractors, but keen competition has served to reduce the margin of profit so low in some cases that jobs are being taken at what amounts to a net loss. Construction in Atlanta continues very brisk, permits for the first two weeks of December amounting to $322,000, divided among 128 jobs. All indications point to the total for the year exceeding $11,000,000. Some pessimism is expressed regarding the outlook for the first sixty or ninety days of the new year on account of the government's estimate of the cotton crop, the fear being that this estimate will cause another break in the price of cotton. Should the break occur, general business will suffer accordingly. Some disappointment over the citrus crop in Florida is to be noted, the storm of several weeks ago having caused a large amount of the fruit to be dumped on the market, thus breaking the anticipated price.

Meters—A very satisfactory volume of business is reported, especially in the 5-amp. and 10-amp., two-wire sizes. One of the largest jobbers reports a growing tendency in the larger centers to purchase an increasing proportion of their meters in the 10-amp. size. Stocks are in good condition throughout the line.

Distributing Transformers—Some increase in the volume of sales is to be noted, the demand coming from all over the district generally for the 5, 7½ and 10-kw. sizes. A price reduction of 7 per cent became effective on Dec. 12. Local stocks are in good shape.

High-Tension Transformers—Quite a number of satisfactory orders have been received for apparatus of 11,000 volts to 66,000 volts, while an increasing number of inquiries are also being received, the sizes varying from 50 kva. to 1,500 kva. Shipments are from stock to 12 weeks.

Electric Toys—The poor outlook of two weeks ago has been replaced by a brisk demand for the more moderate-priced electric toys, such as ranges, washers and trains. It is anticipated, however, that even at the present rate there will be a carry-over in this line. There have been some sharp price reductions within the past ten days.

Sewing Machines—This line continues inactive, despite price reductions and dealers' efforts to move their stocks. Little renewed activity is expected before early spring. All jobbers have good to heavy stocks on hand.

Vacuum Cleaners—There is quite a noticeable Christmas demand for this article, especially in the moderate-priced machine. Sufficient quantities are on hand to satisfy requirements, while shipments are reported good.

Christmas Tree Outfits—Sales in this line are quite satisfactory, though there is considerable price cutting by some firms who allowed themselves to overstock, some sixteen-light sets being offered to the consumer as low as $3.50 per set.

Hollow Ware—All jobbers in this section report brisk sales in this line for the holiday trade, refill orders having begun to be quite in evidence. Stocks are on hand in sufficient quantities to meet the demand.

ST. LOUIS

Industrial construction work is gradually and consistently assuming larger proportions, but a vast amount of construction of all kinds still awaits a settlement of labor and material prices. A vote is now being taken by the various craftsmen on a general wage reduction from $1.25 to $1 per hour, and if an affirmative decision is reached construction work on a large scale will be opening in a very few months. Building permits for the city of St. Louis were less in November than in any month since March, being $975,125, of which $75,000 was for five new manufactories and workshops. However, the amount compares favorably with that for the same month of last year, which was $525,730.

Municipalities are not making extensive changes in their electric systems, though quite a bit of work is under contemplation. The difficulty lies in an aversion to additional bonded indebtedness, as taxes have been materially increased with the establishment of higher valuations, and business in the smaller communities is dull because of adverse agricultural conditions. The utility companies, however, are securing additional capital and are steadily making plant additions. Several small transmission lines in this territory are now under construction and many more are being actively considered. Manufacturers are increasing their production, but are slow in making changes or additions of magnitude to their equipment, pending more active business conditions.

Wire—Considerable variation is found in prices of rubber-covered, depending on the make of the wire handled. Quotations on No. 14 vary, in 10,000-ft. lots, from $6.25 to $6.87 per 1,000 ft. Stocks are in good condition and a reasonable demand continues. The base price on bare is 15 cents per pound and that on weather-proof is 15¾ cents per pound.

Safety Switches—Some report that business is good and others that it is very dull. The industrial types are moving slowly, but there is a good demand for entrance types.

Flashlamps—The demand has been exceeding the supply of the spotlight type of flashlamps. Stocks this week are satisfactory, but difficulty has been experienced in getting sufficient shipments from the factories. Sales of flashlamp batteries are strong. A new type of unit cell is finding especial favor.

Dry Cells—The railroads are well stocked from the heavy buying at the time of the threatened strike, but nevertheless the demand has remained strong. Stocks are slightly low. The regular is priced at 31 cents and the igniter at 32 cents, both in barrel lots.

Tubes—Sales are improving and stocks are in good shape. The 2½-in. size is priced at $5.75 per 1,000 in barrel lots.

Lightning Arresters—Good sales obtain in the compression type, especially for 2,300-volt circuits. Several small transmission line extensions are under way in southern Illinois and inquiries are being received for a number of others in the territory. Stocks are in line with the requirements.

Motors—No appreciable increase in demand has been noticed as a result of the recent price reductions in three-phase motors, but an increased interest in the conversion of belt-driven plants to electric drive is developing as a result of the lower costs.

SEATTLE—PORTLAND

Merchants report many shopping but fewer buying than usual at this time of the year. Purchases are more for the necessities than for luxuries. Lumber production continues somewhat below normal, being 14 per cent low for the week ended Dec. 10. Shipments for the same week showed a material decrease, amounting to 28 per cent below production. New business, however, was only 11 per cent below production. The lumber business for 1921 shows a remarkable increase over that of 1920, especially as regards shipments to Japan, which it is estimated will reach 200,000,000 ft. as compared with 77,000,000 ft. for 1920 and 39,000,000 ft. in 1919. Rumors are current that several large orders have been placed with Northwest mills which will create a very heavy demand for the spring. Electrical jobbers are well satisfied with the progress which business is making toward normal. They report a satisfactory market in most lines and in specialties which are most affected by the Christmas demand. In many cases the past week's sales have exceeded expectations. Retailers of Seattle were unusually timid this year in the matter of laying in stocks of Christmas goods. They purchased sparingly in order to avoid overstocking, and as a result of this policy many of them and some jobbers are already sold out in certain lines and a shortage exists which cannot be met. Some lines of jobbers' stocks in Portland are running very low, but other jobbers are well supplied in these lines, and it would seem that unless there is an unusual last-minute demand local stocks can be depended on to take care of the Christmas business.

There is a slight upward trend in prices on some materials. The cost on standard and carton package quantities of switches, switch plates, conduit boxes, etc., remains practically unchanged, but on these same articles in less than carton lots certain advances have been made which means that hand-to-mouth buying on the part of contractors and dealers will be more expensive than it has been and they will necessarily have to cut their profits and add the increase on to the customer or buy in somewhat larger quantities. This will probably have the effect of eliminating somewhat the short buying which has existed for some time.

Wire.—The movement in rubber-covered wire has been very satisfactory and prices have remained steady during the past week. Stocks are good. No. 14 is quoted at $7 per 1,000 ft. in 5,000 ft. lots. Seattle quotes No. 12 at $9.20 and Portland at $10.20 per 1,000 ft. in 5,000 ft. lots. Weatherproof-wire prices have stiffened and demand is good. No. 6 is quoted at $19 and No. 8 at $20 per 100 lb.

SAN FRANCISCO

The dry weather has enabled building to be carried on without interruption, Los Angeles maintaining its high record and San Francisco steadily recovering from its midseason slump. Architects claim to have estimated much work so far unreleased, so that a good start for 1922 is assured. Rain is urgently needed because the soil is dry and hard.

Lamp Cord—New lamp-cord prices are in the nature of a general adjustment, a slight increase in silk and reinforced being noted with a 10 per cent decrease in cotton-covered. The following prices will give an idea of the market: No. 18, cotton-covered, twisted, $12 per 1,000 ft.; No. 18, silk, twisted, $28.50 per 1,000 ft.; No. 18 cotton, reinforced, $24 per 1,000 ft.; all for coil lots, the maximum quantity scheduled. There has been a sharp increase in the demand for No. 18 cotton-covered, which has cut down stocks.

Conduit.—A decrease of about 5 per cent has been registered, ½-in. black now selling for $6.25 per 100 ft. and galvanized for $6.75 per 100 ft. in 10,000-ft. lots, with carloads 5 per cent lower. The call is better, but local stocks are so far entirely adequate.

Boxes and Covers—Here increase is noted, the new discount being 40 per cent on galvanized, which is 10 per cent higher than previously. This price is for 1,000 pieces assorted in standard packages. Such orders are rather rare, the usual sale being in packages for a few stock sizes at an advance of 10 per cent.

Tapes—Commercial friction rubber tape is quoted at 39 cents per pound. Nearly all the demand is for 50 lb. or smaller quantities at an advance of 10 to 15 per cent. The sudden increase in call reduced some of the jobbers' stocks to the emergency buying point. Tape stock is a good barometer of demand because at this distance from the point of manufacture it is manifestly unwise to stock beyond the demand or legitimate expectations of an increased demand.

Holiday Goods—A disappointing cessation to what appeared to be the promise for a brisk holiday season is reported. It is a fact, however, that holiday business in all lines will be below last year's sales and that electrical goods are more than holding their own when the proportionate rate of decrease is figured. Smaller devices and Christmas tree outfits make up the bulk of the call.

SALT LAKE CITY—DENVER

The past week was somewhat disappointing in volume of pre-Christmas sales. Luckily for the electrical dealers, buyers are turning more to useful gifts and electrical appliances are having a fair run. A seasonable snowstorm has come to the intermountain country and is being counted on as a stimulator of holiday business. A cold wave has halted outside concrete work, and as a result building is continuing only on the inside. It is declared that prices of lumber and building hardware have finally hit the bottom and that this stabilized condition will promote construction in the spring. The average price of lumber was about 70 cents in 1920. It has now dropped to about 50 cents.

Banks are gradually acquiring more funds available for loans, and the tendency to force liquidation on their debtors is growing less marked. As the year draws to a close business in the Mountain States is congratulating itself on the comparatively small number of failures. Some sections have been hard hit and are just now struggling through the most critical period. There is a certain widespread and general improvement, however. Public confidence in a better future for business and returning prosperity is reflected in a sustained revival of bond buying. Prevailing retail prices on electrical merchandise are about as follows: Percolators, $10 and up; curling irons, $6.25 and up; electric sewing machines, $58 and up; washing machines, $80 and up; heating pads, $6.75 and up; toasters, $6.75 and up; electric irons, $6.75 and up; grills, $12.50 and up. Vibrators are quoted as low as $4.29. Toy trains and Christmas tree lighting units are moving well. Dealers are stocking only as their needs require. There is evidence of considerable uncertainty about the future of prices.

Manufacturers' Activities

Devoted to the Business Side of Manufacturing, Distribution and Sales, News from Jobbers and Foreign Fields and a Record of New Devices and Trade Literature

Torrington Reports Heavy Demand for Cleaners

A phenomenal increase in electric vacuum-cleaner sales is reported by the Torrington Company, Torrington, Conn. G. Q. Porter, general manager of the company, recently issued the statement that orders to date for the present quarter are 270 per cent of those to the corresponding date of the previous quarter. Billings of the company showed a 30 per cent increase over the quarter before. Mr. Porter attributes much of this improvement in business to more intensive sales efforts, coupled with the offer of free attachments with each cleaner, a feature which was not in effect during the previous quarter.

Lighting Fixture Council Wants Slogan

A contest for a slogan which will best epitomize the benefits of lighting has been inaugurated by the National Council of Lighting Fixture Manufacturers. This movement was started by E. F. Guth, president of the St. Louis Brass Company, and the executive committee of the National Council has offered prizes of $100 for the best slogan and $50 for the next best. The desire of the council is to have a motto which will express in a few words the value of good lighting in the home and in the social and business life of the country.

St. Louis Electrical Men Prepare for Show

The executive committee of the St. Louis Electrical Board of Trade has decided to form a corporation for the actual management of and responsibility for the electric show to be held there. The first board of directors of the corporation is to consist of C. E. Michel, J. S. Tritle, J. N. Goodell, H. D. McBride and E. J. Spencer. The name of the corporation is to be the St. Louis Electrical Board of Trade Exposition Company.

Yale & Towne to Have German Plant

The Yale & Towne Manufacturing Company, manufacturer of locks, builders' hardware and material-handling equipment, such as electric industrial tractors, has announced that it will soon establish a factory in Germany to avail itself of the low production costs prevaling in that country and in an effort to regain its foreign business, which has been practically wiped out on account of the war. Peter F. Augenbraun, who for years has been a department head in the Stamford plant, will have charge of the German plant, which is to be established near Hamburg.

"A recent investigation," the statement of the company says, "has indicated that the cost of production in Germany is so much lower than in the United States that it is hopeless at this time to compete in many foreign markets with goods of American manufacture."

The entire line of the company will continue to be exported for some time. German manufacture of the company's electric industrial tractors is not contemplated immediately, and the principal products of the new plant for the time being will be blocks and hardware.

Duquesne Electric Buys Plant It Has Occupied

The Duquesne Electric & Manufacturing Company, Pittsburgh, rebuilder of electrical machinery, has bought the plant, site and buildings in the East Liberty industrial district, which it has occupied for the past five years. Besides this property, it has acquired 22,000 sq.ft. of ground adjoining the plant for expansion purposes. The company is completely equipped for handling electrical machinery of any size, the plant being on a railroad and fitted with electric cranes. It is the intention of the company to erect an additional building on that part of the property at Hamilton Avenue and Broad Street.

Ford Company Orders Largest Electric Furnace

The Ford Motor Company, Detroit, has ordered from the Electric Furnace Construction Company, 908 Chestnut Street, Philadelphia, the largest electric melting furnace ever designed. The furnace is of 9,000-kva. capacity and is designed with six electrodes. The bottom is of the "Greaves-Etchells" bottom-conducting type, similar to those already installed and on order for the company. This furnace is to be the principal melting unit of the new battery of electric furnaces being put down at the Ford Company's River Rouge works.

Friction Tape Market Outlook Brighter

Signs of increasing confidence in the friction tape market are apparent and the outlook for next year is very promising, according to a statement to a representative of the ELECTRICAL WORLD by P. G. Alexander, manager tape department, Boston Woven Hose & Rubber Company, Cambridge, Mass. Business began to pick up well in September and with some fluctuations has continued to hold good gains since. Jobbers are buying somewhat more freely, although purchases for distributers' stocks are not very active as yet. Considerable scattered building is being done and this absorbs increasing production. Some manufacturing is being done for factory stocks in order to make prompt shipments. Mr. Alexander said that orders from abroad are gaining somewhat, Australia and other points having made commitments regardless of the exchange situation. Raw materials are more costly than earlier in the year, and some stiffening in prices is not unexpected.

Anaconda Copper and American Brass Announce Plans for Merger

Will Be Union of Largest Producer and Largest Consumer in World—Plan Approved Subject to Working Out Details

Plans for what is thought to be one of the most important mergers affecting the electrical industry in some years were announced last week when large stockholding interests of the Anaconda Copper Mining Company and the American Brass Company met in New York to discuss a merger of the latter company with the Anaconda company. This will be accomplished, according to John A. Coe, president of the brass concern, through the offering to American Brass shareholders of an opportunity to obtain in the near future an option to dispose of their holdings to the Anaconda company at $150 cash per share and three shares of Anaconda. Figuring each share of Anaconda worth $50, the transaction will involve a total payment to American Brass shareholders of $45,000,000.

This offer, it was stated, will be conditional upon the deposit of at least 51 per cent of the outstanding American Brass capital stock. The period in which these shareholders may signify their assent to the deal will probably last through January.

There were present at last week's meeting stockholders approximating 40 per cent of the brass company's stock, and these representatives unanimously approved the merger plan, subject to working out of the details. A committee was formed for this purpose. If and when the consolidation is completed, the American Brass working organization will continue as at present.

The American Brass Company, it was stated by John D. Ryan, chairman of the board of the Anaconda company, is the largest single consumer of copper and zinc in the world, while the Anaconda is the largest single producer. American Brass in its peak year turned out 600,000,000 lb. of the metal, or 40 per cent of the country's entire output. Negotiations for the acquisition of the brass company have been going on for the past six months, he said, and a letter will soon be sent out to Anaconda stockholders, asking them to approve the transaction.

The merging of these two companies has been followed by talk of other copper mergers. The American Smelting & Refining Company, the Kennecott Copper Corporation and the Utah Copper Company are being mentioned together, while another group may include Inspiration, Magma, Calumet & Arizona.

Philadelphia to Have Foreign Trade Convention

The ninth convention of the National Foreign Trade Council, it is announced, will be held in Philadelphia May 10, 11 and 12, 1922. Previous meetings have been held in St. Louis, New Orleans, Pittsburgh, Cincinnati, Chicago, San Francisco and Cleveland. The aim of the convention, according to O. K. Davis, secretary of the council, will be partly to show that the foreign trade of the country must be expanded if the United States is to enjoy any real domestic prosperity, as since 1913 the capacity of American farms and factories has been so increased that our former "normal" exports are not nearly great enough to absorb the surplus over and above domestic consumption.

Holophane to Have Lighting Exhibits at Office

The Holophane Glass Company, Inc., has moved its New York office and showroom from its old quarters at 340 Madison Avenue to the Canadian Pacific Building at 342 Madison Avenue. The new office is illuminated scientifically, a uniform illumination of 10 foot-candles being obtained. The office is to be used as an exhibit of proper office illumination. Show-window-lighting exhibits have been installed for the benefit of electrical contractors.

Wilson Company Moves Plant to New York

The Wilson Welder & Metals Company, formerly at 253 Thirty-sixth Street, Brooklyn, recently moved its offices and factory to 132 King Street, New York. The company in its new location will have 15,000 sq.ft. of floor space for factory purposes, a considerable increase over its former plant. The move was made necessary by increasing business. Thomas B. Hasler has just been elected president of the company.

Intelligent Credit Hope of World, Banker Tells Credit Men

The intelligent extension of credit by America to the rest of the world is the best means to put industry back on a sound footing, according to Willis H. Booth, vice-president Guaranty Trust Company, who spoke at the annual dinner of the New York Electrical Credit Association on Dec. 14. America is now the credit center of the world, said Mr. Booth, and though the comparative inexperience of American bankers in international trade is a handicap, the job is ours and must be done intelligently. The first thing to do is to work for a restoration of a sound basis of credit rather than to attempt to solve the problem by inventing machinery for the use of credit, and to accomplish this America must help business in Europe and South America to get started by trading with them. Various South American countries, Mr. Booth disclosed, were on the verge of a trade breakdown last spring, which would have caused large losses to American manufacturers. The banks came to the rescue, however, and at present business there is gaining. Cuba still remains a bad spot.

The report of the secretary showed a large increase in number and value of overdue accounts reported, there being 4,080 reports with a value of $735,053, 28 per cent more than the previous year. However, 67 per cent of these were settled before it became necessary to post them. It was necessary to post 1,464 cases for $259,641, an increase over 1920 of 100 per cent in number and amount. Of these 80 per cent were finally settled. It will be seen that while payment of many accounts was delayed longer than in 1920, a satisfactory settlement was arrived at in a correspondingly large number of cases.

G. H. Potter, Sprague Electric Works, and W. J. Kranzer, Crannell-Nugent-Kranzer, were elected directors for a three-year term. Election of other officers was set for Dec. 21.

G. E. Billings Expected to Reach $220,000,000 in 1921

Billings of the General Electric Company for 1921 should reach $220,000,000, if the rate of billings averaged in the first nine months of the year continue until Jan. 1. This is approximately 80 per cent of billings in 1920, which totaled $275,758,000, or $43,000,000 under orders received. There is every reason to believe, the statement says, since the ratio has continued during the present quarter that net sales billed will actually reach $220,000,000.

Bookings for the first nine months of the year indicate an annual total of $180,000,000, which is approximately 60 per cent of the capacity of all the plants of the company. The company's unfilled orders on the books at the close of last year stood at $111,000,000. There was a margin of somewhat over $50,000,000 against which the company could operate over its booking rate. Unfilled orders are usually kept around $50,000,000.

Present conditions would seem to indicate that buying is again on the upward path. The company has pointed out in a recent statement that public utilities have funds in hand for expansion and that when they enter the field the manufacturing capacity of the company will not be in excess of what is necessary.

Benjamin Plans Dealer Aid Campaign

A plan of direct-by-mail advertising to prospects of contractor-dealers is being formulated by the Benjamin Electric Manufacturing Company, Chicago. Dealers are to be invited by the Benjamin company to submit lists of local "prospects," to whom the Benjamin company will send advertising matter direct, while at the same time calling attention to the fact that the particular contractor-dealer is carrying a stock of the products advertised.

Reasons for Prosperity Outlined by Laclede-Christy

In the thirteenth semi-annual chart letter got out by Laclede-Christy, St. Louis, are pointed out a large number of reasons why the year 1922 should see a return to a condition of stable prosperity. The letter asserts that business has always moved in up-and-down cycles and cites the good business following the slumps of 1903, 1908 and 1911 as proofs. It is logical, it continues, that 1922 is scheduled for a period of real activity.

Okonite Company Opens Atlanta Branch

The Okonite Company, Passaic, N. J., manufacturers of insulated wires and cables, tape and loom, has opened a branch office at 1513 Candler Building, Atlanta, Ga. The branch is to be in charge of John L. Phillips, while E. A. Thornwell will be Southeastern sales representative. The territory served by this office includes North and South Carolina, Georgia, Tennessee, Alabama, Florida and the city of New Orleans.

Habirshaw Company Explains Receivership Reasons

The present condition of the Habirshaw Electric Cable Company, Inc., and the reasons for the recent appointment of a receiver are given at some length in a statement published in the December *Wire Message*, the house organ of the company. Since last June, it is stated, loans have not been increased. Administration, operating and miscellaneous expenses have been reduced 58 per cent compared with last January. Business has increased in the meantime and most of the stock accumulated before the depression has been wiped out. A net profit has been made every month since and including last June, and each month has shown a substantial gain over the previous one. A rigid account of expenditures is being kept.

The Bridgeport plant is running double shift with enough work on hand and in sight to keep it running to capacity until March or April. The Glenwood plant is running at part capacity with seasonal improvement expected in February. The Dock Street plant has been closed all year and probably will not be reopened for some time. The bare wire plant is operating without loss.

The receivership, it is stated, was due to the inflation of the company's plant and facilities to supply the government with wire and to the wholesale cancellation of government contracts after the armistice, as well as to the slump in business during the past year. Confidence is expressed that the company will be back on its feet with the return of prosperity.

National Illuminating Appliance Changes Name

The Cook-Art Illuminating Products Corporation is the new name of the National Illuminating Appliance Company, 225 Fifth Avenue, New York. The factory of the company, formerly located at 255 West Forty-fourth Street, has been moved to 115 East Twenty-sixth Street, where it will have considerably enlarged quarters. The company manufactures art lamp shades and illuminating displays. M. K. Kassony is president.

The Bullock Manufacturing Company, manufacturer of lighting equipment and fixtures, has removed its plant from 408 West Thirteenth Street to 356-58 West Fortieth Street, where it will have approximately four times as much manufacturing space.

The American Electric Supply Company, 953 West Washington Street, Chicago, has awarded contract for a three-story concrete warehouse.

Foreign Trade Notes

RAILWAY TRAINS TO BE LIGHTED BY ELECTRICITY IN FRANCE.—The French government, technical journals report, has decided to eliminate the use of gas as an illuminant on railway trains. The Minister of Public Works and Transport, M. Le Trocquer, according to *Commerce Reports*, has issued a circular which decrees that after Jan. 1, 1923, no gas lighting will be permitted on express trains. On suburban trains electricity must be used for lighting after Jan. 1, 1924, and by the first of 1925 all trains operating in France must be electrically lighted. In 1914 the French government contemplated eliminating from trains all lighting except by electricity, but action was delayed by the war. Recent train wrecks, however, where cars were set on fire through ignition of gas following collisions, have brought the matter to a head and emphasized the risk incident to the use of gas.

BRAZILIAN COURT DECISION AFFECTS TRADEMARK REGISTRATION.—An important decision affecting trademark registration in that country has recently been handed down by the Brazilian Supreme Court. In writing on this subject Dr. R. P. Momsen of the Brazilian bar says that the court decided that international trademark registrations made in Berne, according to the Berne international convention, are not effective in Brazil unless full description of such registrations is published in the *Diario Official* (Official Gazette). A trademark in order to be effective in Brazil must be published in the *Diario Official* in the same way as Brazilian registration. The American merchant is not vitally interested in the Berne registrations, because the United States is not a party to the Berne convention. But as the decision reflects upon the validity of the registrations of trademarks at Havana, under the Buenos Aires convention of 1910, the matter becomes of vital importance to the American merchant. According to the Buenos Aires convention two inter-American trademark bureaus were provided for, one at Havana, to serve the northern group, and one at Rio de Janeiro, for the southern group. Registrations made at one bureau are transferred to the other, without additional registration, and become effective for the whole group of American republics. The Havana registrations, however, are deposited in Brazil under the same procedure as that of the Berne registration, that is to say, without publication. Therefore the decision of the Supreme Court denying the validity of a Berne registration for lack of publication, in so far as Brazil is concerned, equally denies the validity of the Havana registrations, which are deposited in Brazil in the same manner.

ELECTRICAL POWER FOR THE HUON DISTRICT, TASMANIA.—The State Hydro-Electric Department, according to the *Industrial Australian and Mining Standard*, has submitted an offer to supply electricity to various municipalities of the Huon district south of Hobart. The scheme provides for a high-tension main-feeder line to serve Kingston, Franklin, Huonville and Port Cygnet, to be delivered at each town at approximately 10,000 volts. Under the present plan the Councils would be called upon to provide the necessary transforming apparatus as well as the general distribution system for their respective districts.

AMALGAMATION OF ELECTRIC COMPANIES IN CHILE.—The Chilean Electric Tramways & Light Company and the National Electric Power Company, according to *Electrical Industries*, have recently consolidated, with a combined capital stock of £12,000,000.

NEW ELECTRIC PROJECT IN RUSSIA.—The Allmanna Svenska Elektriska Aktiebolaget, according to *Electrical Industries*, has been granted a concession to build an electric plant at Yaroslav on the Upper Volga.

HYDRO-ELECTRIC SCHEME FOR SOUTH ISLAND, NEW ZEALAND.—An examination of Lake Tekapo with a view of utilizing the water power to develop electricity has, according to *Electrical Industries*, been made by H. B. Hall of Timaru. He finds that, after leaving Lake Tekapo, the river takes a turn, and 3 miles from the outlet approaches the lake again and is only a mile from it. To tunnel this distance would give a fall of 80 ft., which, with a minimum lake discharge of 4,000 cu.ft. per second, would develop 30,000 hp. at the water turbines. He proposes aerial transmission at 55,000 volts via Mackenzie Pass (15 miles), and then 40 miles to Timaru. The cost of the tunnel power house and transmission line is estimated at £400,000 and that of the distribution system to cover the entire district at £240,000. This is the first time Tekapo has been considered in connection with a low-pressure power scheme from the new lake.

PROPOSED CABLE BETWEEN ITALY AND BRAZIL.—Representatives of the Italian government, according to *Electrical Industries*, have announced that a cable between Italy and Brazil will be laid within two years. It is proposed later to extend the line to the Pacific Coast.

HYDRO-ELECTRIC PROJECT FOR NEW SOUTH WALES, AUSTRALIA.—The New South Wales Cabinet, according to *Electrical Industries*, has agreed to issue a loan of £80,000 in order to carry out the proposed hydro-electric project on the Clarence River, known as the Nymboida hydro-electric scheme, which will supply electricity to all the extreme north coast towns in the state.

GERMAN-AUSTRIAN ELECTRICAL MANUFACTURERS MAY COMBINE.—Austrians and Germans have been negotiating in Berlin for the formation of a sales company to exploit the German-Austrian electrical industry, according to a statement in the Vienna press, reported by Charles H. Foster of the American Mission at Vienna. The headquarters of the new company will be in Vienna, and its capitalization will be 500,000,000 crowns. A wage contract for production is under consideration with the Berlin and Vienna electric companies, while the proposed sales company will attend to the actual disposition of the product of the two branches of the industry for their joint account.

ELECTRIC SYSTEM FOR SALE IN BEIRUT, SYRIA.—The electric and gas systems and franchises in Beirut, Syria, according to cable reports to the Bureau of Foreign and Domestic Commerce, are for sale. The enterprise consists of a 400-kw. electric generating plant, a gas plant (not now operating) and real estate. The electric franchise is for eighty-two years and the gas franchise is for sixty years. Further information may be secured from the Electrical Equipment Division of the Bureau of Foreign and Domestic Commerce by referring to exhibit No. 41,298.

ELECTRIFICATION OF RAILWAYS IN SOUTH AFRICA.—P. J. Stevenson, trade commissioner at Johannesburg, South Africa, has notified the Department of Commerce that the Railway Board has decided to go ahead with the electrification of the Durban-Glencoe line. The cost is estimated at £5,000,000.

EXTENSIONS PROPOSED TO ELECTRIC SYSTEM AT HELSINGFORS, FINLAND.—Negotiations are in progress between the city of Helsingfors and the South Finland Power Company, according to reports received by the Department of Commerce, looking to the development of additional water power which will enable the power company to deliver a minimum of 10,000,000 kw.-hr. annually. The present maximum output of the power company and the municipal steam plant, which have been interconnected, is only 6,000,000 kw.-hr. annually, which is inadequate to meet the increasing demand for electrical service.

New Apparatus and Publications

WIRE.—The Belden Manufacturing Company, Twenty-third Street and Western Avenue, Chicago, has developed a light, flexible and insulated contact wire for sign flashers.

TOASTER.—A reversible electric toaster has been placed on the market by Manning-Bowman & Company, Meriden, Conn.

INCUBATOR HEATER.—An electric heater that will fit any "Queen" incubator from 70-egg to 1,000-egg size has recently been developed by the Queen Incubator Company, Lincoln, Neb. The company also manufactures a similar device for use on chicken hovers.

FRACTIONAL-HORSEPOWER MOTORS.—The Calumet Motor Company, Lake Linden, Mich., has placed on the market several types of ½-hp., 60-cycle, 110-volt, single-phase motors.

TIME SWITCH.—A time switch provided with a clock movement with a chronometer escapement has been placed on the market by the A. & W. Electric Sign Company, 2120 East Nineteenth Street, Cleveland.

AGITATOR DRIVE.—A motor-driven, direct-connected "Nett-Co" agitator drive has been developed by the New England Tank & Tower Company, Everett, Mass.

WIRELESS BATTERY.—The Hipwell Manufacturing Company, 831 North Avenue, West, Pittsburgh, Pa., has brought out a new refillable and variable B "Hipco" battery.

SEARCHLIGHT.—The Franco Electric Corporation, 60 Tillary Street, Brooklyn, N. Y., has developed a "3-in-1" searchlight, equipped with three flashlights.

DRILL.—A special half-inch drill with "the pistol grip and trigger switch" has been placed on the market by the Black & Decker Manufacturing Company, Towson Heights, Baltimore.

TRANSFORMER TESTING SET.—The Leeds & Northrup Company, 4901 Stenton Avenue, Philadelphia, has brought out the Silsbee current-transformer testing set. This is a compact portable set for making precision tests of current transformers in position.

DRILLS.—The Hisey-Wolf Machine Company, Cincinnati, is distributing bulletin No. 105-A, describing the new "Hisey" super universal motor drills.

ELECTRIC FURNACE.—"When You Buy an Electric Furnace" is the title of bulletin No. 302 issued by the Repel-Arc Furnace Company, Indianapolis, describing the "Repel-Arc" furnace.

ATTACHING DEVICE.—The Cutler-Hammer Manufacturing Company, Milwaukee, manufacturer of electric controlling devices, has developed a [illegible] attaching device for portable electrical appliances.

WHITE LIGHT CONVERTERS.—The Wagner Electric Manufacturing Company, St. Louis, is distributing four folders describing the "Wagner" type S. C. and type O. S. white-light converters.

TERMINALS AND FUSE PARTS.—"Metal Stampings" is the title of an eight-page folder distributed by the Patton-MacGuyer Company, Providence, R. I., covering its wire terminals, cable lugs, fuse parts and special stampings.

New Incorporations

THE BUFFALO (N. Y.) ELECTRO-THERMO CORPORATION has been organized with a capital stock of $250,000 to manufacture electrical specialties. The incorporators are R. Anderson and C. T. and R. F. Penton, Ellicott Square.

THE S. A. V. COMPANY, Nutley, N. J., has been incorporated by Minard S. Smith, Norman K. Althouse and Ernest C. Van Winkle, 113 Myrtle Avenue. The company is capitalized at $125,000 and proposes to manufacture electrical appliances.

THE IDEAL APPLIANCE COMPANY, 266 Newark Avenue, Jersey City, N. J., has been organized to manufacture and deal in electrical appliances. James Cavolosi is interested.

THE HALLOWAY ELECTRICAL SUPPLY COMPANY, New York, N. Y., has been organized by H. A. Halloway, M. Comerford and I. Josephson, 1482 Broadway. The company is capitalized at $20,000 and proposes to manufacture and deal in electrical equipment.

HERBERT G. PECK, INC., Newark, N. J., has been incorporated with a capital of $5,000 to manufacture and deal in electrical devices. The incorporators are Herbert G. Peck and Henry Durna, 786 Broad Street.

THE ATLAS ELECTRIC COMPANY, 123 Franklin Street, Union Hill, N. J., has been organized to manufacture and deal in electrical equipment. William Goodman is interested in the company.

THE UNEEDA LIGHTING FIXTURE COMPANY, [illegible] Newark Avenue, Jersey City, N. J., has been incorporated with a capital stock of $10,000 by Joseph Panchelft, Michael Tozzi and Joseph Marosem.

THE KINGSVILLE (OHIO) ELECTRIC LIGHT & POWER COMPANY has been organized with a capital stock of $35,000 by F. D. Comp.

THE DELTON (WIS.) ELECTRIC COMPANY has been incorporated with a capital stock of [illegible] by S. S. Squires, A. M. Reynolds and Otto Timme, Delton.

THE ELIZABETHTOWN (IND.) POWER & LIGHT COMPANY has been incorporated by W. H. Newson, R. W. Parker, J. M. Cox, G. O. Cosby and D. M. Branham. The company is capitalized at [illegible] and proposes to generate and distribute electricity.

Record of Electrical Patents

Notes on United States Patents

(Issued Nov. 22, 1921)

1,398,213. BATTERY; David H. Wilson, Philadelphia, Pa. App. filed May 2, 1919. Large active area of electrodes.

1,398,217. ELECTRIC HEATER; Edmund N. Brown and Milton H. Shoenberg, San Francisco, Cal. App. filed Oct. 2, 1919.

(Issued Nov. 29, 1921)

15,241 (reissue). CONDENSER AND METHOD OF MAKING THE SAME; Albert Pruessman, East Orange, N. J. App. filed July 27, 1917. To prevent permanent change in electrical constants as result of temperature changes.

1,398,228. ATTACHMENT PLUG; Bertram J. Grisgby, Chicago, Ill. App. filed Jan. 12, 1918. Prevents pull on terminals and kinking of cord.

1,398,247. APPLIANCE FOR HOLDING FILMS FOR DENTAL RADIOGRAPHS; Thomas B. S. Wallace, Chicago, Ill. App. filed Feb. 24, 1920.

1,398,266. ELECTRICAL INDICATING AND MEASURING DEVICE; Harry W. Hitchcock, New York, N. Y. App. filed April 7, 1920. To indicate component frequencies.

1,398,287. SELECTIVE SIGNALING SYSTEM; George K. Thompson, Maplewood, N. J. App. filed Jan. 15, 1920. Multi-station telephone lines.

1,398,358. BATTERY COVER; Glenn J. Bundy, Detroit, Mich. App. filed June 29, 1918. Terminal construction.

1,398,366. DRY CELL; Harold De Olaneta, New Haven, Conn. App. filed Sept. 2, 1919. Method of sealing.

1,398,372. COIL MOUNTING; Robert F. Gowen, New York, N. Y. App. filed July 23, 1920. Radio inductance coils.

1,398,391. AUTOMATIC TELEPHONE SYSTEM; Winfred T. Powell, Rochester, N. Y. App. filed July 28, 1919. Service-charging device.

1,398,401. DISK-SHAPED COMMUTATOR FOR GYROSCOPE MOTORS; Hermann Sundhaussen, Essen, Germany. App. filed Jan. 15, 1921.

1,398,410. EMBEDDING PROCESS; Edwin L. Wiegand, Pittsburgh, Pa. App. filed June 21, 1920. Electrical heating devices.

1,398,515. SYSTEM OF CONTROL FOR INDUCTION MACHINES; Rudolf E. Hellmund, Swissvale, Pa. App. filed May 15, 1917. Simply, efficiently and effectively accelerated.

1,398,518. FLASHLIGHT BATTERY; Harry H. Hipwell, Pittsburgh, Pa. App. filed Nov. 16, 1920. Core manufacture.

1,398,526. ELECTROMAGNETIC APPARATUS INTENDED TO MAGNETIZE PERMANENT MAGNETS; Antoine Luzy, Paris, France. App. filed Nov. 22, 1919.

1,398,542. ARRANGEMENT OF HEATERS IN ELECTRIC OVENS; Frank F. Forshee, Flint, Mich. App. filed Dec. 13, 1919. Uniform heat.

1,398,545. MERCURY LAMP; Henri George, Paris, France. App. filed April 4, 1919. Started without rocking and may be operated on alternating current.

1,398,589. TELEPHONE-EXCHANGE SYSTEM; Clarence B. Fowler, New York, N. Y. App. filed Nov. 19, 1920. For connecting common-battery toll switchboard with magneto switchboard.

1,398,593. ALARM SYSTEM; Richard M. Hopkins, Rutherford, N. J. App. filed March 29, 1920. For use in banks.

1,398,594. TRANSMITTER; Richard M. Hopkins, Rutherford, N. J. App. filed March 29, 1920. Employed in alarm systems.

1,398,595. MEANS FOR CALIBRATING AMMETERS; Adrian H. Hoyt, Penacook, N. H. App. filed June 7, 1920. Without disassembling.

1,398,605. COMPRESSION RHEOSTAT; Thomas Spooner, Pittsburgh, Pa. App. filed May 14, 1920. Blocks of resistance material and radiating plates maintained in uniform contact.

1,398,620. PROTECTING DEVICE FOR MULTIPHASE ALTERNATING-CURRENT APPARATUS; James R. Beard, Newcastle-Upon-Tyne, England. App. filed Oct. 9, 1917. Balanced relays.

1,398,630. ELECTRICAL RESISTANCE APPARATUS; Philip H. Dawe, London, England. App. filed Aug. 25, 1917. Resistance is flowing liquid.

1,398,656. POWER-TRANSMITTING MECHANISM; William A. Stevens, Maidstone, England. App. filed Sept. 24, 1918. For motor vehicles, rolling mills, etc.

1,398,658. PROCESS FOR EXTRACTING GASES FROM LIQUIDS; Frank S. Vincent, Grand Rapids, Mich. App. filed Jan. 13, 1919. Oxygen and hydrogen from water.

1,398,665. THERMIONIC AMPLIFIER; Harold D. Arnold, Maplewood, N. J. App. filed Jan. 8, 1920. Three-element type.

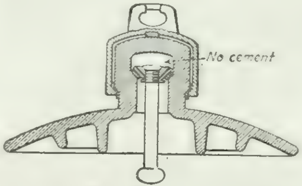
1,398,687. THERMOPHONE; Budd D. Gray, Greenwich, Conn. App. filed Feb. 19, 1920. Economical to make and easy to repair.

1,398,728. VOICE-CURRENT TELEPHONE REPEATER; George H. Kuhl, Chicago, Ill. App. filed May 31, 1919. Method of reversing or switching amplifier.

1,398,736. HANDLAMP; Arthur P. Paine, New Haven, Conn. App. filed April 2, 1921.

1,398,784. ELECTROLYTIC CELL; J. Cranston, Trenton, N. J. App. filed Oct. 19, 1920. Production of chlorine and alkaline liquor.

1,398,792. PRESSURE-GAGE LOG; Josua G. Paulen, Stockholm, Sweden. App. filed April 10, 1918. For indicating speed and distance.



No. 1,398,937. Suspension Insulator

1,398,793. INDUCTION COIL; Glen Peplinski, Mohawk, N. Y. App. filed Oct. 17, 1919. Primary and secondary coils side by side.

1,398,799. FLASHLIGHT; Adolph C. Recker, Oakville, Conn. App. filed Feb. 28, 1921. Lamp mounted on cell.

1,398,806 CURRENT COLLECTOR; Isaac D. Shipper, Philadelphia, Pa. App. filed Sept. 12, 1921. Two-wire trolley for trackless vehicle.

1,398,847. STORAGE-BATTERY CELL; Frank Engel, Niagara Falls, N. Y. App. filed Sept. 12, 1917. Means for ventilating.

1,398,848. WIRELESS RECEIVING AND TRANSMITTING APPARATUS; James Erskine-Murray and James Robinson Biggin Hill, England. App. filed March 30, 1920. Receiving station can determine its bearing relatively to transmitting station.

1,398,876. METHOD OF FRACTIONATE DISTILLATION; Fritz Hansgirg, Grätz, Austria. App. filed Nov. 7, 1919. Distillation of oils.

1,398,866. ELECTRIC COOKING OR HEATING VESSEL AND APPARATUS; Clarence H. Lauth, London, England. App. filed Dec. 16, 1919. Heating current flows through shell of vessel.

1,398,867. ELECTRIC COOKING OR HEATING VESSEL AND APPARATUS; Clarence H. Lauth, London, England. App. filed Dec. 16, 1919. Heating vessel forms part of secondary circuit of transformer.

1,398,892. TELEGRAPHY; Herbert G. Dorsey, Granville, Ohio. App. filed Oct. 6, 1916. Multiple telegraphy.

1,398,903. ELECTRICALLY HEATED LIQUID HEATER; Clarence H. Lauth, London, England. App. filed June 16, 1920. Heating resistance in shell of vessel.

1,398,937. SUSPENSION INSULATOR; Max Carolus, Tetlow, Germany. App. filed Sept. 29, 1921. Cementless insulator in which major stresses in porcelain are compression stresses.

Construction News

Projects, Plans, Bids and Contracts Contemplated or Under Way

New England States

WOONSOCKET, R. I.—Plans have been filed by the Blackstone Valley Gas & Electric Company for the construction of a branch power house at Second Avenue and River Street.

THOMPSONVILLE, CONN.—The installation of an ornamental lighting system on Main Street is under consideration.

Middle Atlantic States

BINGHAMTON, N. Y.—Negotiations are reported under way for the erection of an electric transmission line from the Willow Point plant of the Binghamton Light, Heat & Power Company along the proposed Binghamton-Vestal Highway through Vestal, Appalachine and Owego to Nichols, a distance of 30 miles. The company also contemplates extending its line from the center of Chenango Bridge village highway eastward 2½ miles along the Chenango River to Port Crane and the erection of rural lines in the direction of Kirkwood and Hawleyton. The cost of the project is estimated at $200,000. Roy L. Peterman is vice-president.

OSWEGO, N. Y.—The Water Service Commission is considering the construction of a municipal electric light plant to cost about $90,000. J. A. Bensel is consulting engineer for the commission.

ROCHESTER, N. Y.—A resolution has been adopted whereby the Town Board of Irondequoit is requested to arrange for the installation of arc lamps on St. Paul Boulevard from the city line to Summerville. Charles F. Brooks is chairman of the boulevard light committee.

ROCHESTER, N. Y.—Bids will be received by Charles L. Cadle, Superintendent of Public Works, Albany, until Jan. 4, 1922, for furnishing and installing two 2-ton electric overhead traveling cranes at the barge canal terminal at Rochester.

NEWARK, N. J.—Bids will be received by the Passaic Valley Sewerage Commissioners, 128 Market Street, until Jan. 3, 1922, for the construction of the Yautacaw pumping station, including superstructure and appurtenances, crane runway, electrical work, etc.

BELLEFONTE, PA.—The Hecla Park Association is planning to establish an electric plant in the park. It is proposed to utilize the water power of the "old mill" stream near the park grounds.

BRADDOCK, PA.—The City Council is considering the establishment of a municipal electric light and power plant in Braddock.

FRANKLIN, PA.—Arrangements are being made by the Titusville Light & Power Company for the erection of a high-tension transmission line from the local plant of the Citizens' company to Titusville. Bids have been asked for the poles for the line. The Titusville company plans to extend its lines to Hydetown and Pleasantville.

PHILADELPHIA, PA.—Bids will be received at the office of William S. Twining, director, Department of City Transit, 1211 Chestnut Street, until Dec. 28 for 13,660 ft. of underground electrical conduit in Kensington Avenue, Frankford Avenue and Bridge Street (Contract 61, Frankford Elevated Railway).

EASTON, MD.—Plans are under consideration by the Eastern Utilities Commission for the installation of a new turbine, engine and auxiliary electric equipment at the municipal power plant.

DANVILLE, VA.—Plans are under consideration for the installation of a steam turbine, additional boilers and accessories at the municipal electric power plant. The cost is estimated at $100,000.

WASHINGTON, D. C.—Estimates have been submitted to Congress by General Beach, chief of engineers, for the installation of a lighting system in Rock Creek Park. The cost is placed at $11,000.

North Central States

FLINT, MICH.—The Board of Education contemplates the construction of a one-story power house in connection with proposed school to be built in the Oak Grove district of Flint, and for which bids will be received until Dec. 28. Malcomson, Higginbotham & Palmer, 1009 Flint P. Smith Building, Flint, are architects. A. J. Wildanger is secretary of the board.

CLEVELAND, OHIO.—An ordinance introduced in the City Council authorizing the expenditure of $100,000 for the erection of police stations, purchase of cable and other apparatus and instruments for the extension of the police signal system has passed its first reading.

LIMA, OHIO.—The Council has passed an ordinance requiring all electric light, telephone and telegraph companies to place certain wiring underground within a year. The cost is estimated at $1,000,000.

LIMA, OHIO.—The construction of a power plant at the Lima Woolen Mills, Inc., is under consideration.

PADUCAH, KY.—The Paducah Electric Company has plans under way for the construction of power cables from Paducah to southern Illinois for the transmission of electrical energy. Two methods are under consideration, one to erect the cable over the Burlington Railroad bridge between Paducah ferry and Metropolis, and the other to lay a submarine cable under the Ohio River. Alfred S. Nichols is manager of the company.

ELIZABETHTOWN, IND.—A company has been organized by William H. Newson and others, with a capital stock of $10,000, to furnish electricity in Elizabethtown and to farmers within a radius of 10 miles. Connection will be made with the Mineral Springs high-tension line of the Interstate Public Service Company.

INDIANAPOLIS, IND.—The Mutual Milk Company, Bethel Avenue and Minnesota Street, plans to build a one-story power house in connection with a proposed addition to its plant.

SOUTH BEND, IND.—Plans are being prepared for the construction of a one-story power station, 20 ft. x 50 ft., in South Bend, to cost about $15,000. W. W. Artingstall, 37 West Van Buren Street, Chicago, Ill., is engineer.

BURLINGTON, ILL.—The question of issuing electric light and power bonds is under consideration.

CARMI, ILL.—Plans are under consideration for the installation of an ornamental lighting system on Main Street. W. R. Archer, president of the Carmi Commercial Association, is interested.

COLUMBIA, MO.—Bonds to the amount of $760,000 appropriated at the last session of the Legislature for the construction of buildings at the University of Missouri have been released by the Governor. Of this amount $150,000 will be used for a new woman's building, $200,000 for a new agricultural building, $150,000 for a new power plant, and $125,000 for a new chemistry building.

SHAWANO, WIS.—Plans are being prepared by the North Wisconsin Power Company, care of J. B. Read, University of Wisconsin, University Avenue, Madison, for the erection of a transmission line from Shawano to Stiles Junction, including 40 miles of 66,000-volt primary lines and 46 miles of 13,000-volt intermediary lines. The cost is estimated at $200,000. J. S. Allen, Madison, is engineer.

CARRINGTON, N. D.—A proposal to issue $40,000 in bonds for the erection of a high-tension transmission line from Carrington to the central plant in New Rockford will be submitted to the voters. C. C. Carnahan is clerk.

WATERTOWN, S. D.—Bids will be received by the Public Utilities Commission until Jan. 12, 1922, for a complete distribution system including street and commercial wiring. The cost is estimated at $40,000. A. J. Mueller is superintendent of the electric light plant.

WHITE RIVER, S. D.—F. W. Schwartz is having plans prepared for the construction of a hydro-electric plant and dam on the White River.

BEATRICE, NEB.—The Nebraska Gas & Electric Company contemplates the construction of a new plant, to cost about $150,000.

LINCOLN, NEB.—Bids will be received by T. H. Berg, city clerk, until Jan. 4, 1922, for furnishing and erecting one 2,500-kw. turbo-generator with surface condenser and switchboard complete, to cost about $75,000, at the municipal electric light and water plant.

Southern States

HERNDON, GA.—The construction of a hydro-electric plant, to cost from $200,000 to $300,000, is under consideration. The project includes the erection of 106 miles of transmission line connecting Millen, Waynesboro, Midville, Swainsboro, Summit, Graymount, Statesboro and Garfield. W. N. Drake, Pelham, Ga., is interested.

TARPON SPRINGS, FLA.—The Southern Utilities Company is planning to increase the output of its plant from 200 kw. to 440 kw.

MOBILE, ALA.—The Mobile Electric Company has leased the power station in Chickasaw, a suburb of Mobile, and is considering improvement. The company plans to furnish electricity in this district.

NEWTON, ALA.—The Houston Power Company, Newton, is contemplating the construction of a hydro-electric power plant and dam to develop about 3,000 hp. The project also includes the erection of a 1½ mile transmission line to connect with the present system between Ozark, Newton, Hartford and Slocumb, all in Alabama, and Gracely and Chipley in Florida. The cost is estimated at $300,000. N. A. R. Killebrew is in charge. The Southern Engineering Company, Albany, Ga., is engineer.

ABBEVILLE, LA.—Bids will be received by the Mayor and Board of Aldermen of the town of Abbeville until Jan. 5, 1922, for improvements to the electric light and waterworks system, including the installation of oil engines, generators, exciters, switchboards, light and pole line equipment, etc. J. Camile Broussard is secretary. Harry A. Mentz, Magnolia, Miss., is consulting engineer.

NEW ORLEANS, LA.—Bids will be received by R. M. Murphy, Commissioner of Public Finances, City Hall, until Jan. 4, 1922, for furnishing and installing incinerator equipment of the Decarie type, including electric traveling crane and electric generating equipment complete.

RAMONA, OKLA.—The City Council is considering the installation of an electric light system, to cost about $20,000. V. V. Long & Company, 1300 Colcord Building, Oklahoma City, are engineers.

DALLAS, TEX.—Steps have been taken by property owners on Pacific Avenue for the installation of a lighting system on that thoroughfare. The cost is estimated at $30,000. Rhodes S. Baker is chairman of the Chamber of Commerce.

FORT WORTH, TEX.—The Fort Worth Power & Light Company is considering the construction of a power station to cost about $40,000.

GROESBECK, TEX.—The installation of a new electric light plant and an ice plant in Groesbeck is under consideration.

HOUSTON, TEX.—The Houston Electric Company has submitted to the City Council a proposal to spend $1,200,000 within the next two years for improvements to its railway system in return for an extension to its franchise. Luke C. Bradley is district manager.

MERTENS, TEX.—The Prairie Pipe Line Company is planning the construction of a new electrically operated pumping plant, for which a site has been acquired. The cost, including machinery, is estimated at $100,000.

Pacific and Mountain States

SEATTLE, WASH.—The Washington Coast Utilities Company, Seattle, is having surveys made of its generating plants, transmission lines, transformer and distribution stations, with a view to making changes and improvements. The company has acquired the properties of the old Wenatchee Valley Gas & Electric Company, Wenatchee.

SPOKANE, WASH.—The Great Northern Icing Company is reported to be considering the construction of an ice-manufacturing plant in Spokane, to cost about $100,000.

TACOMA, WASH.—Plans are under way for the installation of dock equipment including four 3-ton to 5-ton cranes of loft and boom type, about 4,000 ft. monorail trackage and one 2-ton electric monorail hoist, conveying equipment, loading and unloading equipment, etc. G. W. Osgood, 612 Tacoma Building, is port engineer.

REEDSPORT, ORE.—The Three Rivers Light & Power Company, recently incorporated with a capital of $10,000 by Stanley D. Chapin and others, is preparing plans for furnishing electricity in Reedsport. The company proposes to acquire the distribution system of the old light plant and install two Diesel engines.

HAYWARD, CAL.—Plans and specifications are being prepared for the installation of a new electrolier system in Hayward. M. Templeton is clerk.

LATHROP, CAL.—The installation of a lighting system in the town of Lathrop is under consideration.

QUINCY, CAL.—Surveys are being made for the erection of a transmission line to connect the local electric light plant with the line of the Great Western Power Company at a point between Indian Falls and Paxton to supply electricity in Quincy. F. G. Ganser is owner of the local plant.

REDWOOD CITY, CAL.—Bids will be received by the City Trustees, until Jan. 3, 1922, for the installation of fifty-three electroliers, 9,600 lin.ft. 1¼-in. conduit and 9,600 lin.ft. 2-in. conduit cable. C. L. Dimmitt, First National Bank Building, is engineer.

ESCALANTE, UTAH.—Bonds have been authorized for the purchase of the local electric light and power plant for municipal operation.

Canada

BRANDON, MAN.—Negotiations are under way between the City Council of Brandon and the government of Manitoba for extending the provincial hydro-electric lines to Brandon. The cost of the extension of the Winnipeg-Portage line from Portage la Prairie to Brandon and necessary equipment in Brandon, Portage la Prairie and Winnipeg is estimated at $1,200,000.

MONCTON, N. B.—General contract has been awarded by the Moncton Tramway, Gas & Electric Company, Ltd., to T. E. Gilbert, 15 Ralph Street, for the construction of a power plant, to cost about $35,000.

GUELPH, ONT.—The city authorities contemplates the installation of one imperial 3,000,000-gal. electrically driven centrifugal pump and one 3,000,000-gal. electrically driven booster pump as an auxiliary to supplement the steam equipment now in use at the waterworks plant. Two 3,000,000-gal. gasoline or Diesel-driven units will also be purchased.

KINGSTON, ONT.—The City Council has decided to submit to the voters at the elections in January a by-law authorizing $12,000 in debentures for an electric police signal system in Kingston.

LONDESBORO, ONT.—The installation of an electric light and power distribution system in Hullet Township, to cost about $40,000, is under consideration. J. Fingland, Londesboro, is interested.

LONDON, ONT.—The Ontario Power Commission is considering the installation of a hydro-electric system in the towns of Tara, Port Elgin, Southampton and Paisley. The cost is estimated at $100,000. A. Beck, 169 Albert Street, is chairman.

ST. MARY'S, ONT.—Plans are under consideration for the installation of an electric light and power distribution system in Blanshard Township, to cost about $40,000. For further information address J. H. Jameson, St. Mary's.

THEDFORD, ONT.—The installation of an electric light and power distribution system in Bosanquet Township, to cost about $30,000, is under consideration. J. N. Wilson, 190 University Avenue, Toronto, is engineer.

WINDSOR, ONT.—The Grand Trunk Railway Company, London, is planning the electrification of its railway yards at Windsor. C. Forrestly, London, is division engineer.

Miscellaneous

PANAMA.—Bids will be received at the office of the General Purchasing Officer, the Panama Canal, Washington, D. C., until Dec. 29, for furnishing steel cable, fire-alarm switchboard, etc. (Circular 1463).

CHIHUAHUA, MEXICO.—The electric light and power plant and street railway system of the Chihuahua Electric Railway Company have been taken over by R. Lopez of Durango, and others. Improvements and extensions, including the installation of new machinery and the rehabilitation of the street railway lines, is under consideration. Jose Asunsolo has been appointed general manager of the company.

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Electrical World

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W. H. ONKEN, JR., and D. H. BRAYMER, *Editors*

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Lightning Arrester Protection

should cover everything in the nature of Excessive Rises in Potential, due to Atmospheric Lightning, or to Switching or other operations.

Effective Protection is only secured from a Lightning Arrester which successfully discharges the high potential surge, prevents the excessive flow of dynamic or generator current, and does this *without itself producing other disturbances* on the system.

The Ordinary Horn Gap, without Series Resistance, short circuits the line to ground and the resulting current trips the oil circuit breakers, the line voltage is pulled down, or the arc in suddenly breaking at the horns, produces another dangerously high potential surge which may again discharge over the horns.

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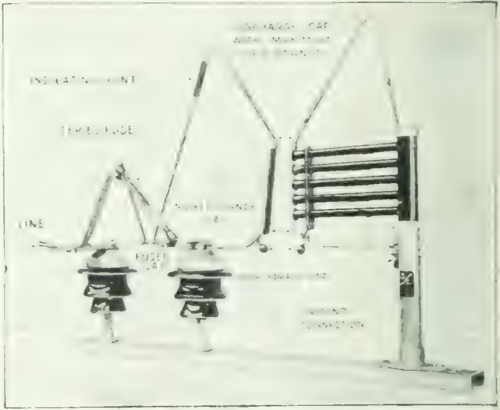

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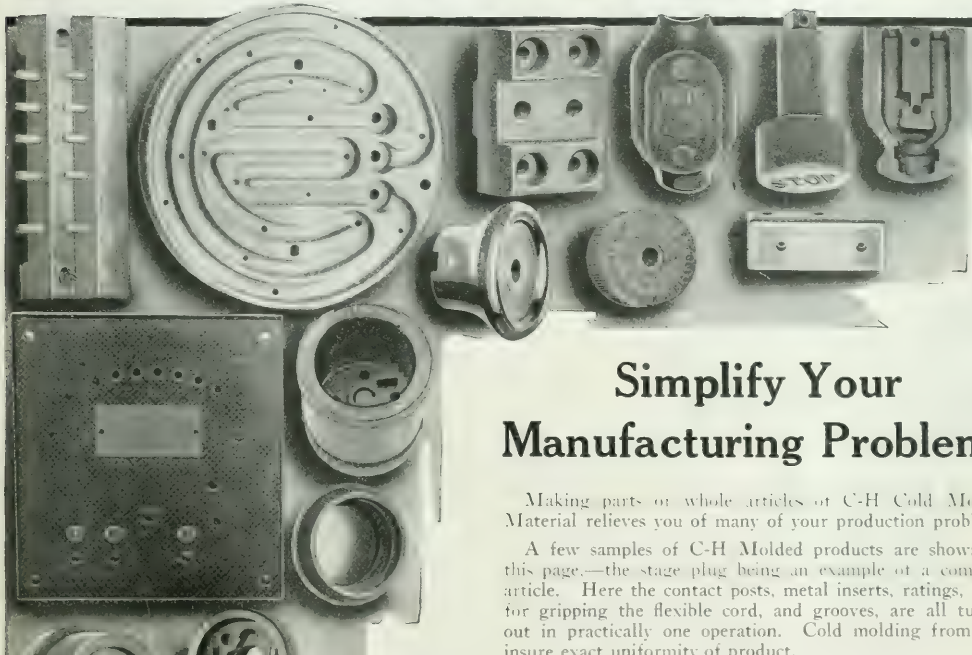
Cleveland, Ohio, 1207 Illuminating Bldg.
Minneapolis, Minn., 91[illegible] Metropolitan Life Bldg.

St. Louis, 713 Star Bldg.
Kansas City, [illegible] Bldg.
Denver, Colo., [illegible] Bldg.
Los Angeles, 711 I. W. Hellman Bldg.
San Francisco, 766 Folsom St.

Seattle, Room 1427 L. C. Smith Bldg.
Portland, 308 Lewis Bldg.
Winnipeg, Manitoba, 503 Confederation Life Bldg.
Vancouver, 609 Credit Foncier Bldg.

CUTLER-HAMMER



Simplify Your Manufacturing Problems

Making parts or whole articles of C-H Cold Molded Material relieves you of many of your production problems.

A few samples of C-H Molded products are shown on this page,—the stage plug being an example of a complete article. Here the contact posts, metal inserts, ratings, teeth for gripping the flexible cord, and grooves, are all turned out in practically one operation. Cold molding from dies insure exact uniformity of product.

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The Molded Products Department of The Cutler-Hammer Mfg. Company operates two plants;—one in Milwaukee; one in New York; with an associated plant in Toronto, Canada.

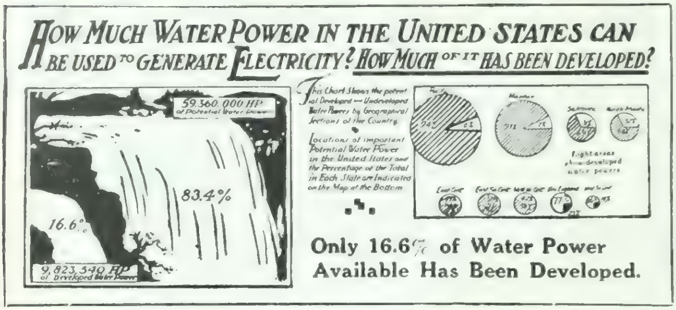
If one plant cannot supply you, one or both of the others can be put to work producing your article. In fact on big runs, we recommend the splitting up of the production as an insurance measure.

Let us explain to you how the cold molding art has been changing, how the scope of C-H Cold Molded Products will allow you to replace other compositions and materials to your advantage. Different kinds are made, suitable for various purposes. Send us parts, or drawings and we will give you complete information.

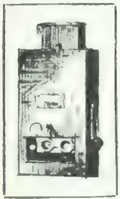
THE CUTLER-HAMMER MFG. CO.
Milwaukee, Chicago, New York

MOLDED PRODUCTS

The More Water Power Developed

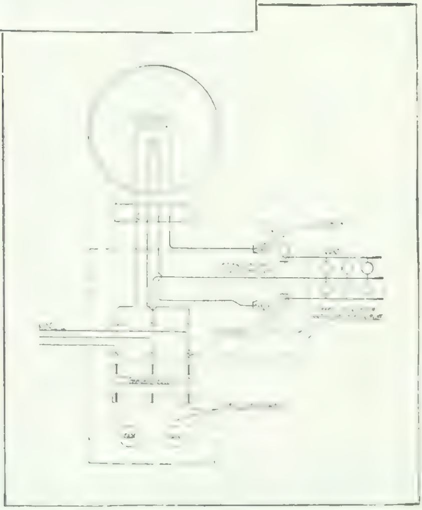


The Greater the Demand for Compro Meter Entrance Switches



"It carries electrical protection a step farther"

The meter adapters supplied are of the one-piece or universal type, the one piece type being suitable for use with meters of the particular type for which it was designed. All Compro meter test switches have upturned lips at each end of switch which offers suitable connections for any known method of testing.



Think of it. 83.4% of all the available water power in this country going to waste.

But after all it's no greater than the waste of perfectly good central station dollars that are needlessly being paid out for fuse and service costs in every nook and corner of this great U. S.

Just as development of water power will reduce the amount of power now being wasted, the increasing growth and general use of Compro meter entrance switches will reduce the number of central station dollars now going into fuse and service expenses.

More water power means more Compro meter entrance switches. As more and more of the unwired houses become wired, Compro sales will increase because of the service they give—they permit customers to renew fuses —and thus save time and money for the central station.

Full information will be cheerfully furnished.
No obligation.

The Wadsworth Electric Mfg. Co.
Incorporated
Covington, Ky.

BRANCH OFFICES:

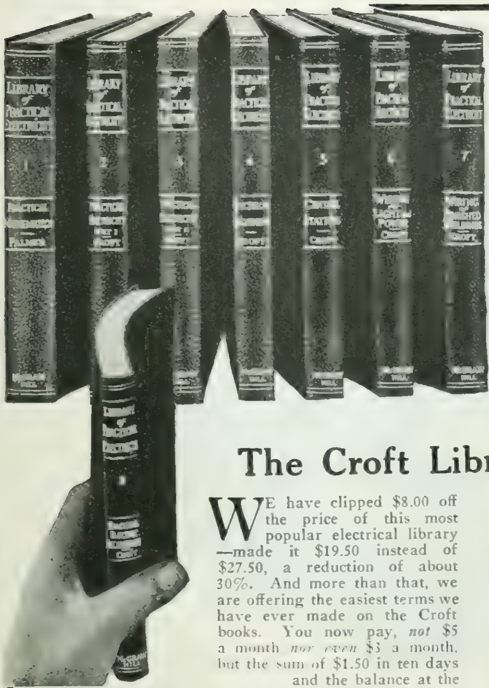
New York City
50 Church St.

Chicago, Illinois
559 West Monroe St.

Boston, Mass
170 Federal St

Pittsburgh, Pa
122 First Ave.

COMPRO Meter Switch



Raise Your Pay With These Books

"Know electricity as experts know it, and get an expert's pay."

Big salaries are paid in the electrical field for expert knowledge. The man who knows electricity in all its many phases—the man who has completely mastered the subject from A to Z—can pick his own job and name his own salary. The only way you can earn more is to learn more. Small knowledge means small pay. Learn the way to bigger pay. Become an expert. Croft will show you how.

The Croft Library of Practical Electricity

WE have clipped $8.00 off the price of this most popular electrical library—made it $19.50 instead of $27.50, a reduction of about 30%. And more than that, we are offering the easiest terms we have ever made on the Croft books. You now pay, *not* $5 a month *nor even* $3 a month, but the sum of $1.50 in ten days and the balance at the rate of *only* $2 a month. This gives you ten full months to complete your payments.

Was
~~$27.50~~
Now
$19.50

Think of getting this great Home Study Course and Reference Library at $19.50—a saving of $8.00! This is a real opportunity! No electrical worker who wants to fill a bigger job can afford to miss it. Hundreds of men have told us that the Croft Library at $27.50 was the best buy on the market. At $19.50 it represents the *biggest bargin* in sound, electrical training ever offered to the electrical workers of America.

Free Examination—No money down

CROFT has had an almost sensational climb. Beginning as an apprentice lineman, he went through the various stages of wireman, draftsman, etc., until he attained the position of electrical engineer with one of the great electrical manufacturing companies. Now he heads his own consulting company with a large and successful practice, and his name is known in every corner of the electrical world.

Only Boiled-Down Facts

Croft gives you only the boiled-down records of everyday electrical practice. His knowledge of electricity has been obtained through actual shirt-sleeve practice, and because he knows your problems he is able to tell you in clear understandable language the best way to solve them.

Consider the Small Cost

The Croft Library has always been the leader among the higher grade electrical libraries. Now at its new price of $19.50 it becomes the biggest value in electrical books on the market. Men who are using Croft will tell you that no set of electrical books published, regardless of price, can equal the Croft Library in completeness, up-to-date-ness and all-round practical value. The price is cut, but not the value.

Can you answer these questions?

1. **Are you sufficiently familiar with the operating principles of motors and generators so that you can locate and correct their troubles with a minimum expenditure of time, thought and work?**

2. Can you lay out the **wiring in your plant so that** it is in accordance with the **best practice, both electrically and mechanically?**

3. If you have a room or building to light can you select the lamps properly and choose the correct reflectors and locate the units at the right heights and in the proper positions?

4. Do you know enough about electric circuits so that you can figure wire sizes, resistances and the like?

5. **Do you really understand the principles of alternating currents and alternating current circuits—power factor, inductance, reactance, impedance, permittance and the like?**

6. Are you familiar with **the modern electron theory** of electricity which has made easy of understanding many things about electricity that were obscure formerly?

7. If you have to wire an old building with concealed wiring, do you know just how to go about it? Do you **know all the time-saving stunts in fishing wires, boring** raceways and how to make the tools required?

8. Do you know the National Electric Code Rules and the reason for their adoption?

The Croft Library answers these and thousands of other questions.

10 months to pay

We want you to test our statements. We want you to compare the Croft books with others. Fill in and mail the coupon attached and we will send you the entire set of eight volumes for ten days' Free Examination. We take all the risk, pay all charges. You assume no obligation. You pay nothing unless you decide to keep the books. Then $1.50 in ten days and the balance at the rate of $2 a month. Send the coupon NOW and see the books for yourself.

Send no money—just the coupon!

Free Examination Coupon

McGraw-Hill Book Co., Inc.
370 Seventh Ave., New York

Gentlemen:—Please send me the Library of Practical Electricity (shipping charges prepaid) for 10 days' free examination. If satisfactory I will send $1.50 in ten days and $2 per month until $19.50 has been paid. If not wanted I will write you for return shipping instructions.

Name

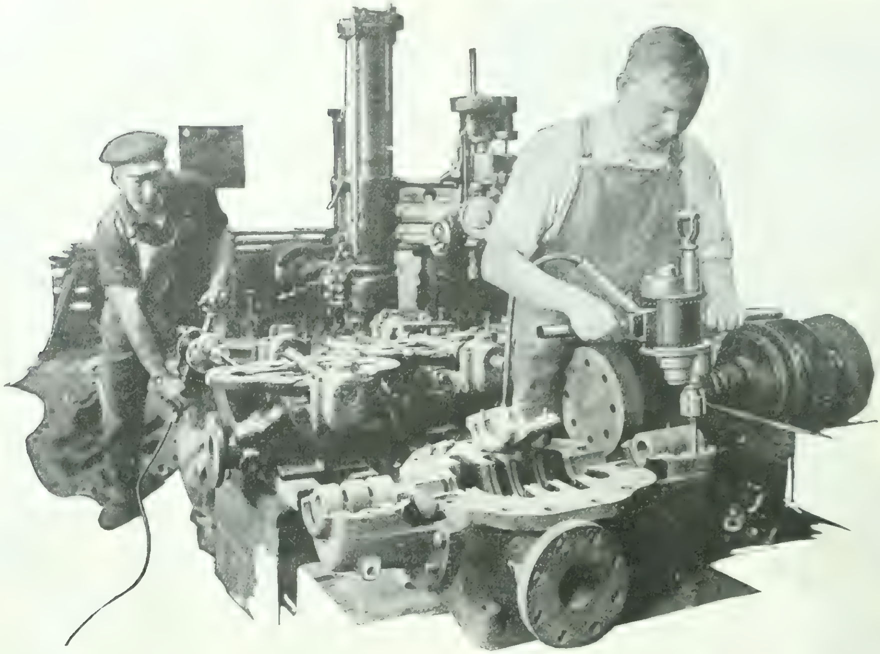
Home Address

City and State

Where Employed

Occupation

W 12-31-21



They take the tool to the job!

THERE are three ways to handle the job illustrated—

1—Hire extra labor to carry heavy castings to the expensive stationary machine in the background.

2—Slow up the work and increase man-hour costs by tedious hand drilling.

3—Hustle up the work, reduce tool expense, and lower man-hour costs by taking a Little Giant Portable Electric Drill to the job.

Little Giants don't stop with saving over hand or stationary drilling—they are *built* for and *give* lower-cost-per-year performance to the drill user who demands *cheaper drilling*—*not* cheaper drills.

Little Giants are not *orphans* by any means! They're backed by a nation-wide chain of Service Branches completely stocked with new tools and spare parts, and by the largest builder of portable electric tools in the world.

Ask for Booklet 397.

Chicago Pneumatic Tool Company
Chicago Pneumatic Building · 6 East 44th Street · New York
*Sales and *Service Branches all over the World*

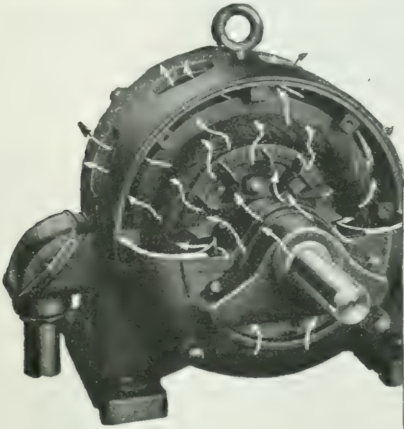
•Birmingham •Boston •Buffalo •Chicago •Cincinnati •Cleveland •Detroit El Paso Erie Franklin Houston Joplin •Los Angeles •Minneapolis •New Orleans •New York •Philadelphia •Pittsburgh •Portland Richmond Salt Lake City •San Francisco •Seattle •St. Louis Barcelona •Berlin Bombay Brussels Buenos Aires Cadiz Christiania •Fraserburgh Havana Honolulu Johannesburg Lisbon •London Madrid Milan •Montreal Osaka Paris Seoul Tokyo Toronto Vancouver Winnipeg

EL 28

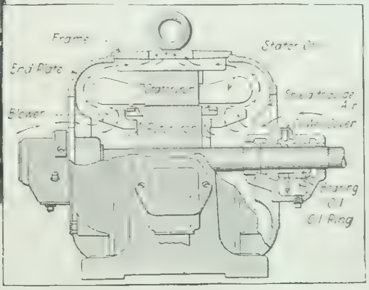
BOYER PNEUMATIC HAMMERS · LITTLE GIANT PNEUMATIC AND ELECTRIC TOOLS
CHICAGO PNEUMATIC AIR COMPRESSORS · VACUUM PUMPS · PNEUMATIC HOISTS
GIANT OIL AND GAS ENGINES ROCK DRILLS · COAL DRILLS

LITTLE GIANT
Electric Tools

This is one of a series of advertisements describing the main features of Wagner Pow-R-full Motors



Illustrating the passage of the air through the Pow-R-full Motor. It will be seen that all parts where heat is produced are bathed with currents of cooled air.



Cool running

The load a motor can carry continuously is determined by its ability to dissipate the heat, because heat destroys insulation and without insulation there is no motor.

Everything else being equal, the life of a motor depends upon its insulation which in turn is determined by the temperature of the hottest point; therefore, *perfect ventilation not only increases the load capacity of a motor but also prolongs its life.*

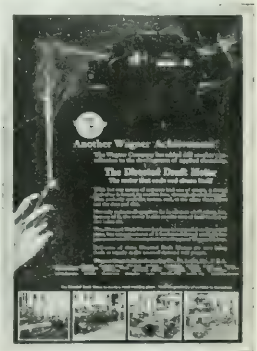
To use a fan on the end of the rotor for ventilation purposes is well established practice, but to provide a free passage for handling a considerable quantity of air along *definite* paths is a radical improvement that was first introduced in the Wagner Pow-R-full Motor.

The fans on the ends of the Wagner Pow-R-full rotor handle a large quantity of air. They draw it in along the shaft and send it through the stator windings and all around the stator iron, all air leaving by large openings in the casing or frame.

These fans absorb power but they add many times this power to the load capacity of the motor, and the final result is an increase in the overall efficiency.

The whole secret of the success of this ventilating system is the directing of the air along *definite* paths.

Bulletin 129, describing the advantages of the Pow-R-full motor development, gladly sent upon request.



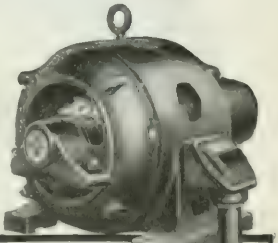
Another Wagner Achievement

The Directed Draft Motor

Wagner,Quality Motors were the first motors in which Directed Draft was used, as evidenced by the above advertisement, which appeared in the popular and technical press of March, 1917.

Even then this feature had been included in Wagner,Quality Motors "for several years" as the advertisement explains.

Isn't it only natural that the pioneers in Directed Draft should be the leaders of today in this feature?—as indicated by the Pow-R-full Motor.



Wagner Electric Manufacturing Company,
Saint Louis, Missouri

2600

Wagner, Quality **Pow-R-full Motor**
Polyphase

THE efficient and dependable service for which paper pulleys are known is the result of ROCKWOOD quality, *conscientiously* built in. Complete records assist us to know the history of every Rockwood Paper Pulley built. Each Rockwood pulley is carefully registered and *labeled* that you may know it conforms to the high Rockwood standard. To avoid unscrupulous imitators, order by the name only "Rockwood Paper Pulleys"—and see that the pulley you get carries the Rockwood *quality* label.

THE ROCKWOOD MFG. CO.
1947 English Ave. INDIANAPOLIS, U.S.A.

PAPER PULLEY

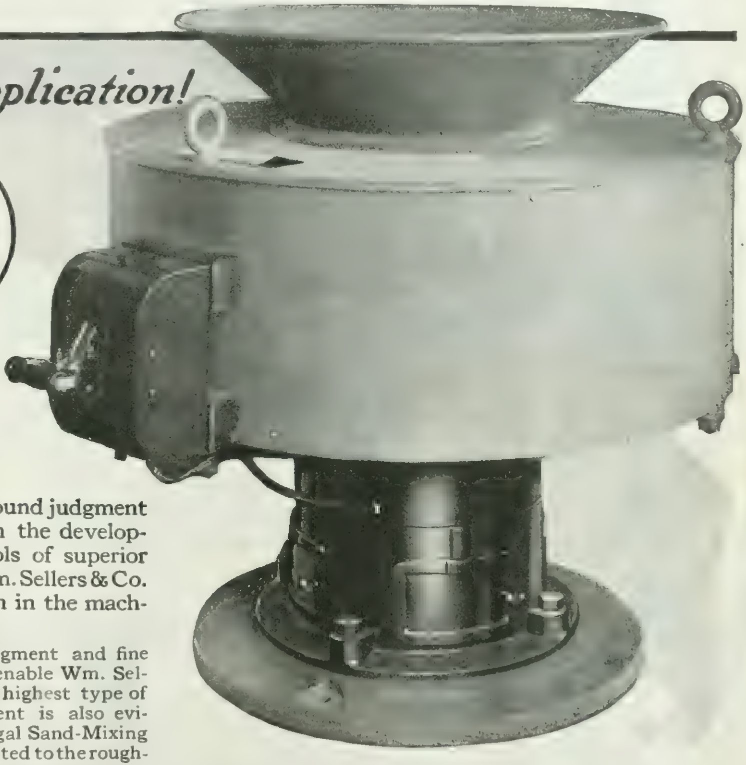
All the Power—All the Time

ROCKWOOD PULLEY SERVICE

Watson Motor—the Choice of Wm. Sellers & Co. for this Extremely Severe Service!

A Unique Application!

EVERY
WATSON
SALESMAN
IS AN
ENGINEER



LONG experience, sound judgment and ingenuity in the development of machine tools of superior merit have placed Wm. Sellers & Co. in a foremost position in the machine tool industry.

The same careful judgment and fine discrimination which enable Wm. Sellers & Co. to build the highest type of machine tool equipment is also evidenced in this centrifugal Sand-Mixing Machine which is subjected to the roughest, most severe service imaginable.

Careful judgment and fine discrimination likewise entered into Wm. Sellers & Co's. choice of the Watson Motor to power this mixer. A thorough investigation convinced them of the adaptability of the Watson to this particular machine. Co-operation of Watson engineers helped to insure the success of the application which is a unique example of Watson built-in construction.

The motor constitutes the pedestal of the machine. It is the fully-enclosed type, ball-bearing equipped. Sand or dust cannot get into the bearing chamber; lubricant cannot get out. Bearings are extra large. A dependable, low-maintenance motor. Insures quick, economical sand-mixing.

The machine, Watson-powered, accomplishes as much work with two laborers working three hours as five men could do in a ten-hour day.

What is your problem? Let Watson Engineers "roll up their sleeves" and help you work it out. Watson Service is for you. Consult our nearest district office.

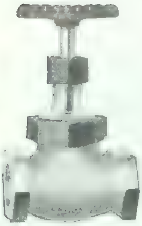
The Mechanical Appliance Company, Milwaukee, Wisconsin

Buffalo
Chicago
Cincinnati
Cleveland
Boston
New York
Detroit
Grand Rapids, Mich.
Minneapolis
Dallas
Burlington, Ia.
Des Moines
High Point, N. C.
Los Angeles
San Francisco
Philadelphia
Pittsburgh
Amherst, N. S.
Atlanta
St. Louis
Toronto
Winnipeg

40° Rating—A Dependable Motor

WATSON ELECTRIC MOTORS

CRANE CO.



No. 7 Brass Globe Valve

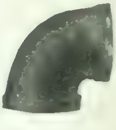
No. 461 Iron Gate Valve

We are Manufacturers of about 20,000 articles, including

Valves, Pipe Fittings and Steam Specialties

made of brass, iron, ferrosteel, cast steel and forged steel, in all sizes, for all pressures, and all purposes, and are distributors through the trade, of pipe, heating and plumbing materials.

Brass Cock



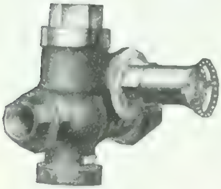
Malleable Iron Elbow

No. 437 Brass Gate Valve

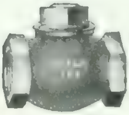
No. 09 Oil Separator

Malleable Iron Return Bend

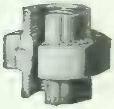
Reducing Flanged Tee



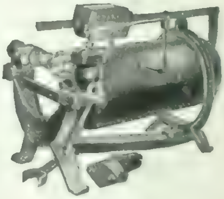
No. 962 Pressure Regulator



No. 20 Horizontal Brass Check Valve



Union



Non-Return Steam Trap

SALES OFFICES, WAREHOUSES AND SHOWROOMS:

BOSTON
SPRINGFIELD
HARTFORD
BRIDGEPORT
ROCHESTER
NEW YORK
HARLEM
ALBANY
BROOKLYN
PHILADELPHIA
READING
ATLANTIC CITY
NEWARK
CAMDEN
BALTIMORE
WASHINGTON
SYRACUSE
BUFFALO
SAVANNAH
ATLANTA
KNOXVILLE
BIRMINGHAM
MEMPHIS
LITTLE ROCK
MUSKOGEE
TULSA
OKLAHOMA CITY
WICHITA
ST. LOUIS
KANSAS CITY
TERRE HAUTE
CINCINNATI

FOUNDED BY R. T. CRANE, 1855

CRANE CO.

836 S. MICHIGAN AVE.

CHICAGO

WORKS: CHICAGO AND BRIDGEPORT

INDIANAPOLIS
DETROIT
CHICAGO
ROCKFORD
OSHKOSH
GRAND RAPIDS
DAVENPORT
DES MOINES
OMAHA
SIOUX CITY
MANKATO
ST. PAUL
MINNEAPOLIS
WINONA
DULUTH
FARGO
WATERTOWN
ABERDEEN
GREAT FALLS
BILLINGS
SPOKANE
SEATTLE
TACOMA
PORTLAND
POCATELLO
SALT LAKE CITY
OGDEN
RENO
SACRAMENTO
OAKLAND
SAN FRANCISCO
LOS ANGELES

CRANE LIMITED
MONTREAL, TORONTO VANCOUVER, WINNIPEG,
CALGARY REGINA HALIFAX OTTAWA

CRANE-BENNETT, LTD.
LONDON ENG

UNIVERSAL SERVICE

Coxe Stokers

are stokers of universal application. No matter what fuel you burn they will meet your needs as they are meeting the needs of plants burning

Bituminous Coal
Coke Breeze
Anthracite Coal

International Combustion Engineering Corporation

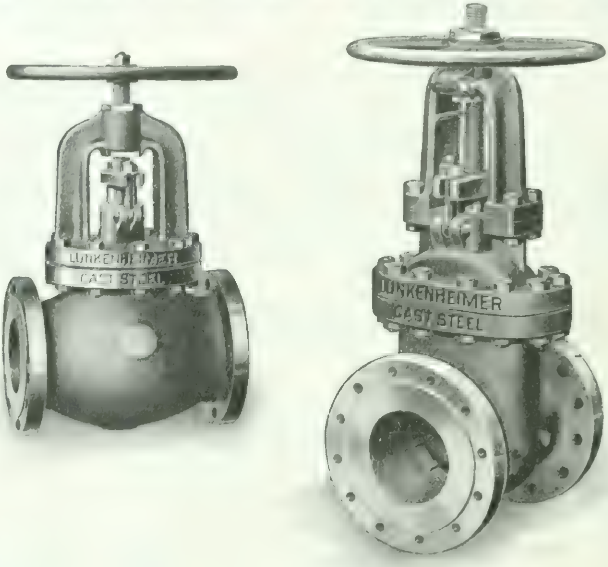
Combustion Engineering Corporation

Combustion Engineering Building, Broad Street, New York City

Type E Stokers—for Bituminous Coal   Lopulco Pulverized Fuel Systems   The Grieve Grate—Hand-Firing
Coxe Stokers—Anthracite Coal, Coke Breeze and Bituminous Coal

PHILADELPHIA, PA.   PITTSBURGH, PA.   MINNEAPOLIS, MINN.   ATLANTA, GA.   BIRMINGHAM, ALA.
HAZLETON, PA.   BOSTON, MASS.   CHICAGO, ILL.   SALT LAKE CITY, UTAH   ALBANY, N.Y.
DETROIT, MICH.   OMAHA, NEB.   DENVER, COLO.   MILWAUKEE, WIS.   SEATTLE, WASH.   CHARLOTTE, N. C.
TAYLOR ENGINEERING CO., VANÇOUVER, B. C.

LUNKENHEIMER
Cast Steel Valves



For power plants where high pressures and more particularly excessive temperatures prevail. The 800°F. temperature and 350 pounds pressure rating for which *Lunkenheimer Cast Steel Valves* are guaranteed covers every requirement of modern practice and provides a margin of safety which insures both efficiency and maintenance economy.

Lunkenheimer "Valve-steel" is melted by the electric process exclusively, with definite regulation of each step in the foundry. This method provides a metal structure both homogeneous and free from casting defects and highly suitable for valve service. The trimmings are monel.

The line is complete and includes Globe, Angle, Check, Gate, Non-return, Pop Safety and Blow-off types in all standard sizes.

Specify LUNKENHEIMER CAST STEEL VALVES and insist on their installation. Distributors of Lunkenheimer Products situated in every commercial center.

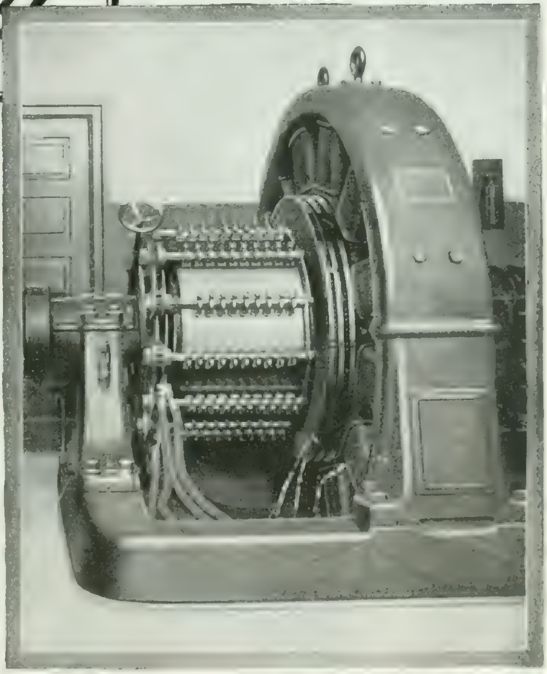
Write for Catalog No. 58-AC.

AMERICA'S BEST
LUNKENHEIMER
—QUALITY—
SINCE 1862

THE LUNKENHEIMER CO.
—"QUALITY"—
LARGEST MANUFACTURERS OF
HIGH GRADE ENGINEERING SPECIALTIES
IN THE WORLD
NEW YORK CHICAGO CINCINNATI, U.S.A. BOSTON LONDON
EXPORT DEPT. 129-135 LAFAYETTE ST. NEW YORK

15 18 13

ROME
Quality
BRASS & COPPER



Rome Quality reflects in the service

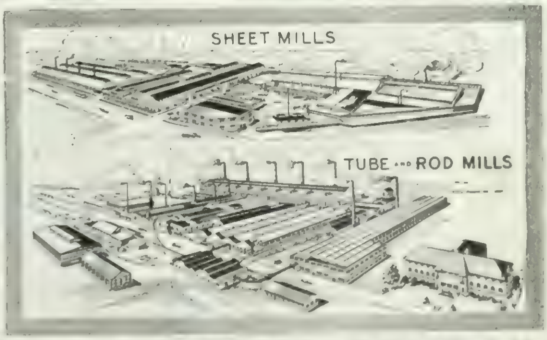
Those who use Rome Electrical Copper buy more than metal; they provide for themselves a dependable service — and dependability always proves economy.

Rome Quality is uniform; the high standard set by the Rome Brass and Copper Company is constantly maintained by each and every one who has to do with the production of Rome Electrical Copper from workman at furnaces, rolls, and machines, to the expert and specially trained inspectors and metallurgists.

Rome Quality Electrical Copper includes: switchboard copper; drawn copper commutator bars of any shape or length; strips for armature winding; brush and battery copper; rectangular copper bar drawn or sawed; round or square edge strip copper, soft or hard (in coils or wound on bucks, or in straight lengths).

BRASS COPPER BRONZE

Sheets; rolls; rods; anodes; tubes, brazed and seamless; strips; extruded shapes; angles and channels; tapered tubes and hose pipes; door rail; commutator bars and segments; electrical copper bar; and rivets and burs.



ROME BRASS AND COPPER COMPANY - ROME, N.Y.

BRASS ROME COPPER

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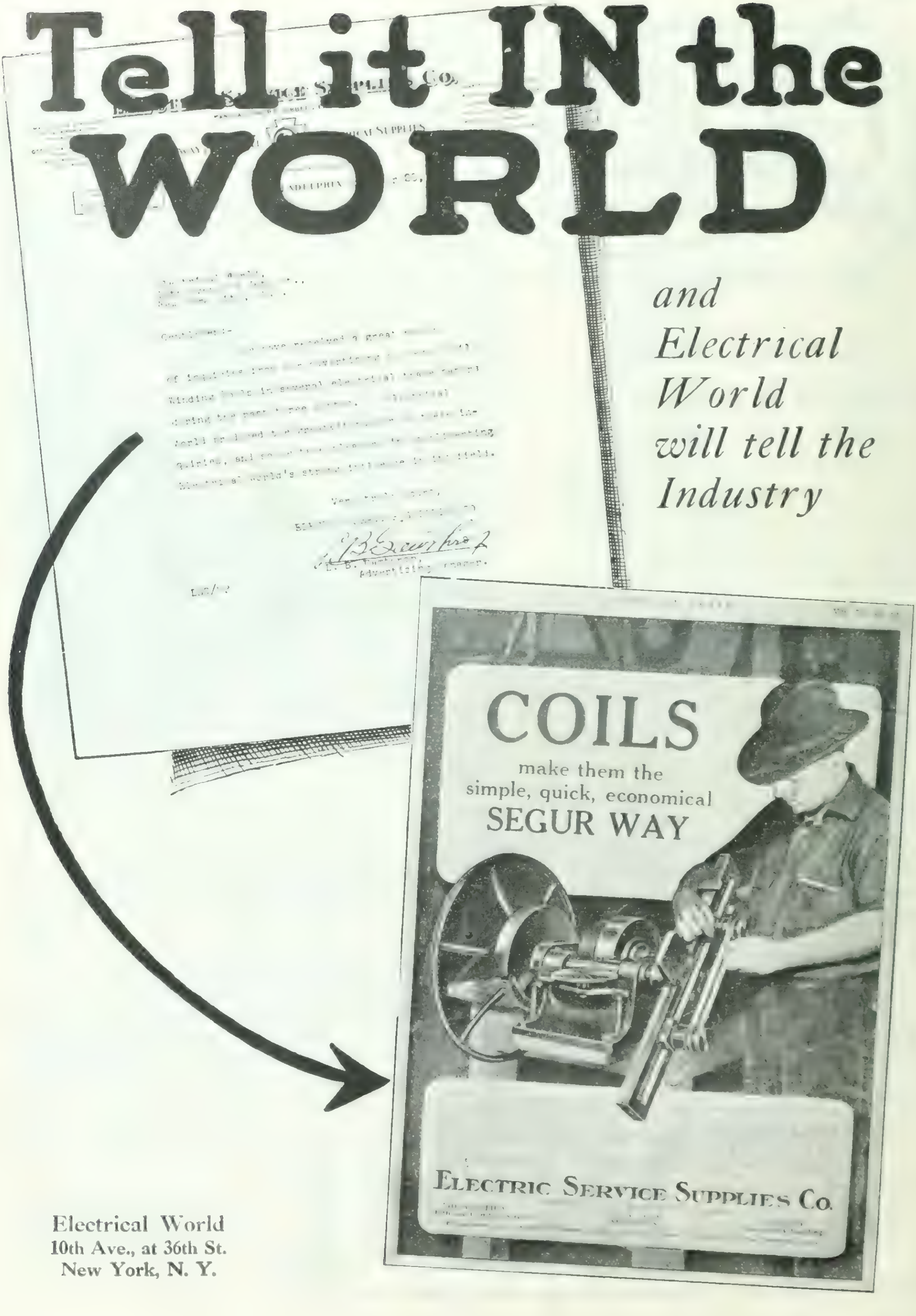
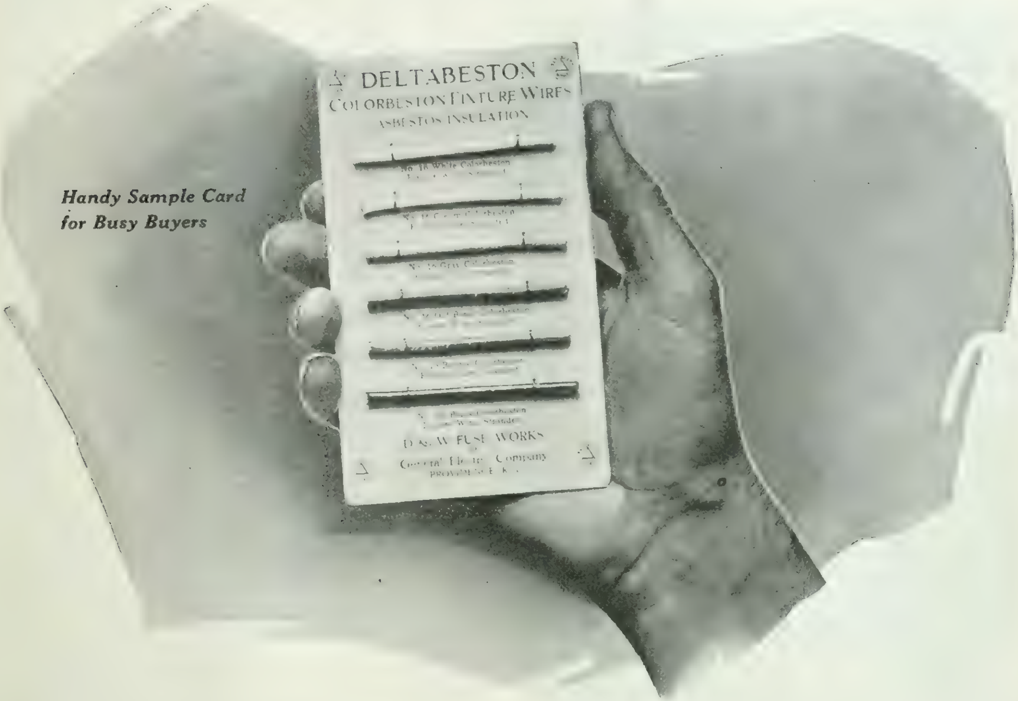
Tell it IN the WORLD


Electric Service Supplies Co.
Philadelphia
Electrical Supplies
COILS
make them the
simple, quick, economical
SEGUR WAY
Electric Service Supplies Co.

and Electrical World will tell the Industry

Electrical World
10th Ave., at 36th St.
New York, N. Y.



Handy Sample Card for Busy Buyers

A New Form
of an old and tried product

"COLORBESTON," a new, colored, asbestos-insulated wire, has been developed to meet the need for a fixture wire that will match standard fixture finishes, but which has no braid to char when used in close contact with high wattage nitrogen lamps.

Asbestos Fixture Wires for Permanency

The superiority of asbestos insulation, notably DELTABESTON, on wires subjected to heat, is well established. "COLORBESTON" Fixture Wire is a new form of DELTABESTON, and is finished in six permanent colors, gray, cream, old brass, bronze, black and white.

A handy sample card will be furnished on request

Fuse D&W Works
of General Electric Company
Providence R.I.

DWD-46

KERITE

AN INVESTMENT

When you put your money into KERITE you make an investment in service. You do more than buy conductors, insulation and protection. You obtain the best possible combination of the most desirable qualities in permanent form.

KERITE remains long after the price is forgotten.

KERITE INSULATED WIRE & CABLE **COMPANY**
NEW YORK CHICAGO

IF IT'S **PARANITE** IT'S RIGHT

Rubber Covered Wires and Cables
Lead Covered Wires and Cables
High Tension Cables
Automobile Cables
Telephone Wires
Lampcords (Silk and Cotton)
Portable Cords (Silk and Cotton)
Fire Alarm Cables
Mining Machine Cables

For 30 Years the Standard

Indiana Rubber and Insulated Wire Co.

Factory and General Offices:
Jonesboro, Indiana

Chicago Office:
210 So. Desplaines St.

New York Office:
Thomas & Betts Co.
63 Vesey St.

MAGNET WIRE
MAGNET WIRE PRODUCTS

DUDLO

The Sign of Highest Quality and Good Service

WINDINGS

Ignition
Wireless
X-Ray
Magnet
Telephone
Meter
Transformer
Field

Coils for all Electrical Work

All coils made according to specifications of customer, and guaranteed to be satisfactory.

MAGNET WIRE

Plain enameled copper wire
Single cotton enameled copper wire
Single or double cotton magnet wire
Single or double silk magnet wire
Single silk enameled copper wire

We have one of the largest and most modern plants in the world devoted to the manufacture of magnet wire and windings

Dudlo Manufacturing Co.
Fort Wayne, Ind.

TIREX CABLE
for Mining Machines

A demonstration that

TRADE **TIREX** MARK

Wears at least four times as long as other cables

"We have had one 'Tirex,' number 3 concentric cable on an arcwall mining machine, which has been in operation about one year. This cable shows no sign of wear and we have never had the slightest trouble with it." *From a Superintendent of Power and Equipment in a coal mine.*

Every time a cable is repaired or replaced there is a loss due to idle men and machinery. As "Tirex" wears at least four times as long as other cables, it reduces this loss 75%.

Free samples upon request stating type, sizes and quantity usually bought

SIMPLEX WIRE & CABLE Co
MANUFACTURERS
201 DEVONSHIRE ST. BOSTON
CHICAGO SAN FRANCISCO

Electrical World

New York, Saturday, December 31, 1921

Is Economical Distribution Wanted?

ELECTRICAL men are worrying a lot just now about the critical problem of distribution. The present system—or lack of system—is breaking down because the men who are doing the distributing are not prospering. And when a distributer ceases to prosper he soon must cease to function.

But this situation is more than a problem—it is two problems. And it is vital that in thinking on it every one should have this point in mind. For there are today two broad classes of electrical goods that are distributed — general wiring supplies, for the most part staples and in steady demand, and energy-consuming appliances, for the most part specialties still in the pioneering stage.

The economic service of the distributer of the staples is to collect them from the many factories, warehouse them and resell them to the individual contractors, dealers, central-station companies and industrial plants, which can more easily draw on the one fast-moving jobber's stock with much reduced investment, effort and expense.

The function of the distributer of appliances is quite different, because in addition to the selecting and warehousing he must perform an active service in the creation of market. He must play a forceful part in the education and the stimulation of the trade to the necessity of pioneering these commodities by creative selling direct to the homes of all the people. And the economic service rendered here is one of greater detail and far greater cost.

The principle of such a system of distribution is easily set down. Many scattered factories ship goods to many geographically distributed warehouses where the retail trade of every town may have convenient access to combined and ample stocks and be relieved of both the labor and expense of ordering each article from its own factory and carrying large frozen stocks of waiting goods in wasteful duplication. This is the principle, but if in practice the manufacturer fails to protect and promote this economic function of the warehouse and sets up too many jobbers, then the duplication of distributers' stocks and the dividing of the distributers' profits defeat the very purpose of such distribution.

For when the goods cease to flow freely through the jobber's warehouse, clearing all lines from the factory to the trade, this business, which depends on volume and turnover for success, chokes up and dies. And when the jobber's business ceases to be prosperous, he can no longer do his job of saving money for both factory and trade and cannot even hope to play his part in the great work of pioneering.

The question is: Does the electrical industry want to maintain an economic distribution? If so, all branches of the industry must come to a common understanding as to the methods by which both specialties and staples can be distributed most economically.

William Ewart Robertson

A leader among electrical jobbers with a background of manufacturing and contracting experience who has been a pioneer in co-ordinating the work of electrical men.

PRACTICAL evolution in the electrical industry has come within the short space of forty years. From the first commercial utilization of electricity the expansion has been so rapid that the fabric of its organization has been woven loosely. The function of manufacture and distribution of electrical commodities, the generating of energy and the local application and installation of electric service from small beginnings have grown to great specialized activities demanding the entire attention of the manufacturer, the jobber, the central-station man and the contractor-dealer each in his own work.

It has been fortunate that standing near the middle of this steadily growing web of the electrical industry, in contact as a jobber with both the manufacturer, engrossed in his production problems, and the central-station company, the contractor and the dealer, intent on selling and serving the local market, there has been a man like William E. Robertson, gifted with the power of seeing broadly and thinking straight. He has brought into the counsels of the industry a constructive harmonizing and co-ordinating influence that has been an impulse of incalculable value.

Mr. Robertson has a knowledge of the electrical business possible to few. He is general manager of the Robertson-Cataract Company of Buffalo, one of the leading jobbing houses of the country. He has been a manufacturer, a contractor and a retailer, all in the electrical industry. He is financially interested in central-station properties. He has had a legal training. He is a skilled accountant and financial man. He possesses a searching mind with a keen ability to analyze. He was one of the first men in the industry to comprehend the relations which exist between the groups and classes of electrical men and grasp the necessity for the development of a practical co-ordination between them that will knit these tangent forces into a progressing power. And he has preached this gospel to electrical men for the many years in which his counsel has been sought and freely given in the co-operative work of all branches of the industry.

Mr. Robertson was born in South Carolina in 1874 and is a graduate of Cornell University and the Buffalo Law School. He entered the electrical business in 1898 with his brother, James D. Robertson, and in the following year became a partner in the Robertson Electric Construction Company. He is today general manager of the Robertson-Cataract Electric Company and vice-president and general manager of the Robertson Electric Construction Company.

There has been no movement of any consequence in the electrical jobbing industry in which Mr. Robertson has not participated as a leader. He was an early member of the Electrical Supply Jobbers' Association and one of the founders and first directors of the Society for Electrical Development. He was sixth Jupiter of the Jovian Order. He rendered distinguished service as chairman of the committee representing the electrical jobbers on the War Industries Board during the World War. It was logical, therefore, for the National Electric Light Association, when it decided to include the entire industry in its counsels to take Mr. Robertson as the jobber member of its executive committee. He is an active public worker in Buffalo, a member of the Chamber of Commerce, of which he has been president, and of many industrial, civic and social clubs and organizations.

Mr. Robertson is a man of energy and optimism. He believes in the electrical industry and in the economic function of the jobber. He looks forward to a steady improvement in prosperity for the man who will organize his business to promote high standards of quality in electrical installation and a service that is creative in its influence.

Electrical World

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Ontario Overshoots the Mark

THIS week water was let into the canal of the largest hydro-electric development in Canada, the Chippawa-Queenston station of the Hydro-Electric Power Commission of Ontario. Wonderful in conception, bold in engineering execution and mammoth in the size of its units, the installation stands as a monument to the vision and skill of that enthusiastic Canadian Sir Adam Beck. But because of untoward circumstances it also stands a monument to economic folly. The Hydro-Electric Power Commission of Ontario was able to purchase 100,000 hp. from a privately owned utility, the Ontario Power Company, for $9 a horsepower-year, and on the strength of that built up the immense network extending a thousand miles in all directions, from Niagara Falls to Toronto on the north, and to Windsor, opposite Detroit, on the west. Despite the fact that its turbines at Queenston operate under a head 100 feet greater than that available at Niagara Falls and thus generate one-third more energy for the same amount of water, the Hydro-Electric Power Commission of Ontario cannot manufacture at Queenston, much less sell, a horsepower-year of electrical energy for twice the amount it paid the Ontario Power Company when the company was privately owned and operated. Thus has the Hydro-Electric Power Commission of Ontario, lured on by ambition, fallen into a pit of its own digging.

Open-Price Associations and the Law

THE Supreme Court of the United States has sat in judgment on "so-called" open-price associations and decrees them unlawful. Originally formed for the purpose of acquainting members with the conditions of supply and demand in industry and with the prevailing prices, these associations have degenerated into price-fixing combinations of the worst sort, as recent disclosures in New York and elsewhere have shown. Obviously the collection and distribution of statistics on prices, stocks, production, etc., advantageous as these are to trade and industry, must be hedged about with certain safeguards if they are to escape censure. It was not the intention of the Supreme Court to stop the collection and publication of trade information—its edict was leveled against misuse of the information. The publication of prices and production statistics, it is generally admitted, will go far to cure cut-throat competition, and we know of no better way of disseminating such information than through the columns of the business press. Economic right can only be maintained by public understanding, and that in turn begets public confidence. Fortunately, the electrical industry is animated by a desire for full and free publicity as a cure for economic evils, and time has proved the advantages of such a course. However, now and then there crops up a natural desire to fix things, and while wiser counsels usually prevail, it is well that the decision of the highest court of the land is now available to squelch any further longings in the direction of price fixing.

Incomprehensible Variety of Voltages in Pennsylvania Industrial Plants

AN EXTRAORDINARY and almost incomprehensible variety of voltages are in service in Pennsylvania, as the survey which we present this week shows. With direct-current motors seventeen separate figures are reported, thirteen of them under 500 volts. Among alternating-current motors there are twenty-one voltages in use, of which again thirteen are under 500 volts, and of the group only five are characteristically primary voltages. In the name of all the standardizing committees of the various engineering organizations, why should these things be?

If the truth were known, it would generally be found that trivial concessions to circumstances account for most of the variations from the usual figures, yet it is very doubtful whether there is justifiable cause for continuance of this kind of practice. In some cases, doubtless, the figures cited are merely nominal, representing the running of a standard machine at a disadvantageous voltage, while in other cases it can hardly be doubted that the apparatus is really of a special kind. In the former case, particularly with alternating motors, the results of off-voltage running are pretty certain to be bad, and there seems to be no conceivable reason why there should be motors rated at every 10 volts between 200 and 250, with 225 thrown in for good measure. It certainly is a case for reform.

In the earlier days of alternating-current working we used to be afflicted with all kinds of curious frequencies, sometimes used apparently for fanciful reasons, again as the result of some insistent though utterly foolish demand for special speeds, which were obtained at the very high cost of abnormal frequencies in the plant. We realize fully that in some particulars standardization means standing still instead of progressing, but surely in so simple a matter as voltages there ought to be more general agreement among engineers and operators than seems to be the case in the Keystone State.

It's the Small Courtesies that Count with Most People

AT THE entrance to the office of the Minneapolis General Electric Company an attractive and tactful young lady is stationed whose business it is to greet with a smile all who come in and to volunteer assistance and information. She knows regular customers by name, and to them she typifies a desire to serve. When the traveler steps out of the Kansas City Union Station a sign so placed that it is impossible to miss it tells him the facts he wants to know regarding street-railway fares. Across the viaduct and a few blocks up town in the direction in which the stranger is most likely to go is a little information booth at which a street-railway employee cheerfully gives the information that is needed to get around the city without loss of time.

These are little things, but they are the finest and easiest of avenues to pleasant public relations. The average individual dislikes to go into an establishment and wander around trying to discover where he can be quickly served or obtain the information he may be seeking. If he has, added to this, the feeling created by the familiar "wotinell" attitude so many persons delight in assuming toward an inquirer, he is quite likely to go away with an unfavorable impression of those with whom he has been forced to transact his business. Even to the seasoned traveler whose sensitiveness has been toughened by varied experience the service arrangements referred to are a pleasant experience.

It cannot be expected that every employee in a large force can answer all the questions that may be put to him. But he can be trained to answer courteously and to direct the inquirer to the place where the information desired can be had. The time of customers is thereby conserved, and they will go away in most instances with a feeling of satisfaction that means real friendship. It's the small courtesies that count most with the average run of people.

New and Powerful Instrument for High-Voltage Research

ADDITIONAL information as to the tests at 1,000,000 volts recently conducted by the General Electric Company is now available. In an article in this issue F. W. Peek, Jr., presents a brief account of the observations on sparkover voltages between needle gaps, between sphere gaps and over insulators, and on corona formation on tubular conductors up to 3.5 in. in diameter. It appears that in all these cases, as already announced in the earlier accounts in the ELECTRICAL WORLD, the laws of sparking and corona voltages already determined for values up to 250 kv. also hold within the hitherto unexplored range up to 1,000 kv. Although an accuracy of measurement of only 5 per cent is claimed, and although the account leaves something to be desired in the way of description of the methods of determining the values of voltage, it may be safely assumed that the conclusions are warranted to within a satisfactory approximation.

Sparkover and corona begin in the air at the surfaces of conductors and are directly dependent on values of voltage gradient whether due to voltages of the order of 10 kv. or 1,000 kv. Consequently the extension of the laws at lower voltages would probably have been predicted by any high-voltage engineer. Nevertheless, it is a satisfaction to have this experimental confirmation, which will undoubtedly forestall much future dubious speculation as voltages advance.

Another interesting feature of Mr. Peek's paper is his description of the necessary dimensions of a 1,000-kv. line. We are asked to think of tubular conductors 5 in. or 6 in. in diameter hung on insulator strings of twenty units and at a spacing of 20 ft. If the voltage is allowed to rise 10 per cent above the critical corona-forming value, the loss per mile of line is more than 300 kw. The capacity current is 4.4 amp., or 7,600 kva. per mile. These figures, when reduced to reasonable percentage values on the basis of operative economy, indicate enormous values of generated and transmitted power, quite beyond any possible project or need now in sight. The examination nevertheless stimulates the imagination and fixes our ideas in a very useful way.

As pointed out by the author, the greatest value of this extension of voltage lies rather in the opportunities it offers for studying through artificial means the behavior of lines and equipment under the abnormal voltages due to lightning and kindred causes. It constitutes a new and powerful instrument for the research laboratory.

Development on the Colorado River

IT APPEARS that the Secretary of the Interior will recommend to Congress that the federal government be the agency to undertake the construction, operation and ownership of the reclamation, flood-control and power-develpment works on the Colorado River. This attitude is based on the grounds that the Colorado is an international and a navigable stream, that the federal government is the only agency competent to protect the rights of all seven states of the Colorado River basin in order that each may obtain its "equitable distribution" of the water and power, and finally that the success of the disarmament conference will release large funds which may be turned by the government from destructive to constructive applications. This policy, as announced by the Secretary at the hearing held in San Diego, Cal., on Dec. 12 to consider the problems of the lower Colorado, met with almost unanimous approval from the hundreds present. Whether it is to apply only to the first dam, the one proposed for construction at Boulder Canyon, is undetermined. If such be the case, there will probably be small protest; but if all succeeding steps in the development of this stream, involving the ultimate generation of four or five million kilowatts of hydro-electric energy, are to be under government ownership, a determined protest will and should be entered. There appears to be no sound reason why the government should enter the province of private business in the generation, transmission and distribution of power. Existing agencies have proved competent to do this, and it is a fact that the present high state of development of this region has been due to the initiative and courage of private capital. To turn from what has proved a success to do what has proved at least a partial failure would be folly.

A Point to Consider in Pole Specifications

WHEN existing specifications for line construction were drawn, years ago, poles of all kinds were apparently present in the woods in inexhaustible supply, and it was possible to pick and choose without danger of forcing prices up to an embarrassing degree. While good poles are still available in Western cedar, chestnut poles are scarce and of poorer quality than they were because of their extensive use and the chestnut blight that has made such an inroad on the growing trees. The pressure of the producer on purchasers to take "woods run" of poles is rapidly increasing. It is becoming increasingly apparent that the time is not far distant, if it be not already here, when for economic reasons the present pole specifications must be revised if they are to continue as a reliable purchasing guide.

One significant complaint is that the familiar top-diameter specification no longer produces a pole with a proper butt diameter and in some cases produces a pole that is entirely too slender for use where heavy strains are to be carried. Several associations are at work. and it begins to appear that the problem is developing into a survey of the sizes of trees nature is growing in large enough quantities to be useful rather than what is desirable from an engineering point of view. The old question of theoretical as contrasted with practical considerations is making itself felt. As a result it is well to go slow in the writing of construction specifications for poles, at least until the present situation is cleared up.

Self-Examination an Executive Need

TOO FREQUENTLY the executive, who is confined to a narrow field bounded by pressing management problems, largely economic in character, loses the broad outlook that avoids pitfalls. In fact, every executive needs a brutally candid friend, far enough removed from the worry of routine work to see clearly the drift of present-day policies, who can, in the most pointed way but without offense, not only indicate faults but suggest the needed corrective measures. It is unfortunate that so few individuals welcome frank criticism. Because of his close contact with the whims and caprices of an exacting public, the utility executive needs the tonic of such criticism more than almost any other individual in the business world, and his attitude of mind in this regard does more than anything else to bring success.

Some Idiosyncrasies of the Coal Clause

A COAL clause in contracts for power and general service of public utilities became during the war a very common and very proper addition to the usual rates. It was arranged as a sliding scale so that for each unitary increase in cost of coal above the base price there should be a certain increase in the price charged for energy and for each unitary decrease a similar decrease in the price of energy. This protection to public utilities was necessary and fair, but difficulties were introduced into the rate situation by such clauses. Some of these are analyzed in this issue by Franklin P. Wood and Eugene Weber, who point out their effect on the consumer as well as on the station.

The well-taken point of their argument is that if the consumption of coal per kilowatt-hour is estimated too high, undue weight attaches itself to the coal clause: for if this assumed rate is higher than the actual plant economy, the supply company may be a large gainer, and there are apparently existing cases where this is the actual fact. To be absolutely fair, another factor enters the situation in the active efforts made on general principles by all supply companies to increase their economy of operation as far as possible. Great efforts were made in this direction during the war and great successes gained in many cases, but Messrs. Wood and Weber very plainly point out that with a coal clause based on too high an estimate of coal consumption cases would frequently arise where the utility could gain more by buying high-priced coal than it could by improving its operating conditions. This state of things could not, of course, have existed if at the beginning before the coal clause was fixed careful study had been made of the actual operating conditions and their possibilities for improvement. We do not believe that utilities in general have been taking advantage of their consumers by encouraging high prices for fuel. There is, however, a moral risk here which is not altogether negligible, particularly in cases where insiders are indirectly interested in the coal purchases of the public utility company.

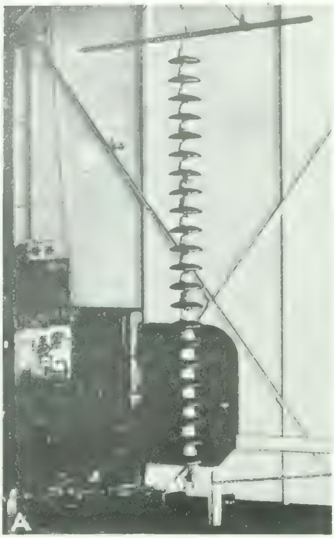
As we have often reiterated, there is no perfect system of rate making. All rates depend on picking out certain obviously important factors in the cost of meeting the consumer's demand and averaging all the other factors. It is sometimes the case, as seems to be here shown, that the factors averaged are of more importance than those rigorously taken into account. We believe, however, that on the whole the coal clause was fair and has been fairly carried out. In cases where it has not been righteously administered the public utility commissions having jurisdiction will not be slow to take the matter in hand.

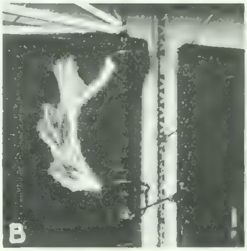
Selecting Lighting Units by Competition

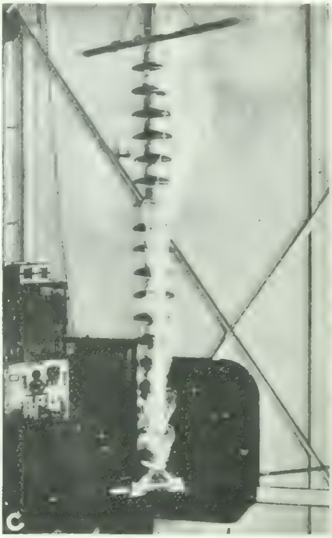
COMPETITION plays an active part in the sale of most electrical equipment, but to give several types of illuminating apparatus a simultaneous field service trial in a modern industrial plant and then to select the winner on the basis of an evening's impartial inspection supplemented by foot-candle tests is clearly to invite a real "showdown." An interesting test of this sort is described elsewhere in this issue of the ELECTRICAL WORLD by R. A. Packard, superintendent of power and shops at the Ludlow (Mass.) Manufacturing Associates' factories. The author was confronted with the problem of standardization in the illumination of these mills. and on account of their great size and their well-unified productive equipment it was possible to put in trial installations in competition without mutual interference. This enabled the attention of those charged with selecting the equipment to be concentrated upon each section with maximum convenience, both in securing foot-candle readings and in studying the appearance and other qualities of the competitive units.

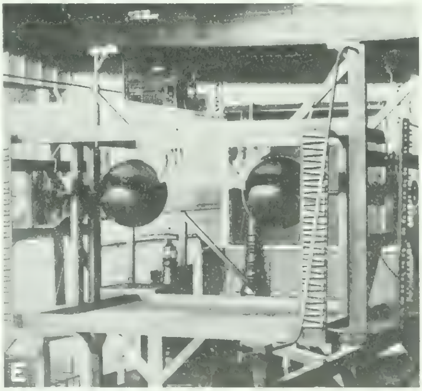
The relative merits of the competing units were determined on the basis of a table of percentages, values in each installation being assigned by a board of judges qualified to appreciate and compute the allowances. The foot-candle requirements were specified in a carefully prepared statement and the procedure for manufacturers' representatives was laid down. Every step in the determination was carefully planned, and the results of the finding of the judges, which was accompanied by a view of the installations by plant executives, was embodied in the tabular summary printed. The further details of the plan may be left to the reader, but in passing it is noteworthy to find methods of this sort utilized in the present stage of industrial lighting applications. They indicate how far engineering purchasing has progressed in comparison with the old haphazard methods of selecting lighting appliances. and although subject to the limitations of human judgment, they certainly go a long distance toward restricting those limits within intensely practical fields. Systematized thinking yields great rewards in industrial engineering practice, and we expect to see more rather than less analyses of the Ludlow kind in important illumination work bearing upon production efficiency.

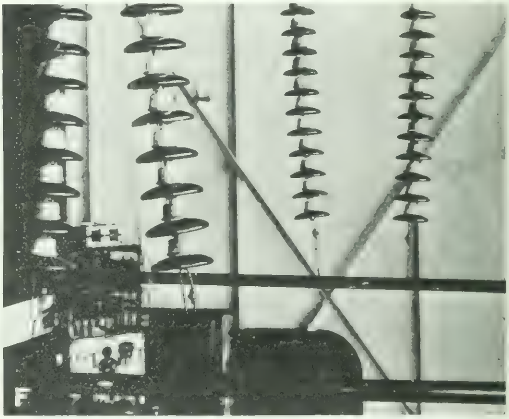
New Fields of Investigation Opened by Million-Volt Test Apparatus







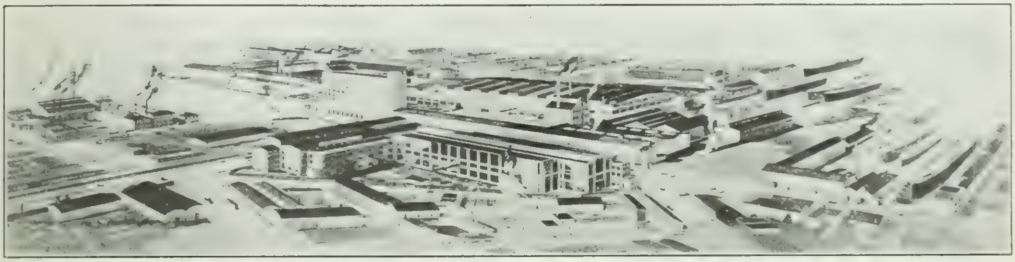




ELECTRICAL engineers are apt to forget that there are other uses for a million volts than the transmission of energy, says F. W. Peek, Jr., consulting engineer of the General Electric Company. With the impulse generator now available it is possible to make tests at potentials approximating voltages caused by direct lightning strokes and far in excess of voltages induced on transmission lines. Many less tangible uses for a million volts exist, the outcome of which would be difficult to predict. With the tremendous electric gradients or forces the electrons may be brought up to maximum speeds. It is even possible that matter may be disintegrated. The range of X-ray wave length will be greatly increased. Furthermore, it should now be possible to extend knowledge of the constitution of matter. For comments regarding above illustrations see page 1319.

The Industrial Load in Pennsylvania

Electrical Energy Consumed by All Industrial Plants of Pennsylvania During 1920 Is Estimated at 4,666,928,000 Kw.-Hr., 50.3 per Cent of Which Is Purchased from Central Generating and Distributing Systems



THE PLANT OF THE WILLIAM CRAMP & SONS SHIP & ENGINE BUILDING COMPANY, AT PHILADELPHIA, WHERE ELECTRIC SERVICE FINDS A WIDE APPLICATION

DURING the past year and a half the ELECTRICAL WORLD has initiated a country-wide survey to ascertain the extent to which electrical energy is being used by the various industries. A detailed analysis of the industrial load of California appeared in the ELECTRICAL WORLD for Aug. 28, 1920; a similar analysis of the industrial load of the Southern States appeared in the issue of June 25, 1921, and the industries of New York State were covered in the issue of July 30, 1921.

The survey to ascertain the use of electrical energy by the various industries of Pennsylvania involved the sending out of about 6,000 questionnaires to the larger manufacturing plants and mining companies. A summary of the replies received and estimates of total operations are presented in the accompanying tables.

The Census of Manufactures for 1919 indicates that while Pennsylvania follows New York State in number of establishments, number of wage earners and value of manufactured products, it leads every state in the Union in the capital invested in industries. The total is $6,227,268,000, or $193,416,000 above that reported for New York State. Its importance as a manufacturing state is due in large part to its extensive railroad systems and to the water-transportation facilities afforded by Lake Erie on the northwest and by a number of canals and navigable rivers. In mineral production Pennsylvania leads all other states, its coal beds being the most extensive in the United States, and its anthracite deposits are the largest mines anywhere in the world. Except for a small quantity from Colorado, the entire production of anthracite coal comes from Pennsylvania.

The use of electrical energy by industrial plants in Pennsylvania has shown a remarkable growth since 1914. In 1914 the connected industrial load of the cen-

TABLE I—SEGREGATION OF THE INDUSTRIAL LOAD IN THE STATE OF PENNSYLVANIA

These data are compiled from an industrial survey being conducted by the McGraw-Hill Company, Inc., under the supervision of the editorial departments of the ELECTRICAL WORLD and *Power*, and cover plants in all industries employing more than fifty operatives

Industry	Companies Reporting		Electric Generators Direct-Current		Electric Generators Alternating-Current		Electrical Energy Consumed		Motors Installed			Distribution of Drives		
	Total No.	Number Using Electrical Energy	No.	Total Rating, Kw	No.	Total Rating, Kw	Privately Generated, Kw.-Hr.	Purchased, Kw.-Hr.	No.	Total Rating, Hp.	No. Under 5 Hp.	Belt	Chain	Direct or Geared
Chemicals and allied products	71	39	45	2,351	20	12,174	24,222,850	37,362,241	2,173	43,733	590	873	110	1,190
Electrical equipment and machinery	33	18	14	1,200	8	21,700	35,902,645	10,609,074	7,010	35,479	4,043	1,880	33	5,097
Food and kindred products	44	24	37	4,239	18	4,515	28,381,704	4,359,915	1,506	18,039	736	925	278	303
Iron and steel and their products	531	292	375	84,655	66	67,777	423,051,605	376,859,390	38,679	431,693	11,305	15,026	1,146	22,507
Leather and its products	56	31	32	2,665	13	3,485	10,564,341	1,956,775	841	9,206	310	668	99	74
Lumber and its products	71	39	14	963	17	4,410	5,913,686	3,372,082	1,770	15,320	625	1,250	94	426
Metals and metal products other than iron and steel	86	47	36	6,239	21	14,005	52,551,211	16,246,175	2,082	46,824	794	1,235	210	637
Bituminous and anthracite coal mining	204	112	205	34,383	37	31,333	159,682,535	114,167,145	12,170	179,116	4,398	3,163	455	8,552
Paper and printing	78	43	39	4,472	13	10,515	32,051,881	22,807,872	2,312	29,212	1,383	1,852	127	333
Railroad repair shops	13	7	14	922	5	2,650	6,138,278	3,707,302	514	12,078	57	92	18	404
Shipbuilding	5	3	3	600	3	4,000	5,475,000	26,814,700	1,236	31,509	534	176	9	1,051
Stone, clay and glass	107	59	29	2,235	16	5,775	19,677,672	128,943,053	2,172	56,298	544	1,309	361	502
Textiles	484	266	94	10,119	44	7,577	32,263,466	39,394,966	12,569	55,313	8,462	4,737	953	6,879
Tobacco	15	8	1	150	1	150	73,480	226,709	56	181	36	52	2	2
Vehicles for land transportation	16	9	9	1,789	6	3,750	14,276,000	11,006,284	1,696	22,250	386	814	76	806
Miscellaneous	65	36	27	2,727	11	1,462	8,220,105	8,192,423	1,323	13,248	724	723	99	501
Totals for all industries of Pennsylvania	1,879	1,033	974	159,709	299	195,278	858,446,459	806,026,106	88,103	999,499	34,927	34,775	4,070	49,264

tral generating stations of the state, exclusive of the lighting load, was only 608,000 hp. In the five succeeding years this load increased 214 per cent, or to 1,908,000 hp. The increase in electrical energy sold to power customers, exclusive of railroads, by the central generating stations of Pennsylvania during this period was also marked, increasing from 880,000,000 kw.-hr. in 1914 to 2,560,000,000 kw.-hr. in 1919, or at the rate of 191 per cent. No statistics are available as to the increase in the operations of private generating plants in Pennsylvania during that period.

The returns received from the survey have been grouped under sixteen general industries as indicated in Table I. Complete returns were received from 1,879 mines and factories scattered throughout the state, employing fifty or more operatives each. Of these plants 1,033 reported the use of electrical energy as the main source of power. The plants using electrical energy reported private generators totaling 354,987 kw., of which direct-current generators totaled 159,709 kw. and alternating-current generators totaled 195,278 kw. The output in 1920 of these private generating plants was 858,446,459 kw.-hr. The electrical energy purchased by the plants and mines reporting was 806,026,106 kw.-hr. A close study of the census data indicates that, taking the industrial plants of the state as a whole, about 37 per cent of the plants and mines generating all or a portion of their electrical energy reported to the ELECTRICAL

TABLE II—"ELECTRICAL WORLD" ESTIMATE OF THE USE OF ELECTRICAL ENERGY IN PENNSYLVANIA
(Based on industrial survey, federal and state census data)

	Electric Generators: Direct-Current		Electric Generators: Alternating-Current		Electrical Energy Consumed			Total Motors Installed			Distribution of Drives		
Industry	No.	Total Rating Kw.	No.	Total Rating Kw.	Generated in Private Plants, Kw.-Hr.	Purchased from Public Utilities Kw.-Hr.	Total Energy Consumed	No.	Total Rating Hp.	No. Under 5-Hp.	Belt	Chain	Direct or Connected
Chemicals and allied products	116	6,100	52	31,400	62,700,000	44,550,000	107,250,000	3,780	76,100	1,026	1,518	192	2,070
Electrical equipment and machinery	42	3,600	24	66,500	110,000,000	12,550,000	122,550,000	18,500	93,570	10,660	4,960	90	13,450
Food and kindred products	108	12,320	52	13,100	82,300,000	114,800,000	197,100,000	9,060	108,600	4,430	5,570	1,670	1,820
Iron and steel and their products	1,142	258,000	201	206,500	1,290,000,000	1,225,000,000	2,515,000,000	91,700	1,061,000	26,800	35,600	2,720	53,380
Leather and its products	52	4,280	21	5,630	17,000,000	8,020,000	25,020,000	1,730	18,900	637	1,375	204	151
Lumber and its products	24	1,580	28	7,380	9,860,000	18,050,000	27,910,000	5,320	46,100	1,880	3,760	280	1,280
Metals and metal products other than iron and steel	64	11,000	37	24,700	92,600,000	64,300,000	156,900,000	4,750	106,600	1,810	2,815	478	1,457
Bituminous and anthracite coal mining	248	41,500	44	37,750	193,000,000	253,500,000	446,500,000	28,750	427,746	10,480	7,480	1,070	20,200
Paper and printing	65	7,400	21	17,400	53,000,000	46,200,000	99,200,000	4,180	52,800	2,500	3,350	230	600
Railroad repair shops	177	11,700	63	33,400	77,000,000	36,350,000	113,350,000	6,160	144,600	683	1,103	216	4,841
Shipbuilding	3	600	3	4,000	5,475,000	34,805,000	40,280,000	1,690	43,100	728	241	12	1,437
Stone, clay and glass	250	19,550	142	50,450	171,500,000	242,000,000	413,500,000	6,040	156,600	1,510	3,640	1,004	1,396
Textiles	138	14,870	64	11,130	47,300,000	90,000,000	137,300,000	24,100	106,100	16,210	9,090	1,810	13,200
Tobacco	6	986	6	986	483,000	3,685,000	4,168,000	670	2,152	431	622	24	24
Vehicles for land transportation	34	3,450	14	1,850	18,100,000	28,200,000	46,300,000	3,090	40,600	703	1,482	138	1,470
Miscellaneous	290	2,930	110	1,570	88,300,000	126,300,000	214,600,000	16,860	168,600	9,220	9,200	1,260	6,400
Totals for all industries of Pennsylvania	2,759	399,866	882	513,746	2,318,618,000	2,348,310,000	4,666,928,000	226,380	2,653,168	89,708	91,806	11,398	123,176

TABLE III—DIRECT-CURRENT MOTOR-OPERATING VOLTAGES OF INDUSTRIAL PLANTS IN PENNSYLVANIA

Industry	Number of Companies Reporting Various Motor Operating Voltages — Voltages: 80	110	115	120	125	200	220	225	230	240	250	275	440	500	550	600	2,200
Chemicals and allied products		7	1				2		1	1	1						
Electrical equipment and machinery		3	2	1			7			1	1						
Food and kindred products		3	2		1		4								1		
Iron and steel and their products		18	4	2	1		64		47	4	14	1		2	1		
Leather and its products		4			1		2		1								
Lumber and its products		2		2			3										
Metals and metal products other than iron and steel		6		2			7		2		3			1			
Bituminous and anthracite coal mining	1				2		8		5	1	43	4	1	7	6		4
Paper and printing		2	1		1		8		6								
Railroad repair shops					1		2		1		1					1	
Shipbuilding											2						
Stone, clay and glass		4			2		4	1	2		3						
Textiles		21	6	1	2	1	24		3	2	1		1	1			
Tobacco																	
Vehicles for land transportation							3										
Miscellaneous		10	1				8		3								
Totals for all industries of Pennsylvania	1	69	13	7	10	1	113	1	61	9	64	5	2	11	8	1	4

TABLE IV—ALTERNATING-CURRENT MOTOR-OPERATING VOLTAGES OF INDUSTRIAL PLANTS IN PENNSYLVANIA

Industry	Number of Companies Reporting Various Motor Operating Voltages — Voltages: 110	120	130	200	210	220	225	230	240	250	440	460	480	500	550	600	2,100	2,200	2,300	2,400	6,600
Chemicals and allied products	1		1			18					7										
Electrical equipment and machinery	3					2								1							
Food and kindred products	1				1	9					1										
Iron and steel and their products	7			2		16		5	2	1	42					1		6	2	1	
Leather and its products	1					14					1				1						
Lumber and its products				1		17	1			1	4		1								
Metals and metal products other than iron and steel	1					28					2	1							1		
Bituminous and anthracite coal mining	1					17		1			33						1	14	4	1	1
Paper and printing	1	1				2					6				4			1	1		
Railroad repair shops						3		2													
Shipbuilding											1							1			
Stone, clay and glass						21			1		10				4			2			
Textiles	10	1			1	127			1		21				1						
Tobacco	1					2															
Vehicles for land transportation	1					4					2										
Miscellaneous	1	2				14					1										
Totals for all industries of Pennsylvania	29	4	1	3	2	384	1	8	4	2	131	1	1	1	10	1	1	24	8	2	1

TABLE V—TYPES OF MOTOR CONTROL USED IN INDUSTRIAL PLANTS OF PENNSYLVANIA

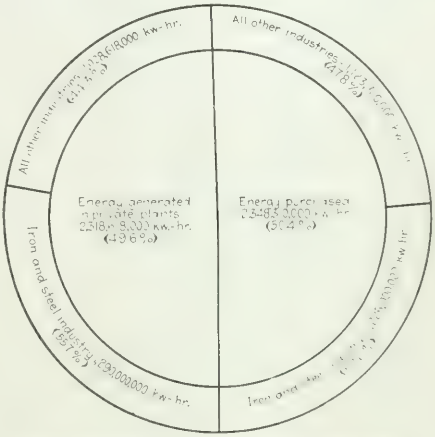
Industry	Number of Companies Reporting on Motor Control	Number of Companies Reporting Various Types of Motor Control: Snap Switches	Knife or Safety Switches	Auto Starters	Magnetic Switches	Remote Control	Circuit Breakers
Chemicals and allied products	33	7	23	19	9	11	22
Electrical equipment and machinery	17	8	15	11	6	5	9
Food and kindred products	20	4	18	11	6	4	13
Iron and steel and their products	251	71	218	163	94	76	155
Leather and its products	26	6	25	12	6	4	11
Lumber and its products	34	9	32	11	7	3	17
Metals and metal products other than iron or steel	42	10	39	25	7	5	24
Bituminous and anthracite coal mining	92	16	74	60	37	16	81
Paper and printing	39	8	34	19	12	7	20
Railroad repair shops	7	2	6	4	5	3	5
Shipbuilding	2	1	2	2	2	2	2
Stone, clay and glass	46	10	33	31	13	14	28
Textiles	191	39	150	83	24	20	74
Tobacco	4	1	4	1	0	0	0
Vehicles for land transportation	8	2	6	5	3	4	6
Miscellaneous	29	12	24	14	9	8	14
Totals for all industries in Pennsylvania	841	206	703	471	240	182	481

WORLD and that only about 34 per cent of the plants and mines purchasing all or a portion of their electrical energy made such reports. On this basis the indications are that about 50.3 per cent of the electrical energy used by the industrial plants and mines of Pennsylvania is purchased from central generating and distributing systems.

Table II gives the ELECTRICAL WORLD'S estimate of the total use of electrical energy in the industrial plants of Pennsylvania based upon the returns received from the survey, supplemented by federal and state census data. It is estimated that there are 226,380 electric motors installed in the factories and mines of Pennsylvania, with a total rating of 2,653,168 hp. Of these motors, 89,708, or 39.6 per cent, are under 5 hp. About 41 per cent of the machines are belt-driven, 54 per cent are directly-connected, and only 5 per cent are chain-driven.

The returns indicate that seventeen voltages are in use in Pennsylvania mines and factories for the operation of direct-current motors, and that twenty-one voltages are used in the operation of alternating-current motors. It appears that about 30 per cent of the direct-current motors are operated at 220 volts, but a large percentage are also operated at 110, 230 or 250 volts. Textile mills particularly reported a high percentage of direct-current motors operated at 110 volts. Almost three-quarters of the alternating-current motors are operated at 220 volts, and nearly one-quarter are operated at 440 volts. The details of motor-operating voltages will be found in Tables III and IV.

More than 83 per cent of the companies reporting on types of motor control use knife or safety switches exclusively or in conjunction with other types of motor control. Only a little over half of the companies reported the installation of automatic starters, and about the same number reported circuit breakers installed in their plants or mines. The detailed figures on types of motor control will be found in Table V, tabulated according to industry. Refillable fuses were reported in use by 477 out of 612 companies reporting on fuses, as against 196 companies using standard fuses. A large number of companies reported the use of both standard and refillable fuses. The iron and steel industry reported the use of 13,678 fuses per month, of which 87 per cent were of the refillable type. The returns indicate that 0.412 standard fuse is used per month for each



Estimated electrical consumption of all industries during 1920 4,666,328,000 kw.-hr.

FIG. 1—HALF OF THE ENERGY USED IN INDUSTRIAL PLANTS AND MINES OF PENNSYLVANIA IS GENERATED IN PRIVATE GENERATING STATIONS

TABLE VI—TYPES OF FUSES USED IN INDUSTRIAL PLANTS OF PENNSYLVANIA

Industry	Total Number of Companies Reporting on Fuses	Standard Fuses: Number of Companies Using This Type	Standard Fuses: Fuses Used per Month: Number	Standard Fuses: Fuses Used per Month: Number per Motor	Refillable Fuses: Number of Companies Using This Type	Refillable Fuses: Fuses Used per Month: Number	Refillable Fuses: Fuses Used per Month: Number per Motor	ELECTRICAL WORLD Estimate of Fuses Used per Month by All Industrial Plants in Pennsylvania: Standard	Refillable
Chemicals and allied products	25	12	202	0.266	20	1,139	1.300	470	2,630
Electrical equipment and machinery	10	6	616	0.170	7	454	0.712	2,680	1,980
Food and kindred products	17	9	550	0.690	13	230	0.717	4,620	1,680
Iron and steel and their products	183	58	1,786	0.579	166	11,892	0.678	7,940	53,000
Leather and its products	19	9	137	1.161	18	623	2.220	600	2,700
Lumber and its products	25	8	80	0.615	23	212	0.322	540	1,430
Metals and metal products other than iron or steel	34	6	131	2.300	28	1,485	1.118	450	5,100
Bituminous and anthracite coal mining	61	16	251	1.470	55	1,264	0.815	4,200	21,120
Paper and printing	39	11	80	0.147	19	268	0.449	290	970
Railroad repair shops	3	0	0	0	3	380	1.680	530	3,560
Shipbuilding	2	0	0	0	2	1,430	1.530	147	975
Stone, clay and glass	43	13	201	0.841	38	512	0.476	986	2,490
Textiles	121	37	597	0.299	63	1,250	0.295	2,310	4,330
Tobacco	2	1	10	0.909	1	2	0.192	64	134
Vehicles for land transportation	5	2	185	0.953	4	205	0.234	534	590
Miscellaneous	23	8	44	0.412	17	893	1.060	782	15,680
Totals for all industries of Pennsylvania	612	196	4,870	0.412	477	22,239	0.658	27,143	118,369

installed motor, and that 0.698 refillable fuse per motor is used each month. Based on these ratios, it is estimated that 27,143 standard and 118,369 refillable fuses are used each month by the industries of Pennsylvania. Table VI distributes these figures among the various industrial groups.

About 69 per cent of the plants and mines use three-phase, 60-cycle service in the operation of their motors, and 28 per cent reported the use of two-phase, 60-cycle service. Of the various odd frequencies used, three-phase, 25-cycle service was used by twenty-two companies. The use of odd frequencies to such a large extent is probably due to continued operation of private electric generating plants which were installed several years ago. Table VII shows the use of the various frequencies by the plants and mines of Pennsylvania.

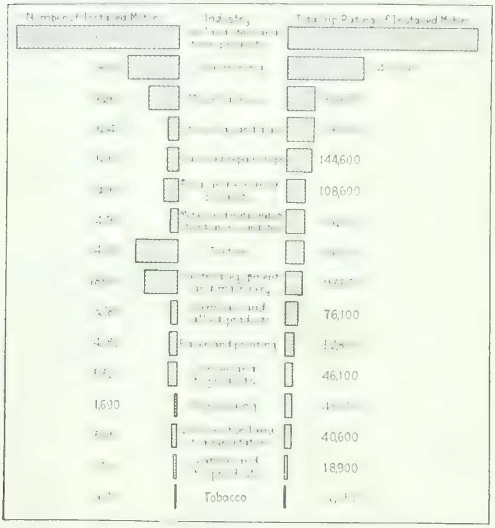


FIG. 2—DISTRIBUTION OF INSTALLED MOTORS AMONG THE VARIOUS INDUSTRIAL GROUPS OF PENNSYLVANIA

The rapid growth in the use of the steam turbine is indicated by the figures in Table VIII. It must be understood that these data include only the prime movers and boilers installed in private electric generating plants. It is probable, however, that a large portion of these prime movers operate other machinery than electric generators and that the boilers are used to a large extent in furnishing steam heat for the factories.

TABLE VII—FREQUENCIES USED IN INDUSTRIAL PLANTS OF PENNSYLVANIA

Industry	Total Number of Companies Reporting on Frequency	2 / 25	3 / 25	3 / [illegible]	1 / [illegible]	2 / 30	1 / [illegible]	[illegible]	[illegible]	[illegible]
Chemicals and allied products	[illegible]		[illegible]				[illegible]	7	[illegible]	
Electrical equipment and machinery	11	1					1		[illegible]	
Food and kindred products	13						2	[illegible]	7	
Iron and steel and their products	[illegible]		6	1			7	[illegible]	[illegible]	1
Leather and its products	[illegible]							[illegible]	[illegible]	
Lumber and its products	31						[illegible]	[illegible]	22	
Metals and metal products other than iron or steel	35		2				[illegible]	[illegible]	[illegible]	
Bituminous and anthracite coal mining	71		4				2	[illegible]	[illegible]	
Paper and printing	23							[illegible]	[illegible]	
Railroad repair shops	5		1						[illegible]	
Shipbuilding							2	[illegible]	[illegible]	
Stone, clay and glass	38		4				1	11	24	
Textiles	[illegible]	1	2		1	1	8	[illegible]	[illegible]	1
Tobacco	3						2		1	
Vehicles for land transportation	[illegible]							[illegible]	[illegible]	
Miscellaneous	[illegible]			1			1	7	[illegible]	
Totals for all industries in Pennsylvania	[illegible]	2	22	2	1	1	31	[illegible]	[illegible]	2

The twelve primary industries of Pennsylvania in order of value of products, are as follows: Iron and steel and their products, coal mining, railroad repair shops, silk goods, leather and its products, printing and publishing, slaughtering and meat packing, woolen goods, hosiery and knit goods, tobacco manufacture, petroleum refining, and lumber.

IRON AND STEEL MILLS

The iron and steel industry, which includes steel works and rolling mills and blast furnaces, ranks first among the industries of Pennsylvania. It is by far the largest user of electrical energy, and, as indicated in Table II, more than half of the energy consumed is

TABLE VIII—PRIME MOVERS IN PRIVATE GENERATING STATIONS OF INDUSTRIAL PLANTS OF PENNSYLVANIA

Industry	Number of Companies Reporting on Prime Movers in Private Generating Stations	Power Equipment in Private Electric Generating Stations of Companies Reporting in ELECTRICAL WORLD Survey: Waterwheels, No.	Waterwheels, Rating, Hp.	Internal Combustion Engines, No.	Internal Combustion Engines, Rating, Hp.	Steam Engines, No.	Steam Engines, Rating, Hp.	Steam Turbines, No.	Steam Turbines, Rating, Hp.	Boilers, No.	Boilers, Rating, Hp.	ELECTRICAL WORLD Estimate of Total Power Equipment in Private Electric Generating Stations of Industrial Plants in Pennsylvania: Steam Engines, No.	Steam Engines, Rating, Hp.	Steam Turbines, No.	Steam Turbines, Hp.	Boilers, No.	Boilers, Hp.
Chemicals and allied products	28	8	505	24	4,747	86	9,408	6	9,040	100	30,771	222	24,300	15	23,100	259	79,500
Electrical equipment and machinery	8	0	0	2	112	14	1,905	9	29,015	49	14,783	43	5,840	28	82,000	150	45,300
Food and kindred products	17	0	0	12	2,190	45	11,552	2	600	65	15,175	131	33,500	6	1,740	189	44,100
Iron and steel and their products	228	4	348	144	48,766	477	102,471	61	72,299	701	166,406	1,450	312,050	186	220,500	2,140	507,000
Leather and its products	20	0	0	5	1,005	48	7,906	2	500	56	8,660	77	12,800	3	806	90	13,260
Lumber and its products	25	0	0	8	285	42	9,623	4	1,925	54	12,415	71	16,200	7	3,240	91	20,480
Metals and metal products other than iron and steel	27	0	0	6	940	42	10,763	12	19,065	71	18,076	74	18,950	21	30,360	125	31,800
Bituminous and anthracite coal mining	117	4	3,016	17	935	208	54,305	32	34,126	616	126,417	252	64,890	39	41,500	748	153,500
Paper and printing	27	15	3,354	0	0	113	22,837	15	8,565	112	36,475	187	37,800	25	14,200	186	60,500
Railroad repair shops	4	0	0	0	0	13	8,330	2	264	27	7,080	163	104,500	25	3,310	339	88,800
Shipbuilding	1	0	0	0	0	3	800	3	5,333	12	4,750	3	800	3	5,333	12	4,750
Stone, clay and glass	29	4	6,106	27	3,460	64	14,205	0	0	72	17,150	558	124,000	63	73,000	628	149,500
Textiles	116	7	1,078	8	725	173	32,289	10	2,375	294	53,605	254	47,300	15	3,480	432	78,600
Tobacco	3	0	0	0	0	3	220	0	0	5	700	19	1,450	0	0	33	4,600
Vehicles for land transportation	7	0	0	3	450	9	1,624	6	3,875	37	10,580	11	2,060	8	4,910	47	13,400
Miscellaneous	22	0	0	4	163	42	6,497	2	637	54	11,325	452	70,000	21	6,880	581	122,000
Totals for all industries in Pennsylvania	679	42	14,407	260	63,778	1,382	294,735	166	187,621	2,325	534,368	3,967	876,350	465	521,359	6,050	1,417,790

generated in private plants. The number of installed motors is hardly a criterion of the use of electrical energy in this industry, as a large portion of the electrical energy consumed is used for industrial heating purposes. Notwithstanding this fact, however, it is estimated that 91,700 motors are installed in the various iron and steel mills of the state, with a total rating of 1,061,000 hp. About 29 per cent of the installed motors are under 5 hp. The private electric generating stations in the iron and steel industry have a total generator rating of 464,500 kw., of which 258,000 kw. is in direct-current generators. The boiler installations in electric generating plants are estimated at 507,000 hp.

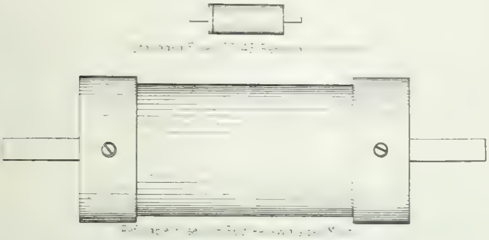


FIG. 3—INDUSTRIAL PLANTS AND MINES OF PENNSYLVANIA USE PER MONTH ALMOST FIVE TIMES AS MANY REFILLABLE FUSES AS STANDARD FUSES

In addition to industrial heating, electrical energy is used in the iron and steel industry to operate air compressors, cranes, machine tools, blowers, hammers, elevators, fans, presses, shears, rolling mills, crushers and grinders.

Coal mining is the second largest user of electrical energy in Pennsylvania, consuming almost half a billion kilowatt-hours in 1920, of which it is estimated 193,000,000 kw.-hr. was generated in private plants. It is estimated that 28,750 motors are installed in the coal mines of Pennsylvania, with a total rating of 427,746 hp., which is an average of 15 hp. per motor. About 26 per cent of the machines are directly connected, 70 per cent are belt-driven, and only 4 per cent are chain-driven.

New England Information Service Well Received

CORDIAL utilization of the material furnished the press by the recently established New England Bureau of Public Service Information has marked the early development of these facilities. All over New England the press has manifested an active interest in the bulletins issued and has carried very satisfactory quotations, both in the city and country districts. Considerable editorial comment has also appeared on the basis of the bulletin material, and editors have begun to write to headquarters for further information on public utility topics. Joseph B. Groce, secretary of the bureau, stated to a representative of the ELECTRICAL WORLD a few days ago that it is hoped to enlarge this inquiry service and that chambers of commerce and investment houses have asked to be placed on the mailing list for bulletins. One of the latter houses is now supplied with fifteen copies weekly for use by members of its staff, and eventually the bulletins will be sent to various interested libraries.

Analysis of Effect of Coal Clause in Contracts

Essential Considerations in Working Out Rate Schedules with Coal Clauses That Are Fair Both to Utility and Customers

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DURING a recent rate investigation conducted by the writers some rather startling results were brought to light bearing on the application of a coal clause providing for a graduated power rate based on the cost of coal. As provisions of this kind are quite commonly incorporated in present-day power contracts, the real effect of such a clause is of interest.

An analysis of the result of the clause in the contract under consideration demonstrated that if the utility obtained its coal for nothing, its gross revenue would be reduced approximately $285,000 per year, and if the customers furnished the coal free of cost to the utility, charging themselves with full market price for the coal delivered at the utility's plant, the customers would make a net saving of approximately $119,000 per year.

The coal clause in this contract is in essence as follows: The normal rate, which consists of a fixed charge and an energy charge, is stipulated as being based on coal costing $1.50 per ton delivered at the plants of the utility company. For each 10 cents increase above $1.50 per ton coal cost the energy rate is to be increased 0.03 cent per kilowatt-hour, and for each 10 cents decrease in the price of delivered coal below $1.50 per ton the energy rate is to be decreasd 0.03 cent per kilowatt-hour.

In order to show clearly how this works out, assume the following conditions: Energy delivered to customers, 25,000,000 kw.-hr. per year; coal consumption, 4 lb. per kilowatt-hour; energy charge, 1 cent per kilowatt-hour ± 0.03 cent per unit (1 unit ± 10 cents charge in base price of coal); base price of coal, $1.50 per ton; actual price of coal $4 per ton. The fixed-charge portion of the rate is neglected, as this remains the same in any case.

TABULATION SHOWING EFFECT OF COAL CLAUSE

Basis: 25,000,000 kw.-hr. per year at 1 cent ± to 0.03 cent for each ± 10 cents change from base price of $1.50 per ton of coal.

Cost of Coal per Ton	Difference Between Energy Charge and Cost of Coal — Pounds of Coal Burned per Kilowatt-Hour				
	6	5	4	3	2
0	$137,500	$137,500	$137,500	$137,500	$137,500
$0 50	137,500	143,750	150,000	156,250	162,500
1 00	137,500	150,000	162,500	175,000	187,500
1 50	137,500	156,250	175,000	193,750	212,500
2 00	137,500	162,500	187,500	212,500	237,500
2 50	137,500	168,750	200,000	231,250	262,500
3 00	137,500	175,000	212,500	250,000	287,500
3 50	137,500	181,250	225,000	268,750	312,500
4 00	137,500	187,500	237,500	287,500	337,500

According to the coal clause, the utility is entitled to charge an increased price for energy, obtained by multiplying the difference between $4 and $1.50, constituting 25 units of 10 cents each, by 0.03 cent per unit; in other words, an increase of 0.75 cent per kilowatt-hour. That is, the energy rate will be 1.75 cents per kilowatt-hour instead of 1 cent, and the total billing for energy will be represented by $437,500.

On the other hand, suppose the utility had coal delivered to it free of all cost; the energy charge would then be decreased from 1 cent per kilowatt-hour by an amount obtained by multiplying 15 (the difference in 10-cent units between 1.50 and 0) by 0.03 cent, or, in other words, a reduction of 0.45 cent per kilowatt-hour. The net charge would be 0.55 cents per kilowatt-hour, and the total billing on 25,000,000 kw.-hr. per year would be $137,500. This, it will be seen, is a difference of $300,000 to the customers.

Further, on the basis that 4 lb. of coal is consumed for each kilowatt-hour delivered to the customer, 50,000 tons will be consumed. Therefore, if the customers should deliver to the utility this amount of coal free of charge to the utility and charge themselves $4 per ton for it, it would cost them $200,000 for the coal; but since they have been saved $300,000 by the application of the rate, they would make a net saving of $100,000, which in the tabulation shows up in the 4-lb. column as the difference between free coal and coal at $4 per ton.

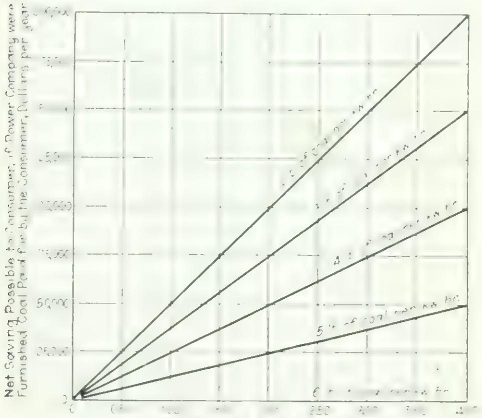

DIAGRAM SHOWING EFFECT OF A COAL CLAUSE
Basis: 25,000,000 kw.-hr. at 1 cent ± 0.03 cent for each ± 10 cents change from base price of $1.50 per ton of coal.

It may be asserted that this is an academic question, but it is not. Although no utility of standing would deliberately pay more than necessary for its coal, it is very evident that the higher the price paid for coal when operating under such a coal clause as above, the higher return will be obtained for the energy sold. There is no incentive whatever, except common decency, to induce the utility to buy low-priced coal. Indeed, many times it is possible to buy the very best grade of coal, which will reduce the consumption of coal at the plants, and since price is no object, the utility will profit both ways.

This particular situation is the result, of course, of assuming, in establishing the coal clause, an arbitrary rate of coal consumption without reference to the actual plant economy. In the case above this rate was evidently taken at 6 lb. of coal per kilowatt-hour. At the rate of 6 lb. per kilowatt-hour it makes no difference to the utility what the coal costs—the customers pay the difference. It is evident, therefore, that if the rate assumed for the coal clause is higher than actual plant economy, the utility is the party benefited; if the assumption is too low, the customer gains. As the utility is ordinarily better versed in power rates and their application, it is probable that the advantage is not often in favor of the customer.

It is not contended that the utility should not have credit for improving its operations, but the customers should not pay a bonus for this, as in the case above cited.

The chart herewith indicates clearly this situation. A study of this chart brings out a further point of much interest—that with a coal clause favorable to itself, the utility will in most cases gain more by buying high priced coal than by bettering the plant economy.

MANY ELEMENTS INVOLVED IN RATE MAKING

There are so many elements involved in making rates for the sale of electricity that it is doubtful if a perfect rate will ever be evolved. There must always be some element of approximation, and the rate that most equitably fits all conditions is the one that is the nearest right. Common sense and good engineering demand in the present day that such a rate must contain two elements: First, a demand or readiness-to-serve charge; second, an energy charge.

The second element is the one that is most likely to be difficult to adjust properly. In recent years it has become customary to introduce a third element which is contingent upon the price of coal burned to produce the power, as in the case in question. The introduction of this element became necessary with the rapidly fluctuating cost of coal, which in steam plants is one of the chief elements of expense. Especially since the beginning of the world war the tendency has been to charge an ever-increasing price for coal which the central-station company was forced to buy in order to remain in operation. It was very necessary in many cases for public utility commissions to take drastic action and grant to electric utilities the right to add what is in many cases called the coal clause. That the case cited above is not an unusual one is evidenced by the fact that we have before us a number of other rate schedules containing a very similar fuel clause.

There can be no question as to the advisability of such a clause, provided that the original rate is equitable and provided that the coal clause is so arranged as to give proper consideration to both the customers and the utility. Each case demands careful study by competent engineers, and it is quite possible in every case to evolve a standard of charging that is entirely fair to each of the participating parties.

Electrification of Japanese Railroads

MORE than 2,000 miles of Japanese railroads have been designated for electrification by the commission having this matter in hand. This mileage is classified by the *Japan Times and Mail* as shown in the following:

1. All sections in the suburbs of cities where there is a heavy railway traffic, 186 miles.
2. Sections of high gradient where there are many tunnels and also those where abundant water power can be utilized, 871 miles.
3. Sections where shortening of the line is required and where water power can be utilized, 395 miles.
4. Sections where increase of transportation capacity and shortening of the line are required, 295 miles.
5. Sections where available water power can be utilized, 265 miles.
6. Sections where increase of carrying capacity is required and where coal can be obtained at a low price, 146 miles.

Tests at 1,000,000 Volts Support Calculated Sparkover and Corona Data

Observations of Effect on Needle-Gap and Sphere-Gap Sparkover Values, Corona-Starting Voltage, Corona Loss, Insulator Sparkover Values and Conductor Sizes Required at Higher Voltages—New Fields of Study Opened

By F. W. PEEK, JR.
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THE laws which have been used in the past for calculation of corona loss and corona-starting voltage were established over ten years ago from tests made at voltages up to 250 kv. Since this voltage has now almost been reached by commercial apparatus, it becomes essential to know whether the laws apply at much higher voltages. With this in view, an investigation was conducted last summer in the Pittsfield works of the General Electric Company in which more than 1,000,000 volts was applied to electrodes typical of those encountered on transmission lines and high-voltage apparatus. The tests were made at 60 cycles with a standard type of transformer rated at 1,000 kva. The maximum error was not over 5 per cent. Some observations regarding needle-gap and sphere-gap sparkover values, corona-starting voltage, corona loss, insulator sparkover values, and conductor sizes required at the higher voltages will be discussed.

In passing it might be pointed out that the needle gap requires the minimum voltage for sparkover at a given sparking distance. This follows because of the non-uniform field caused by point electrodes. On the other hand, the sphere gap possesses as uniform a field as generally occurs in practice and the maximum sparkover voltage for a given spacing. Insulator sparkover represents a typical surface breakdown. Corona is present and causes loss if the electrodes and conductors are improperly proportioned.

The minimum sparkover voltage for a given conductor separation is between sharp points. Such points are likely to occur on transmission-line conductors. The minimum separation is therefore determined by the needle-gap curve. Wet sparkover voltage generally approximates the needle-gap curve. This curve follows a straight line, subject to considerable variation with humidity and pressure, with the sparking distance between 9 kv. and 10 kv. per inch.

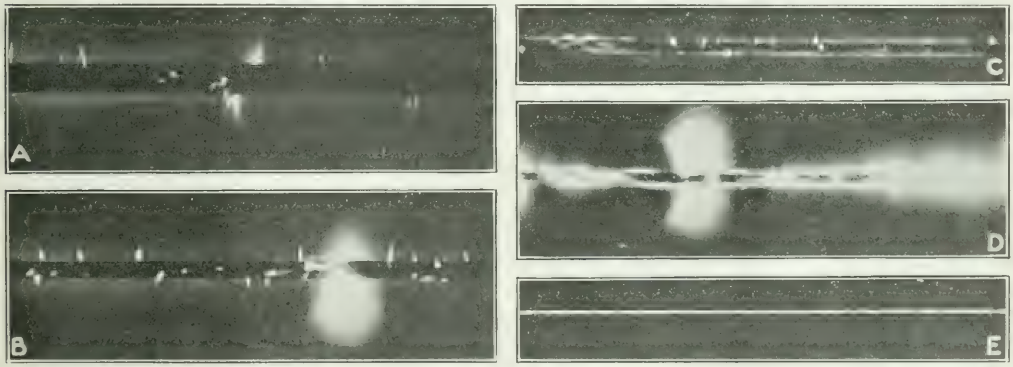

FIG. 1 — APPEARANCE OF CORONA ON CONDUCTORS AT SUPERVOLTAGES UNDER DIFFERENT CONDITIONS

A—900 kv.; 3.5-in. (8.9-cm.) tube; 144-in. (366-cm.) spacing. B—900 kv.; 1.75-in. (4.45 cm.) tube; 144-in. (366-cm.) spacing. C—500 kv.; 1-in. (2.54-cm.) tube; 72-in. (183-cm.) spacing. D—780 kv.; 1-in. (2.54-cm.) tube; 108-in. (274-cm.) spacing. E—800 kv.; 0.040-in. (0.102-cm.) wire; 144-in. (366-cm.) spacing. Fig. 2D shows relations between measured and calculated corona voltages.

Needle-Gap Sparkover.—The measured needle-gap sparkover curve shown in Fig. 2A has no discontinuity. It is simply an extension of the approximately straight-line needle-gap curve of the lower voltages. The curves with both ends isolated and one end grounded are practically coincident. The sparkover of needle gaps at 1,000,000 volts is shown in D, page 1312.

Sphere-Gap Sparkover.—The sparkover voltage curve for spheres 75 cm. (29.5 in.) in diameter is given in Fig. 2B. No discontinuity was observed in this curve either, the calculated values[1] being followed as closely as they could be checked. Fig. E, page 1312, shows a sphere-gap sparkover at 950 kv. Accurate measurements could not be made up to 1,000 kv., when one sphere was grounded, because the spheres were not large enough (75 cm.).

Corona.—Visual corona tests were made on parallel brass tubes 1 in., 1¾ in. and 3½ in. in diameter at various spacings. These tests showed that the corona-starting point for the very high voltages studied can be calculated from laws established at the lower voltages.

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[1] Peek, "Dielectric Phenomena in High Voltage Engineering."

The observed and calculated values, which are plotted in Fig. 2D (see table), agree very closely. The calculated values are based on the equation:[2]

$$e_v = 21.1\, m_v r \delta \left(1 + \frac{0.301}{\sqrt{\delta r}}\right) \log_e \frac{s}{r} \quad \text{(kv. to neutral)}$$

where $\delta = 3.92b/(273 + t)$,

b = barometer pressure (cm.),
t = temperature, deg. C.,
s = spacing (cm.),
r = radius (cm.),
m_v = 1.

The irregularity factor $m_v = 1$ corresponds to the value for smooth tubes at the lower voltages. However, where special cables or special conductors are used at the higher voltages, the m_o and m_v values should be determined on short lengths. Increase in stress due to special design may more than offset the gain by increase in diameter. (See Figs. 1A to E.)

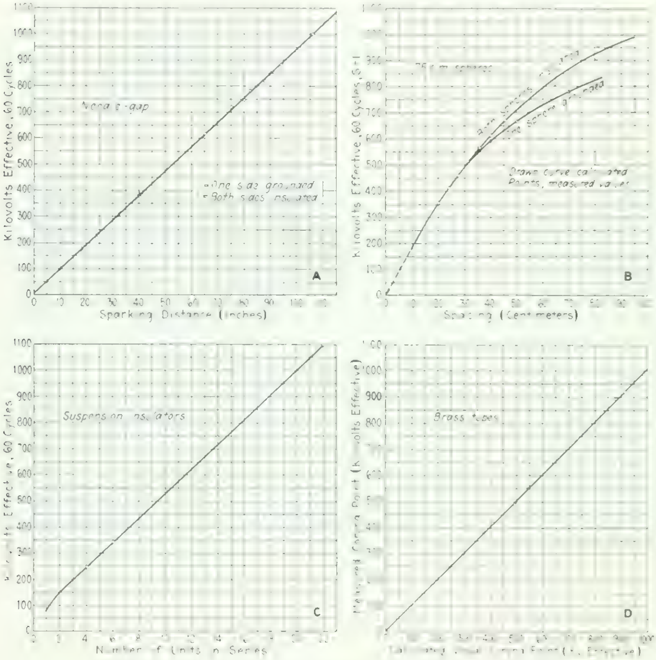

FIG. 2—OBSERVATIONS OF SPARKOVER AND CORONA VOLTAGES

A—Needle-gap sparkover values; B—Sphere-gap sparkover values; C—Suspension arc-over values; D—Relation between calculated and measured corona points using brass tubes.

Line-Insulator Sparkover.—The line-insulator sparkover curve, shown in Fig. 2C, is also continuous. It is interesting to observe that at low voltages the stress on the line unit of a string of twenty-two insulators would be about 20 per cent of the applied voltage.[3] If this relation obtained at 1,000 kv. on a string of twenty-two units, the stress on the line unit would be 0.20 × 1,000 = 200 kv. Since a single unit arcs over at about 75 kv., the whole string would be expected to arc over as soon as the voltage became 75 kv. on the last line unit, or at 75/200 × 1,000 = 375 kv. However, such a string does not arc over even at a million volts. The reason is that the string is automatically graded by corona.

It is not practicable to use the corona shield shown in Fig. G, on page 1312, so it should be replaced by a proper metal shield, like the one shown in Fig. B on the same page. Fig. F, Fig. C and Fig. A, on page 1312, show respectively a line transmitting a million volts, a string of eighteen units arcing over at 900 kv. and a string of twenty-two units withstanding 1,100 kv.

At present it is not important to speculate just when, if ever, a million volts will be used in practice. However, it is important to know how to predetermine the characteristics of high-voltage lines so as to be ready when economic conditions require higher voltages. Furthermore, it is pertinent to consider the characteristics of the parts of a transmission system affected by the higher voltages. The present discussion will be limited particularly to the possibilities of the system from the viewpoint of insulation, and not from the viewpoint of economics or of regulation. In this connection only the transformer, the transmission conductor and the line insulator need be considered. The low-voltage apparatus would be unchanged except for the ability to handle, regulate and control the large amount of energy necessary to make such a line economical.

The design of high-voltage transformers does not seem to offer any great difficulty, since it would follow very much along the lines of present practice, as did the transformers used in these tests, where the transformer capacity was approximately 1,000 kva. The bushing is probably the most difficult part of the transformer to design.

The size of the conductor necessary for such a line is interesting. Assume that it is possible to use a tubular conductor. At sea level and 20-ft. (6-m.) spacing, three-phase, it is found that a conductor 5 in. in diameter is required for a critical voltage of 1,000 kv. Thus:

$e_o = 21.1\, m_o r \delta \log_e (s/r)$, (kv. to neutral)
$m_o = 0.94$,
r = radius in cm.,
s = spacing in cm.,
$e_o = 578$ (kv. to neutral)
$E_o = 1{,}000$ (kv. between lines)

$$p = \frac{244}{\delta}(f + 25)\sqrt{\frac{r}{s}}\,(e - e_o)^2\, 10^{-5}$$

(kw./km. of single conductor)

$= 0.1\,(e - 578)^2$ (kw./mile, three-phase)

At 1,000 kv. between lines the loss is thus zero. However, if the voltage is increased 10 per cent, the loss becomes:

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[2] Peek, "Dielectric Phenomena in High-Voltage Engineering," page 203.

[3] Peek, "Electrical Characteristics of the Suspension Insulator—I," *Trans. A.I.E.E.*, 1912, Vol. XXXI, page 902; "Electrical Characteristics of the Suspension Insulator—II," *Trans. A.I.E.E.*, July, 1920; "Present and Future of Line Insulators," ELECTRICAL WORLD, Jan. 24, 1920; "Transmission-Line Insulation in America," ELECTRICAL WORLD, Nov. 27, Dec. 4 and 25, 1920. Ryan and Henline, "Unit Voltage Duties on Long Suspension Insulators," *Trans. A.I.E.E.* July, 1920; "Flashover of Insulators for 220-Kv. Lines," ELECTRICAL WORLD, Sept. 17, 1921.

$p = 0.1(635 - 578)^2 = 0.1(57)^2 = 325$ kw. per mile.

This is quite large. By noting the equation it will be seen that a peculiarity of the very high-voltage line is that the corona loss increases very rapidly with a slight percentage increase of the voltage above the critical point. This follows at the higher voltages because the loss increases as the square of the difference between two voltages. At a million volts a small percentage increase means a large actual voltage increase and a large loss. For example, compare the loss for a 220-kv. line and a 1,000-kv. line for a 10 per cent increase in voltage, each line operating just at the critical point.

For 1,000 kv.:

$p = 0.1(578 - 578) = 0.$

At 10 per cent increase:

$p = 0.1(635 - 578),$

$p = 0.1(57)^2 = 325$ kw. per mile.

For a 220-kv. line:

$p = 0.05(127 - 127) = 0.$

At 10 per cent increase:

$p = 0.05(139 - 127),$

$p = 0.05(12)^2 = 7.2$ kw. per mile.

Because of the large increase in loss when the voltage is increased or the critical voltage is lowered, it may be desirable to operate at larger margins between the critical and operating voltages for the higher-voltage lines. For instance, it may be assumed that rain will lower the critical voltage 20 per cent. The loss during a storm would then be

$$p = 0.1(e - 0.8 \times 0.580)$$
$$= 0.1\ (116^{-2}) = 1{,}080 \text{ kw. per mile}$$

or over 1,000,000 kw. loss in a 1,000-mile line. To insure only small loss during a storm it would be necessary to increase the diameter of the tube to 6.5 in. (16.5 cm.).

Other forms of conductors than tubes are of course possible. For special conductors or cables, however, it is well to be sure that the component parts are properly proportioned with respect to the complete conductor, otherwise the irregularity factor may be reduced.

COMPARISON OF OBSERVED AND CALCULATED VISUAL CORONA-FORMING VOLTAGES UP TO 990 KV., 60 CYCLES

Diameter In.	Diameter Cm.	Spacing In.	Spacing Cm.	Visual Corona Effective KV (S = 1) Calculated	Visual Corona Effective KV (S = 1) Observed
3.5	8.9	75.5	192	790	730
		111.5	283	876	895
		147.5	375	915	915
		183.5	466	990	990
1.75	4.45	73.7	188	490	490
		109.7	279	538	560
		145.7	370	568	600
		181.7	4 3	604	675
100	2.54	73	185	340	370
		109	277	364	390
		181	460	402	415

It may be of interest here to estimate the capacity current and kva. per mile of a three-phase line with 6.5 in. conductors separated 20 ft. and energized at 1,000 kv., 60 cycles. The current per mile of line is 4.43 amp.; the kva. per mile is 7,650. The line insulator as at present designed offers the most difficult problems. It may be assumed, however, that the insulator would be 15 ft. to 20 ft. (4.5 m. to 6 m.) long. A rough and approximate picture may now be drawn of a million-volt line with 6½-in. diameter conductors suspended by insulators 15 ft. to 20 ft. in length and spaced over 20 ft. apart—not so formidable as might be expected. The minimum spacing would probably be determined by mechanical considerations.

In order that such a line may be economical the amount of power transmitted, and therefore concentrated at a given place, must be enormous. When losses are reduced to percentages of power transmitted they do not appear so high. With the long lines in which one-quarter, one-half and full-wave length of the operating frequency are approached or approximated, the line characteristics and the effect of capacity current differ greatly from the conditions on shorter lines. It is not proposed to discuss this matter here.

Although a discussion of the characteristics of a million-volt line is interesting, the immediate importance of the investigation is that the field has been explored far in advance of present-day practice. Other uses of million-volt test apparatus are discussed on page 1312.

Uniform Accounting Systems for All Utilities

Municipal and Private Plants Alike Must Use Standard Methods to Permit Proper Comparison of Results and Rates

BY EDWIN O. EDGERTON
Former President California Railroad Commission

SOUND and accurate accounting is an essential in the successful conduct of any business, whether it be public or private. It is manifestly impossible to make proper judgments unless those in responsible charge have accurate information as to the precise condition of the business. Imagine the folly of determining whether or not to expand or contract an existing business activity with no accurate knowledge of the financial condition of the enterprise.

When a municipality enters into business such as the ownership and operation of a public utility service precisely the same reasons exist for exact knowledge of conditions as in the conduct of any private business. Not only is it essential that those in responsible charge of the conduct of a municipal enterprise be fully and accurately informed, but it is also essential that the people of the community before acting upon proposals have an opportunity to know the facts. The only method of ascertaining and presenting the facts is through an accurate accounting system.

Inasmuch as judgments of a given business condition are formed by way of contrast and comparison, it is necessary that a standard and uniform system of accounting be established whereby each community shall keep its accounts according to an established recognized standard. Only in this way will comparisons be possible. It has been said that one of the greatest accomplishments of state regulation of public utilities has been the establishment of a uniform accounting system, by which the public has the assurance that all items are cared for in the same way by all of the public utilities, thus making comparison and check feasible. In any state of the Union today under regulation it is possible to check the financial operations of one public utility against another and at all times to compel an accurate and honest accounting through these standard systems of accounts.

But there is no such system in existence today in most of the states with relation to publicly owned utility enterprises. The result is that in virtually every instance where an assertion is made by the proponents of public ownership that a given municipal enterprise is highly profitable, efficient and successful, the statement is promptly challenged on the score that the accounting system permits of a successful concealment of at least a part of the cost of operation, with the result that a false statement of conditions is given to the public.

One very important feature of this lack of certainty as to the financial effect of municipal ownership and operation of a public utility service is that the citizen cannot adequately contrast the results of public and private ownership and operation. He can, on the one hand, obtain a very minute statement of the results of private operation, because the state regulating authority has in its possession as a result of uniform standard accounting complete records of the financial operations of the companies; but, on the other hand, he cannot obtain such information as to the operation of his own publicly owned utility. He must rely upon the partisan statements of those who are operating the publicly owned utility service, and because of the lack of proper accounting these statements are frequently erroneous and are not to be contrasted with the statements of the privately owned utilities.

It is a common practice to confront the citizen with a comparison of rates charged, and where the publicly owned utility rates are lower than those of the private company to seek to impress upon the citizen that this is complete proof of the less costly and more efficient operation of the publicly owned utility. Those who know understand that this contention is utterly fallacious. It may well be and in many instances undoubtedly is true that a part of the cost of the operation of a publicly owned utility is not charged in the rates but is taken from taxes either directly or through the method of having various departments of government contribute to the operation of the utility with no charge against the service, the result being that the public rates do not reflect the actual overhead cost. There are instances in California where virtually no overhead charge whatever is made against the publicly owned utility service and the entire overhead is carried by the citizens through taxation. Yet these same citizens are told that they are receiving a service at a cost reflected in the low public rates and one which is profitable to the community.

FACTS SHOULD BE ASCERTAINED

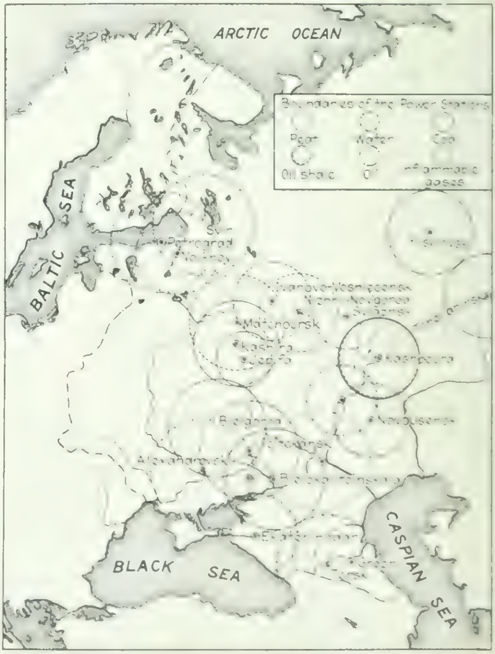
I am not here arguing for or against the policy of obtaining the cost of producing the publicly owned utility service out of taxation, but I do insist that the facts concerning publicly owned utility operations be ascertained and given to the public so that the public may determine for itself the matter of policy. Furthermore, it is bad policy to permit officials to conceal the facts from the public as this leads to abuses on the part of public officials in the conduct of city business. I should say that there is no more dangerous condition in government than one which permits concealment of the facts of the conduct of public business.

Surely no honest public official who asserts that his municipal enterprise is successful should hesitate for a moment to submit to the most rigid test of standard accounting in order that this shall be ascertained—in fact, he should welcome and insist upon such a showing. It would seem as if the simple statement of the wisdom and necessity of proper and standard accounting by municipal enterprises should be sufficiently persuasive, and yet we find a very substantial resistance to the establishment of such accounting systems.

Discarding any question of dishonesty, this can only be accounted for by the extremely partisan and controversial attitude taken by those who are conducting a municipally owned public utility service. Apparently in the fear that if the facts are frankly stated to the public advantage will be taken by the enemies of public ownership to injure the enterprise, resort is had to concealment and subterfuge. It would seem to be a perfectly logical, reasonable and sound proposal that the state, through some agency which is expert in this matter (such as the utility commission), should establish a standard system of accounting to which all municipalities must conform in the conduct of a public utility service, and further that at all times inspection of these public accounts be permitted so that the facts may be ascertained.

In the debates and widespread discussion that are now being engaged in concerning the relative merits of public ownership as contrasted with private ownership of public utility service it has frequently and properly been said that the agency which can best do the job for the public is the one which should survive. But it is obvious that to be sound a determination must be based on the facts, and in the interest of the public every effort should be made to insure that the facts shall be accurately determined and publicly stated in order that citizens may come to an informed judgment of public ownership of the utilities.

Russian Electrification



THE Soviet Government of Russia has prepared plans for the complete electrification of Russia, in the home, factory, farm and railroad and this map from the Manchester (England) *Guardian* shows the boundaries of the plants that the government proposes to build first. All forms of fuel and natural power are included in the scheme.

Selecting Lighting by Trial Competition

Seven Types of Units Installed and Tested Under Working Conditions Ratings Made According to Factors Which Contribute to Good Lighting, Including First Cost, Energy Consumption, Glare, Maintenance, Etc.

By R. A. PACKARD
Superintendent of Power and Shops, Ludlow Manufacturing Associates, Ludlow, Mass.

METHODICAL selection of lighting equipment for factories is very important, notwithstanding the fact that hit-or-miss methods are still quite common. A realization of the great benefits to be derived from proper installation can come only through careful analysis. Moreover, an accurate study is requisite not only in new but also in revised installations. A factory which has paid little attention to its lighting problems for six or eight years is likely to need very thorough investigation in the face of equipment progress. A large factory in Massachusetts recently took up this problem after a long period of placing lamps and reflectors where they appeared to the eye to be essential to give the desired intensity at the working plane. After preliminary surveys were made tests were conducted on different types of equipment actually installed in the factory. The benefits of this procedure were of great value in determining the equipment best suited.

In first attempting to improve the lighting, a drawing-board analysis was made of rooms and machinery, particular attention being paid to intensity requirements. This analysis developed a schematic layout of even intensities over a restricted area requiring uneven spacing of different-sized units, and it was soon found that this method had its limitations. A progressive step brought about a survey of the whole factory during evenings to determine the general lighting conditions. The worst department was then picked out for immediate improvement. A common-sense survey of the situation indicated the poor intensities and suggested the following plan for remedying them:

Mill J, First Floor, Department 44.—Present illumination, 1 foot-candle, should be changed to 3 foot-candles.

Mill A, Third Floor, Department 15.—Present illumination, 1 foot-candle over the cards, should be changed to 3 foot-candles.

Mill H, Third Floor, Department 36.—In this department the illumination is so irregular and inadequate that it ought to be changed immediately. The average light intensity is ½ foot-candles.

Considerations in Designing Illumination for Department 36.—(1) Fairly even distribution of light. (2) Elimination of shadows to a reasonable extent. (3) Conservative intensity of light. (4) A scheme of general illumination adaptable as a standard for many places in the factory. (5) A scheme which will come well within any code which may be adopted by Massachusetts. (6) Elimination of glare.

Probable Results of Better Illumination in Department 36.—(1) Decreased eye strain. (2) Increased efficiency of workmen. (3) Reduction in number of accidents, which, of course, means lower insurance rates. (4) More cheerful surroundings and greater comfort for workmen, which, of course, mean decreased labor turnover.

Since recommendations offered by different factory reflector representatives differed widely, it was decided to have a well-organized test of the competing fixtures or reflectors. Enough reflectors were obtained to determine the exact conditions which would result from a general application throughout the factory of a particular system. As best results may be expected when competition is keenest, it seemed desirable to have a "test night" when the different systems could be tried out in the presence of all the reflector manufacturers and representatives, each to have his opportunity to demonstrate the desirability of his own system. It was decided to have disinterested men capable of judging the various systems present. Subsequent to this "test night" the executives and others interested were to have an opportunity to observe the different systems, and at that time they were to be shown the results of the tests.

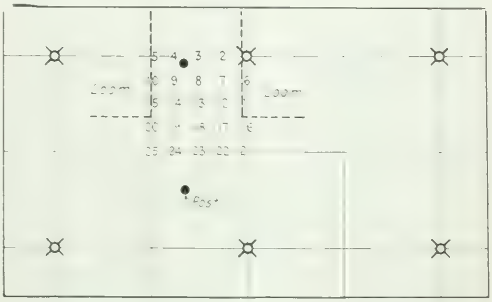


FIG. 1—SECTION OF WEAVE ROOM SHOWING POSITIONS FOR TAKING FOOT-CANDLE READINGS

Twenty-five readings were taken with a meter at each of the positions shown. The average was taken of all readings. The remaining three lamps of this test group (not shown for lack of space) were similarly spaced in a row parallel to the two rows shown.

The floor space in the department selected was 45,000 sq.ft. (4,140 sq.m.) divided into 10-ft. x 20-ft. (3-m. x 6-m.) bays. The white ceiling was 15 ft. 6 in. (4.6 m.) above the floor, and the walls were light-colored with large window area. The work involved was very coarse, dark-colored weaving, done by men standing up, one to a loom, the table of which was 36 in. (0.9 m.) above the floor level. A study was made of the conditions in this room, general factory requirements being kept clearly in mind.

Recommendations were solicited from several sources. This resulted in wide variations in type of reflector, candlepower of lamp, spacing and height above the floor. Three-hundred-watt lamps were eliminated from the competition because of lack of head room to give proper spacing for an even distribution of light, and only 100-watt and 200-watt type "Mazda C" lamps were considered. The room was large enough to permit the installation of seven competitive groups of nine lamps (see Figs. 1 and 2), without any interference between different groups.

Since recommendations and reference tables prescribed an intensity on a 36-in. level above the floor of from 3 foot-candles to 7 foot-candles for the character of work considered in this weave room, and average was taken of about 4½ foot-candles. Each representative was asked to figure on this basis.

Upon a predetermined evening the "test night" was carried through. A copy of the following instructions was handed to each person attending the test.

Instructions for Lighting-Reflector Test. — Referring to the printed table there are several elements, such as first cost, maintenance, depreciation, intensities, glare, etc., which were considered of enough importance to be rated in this test. It was tried to gage them according to their relative importance by giving the maximum allowance in any case for the best-suited reflector. The lowest percentage (one-half of the maximum) under any particular head will stand for the worst condition of any reflector under that particular head. For example, the cheapest first cost will receive 18 per cent and the highest first cost 9 per cent. The element of maintenance should bring in the relative replacement cost. On account of the dusty atmosphere, frequent cleaning of fixtures is necessary. Depreciation should be based on probable length of life of units. They may become obsolete before they are worn out or destroyed. The ratio of watts per square foot and average light intensity is merely a definite calculation which can be made along with the first cost at some time after the test. The smallest ratio or best condition will obtain full percentage, that is 18; the largest ratio or worst condition will obtain one-half the maximum percentage. General ceiling illumination, a desirable feature, will be made from judgment. Glare and shadows, important factors, should be analyzed as the others.

The judges on this test are to be formed into two teams in order to shorten and facilitate the work. A factory engineer and a city illuminating engineer will constitute one team, and a head of a neighboring institution's physics department and a factory engineer the other team. Each team will take foot-candle meter readings under half the installations, and each individual member of the teams will rate all the installations as per table drawn up.

It will be appreciated if the reflector representatives will not talk with the judges.

Subsequent to the "test night," the factory executives will observe the different groups. Their judgment will bear some weight in the final decision.

The readings were taken at twenty-five points located as shown in Fig. 1 with references to the nine lamps in the group. Then an average of these readings was taken as the intensity of illumination. A chart was made for each of the seven reflector groups. The printed table shows the average ratings on all the groups made by all the judges, acting independently.

RESULTS OF COMPETITIVE TESTS OF LIGHTING UNITS

	Ideal	Unit						
	Unit	A	B	C	D	E	F	G
Size of lamp, watts		200	200	100	200	200	200	200
Spacing, center to center, ft		16	17	10 x 10	17	16	20	20
Height over floor, ft		13	13	12	13	12	13	13
Estimated foot-candles 30 in. above floor....	...	6	5	5	5	5	5	5
Average foot-candles as read..............	...	5.98	4.25	4.28	4.82	5.78	3.93	3.30
	Per Cent							
First cost............	18	14.2	17.8	9.00	16.40	16.5	15.50	18.0
Maintenance..........	14	11.0	13.8	7.50	7.25	13.8	8.25	8.0
Depreciation..........	13	10.9	12.5	10.85	10.85	12.5	10.00	10.0
Watts per square foot divided by average foot-candles.........	18	17.5	14.5	9.00	17.00	17.0	18.00	15.5
Ceiling illumination....	8	6.8	4.4	6.20	6.40	4.4	8.00	8.0
Glare................	15	14.0	13.8	14.00	14.00	13.4	14.20	14.0
Shadows.............	14	13.0	13.0	13.40	12.60	13.0	12.80	12.8
Total..............	100	87.4	89.8	69.95	84.50	90.6	86.75	86.3

CONCLUSIONS FROM TESTS

Unit	Discussion
A	This reflector combines to the greatest extent the desirable features in preliminary report. Breakage of glass cylinder should not be high. It will be a good check on proper cleaning. The cheerful appearance of reflector is very apparent. Its efficiency is good.
B	This reflector breaks even with E. Only difference between the two is a solid formation of the reflector.
C	Same as that which is noted under D. First cost prohibits use of this reflector as the advantages are not sufficient to offset it. A much more evenly distributed light may be obtained from it than from the others, because of the frequent spacing.
D	Advantages: Gives slight ceiling illumination, but not so cheerful as A. Disadvantages: Mechanical construction not satisfactory.
E	Reflector shows highest percentage. Very substantially made. Collection of dirt on reflector will not show. No ceiling illumination leaves dark zone above reflector. This is not as easy on the eyes as ceiling-illuminating type.
F	Breakage due to cleaning high. Gives cheerful atmosphere. General appearance good when shades are clean.
G	Breakage due to maintenance high. Gives cheerful atmosphere. General appearance good when shades are clean.

Upon totaling the grades it was found that reflectors "B" and "E" were leading all others and were both of about the same standing, reflector "B" being 89.8 per cent perfect and reflector "E" 90.6 per cent. The final selection was in favor of "B," the poorer of the two. The reason was that its first cost was considerably less than that of E although the watts per candlepower was greater. As the cost of energy was low (hydro-electric energy from the company's own plant), the first cost was of more importance than the energy consumption. This winning unit "B" is the RLM dome reflector, Benjamin No. 5643, with 200-watt lamps. It was spaced on 17-ft. (5.1-m.) centers 13 ft. (3.9 m.) above the floor, and gave 4.25 foot-candles on the working plane 30 in. (0.75 m.) above the floor.

After the selected reflector had been installed throughout the room, appreciation of the change on the part of the operatives was very apparent.

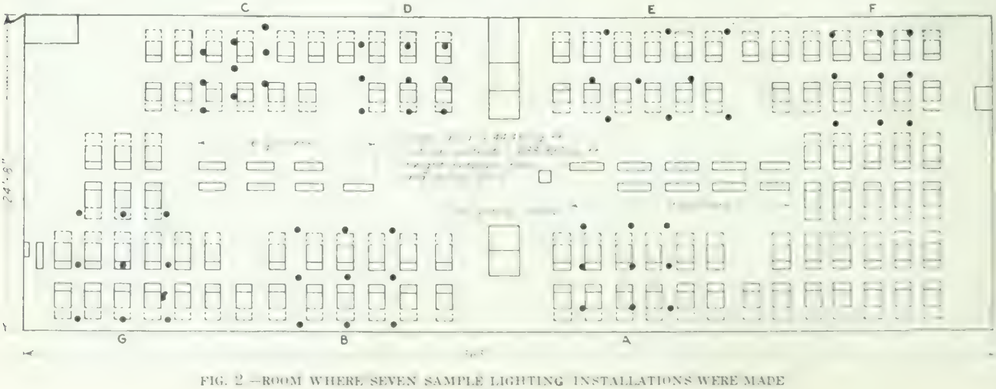


FIG. 2 — ROOM WHERE SEVEN SAMPLE LIGHTING INSTALLATIONS WERE MADE

Simple Substations Are a Necessity

Duplication of Equipment Not Always Justified—How Low-Cost Equipment Can Be Made to Do Duty for Expensive Apparatus—An Example of What Can Be Done from the Kansas Oil Fields

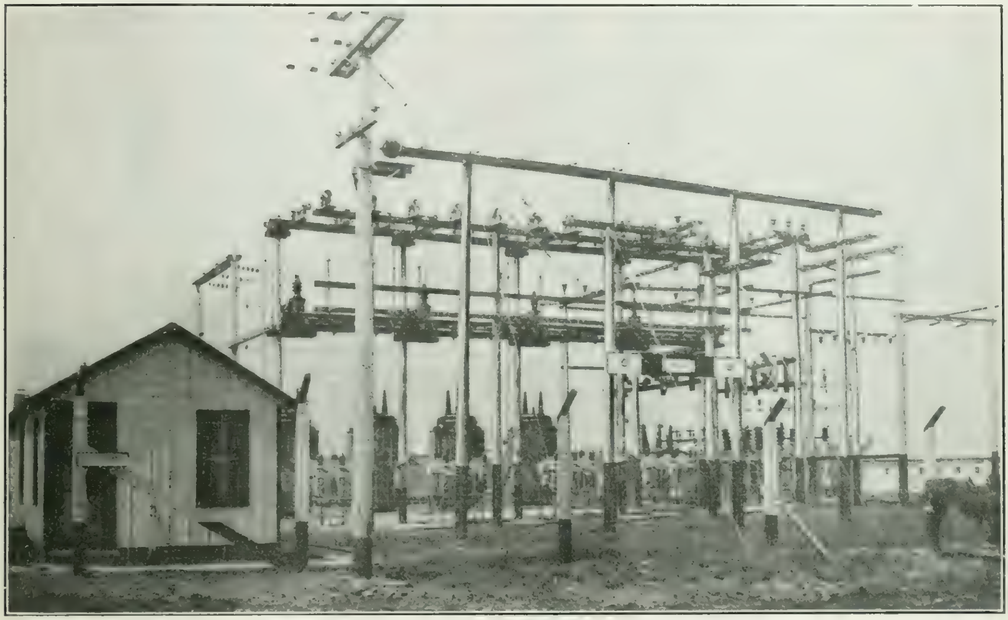


FIG. 1—WELL-DESIGNED AND CAREFULLY CONSTRUCTED WOOD-STRUCTURE SUBSTATION

THE least material and the simplest arrangement that will accomplish the desired result should be the aim of every substation designer. Not only does unneeded material or apparatus mean an additional investment with depreciation and fixed charges to be added to the rates, but additional maintenance charges must be provided for. Unnecessary equipment particularly is not only likely to cause maintenance charges, but it may also be the root from which abnormal operating troubles spring. In many instances where this has been the case the attempt to cure trouble has resulted in still further complication and worse troubles. Examples of this may be found in elaborate relay and protective schemes whose complication makes necessary the constant attention of skilled men to keep the apparatus in working condition, but where, notwithstanding, at the critical moment some unthought-of condition enters to prevent the relay scheme doing what it should. Another example is the tendency to provide duplicate buses and switching equipment to prevent the shutdown of service for maintenance of equipment.

There are many cases where the cost of the installation and the subsequent fixed and operating costs of complete duplicate bus and switching equipment are justified. It is only where severe service conditions, requiring frequent and prolonged inspections and maintenance work, exist that such an expense should be considered. Air-break by-pass switches and light transfer buses for temporary use can be made to serve the same purpose at a marked saving in cost. Theoretically it is bad practice to cut out an oil switch protecting circuits and apparatus and substitute non-automatic switches. If the intervals at which this must be done are long and the service conditions not exceptionally severe during the periods in which maintenance work must be done, it is easy to see that the objection is theoretical rather than practical. The real basis on which the feasibility of duplicate installations should be determined is economic, depending on whether the probable (not possible) operating costs incurred by the lack of the duplicate equipment justify its installation. The use of the word "probable" should be noted. It is easy to list operating troubles that are highly possible under some conditions but extremely improbable under the conditions encountered in the usual type of installation. Design work should always be carried out with the probable operating conditions in mind.

A Simple Oil-Field Substation

The Barnhill substation of the Empire Gas & Fuel Company in the Eldorado oil fields in Kansas is a good example of the things that can be accomplished. The construction is wood except for the lightning-arrester assemblies, which are furnished complete and self-contained in metal construction by the manufacturer. Whether steel or wood construction shall be used depends on the probable life of the installation. The use of long-life structures is not advisable if the growth of the business makes it certain that a new arrangement must be provided before the end of the natural life of a wood structure. This condition exists much more frequently in the central-station and industrial fields than the average designer realizes.

The high-tension equipment, except for the lightning

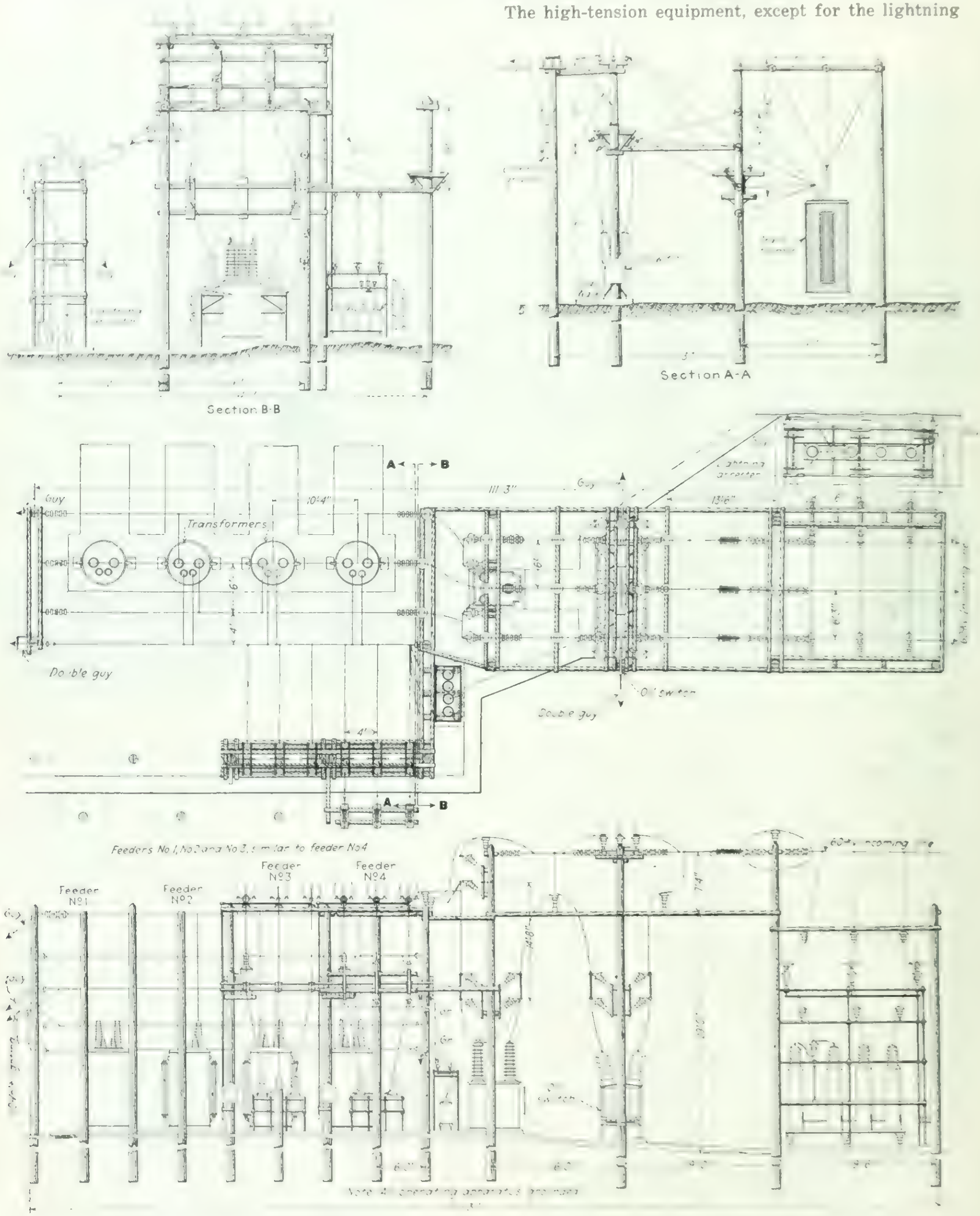


FIG. 2—AN EXAMPLE OF WHAT CAN BE ACCOMPLISHED IN SIMPLIFYING SUBSTATION DESIGN

This wood structure substation is employed by the Empire Gas & Fuel Company, Eldorado, Kan., to serve an oil field pumping load. These drawings, which show the details of a simple substation for high voltage and moderately high capacity, indicate how the amount of equipment can be reduced by the use of air-break switches. Additional sections can be added without reconstructing the existing sections. Thirteen poles only are required for the high-tension structure that supports the 6,000-kva. equipment.

arresters, is arranged in line with the incoming circuit. The unit under consideration cares for 6,000 kva. in capacity and is so arranged that similar units can be built alongside and connected in without disturbance of the existing construction. This avoids one of the most frequent and inexcusable of design errors, that of putting in an installation that cannot be added to without complete or at least partial reconstruction of existing structures. Incidentally it is the most frequent design fault of the small substation.

LAYOUT IS SIMPLE

The arrangement of all apparatus in a straight line with the incoming circuit calls for the least complication in the structures and therefore for the least material in the supports. In this case there are only twelve poles in the entire structure, not counting the three-pole structure on the low-tension take-off. Four of the poles are on the incoming line structure. This takes not only substation structure strains, but also stands between the line and the substation, which requires strength and stiffness. The oil switch is cared for by a two-pole structure on top of which is mounted an air-break switch for by-passing the oil switch for maintenance purposes. The high-tension metering set is similarly cared for and can be cut out in the same way. Disconnecting switches are provided in both cases to cut the apparatus free of any possibility of connection with the high-tension circuit.

The high-tension transformer bus is supported by a four-pole structure, and material is saved by mounting the low-tension bus in a vertical position on two of these poles. The tendency ordinarily would be to provide a separate structure for the low-tension bus that would be more elaborate. The vertical arrangement for situations of this sort is satisfactory and has been proved by experience.

WHY ADD MORE MATERIAL?

There is every opportunity to utilize more material in this structure. A four-pole structure each for the oil switch and potential transformer in place of two-pole structures each would appeal to some designers, and many will question the 48-ft. (14.4-m.) span for the transformer buses. The answer is that such construction has been successfully used. Why, therefore, add more material? Such a structure as this one, especially if constructed of cedar poles and selected timbers and carefully guyed, is neat in appearance, and the very small number of parts makes for low maintenance costs. There is a very large field for such designs in the numerous small industrial plants that are demanding central-station service and the small-town substations that the increasing demand for rural service is bringing about. The designer must get away from the engineering practices that have been considered the proper thing in city distribution. There economic and service conditions have justified rather heavy expenditures and will continue to do so in the future. The newer developments are calling for a simple and sturdy form of design that can be applied in rural and small-power situations with opportunity to grow with the business at the least expense for extensions. This oil-field design will bear careful study because it points the way to a considerable saving in construction, fixed and operating costs. The problem is as much economic as engineering, a fact that must be borne in mind.

Letters from Our Readers

This is a readers' forum. Comments on questions before the electrical industry presenting economic, financial, engineering or commercial aspects and new or supplementary viewpoints on published articles are cordially invited

Development of Static Condensers for Power Factor Correction

To the Editors of the ELECTRICAL WORLD:

Referring to your editorial on page 1111 of the Dec. 3 issue of the ELECTRICAL WORLD, may I call attention to the fact that the General Electric Company has furnished a large number of static condenser equipments which are in operation in various parts of the United States as well as in some foreign countries? They range in capacity from 10 kva. to 300 kva. The company is in a position to furnish static condensers in sizes and voltages which might be required for the smallest individual motor installations and for the highest distribution voltages in units up to 300 kva., multiples of 300-kva. units being used for larger capacities. Several descriptive articles have appeared in the ELECTRICAL WORLD.

R. H. CARLTON.

General Electric Company,
Schenectady, N. Y.

[The editorial in question, as its title implied, was directed to the need of giving more attention to the application of condensers to individual pieces of apparatus which inherently or through underloading operate at poor power factor. So far the chief consideration has been given to locating multi-unit condensers at load centers. This is an excellent step in the right direction. However, if it proves technically and economically practicable to make condensers a permanent appendage of apparatus, this method would be the next logical step since the "wattless" current is compensated at its source. As every one knows, this would have all the advantages of the "load-center" static condenser and in addition would increase the load-carrying capacity of all feeders and switches and eliminate the great torque reduction due to poor power factor. We heartily recommend the construction of both applications.—EDS.]

United States Chamber of Commerce and the American Valuation Plan

To the Editors of the ELECTRICAL WORLD:

I have read with interest and satisfaction the editorial in your issue of Dec. 17 on "This Policy Brings Better Times." In regard to Referendum 37 I want to say as positively as it is possible to say it that the Chamber of Commerce of the United States has not declared against the American valuation plan. It is equally true that it has not declared for it. It has no position in regard to the American valuation plan of any kind until the referendum which raises the question has been voted on at the end of forty-five days, and then whatever the vote indicates will be the position to be carried out.

I want to go further and make it perfectly clear that any recommendation by a committee included in a referendum is merely the recommendation of that committee, and even less than that in many cases, for it is merely the recommendation of those members of the committee who have recorded themselves in favor of that particular suggestion.

The report when it comes before the board comes only on the question of whether it shall be sent out to vote. The merits of the proposals of the committee are not before the board. If the report is made up in accordance with our precedents, the board orders that it be incorporated in a referendum pamphlet and takes responsibility for the fact that appropriate arguments in the negative as well as those affirmative arguments which appear in the report are made up and printed. These arguments in the negative are on alternate pages.

The result of all this, as regards the American valuation plan, is that the members of a special committee, with the exception of one who dissented and put himself on record in favor of the American valuation plan, believe it is inadvisable, for the reasons which you will find in the report as printed in the referendum. Reasons why American valuation should be set up are printed on the page opposite at considerable length. The ballot is so arranged that an organization can vote no as easily as it can vote yes. The Chamber of Commerce of the United States will have no opinion one way or the other until Jan. 21.

ELLIOT H. GOODWIN,
Resident Vice-President.
Washington, D. C.

Use for Surplus Exhaust Steam

To the Editors of the ELECTRICAL WORLD:

Your editorial in the ELECTRICAL WORLD for Dec. 17 concerning the increased use of electrical heat-treating furnaces brought to mind again an investigation which I started but for various reasons was not able to carry very far into the possibility of using electric furnaces in a forge plant in place of oil-burning installations.

In connection with an investigation into the steam and power requirements of a forge plant I was searching for additional electric power load in order that a low-pressure turbine installation might be profitably used to absorb the surplus exhaust steam from the hammers. Electric furnaces would do this and would also, I felt, give much better heat control than oil, with many other advantages in the way of faster production and increased quality of output.

Of course, low-pressure turbines have been used in connection with forge plants, but in the case the writer was investigating and others with which he has come into contact the electrical load is so small in comparison with the amount of exhaust steam available that it will not absorb enough of the output of the low-pressure turbine to pay fixed charges on the investment. In other words, it is cheaper to buy power or to use a small non-condensing engine than it is to install expensive low-pressure equipment.

Allowing for a cooling tower and purchased water at average large city rates, a 500-kw. low-pressure turbine run from steam-hammer exhaust at or near full load will turn out energy at around 0.75 cent per kilowatt-hour. The surplus energy might, of course, be sold to the local power company, but there are few utilities that would care to consider such a proposition, however ideal it might be from the standpoint of fuel conservation. It seems to the writer that the proposition of using the electric furnace in this connection is entirely plausible and worth investigating thoroughly.

Christmas Cove, Maine. ARTHUR S. WELLS.

Comparing German and American Prices for Motors

To the Editors of the ELECTRICAL WORLD:

On page 848 of the Oct. 22 issue of the ELECTRICAL WORLD you make a comparison between American and German motor prices. I beg to draw your attention to the fact that the German prices, which you quote in marks, are not October prices. The October inland prices were higher, as you will observe from the annexed table. These inland prices cannot be compared with the American inland prices. I presume that the American prices which you quote in the last column are for home consumption. It is well known that American firms give higher discounts for export. But even if you take account of the lower American export prices, those prices cannot be compared with German home prices.

You are probably aware that the German government has established export trade offices for the different industries and that these offices have to issue a license for each separate export order. The licenses are given only if an export price is quoted in accord with the standard price of the country to which the goods are exported.

GERMAN MOTOR PRICES

Three-phase, squirrel-cage, 220-volt Hp	R.P.M.	German Inland Prices, in Marks	Export Prices for Holland in Florins	Export Prices for Holland in Dollars
1	1,400	1,672	100.30	35.70
5	1,400	4,004	240.20	86.50
5	925	4,840	290.40	103.40
Three-phase, slip-ring, 220-volt:				
5	1,400	5,500	330.00	117.60
10	1,400	8,008	480.50	171.20
50	1,400	25,088	1,332.00	474.60
Direct-current, 220-volt, shunt-wound:				
5	1,100	6,710	402.60	143.40
7.5	1,800	8,800	528.00	188.10
15	1,650	13,200	792.00	282.20

Prices are understood to include the expenses of export and packing, free delivery at factory, but not duty.

The ruling export prices for the end of October are also given in the table, in which it will be found that those prices are not as low as would appear from the comparison given on page 848. The export trade offices under no condition give licenses at lower prices. If, therefore, German motors reach foreign countries at prices not according to the prescribed conditions, these motors must come from the Rhineland. The Interallied Commission for the Rhineland has opened its own export trade office at Ems, and according to its orders the licenses are given at Ems at any quoted price. If, therefore, you complain of the cheap German prices, you should address yourself to the American representative at the Interallied Commission in Coblenz.

Berlin, Germany. AXEL SCHMIDT.

Difference in Cost of Cedar Poles Is Material

To the Editors of the ELECTRICAL WORLD:

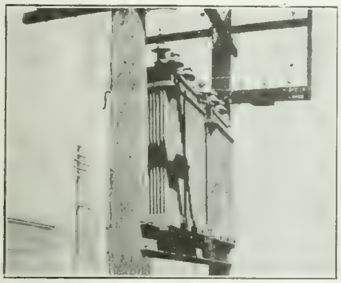
In your issue of Dec. 10, under the caption "Longer Spans Proposed for Rural Lines," is an article one sentence of which I think might be misleading. In giving the comparative cost of 125-ft. and 250-ft. spans it is proposed to use "6-in.-top class C" Western cedar poles. The class C Western cedar pole has a minimum 7-in. top. The difference in cost between a 6-in.-top pole and a class C pole would be very material, more especially as the poles are to be butt-treated.

Sandpoint, Idaho. L. D. McFARLAND.

Industrial and Station Practice

Installation, Operation and Maintenance of
Generating and Distribution Equipment and Economical Utilization of Electrical Energy
in Mills and Factories, Including Testing and Repair Methods

Channel Iron Used to Support Heavy Transformers



TRANSFORMERS WEIGHING ½ TON SUPPORTED BY CHANNEL IRON ON POLE STRUCTURE

When it is necessary to support heavy transformers on pole structures, the Portland (Ore.) Railway, Light & Power Company has found it expedient to use channel iron instead of wooden timbers, this method not only being cheaper but offering a degree of permanence not obtainable when wood is used. The illustration shows two 330-kva. transformers with a total weight of 15,000 lb. supported by two pieces of 10-in. channel iron bolted to poles set 12 ft. apart. Two ¾-in. through-bolts at each end secure the channel iron to the poles.

S. F. New,
General Line Foreman.
Portland Railway, Light & Power Company,
Portland, Ore.

Protecting Cable Against Breakdown of Insulation

In a high-tension cable the electric stresses always are highest close to the conductor surface, and the temperature of the dielectric, likewise, usually is highest in the layer immediately surrounding the conductor. Deterioration, therefore, always starts at the conductor surface, gradually spreading outward until the insulation gets so weakened that a breakdown develops. Conversely, if the dielectric close to the conductor surface is sound, then there is little danger of a breakdown. This fact is utilized in the Pfannkuch system of cable protection, which has been developed by the Allgemeine Elektricitäts-Gesellschaft.

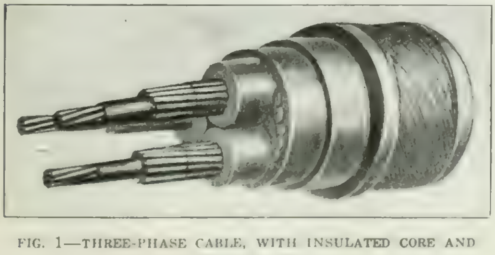


FIG. 1—THREE-PHASE CABLE, WITH INSULATED CORE AND OUTER STRANDS

In a cable arranged according to the Pfannkuch system the highly stressed layer of dielectric close to the conductor surface is kept under constant observation. For this purpose the top-layer strands in each conductor are provided with a thin cover of insulating material, and the core of the cable is also given an insulating covering of this kind. The core strands are connected as usual to the main cable terminal. The strands in the top layer of the conductor are divided into two groups, every other one being connected to one auxiliary terminal, while the remainder is taken to a third cable terminal. In transmitting the power the entire copper section of the cable is utilized to its full capacity, the current density being about the same in all strands; but of the two top-layer groups of strands, one is operated at 20 volts to 50 volts higher than the core, the other group of insulated strands being run at a correspondingly lower voltage. Thus there is 40 volts to 100 volts between adjacent strands in the outer layer. If deterioration sets in at the conductor surface a short-circuit therefore will develop between two of these strands long before the fault has had time to pierce the entire insulating layer so completely that a breakdown occurs between strands, or in the sheath. As soon as a discharge sets in between two strands, however, the cable is disconnected by means of relay-operated breakers. The location of the bad spot then may be very easily determined by utilizing the two groups of strands in a testing bridge. A fault which is about to cause serious trouble thus may be discovered and repaired before anything serious happens and without the service disturbances which follow a real breakdown.

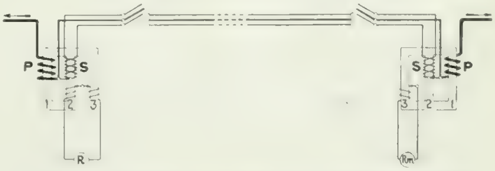


FIG. 2—CONNECTIONS OF THE CABLE PROTECTIVE SYSTEM

The electrical details of the system are indicated in Fig. 2. The voltage difference between the two groups of top-layer strands is obtained by means of a small transformer, similar in appearance to a current transformer but containing two additional windings, connected in opposite ways to the two auxiliary cable terminals. As soon as the differential action of the two extra windings is disturbed by a short circuit between strands a strong magnetic flux will be forced into the third leg of the transformer, and a secondary winding on this leg therefore may be used for supplying breaker-tripping relays, as indicated on the sight. Even under balanced operation, however, there will be set up a certain amount of flux in the third leg, and if the load current exceeds a certain value the relays will operate the circuit breakers even though the cable may be sound. The device thus works as a combined fault and overload protective system. If it is desired to make the relays entirely independent of the load a compensating winding is put in series with the relay winding, as shown in the left-hand part of Fig. 2.

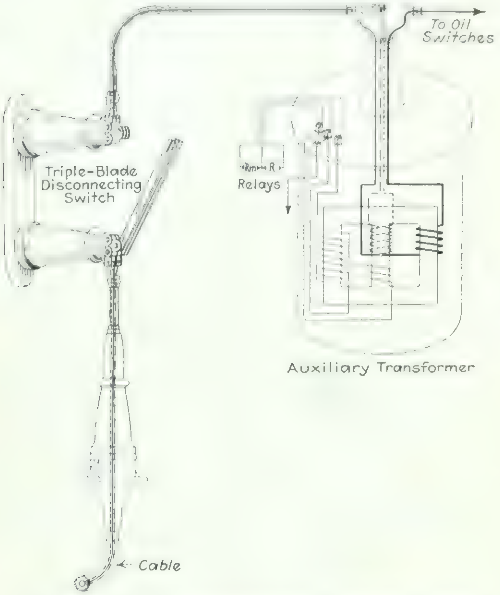


FIG 3—AUXILIARY TRANSFORMER FOR ACTUATING RELAYS

The action of the transformer may be more clearly understood after a study of Fig. 3, where the actual appearance of the device is indicated schematically. This figure also shows one of the special triple-blade disconnecting switches used to cut off the transformer from the cable.

The Pfannkuch protective system is described by the inventor in the *A.E.G.-Nitteilungen* and also by Klingenberg in the *Elektrotechnische Zeitschrift.*

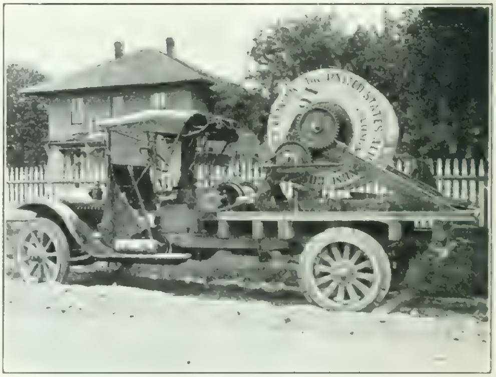
Labor Costs of Restringing Lines Cut in Half by Power Reel

THE cost of removing and replacing line conductors has been cut to about one-half that of hand work by the use of a power-driven reel developed by the Puget Sound Power & Light Company. Owing to the high cost of labor during 1920, a study was made of labor-saving devices applicable to this work, with the result that the power-driven take-up reel was designed by A. C. Riggs, line-construction superintendent in the distribution department of the company. In using this outfit a standard wire reel is placed on a shaft geared to an engine-driven winch, the entire outfit being fitted on a standard truck. This winch is a regular part of the equipment furnished on White trucks used by the company on pole and heavy line work and was supplied by the truck manufacturers at an advance of about $550 on the regular price of the truck. Power for driving the take-up reel is supplied through a chain and sprocket drive from the engine-driven winch. The winch is driven by the truck engine through a separate gear shift operated by the driver. The take-up reel mechanism was developed specially for this work and cost $269 complete with chain and sprockets. The reel is mounted on a frame of heavy timbers which is bolted to the truck floor as the accompanying illustrations show. The list of materials required and the drawing explain details of the construction.

MATERIALS REQUIRED TO BUILD POWER-DRIVEN REEL

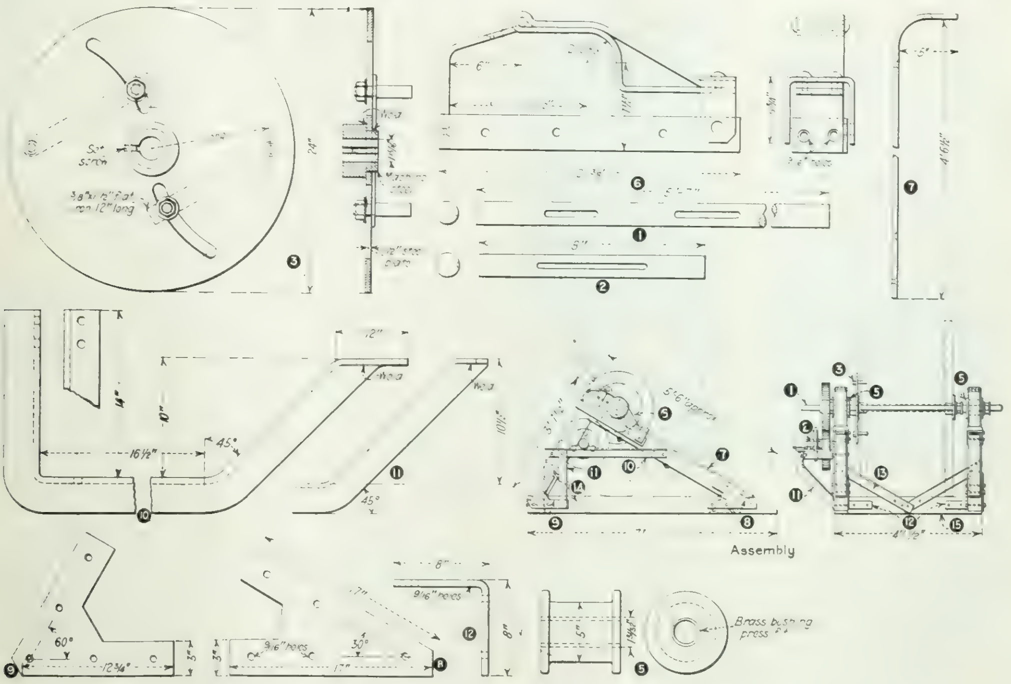
Item No. on Drawing	No. Wanted	Material
1	1	1[illegible]-in. cold-rolled steel
2	1	1[illegible]-in. cold-rolled steel
3	1	Steel plate
5	2	[illegible]
6	2	[illegible]-in. x 4-in. flat iron
7	2	[illegible]-in. x 4-in. flat iron
8	4	[illegible]-in. steel plate
9	2	[illegible]-in. steel plate
10	1	3-in. x 3-in. x [illegible]-in. angle iron
11	1	2[illegible]-in. x 2[illegible]-in. x [illegible]-in. angle iron
12	2	[illegible]-in. x 4-in. flat iron
13	2	[illegible]-in. x 3-in. x 4-in. angle iron
14	6	4-in. x 6-in. dressed spruce
15	2	6-in. x 6-in. dressed spruce
	2	Cast-iron spur gears, 1¼-in. pitch, 43 teeth, 17⅛-in. pitch diameter, ¾-in. face, with standard straight keyway; hub 4 in. from face to face when finished; bored for 1[illegible]-in. shaft; hub to be drilled and tapped for standard set screw
..	2	Cast-iron sprocket wheel, 10-in. pitch diameter, 12 teeth; hub 4 in. from face to face when finished; one sprocket bored 1 [illegible]-in. with standard straight keyway
	1	10-ft. steel-bushed roller chain
	2	1 15/16-in. standard set collars
	2	1 15/16-in. standard cast-iron dolly boxes
	1	2-in. standard pipe, 2 ft. 7½ in. long
	1	2-in. standard pipe, 2¾ in. long

Some examples of work done with this outfit will serve to show how it has saved time and money. One case was the replacement of No. 2/0 seven-strand aluminum conductors by 336,400-circ.mil nineteen-strand all-aluminum cable, in order to increase the carrying capacity of two parallel 55,000-volt pole lines for a distance of 25 miles between Auburn and Seattle, Wash. With this equipment the new wire was pulled into place and the old wire was at the same time reeled up in proper shape for shipment. A reel of new wire was set up at one point on the line, the end of the new wire was tied to the old wire, an empty reel was placed on the power-driven outfit some distance ahead, and the old wire was



THIS REEL HAS CONSIDERABLY REDUCED THE COST OF STRINGING LINE CONDUCTORS

The reel and gearing together with their mounting are readily removable from the truck bed



DETAILS OF POWER-DRIVEN REEL FOR PULLING LINE WIRES
(See accompanying list of materials)

pulled out, drawing the new after it. When the empty reel was filled with old wire, it was removed from the drive shaft and replaced by the reel which had just been emptied of new wire and the outfit moved up ahead to the next pulling point. An average speed of about 190 ft. per minute was attained, pulling lengths of wire up to 5,000 ft. at one time. The new wire was also pulled to its proper tension for tying in before cutting loose from the reel.

Before the power-driven winch was put into operation about 15 miles of this wire was changed by the usual hand methods, pulling wire behind a truck where possible to do so. The labor cost on this stretch averaged $0.026 per lineal foot of wire changed, but it was estimated that the average cost of the entire job by these methods, including work at more favorable locations, would probably not have exceeded $0.02 per lineal foot. With the power-driven apparatus one length of 18 miles of wire, along somewhat inaccessible right-of-way, was changed at a labor cost of $0.0125 per lineal foot. Another length of 15 miles of wire along the city streets was changed at a labor cost of $0.008 per foot. The remaining 77 miles, along country roads and trails, was changed for $0.0069 per foot. These labor costs included wages and immediate supervision, truck operation and maintenance, and accounts for board and lodging which had to be paid on about 80 per cent of the work.

On an 11-mile length of 55,000-volt branch line supplying a coal-mining district this reel was used to replace ¼-in. galvanized, stranded guy wire with No. 4 bare copper wire. An unusual saving was effected as the work had to be done on Sunday at double-time rates to avoid service interruption.

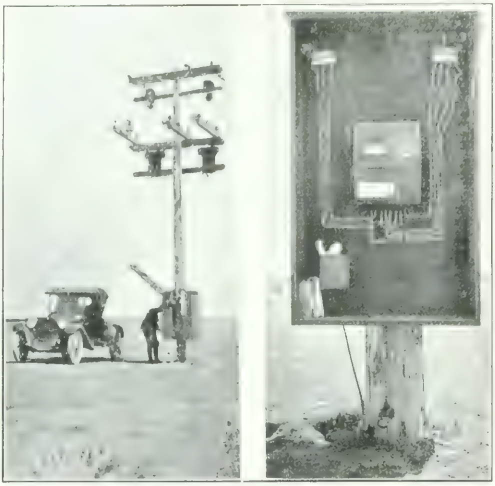
A portion of this replacement was done by ordinary methods, changing about 2.5 miles of line per day. The rest was pulled through by the same crew, using the power-driven equipment at the rate of 6 miles of line per day, and the line was out of service about one and a half hours per mile.

M. T. CRAWFORD,
Superintendent of Distribution.
Puget Sound Power & Light Company,
Seattle, Wash.

Economy in Outdoor Metering on 11,000-Volt Lines

IT BECAME ncessary to meter a number of 11,000-volt circuits at points remote from any substation building a few years ago, when the California Railroad Commission allowed the San Joaquin Light & Power Corporation to make reduced charges to consumers served direct from substation buses or from primary distribution lines. In order to make the cost low, it was determined to eliminate the construction of a shelter to house the instrument transformers. This necessitated the use of out-door type transformers. The current transformers adopted were a dry type. Originally these were made in a single ratio only, but later they were supplied with double ratios which greatly increased their serviceability.

At the time the first equipments were installed it was impossible to obtain any out-door type 11,000-volt potential transformers. However, a number of small distributing transformers were available and on test proved to have very good characteristics so that they were installed for this purpose. More recently outdoor-

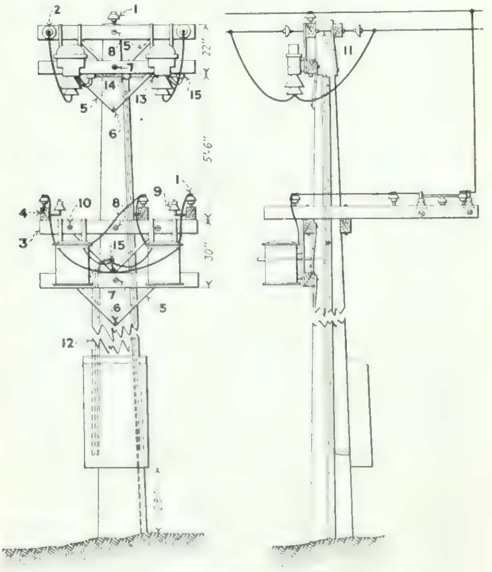


SMALL DISTRIBUTION TRANSFORMERS ARE USED AS POTENTIAL TRANSFORMERS IN THIS OUTDOOR METERING SET

type potential transformers of several makes have been used but they have proved to be more expensive than the small distributing transformers which were installed originally while at the same time the measurements have been no more accurate.

Virtually all of the circuits to be metered have been three-wire, three-phase, so that two current and two potential transformers have been required. The potential transformers are installed with fused disconnecting switches.

The fuses are much heavier than would be required for the protection of the transformer and are intended only to clear the service in case of serious trouble.



A MINIMUM OF PARTS IS USED IN THIS OUTDOOR METERING INSTALLATION

MATERIALS FOR OUTDOOR METERING STRUCTURE FOR THREE-WIRE, 10-KVA., 11,000-VOLT INSTALLATION

No. Req.	Item No.	Description
10	1	Pin insulator, 10 kv.
4	2	Strain insulator, [illegible]
6	3	[illegible]
3	4	[illegible]
8	5	Braces, 28-in. galvanized.
4	6	[illegible]
2	7	Machine bolts, [illegible] x 14 in., four washers.
2	8	Machine bolts, ⅝ in. x 16 in., four washers.
3	9	Primary fuse clips.
8	10	Machine bolts, [illegible] x 4 [illegible], eight washers.
2	11	[illegible] x 16 in., eight washers.
	12	Wood molding for conductor and ground.
	13	Conduit.
1	14	Condulet, type T.
3	15	Condulet, type E.

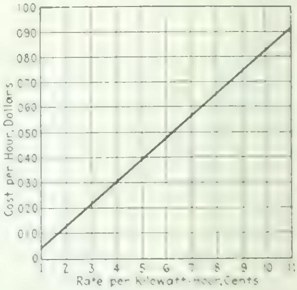
In the five years that this class of installation has been used only one case has been found where the potential fuse opened. The current ratings of the series transformers used varies from 10 amp. to 150 amp. Thus far no defects have developed except those caused by overloads which the consumer created by adding to his installation without giving the company notice before making the change.

Typical installations are shown in the cuts. One meters the power to a large agricultural development, and two meter boxes are used to house two separate watt-hour meters, one being a graphic watt-hour and demand meter, as shown in the "close-up" photograph. Details of construction are shown in the drawing.

C. F. GILCHRIST,
Superintendent Meter Department.
San Joaquin Light & Power Corporation,
Fresno, Cal.

Chart to Show Low Cost of Good Industrial Lighting

TO SHOW how very little it will cost to increase the lighting of a plant to a satisfactory extent the accompanying chart has been prepared. The curve shows the cost per hour of energy to furnish 1 foot-candle over an acre of floor space. The figures apply to regular standard industrial equipment kept in good order. This table was prepared especially to demonstrate the low cost of increasing the lighting in hallways, stairways and exits from 0.25 foot-candle to 0.5 foot-candle, as is recommended in the Industrial Lighting Code of the Illuminating Engineering Society.



COST OF ENERGY FOR 1 FOOT-CANDLE OF INDUSTRIAL LIGHTING PER ACRE OF FLOOR SPACE

As an example suppose that it is desired to raise the present intensity of 0.25 foot-candle to 0.50 foot-candle when the lighting rate is 8 cents per kw.-hr. The chart shows that for 1 foot-candle the cost would be about 66 cents per hour. Therefore to raise the intensity 0.25 foot-candle the cost will be about 16.5 cents per hour per acre of floor space.

Management and Policy

Embracing Central Station Commercial Organization and Management, Customer and Trade Relationships, Public and Financial Policies, Advertising, Selling and Service Methods

A Banker's Analysis of Central Station Securities as an Investment

A Classified Analysis from the Investment Viewpoint in a Useful Form—Nine Reasons for Favoring Them

A MOST interesting analysis of electric light and power securities has just been published by the Guaranty Trust Company of Kansas City as a recommendation to investors. The classification is in an especially convenient arrangement for general use by electric light and power companies which are engaged in selling junior securities to customers. The trust company's analysis follows in part:

At the close of 1920 electric light and power companies in the United States represented an investment of over five billion dollars. Less than one-fifth of 1 per cent of this vast sum was in default. This record, indicating an opportunity for safe investment in bonds, can hardly be equaled and justifies the confidence of discriminating investors. We have reached the conclusion that it is time to recommend the purchase of well-selected light and power company bonds after consideration of the following fundamental factors which clearly point out their desirability:

1. *Light and power companies furnish community necessities.* The value of an electric light and power company depends not alone upon the physical value of the plants, transmission lines and other property, but also upon the fact that they are an absolute necessity to the public. Courts have even held that insolvency must not terminate their service so necessary to public welfare.

2. *They have enjoyed remarkable stability of earnings for many years.* Electric light and power companies are particularly fortunate in that the demand for their product is practically constant, both in good times and bad, and their earnings remain stable. During the recent period of unsettled business conditions light and power companies have actually shown an increase in operating revenue. It is the remarkable showing of these companies during such periods that has aroused so much interest in their securities as a means of safe investment.

3. *They are recognized in law and practice as publicly regulated monopolies.* Public service commissions have been established in forty-two states and laws enacted giving such commissions the power to prevent the issuing of bonds which do not add to the actual physical value of the properties effected. This protection to the companies and the investors (in their securities) is also a protection to the public, because it insures against duplication of utility properties and the consequent economic loss of unnecessary competition, which otherwise would eventually have to be absorbed by the public.

4. *During periods of changing prices for basic commodities they are free from inventory adjustment problems.* Fuel being the principal basic commodity entering into the production of electric light and power, freedom from problems of inventory adjustment is insured during periods of changing prices as the delivery of fuel is made in proportion to the daily demands of these companies. The product which they sell, namely, kilowatt-hours of electricity, is not manufactured until there is a demand for it, and it is sold at the same moment that it is produced. It can therefore be seen that there is no chance for overproduction or accumulated production without a market. No other industry enjoys this distinct advantage.

5. *They enjoy greater immunity from labor troubles than almost any other large enterprise.* Freedom from adverse labor conditions is an outstanding characteristic of electric light and power companies. A comparatively small amount of labor is necessary for operation of plants in comparison with the vast volume of business done. After a plant is once constructed and in operation, its service can be maintained and extended by only a comparatively few men trained in this kind of work.

6. *Their business is very nearly on a cash basis.* In supplying electric light and power there is no necessity for extending credits. The consumption of each customer is metered and bill rendered at the end of each succeeding month. The loss in revenue through failure to receive payment for service rendered is a very small fraction of 1 per cent.

7. *They hold a record almost equal to national banks for minimum risk of failure.* Even though these companies are just emerging from the most trying period in their history, out of a total of five billions of dollars invested in the industry at the close of 1920 there was less than one-fifth of 1 per cent in bonds of electric light and power companies that were in default. This remarkable showing places light and power companies next to national banks as regards the possibilities of receivership.

8. *For prompt payment of principal and interest and for marketability, their bonds are unsurpassed.* The unusually fine record that electric light and power companies have for payment of both principal and interest is responsible for the wide distribution of their securities among an unusually large number of conservative investors. Customers of these utilities have become investors in the securities of their local companies in increasing numbers.

9. *Through new development in the science of electricity, greater economies of operation are secured and new uses for electricity are found, increasing opportunity for added revenues.* The electric light and power industry has developed in less than forty years. In the early days electric power for industrial purposes was unknown and all service confined to lighting. Today we are witnessing constant development of new uses, particularly in the way of industrial uses and in the perfection of new appliances for the household. Through these new uses that are being developed, new sources of revenue result to the light and power companies. This fact, together with the statement that there are still fourteen million unwired homes in the United States, indicates the wonderful opportunity for future growth and increased earning power of these companies.

New England Company's Rural Lines Are Made Self-Supporting

THE METHODS employed by a New England company in making rural line extensions is particularly interesting as most of the information available on this subject has come from companies in the agricultural sections of the Central and Middle West. H. M. Parsons, manager of the Central Massachusetts Electric Company, of Palmer, Mass., in a recent letter emphasizes the necessity of impressing upon prospective customers that rural lines can be built only upon a strictly business basis. Mr. Parsons says:

"This company is supplying, to a very large extent, a rural territory. We have already covered the main centers and our problem now is to find a method which will satisfactorily meet the demands of those living in the outlying sections. Many applications for these so-called country line extensions are being made to us each week.

"It is our policy to give these extensions careful consideration and try to work out a proposition which will be fair to the consumer and to the company. In order to do this, it is necessary that each proposition be considered on its own merits as to distance over which the extension must be constructed, business available and the probable future growth in that immediate section.

"Our method after securing an estimate of the cost of construction and a survey of the probable business, is to get those interested in the proposition together at some point in the community, and frankly discuss with them, the situation prevailing in regard to the extension as it affects the company. That is, cost of the extension, the earnings which it is necessary for the company to have to support this extension, and, in short, put the proposition before them as clearly and concisely as possible.

"We then analyze the carrying charges and establish definite percentages, justifying each percentage as we discuss the item. The total of these percentages represents the net income which we must have available at the end of the year from the extension. The prospective consumers, agreeing with us as we discuss point by point, are brought finally to the conclusion that in order for us to make this extension, they must provide some means to carry it and this is then worked out on the basis of the net returns in the form of a definite guarantee which the community jointly and severally agrees to assume.

"The plan has worked with considerable success in this territory and several others directly under the writer's observation. Our rural lines are the ordinary type of construction and every effort is made to reduce expenses in connection therewith, to the minimum. We request the takers on extensions of this sort to pay this guarantee charge until such time as the actual sales of light and power from the extension equal or exceed the predetermined gross amount, for two consecutive years. The gross amount being fixed at a point that will, we believe, net us sufficient money to carry the investment. If the extension is on private property, we generally work out an arrangement with the customer whereby he pays for the construction of the line, maintains it and purchases his energy at regular, established rates for service."

Courteous Credit Methods Bring Investment in Stock

As THE direct result of a letter from the credit department, one of the salesmen of the Northern States Power Company of Minneapolis recently received an order for a block of the company's preferred stock The letter, which accompanied a check drawn to reimburse the customer for a deposit made with the company when his meter was installed, read as follows:

"We feel that it is not necessary for us to hold your check in the amount of $5 which was deposited with us some five or six years ago for our protection, as you have always paid your bills very promptly and from our point of view your credit is unquestionable. We are consequently forwarding your check together with interest accrual."

The salesman happened to call on this customer and found him so much pleased with the manner in which the company did business and the fact that his deposit, which he had entirely forgotten, had been returned, that he was eager to make an investment in the organization.

Here is an excellent example of the good will and support that a public utility can easily earn through such acts of consideration and thoughtful courtesy to its customers.

What Other Companies Are Doing

East Hampton, Conn.—At a recent fair which was visited by people from many of the neighboring towns the Central Connecticut Power & Light Company used as its display and demonstration headquarters a new motor truck loaded with an electric range, a washing machine, a vacuum cleaner, small motors and portable lamps. The truck, gayly decorated and labeled, attracted so much interest that the new-business representative now drives it to the more remote communities for house-to-house demonstrations. A long cord is extended to the house and a demonstration of any appliance is made on the spot. The company has found it a profitable way to reach customers who live too far away for frequent visits to the store and could not otherwise be interested in electrical appliances.

Augusta, Me.—Thirty-six superintendents and department heads of the Central Maine Power Company assembled recently at Augusta, the company headquarters city, to discuss commercial problems and company affairs, including financing, appliance sales policies and the development of this active utility. A feature of a banquet held on this occasion was a menu card on which was charted the combined system load curves for two representative dates in October, 1920 and 1921, showing a gain in peak load on the 1921 date of about 40 per cent. W. S. Wyman, treasurer and general manager of the company, called attention to the fact that notwithstanding the handicap of the worst drought in seventeen years, the company had been able to meet all demands from customers for power service.

Auburn, Cal.—Advantage of the fact that people in this town must call at the post office for their mail was taken recently by the local manager of the Pacific Gas & Electric Company to effect a security sale to a customer. This customer, in talking to the local manager, was not entirely convinced of the desirability of investing in the company's securities. As the regular dividend date was close at hand, the manager requested the prospective investor to return on the date of the dividend. He did this and in company with the manager visited the post office. There he was surprised to see the great number of colored envelopes containing dividend checks, one appearing in nearly every box in the post office. The argument was conclusive. If such a large number of his fellow townsmen thought well of the security, he felt justified in relying on their judgment and at once signed an order for a block of stock. Every community may not have the same opportunity of salesmanship as existed here, yet the idea is the same. The weight of public opinion is strong and its proper presentation should do much to further the sale of such securities.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
of the World

Generators, Motors and Transformers

Motors for Textile Finishing Plants.—WARREN B. LEWIS.—The adaptation of the electric motor to machines for finishing cotton and cotton-and-silk piece goods. A discussion of the amount of steam necessary for boiling and drying operations is given.—*Electric Journal*, November, 1921.

Generation, Transmission and Distribution

Hydraulic Reaction Turbines—D. J. MCCORMACK.—Outline of the advances in hydraulic turbines made in recent years. This contains a discussion on vertical turbines, horizontal turbines and turbine characteristics, giving examples of efficiencies by means of curves. A chart for calculating specific speed is also shown.—*Electric Journal*, December, 1921.

Outdoor Substations. — L. DRIN. — A comparative study of American and European outdoor transformer substations for large and small capacities and high and medium voltages. Among the greatest advantages are mentioned small investment, excellent transparency, simple installation, smaller fire risk and quick inspection. The author urges the widest use of this type of substation for the new French power transmission lines.—*Revue Générale de l'Electricité*, Nov. 19, 1921.

Study on the Power Factor of Electric Systems.—The November issue of the *Siemens Zeitschrift*, containing eighty-four pages with ninety illustrations, is devoted solely to matters pertaining to the power factor of alternating-current systems. The eight individual papers of this issue contain a large amount of valuable information which in itself is not new but is collected and arranged in a handy and compact form, so that this issue represents a complete reference book on the entire subject. It must suffice to mention the titles of the papers: (1) Origin and action of the wattless currents in alternating-current plants; (2) measurments of the wattless current and the power factor: (3) electric meters, taking care of the wattless component; (4) means to improve the power factor of power houses; (5) improving the power factor on the lines of the Siemens works; (6) parallel operation of power plants; (7) an interesting example of power-factor improvement on a large distributing system; (8) bibliography on the subject. The designer of electric machines will find interesting material in the first paper. The instrument builder will appreciate the second and third. The power-house engineer will get many a good suggestion from the remaining articles. To appreciate the work to the fullest extent the reader should be familiar with vector diagrams.—*Siemens Zeitschrift*, November, 1921.

Trunk Lines at 120,000 Volts in France.—PAUL MEYER.—A French national law passed in August, 1920, authorized the ultilization and the full equipment of the vast water powers and coal resources near the northeastern boundary of France, in the regions of the Ardennes, Briey and the Vosges, a stretch of some 250 km., along which a 120,000-volt power distribution line, connecting five power stations, is now nearing completion. Further lines are planned as far north as Lille, from there south to Paris, and in the east to the Rhine. The present paper is a very detailed and elaborately illustrated report on the 120,000-volt double three-phase trunk line. The salient features of this high-voltage line may be summed up as follows: Steel towers—23 m. above ground, 13½ m. from ground to lowest wire; upper part of towers zinc-coated by Schoop process, remainder painted; normal span between towers 225 m. Conductors—aluminum cable with steel core; over-all diameter, 178 mm.; weight per meter, 0.726 kg.; conductivity, 48.8 per cent of copper; joints are made by means of a mechanical clamp similar to the American Dossert terminal but joining the steel and the aluminum separately and independently; a galvanized steel cable of 10 mm. diameter, running above the lines, connects and grounds all towers and acts as static protector. Insulators—chains of seven Hewlett disks with arcing horns on top and bottom; weight of complete chain, 35 kg.; length of chain, 1.35 m.; dry flashover, more than 300 kv. Telephonic communication along this power-distribution line is possible by radio.—*Revue Générale de l'Electricité.* Nov. 19, 1921.

Circle Diagrams for Transmission Systems.—R. D. EVANS and H. K. SELS.—The development of a graphical method for the solution of transmission problems in many and varied forms. A number of diagrams are given showing the methods of determining synchronous-condenser capacity, variation in receiver voltage, effects of voltage compensation, load condition obtained at supply end with various voltage conditions at both ends, and complete diagrams showing the loss and efficiency circles for a constant receiver voltage. — *Electric Journal*, December, 1921.

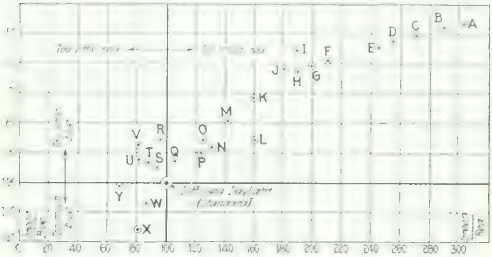
Traction

Changing Railway Substations from 25 to 60 Cycles.—G. C. HECKER.—A description of the changes necessary in the converters, transformers, current and potential transformers, instruments and relays, switchboards, etc.—*Electric Journal*, December, 1921.

Lamps and Lighting

Advances in Lighting Practice in 1921.—Marked advances in the application of lighting equipment to commercial purposes, coupled with a wider recognition of the importance of individual treatment of illumination problems, were emphasized in this report as the chief signs of progress. In seventy-three closely printed pages the year's developments are chronicled succinctly and with breadth of vision. General progress, followed by developments in street lighting, exterior and interior illumination, fixtures, physics and other aspects of the subject of modern lighting, are treated with skill and discrimination.—Report (1921) of progress committee of Illuminating Engineering Society.

Daylight Lamps.—FISCHER.—Assuming diffused daylight as standard, the author describes the many methods known, tried and used, to make artificial electric illuminants as nearly identical with this standard as possible.



COLOR RELATIONS OF VARIOUS LAMPS COMPARED TO DAYLIGHT

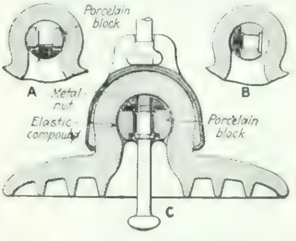
Letter Lamp and Watts per Cp.
A—Gem, 3.5
B—Gem, 2.0
C—Metal-filament, 1.2
D—Metal-filament, 1.0
E—Metal-filament, 0.8
F—Type C, 0.6
G—Type C, 0.5
H—Type C, 0.4
I—Verico
J—Pure carbon arc with opal shade
K—Pure carbon arc without shade
L—Inclosed arc

Letter Lamp and Watts per Cp.
M—Edison "Mazda"
N—Nela "Trutint Sun"
O—"Reinlicht" arc
P—Direct sunlight
Q—Emeralite with daylight attachment
R—L. D. B. K. Ges
S—Nival
T—"Trutint North"
U—"Tageslicht" Company
V—L. D. B. K. Ges.
W—Moore light
X—Blue sky
Y—"Daylight" arc

The additive and the subtractive methods are enumerated and criticised. Of special interest is a target diagram of well-known lamps, arranged in relation to the standard.—*Elektrotechnische Zeitschrift*, Nov. 3, 1921.

Installations, Systems and Appliances

New Type of Suspension Insulator.—It is claimed in this article that the electrical and mechanical shortcomings of other insulators have been overcome by a cap insulator of the "sphere-head" type newly developed by H. Schomburg & Sons. Nearly all troubles with the customary cap-type insulator are caused by the rigid cementing of the metal pin into the porcelain cap. The metal, the cement and the porcelain have different expansion coefficients, resulting sooner or later in cracks, followed by shattering. The new cap has a hollow, spherical head, within which is a movable porcelain block, also of spherical shape. This block is inserted while the porcelain is still soft, and by a special process this block is prevented from baking to the main cap during firing of the porcelain. A suitably formed metal nut is now placed against the underside of this block (see *A* in the diagram), and by turning the two 180 deg. the nut is lodged inside the hollow head of the cap as at *C*. A metal rod may now be screwed into the nut to act as a connecting link to the next chain element. The finished cap may be filled with an elastic compound. The article says that the new insulator has an electric capacity much higher than known types, cutting down considerably uneven voltage distribution on the links of the chain. Hewlett, cap and "sphere-head" insulators compare in capacity as 1:2.1:4.—*Elektrotechnische Zeitschrift*, Nov. 17, 1921.



NO CEMENT IS USED INSIDE HEAD OF INSULATOR

Motor Equipment for Main Drive of Rolling Mills.—A long list including most of the English mills which are electrically driven, containing a description of the kind of mills, the motor horsepower and speed, the kind of electrical energy used and the type of drive. The names of the manufacturers who installed the equipment described are also shown.—London *Electrician*, Nov. 18, 1921.

Telegraphy, Telephony and Signals

Loss Measurements at High Frequencies.—F. TRAUTWEIN.—A differential-zero method is described to measure losses at high frequencies, using a differential transformer, two air condensers and an equalizing rheostat. On the bridge point is connected an exciting coil, and the oscillations of this circuit are generated by an electron tube. The maximum of differential current is obtained when the circuit is in resonance with the exciting frequency. An instrument to read the product of two alternating currents is used as zero indicator. All tests were made with commercial air condensers, which did not permit of high accuracy, but it is intended to repeat the investigation with standard precision air condensers. — *Jarhbuch der Drahtlosen Telegrafie*, October, 1921.

Relation Between the Propagation of Electromagnetic Waves and Conditions of the Atmosphere.—S. WIEDENHOFF.—A number of papers have been published recently on this subject, but all authors agree that sufficient observation material to clear these complex relations has not been gathered. The federal telegraph section of Berlin has therefore authorized the experimental radio station at Strelitz to conduct systematic observations of this kind and to keep an accurate record of them. These results, covering the past year, are tabulated and discussed in this paper. The data are given under two headings, viz., atmospheric disturbances and variations of the receiving intensity.—*Jahrbuch der Drahtlosen Telegrafie*, October, 1921.

Dry-Cell Radio Vacuum Tube.—HARRY M. RYDER.—A description of a new vacuum tube which makes the use of a storage battery unnecessary. The filament requires only 1.1 volt and uses 0.2 amp. continuously, which means a power consumption of less than 0.25 watt as compared with 3 watts to 5 watts in the ordinary tube filament. For this reason it is possible to operate the filament from a single dry cell.—*Electric Journal*, December, 1921.

Miscellaneous

Electricity for the Contractor.—G. GARBOTZ.—This long article describes and illustrates the modern uses of electric power in the building trades and emphasizes the many advantages and the far more economic performance of the electric motor as compared with the coal-fired locomobile. Various kinds of apparatus suitable for electric drive are treated in detail, including cement mixers, power shovels, dredges, reciprocating and centrifugal pumps, air compressors, pile drivers and haulage locomotives.—*Elektrotechnische Zeitschrift*, Nov. 10 and 17, 1921.

News of the Industry

Chronicle of Important Events and General Activities in the
Technical, Commercial and Manufacturing Fields With Announcements and
Reports of Association Meetings and Conventions

Alabama Power Company Starts Work on Mitchell Dam

THE construction of the Mitchell Dam of the Alabama Power Company on the Coosa River, 50 miles southeast of Birmingham, was formally begun, in connection with dedication exercises, on Monday, Dec. 19. This dam, named in honor of James Mitchell, the first president of the company, will be one of the largest in Alabama. The hydro-electric development when complete will have an ultimate capacity of 100,000 hp., while the dam itself is to be 1,115 ft. long and 70 ft. high. The initial equipment will consist of four 24,000-hp. Allis turbines connected to Westinghouse alternators.

Big Ontario Development at Queenston Ready for Operation

BEFORE the year ends the first unit of the mammoth hydro-electric development erected by the Hydro-Electric Power Commission of Ontario at Queenston, on the Niagara Gorge, will begin to generate electricity. The date set for the opening was Wednesday. The 12½-mile canal which will carry the waters of the Niagara from the head of the upper rapids at Chippewa to the power house below the lower rapids was completed this week. Except for the intake, over the design of which there is some question, the hydraulic work for the ultimate capacity of the power house is now finished.

The project, the largest in the Dominion of Canada, was begun in May, 1917. At that time the intention was to develop 200,000 hp.; but before the work was well under way the plans were enlarged so that instead of using 6,500 cu.ft. of water per second, 18,000 cu.ft. of water per second was provided for. This will make available at the waterwheel shafts approximately 500,000 hp.

Built at a time when Canada was at war, the cost of the Chippawa system naturally was high. The original estimate called for $10,000,000; but the project when finally completed will represent an outlay of more than $80,000,000, added to which will be many more millions for transformer houses and equipment, transmission lines and substations. In fact, if the treaty governing the use of water at Niagara is not revised, one of the other power houses at Niagara owned by the Hydro-Electric Power Commission of Ontario will have to shut down in order that sufficient water will be available at Queenston. This will increase the cost of the Queenston development still more and make cheap power at Niagara Falls, Canada, an empty dream.

The engineering unit of the Chippawa-Queenston development is of the same high order which characterizes the other hydro-electric developments on the Niagara frontier. The 60,000-hp. turbines in the power house will operate under a head of more than 300 ft., which is 100 ft. more than is available at the other power houses at Niagara. The Queenston station will use the total fall available on the Niagara River, whereas the other stations utilize only the drop at the falls themselves. Thus, while the older stations obtain 17 hp. for every cubic foot of water per second used, the Queenston station will obtain 25 hp.

West Virginia Registration Law Soon to Take Effect

AFTER Jan. 27 next it will be unlawful to practice in West Virginia as a "registered professional engineer" unless the engineer so practicing is registered under the act passed by the last Legislature. The State Board of Registration for Engineers at Charleston is now ready to receive applications, which will fall under three classes: Form A, for engineers applying for registration without examination; form B, for engineers applying for registration where examination may be required, and form C, for all applicants who are registered in other states.

Indiana Electric Corporation Seeks to Build Large Wabash Plant

SHOULD the Indiana Electric Corporation receive permission from the Public Service Commission to issue approximately $18,500,000 in securities for the purchase of seven public utility plants in Indiana, including that of the Indiana Railways & Light Company at Kokomo, it will proceed at once to construct a large power station in the coal fields on the Wabash River. The construction of this plant is, the corporation says, an integral and essential part of the general plan to purchase and consolidate its constituent properties. It maintains that a new plant must be constructed in the near future to supply the needs of these properties.

The corporation's brief, filed with the commission, contends that the physical property of the seven concerns is worth $18,726,773 and that material and supplies and working cash capital amount to $650,000, making a total valuation of $19,376,773. The earnings for the year ended Oct. 31, 1921, were $1,472,722, according to the brief, while the fixed charges of the new corporation would amount to $943,550 annually, leaving $529,172 for depreciation and common-stock dividends.

The corporation says further that the cost of coal at its projected plant in the coal fields would be reduced from the present cost at Indianapolis of $4.13 per ton to $2.07 per ton, and that the central plant would produce a kilowatt-hour of electrical energy with 2.25 lb. of coal, as compared with the present average consumption of the constituent companies of 4 lb. of coal per kilowatt-hour. In other words, the cost of coal would be cut one-half. These two economies alone, the brief maintains, would result in net savings of approximately $700,000 a year and result in rate reductions to the consumers in the various cities as well as improved and more reliable service.

Fraternal Spirit in Dealing with Utilities Urged by Grange Master

ADDRESSING the annual meeting of the Main State Grange recently, William J. Thompson, the head of that body, said that if the patrons of husbandry want public utilities for their neighbors and servants they must meet them in the fair, fraternal spirit that the order inculcates in all relations. "Farmers," he declared, "above all other people, are in need of public utility service—nearer railroad facilities, electric road accommodation, more and better telephone service, and above all electric lights and power—and yet not a single company has been formed in this state in the past three or four years to do this work. Outside of a few large cities no telephone development is being made, while many farmers are still without any kind of service. Most small villages and farms are without electric lights, and while it is not profitable to extend the lines far into the country, there are many sections that might be developed if there existed the old-time enthusiasm for such work. This depression in public utility work hits the farmer first and hardest, for it is he that must go without.

"The causes," the speaker continued, "no doubt are many, but there is one common cause that we can help to remedy. For the past twenty years the widespread wholesale muckraking criticism of all public utilities has bred a feeling of distrust on the part of the public. If we do not want these utilities, we could not do more to get rid of them than we are doing now. If we do want them as our neighbors and servants, we must learn to meet them in the same fair fraternal spirit that our order teaches we shall extend to all our neighbors."

Utah Supreme Court Upholds Commission in Power Rate Decision

THE Supreme Court of Utah has just handed down a decision sustaining the order of the Public Utilities Commission of Utah involving increased rates for power supplied by the Utah Power & Light Company to its customers in that state. The decision of the Supreme Court is on the appeal of the Utah Copper Company from the commission's award, by review proceedings in the Supreme Court. It was the contention of the copper company that the new rates were confiscatory, and it also questioned the jurisdiction of the commission and the legality of its proceedings in general, both in the "special contract case" and in the granting of the rate increase.

In September, 1919, the commission ordered the holders of special contracts with the Utah Power & Light Company to show why these contracts should not be considered as preferential and discriminatory as against other power users. About three months later the power company applied for a general increase in its power schedules in the State of Utah.

The two cases were heard together, and the first was decided in October, 1920, by which decision the commission ordered the holders of special contracts to be placed on standard schedules, on the same basis as other power customers.

This decision was appealed to the Supreme Court, and last February it was affirmed, the Supreme Court upholding the right of the commission to alter the contracts in question as to rates. The State Supreme Court's findings in this case are now pending before the United States Supreme Court.

In March, 1921, the commission decided the application of the power company for a general increase of its power rates by allowing an increase, which, however, was not so great as that requested by the company.

Four Main Problems in Applying Electricity in Steel Mills

THE application of electric power to the iron and steel industry was the subject discussed by the Western Society of Engineers, Chicago, on Dec. 16. Owing to the unavoidable absence of W. S. Hall, president of the Association of Iron and Steel Electrical Engineers, who was scheduled to speak on this subject, his paper was read by one of his associates from the Illinois Steel Company, C. J. Smith. This paper considered the following four problems of applying electricity to the steel mills: (1) The fuels used for the generation of electric power; (2) differences in frequency; (3) the transmission of this power; (4) synchronizing power demand with waste-fuel supply.

In considering the fuels used for generation of power, Mr. Hall said that coke-oven gas and blast-furnace gas offer the greatest quantity of fuel, but that there soon arrives a limit to the waste fuel available. Therefore waste-heat boilers may be installed which use the heat from open-hearth furnaces. However, since all these sources of heat and fuel may not only be intermittent but have no storage possibility, a high-pressure steam system using coal-fired boilers is often installed in order to provide continuity of service. This study of supplying varying quantities of fuel to varying load demands has been the biggest single question in the steel industry.

Nearly all the old-time plants are equipped with 25-cycle apparatus, while the majority of present installations are at 60 cycles. This presents a problem of considerable importance, but it is recommended that new installations, generally speaking, should be 60 cycles because that frequency is becoming the standard.

The transmission problems in a new large plant should be solved by the use of underground cable, said Mr. Hall. While the cheaper first cost makes the overhead system desirable, each installation must be worked out separately and with future expansion in mind. Voltages can be varied according to the peculiar conditions existing at the mills, but for usual large-motor drive voltages are around 2,200.

The next question considered was the demand and use of power. Since motor drives are replacing many of the engine-driven rolling mills, any delays occasioned by insufficiency of power are very costly. The care and maintenance of these motors should be watched continuously, because of the large quantity of carbon dust in the air, which is not only very destructive but is a good conductor. Moreover, electric furnaces which are large users of energy must have a continuous flow of current or the charge will freeze.

Discussion followed in which Gordon Fox stated that the diversity factor on a group of blast furnaces allows a fairly total uniform flow of gas to the engines. He said that a 600-ton blast furnace could produce on the average enough gas to generate 3,500 kw., and that the usual voltages for direct-current cranes runs about 220-250, while alternating-current wound-rotor motors operate on 220.

Congressmen Want More Speed on Ford's Muscle Shoals Scheme

IT IS understood that certain members of the military affairs committee of the House of Representatives are evincing increasing restlessness as a result of the delays in submitting the Ford proposition to Congress. They point out that six months have passed since Mr. Ford made his offer and that, despite the fact that no other offer which is regarded seriously has been submitted, the matter still hangs fire. Representative Kahn, the chairman of the committee, is understood to have requested members to be patient a little longer as he has assurances from the Secretary of War that that matter soon is to be laid before the committee. Those who think favorably of the Ford proposition are asking why so much time is given to offers that are obviously not entitled to serious consideration.

Another Ruling by New York Appellate Court on Service Charge

THE difference of opinion which the higher courts of New York State are showing in the matter of the legality of a service charge for gas, which has in some instances been construed as a rental charge for the meter—a thing distinctly prohibited by the law—was accentuated this week when the Appellate Division of the Supreme Court for the Second District, sitting at Brooklyn, sustained the finding of the Supreme Court in Nassau County, in an action brought by the Town of North Hempstead against the Public Service Corporation of Long Island, that a service charge is not a rental charge and that the Public Service Commission was within its powers in authorizing the former.

Up the state the Appellate Division for the Third District has by a majority finding of three to two held the service charge permitted the Rochester Gas & Electric Corporation by the commission to be illegal, and the Rochester company is carrying the case to the highest court of the state, the Court of Appeals, for a definitive opinion. These cases, which have been noted in the "Recent Court Decisions" of the ELECTRICAL WORLD for Nov. 4 and Dec. 24, have, of course, an interest for electric light and power companies as well as for gas utilities.

Federal Light & Traction to Increase Its Capital Stock

SHAREHOLDERS of the Federal Light & Traction Company, New York City, which controls electric utilities in seven or eight Western states, are to meet on Jan. 11 to consider a proposed readjustment of the company's finances. The plan is to increase the capital stock from $11,000,000 to $21,000,000, the new issue to be in the form of cumulative first preferred 8 per cent stock having priority over present preferred and redeemable stock at any time, at $110 a share. It is also proposed to amend the certificate of incorporation to permit the issuance of 55,000 shares of no-par-value common stock, to be exchanged share for share for the present common stock.

A modification of the terms of the company's thirty-year first-lien 5 per cent bonds to permit from 5 per cent to not exceeding 7½ per cent interest on all or any part of them, subject to certain provisions and the discretion of the directors, is also contemplated, as is the execution of a general and refunding mortgage to secure bonds, notes or debentures which may be issued from time to time in series bearing interest not exceeding 8 per cent.

Industrial Heating Courses Begin Jan. 4

INTENSIVE courses in industrial electric heating under the auspices of the industrial electric heating and electric furnace division of the National Electric Light Association's Power Sales Bureau of the Commercial Section are scheduled to begin Jan. 4 at Mansfield, Ohio. For several years the central-station industry has felt the need of a more comprehensive knowledge of the development and use of industrial heating equipment and the methods used in the successful promotion of the sale of electricity in competition with other heating agencies in this attractive field. Last spring a three days' convention devoted to this work was held at Boston, under the auspices of the New England Division of the association, and as long ago as 1920 the suggestion was made that factory courses for power engineers of central stations would be most valuable. The Power Sales Bureau of the association has been developing this idea for some time in co-operation with leading manufacturers, and the success of the courses planned depends only upon the extent to which executives of central-station companies turn the facilities offered to account.

The courses are to be conducted by the foremost experts in industrial electric heating in the United States, and the assistance of engineers on the staffs of these experts will also be utilized. The so-called "laboratory method" will be applied, the courses being composed of lectures in conjunction with laboratory and shop work, followed by quizes. The first course will be opened at the Mansfield shops of the Westinghouse Electric & Manufacturing Company, and will extend from Jan. 4 to 21, 1922, the latter part of the course being completed at Pittsburgh, Pa., and Newark, N. J. Courses at the General Electric Company's factories at Schenectady, N. Y., and Pittsfield, Mass., are scheduled to run respectively from Feb. 6 to Feb. 25 and March 6 to 25. Each class is limited to ten men, and the only cost to central-station men for the course is their time, the outlay for their companies being for traveling expenses, board and rooms in addition. Arrangements have been made in connection with the first course whereby board and room can be obtained for the entire course for approximately $100. Those who take the first course are to report to Wirt Scott at 9 a.m. Jan. 4 at the office building of the Westinghouse factory at Mansfield, Ohio, and hotel reservations may be secured through M. K. Armstrong of the Mansfield factory.

The first course will be conducted by Messrs. Scott, Woodson, Tholin, Forshee, Thornton, Armstrong, Hayensworth, Ott, Lynch, Mills, Smalley, Hayden and Craig of the Westinghouse company, and the outline of instruction is as follows:

OUTLINE OF SESSIONS AND SUBJECTS

The combined schedule of lectures, shop practice and classes will cover not only the following subjects but many other types of equipment too numerous to mention here, but which, however, are thoroughly needed in the industries.

Lectures.—History of industrial heating, study of fundamental principles, methods of calculation, review of apparatus now available, methods of application, review of important and interesting applications, commercial and engineering problems involved in connection with industrial heating work, building and factory heating.

High-Temperature Electric Furnaces (for 1,200 to 2,000 deg. Fahr.).—Combustion tube and crucible furnaces, muffle furnaces, crucible furnaces for melting of metals and alloys up to 1,600 deg. Fahr., small heavy-duty furnaces for industrial uses, large heavy-duty furnaces for industrial uses.

Combined Shop and Lecture Course.—Study of each piece of apparatus, details of construction, operating characteristics, reasons for physical dimensions and materials used, methods of application, heat control.

Shop Course.—Industrial ovens, oven heaters and accessories, automatic temperature-control equipment, bread-baking ovens, space and steel-clad heaters, bayonet water heaters, enameling ovens, vitreous enameling furnaces, forging furnace, large solder and babbitt pots, grid heaters for oil, metal-melting pots, core-baking ovens.

Trips to operating installations in several different cities are to be included.

The representatives of the Power Sales Bureau in these courses are V. M. F. Tallman, chairman Charles H. Tenney & Company, 201 Devonshire Street, Boston; A. V. S. Lindsley, Connecticut Light & Power Company, Waterbury, Conn.; R. T. Kaighin, Cleveland Electric Illuminating Company; Wirt S. Scott, Westinghouse Electric & Manufacturing Company, Mansfield, Ohio, and Harold Fulwider, General Electric Company, Schenectady, N. Y. The geographic divisional representatives of the N. E. L. A. are J. F. Schwab, New Orleans Railway & Light Company; W. C. Heston, Portland (Ore.) Railway, Light & Power Company; C. R. Rudy, Colorado Power Company, Denver, and H. E. Kahlert, Minneapolis General Electric Company.

Oklahoma Utilities Association to Meet in March

THE fourth annual convention of the Oklahoma Utilities Association will be held March 14, 15 and 16, 1922, at Oklahoma City. A number of interesting exhibits by electrical and gas manufacturers, jobbers and suppliers will be features of the convention. Prominent speakers connected with public utilities are being engaged. New officers will be elected.

Progressive Party of Nebraska Favors Government Ownership

EARLY this month at a convention at Grand Island, Neb., a "Progressive" party was organized for the avowed purpose of curbing governmental extravagance and reducing taxes. After deciding that the prices of farm products must be such as to cover the cost of production plus a reasonable profit and that wages must be high enough to maintain American standards of living, the platform deals with monopolies, Wall Street, public utilities and legislation in characteristic "non-partisan" fashion. Of the railroad, telegraph and telephone systems the platform has this to say: "Railroads must not be the sole beneficiaries of government guarantees of profits, based on inflated capital, but all carriers, whether of freight, passengers or intelligence, should, like the mails, be operated at cost by governmental agencies, for the benefit of all the people."

Touching public utilities the Progressive party is out and out for state and municipal ownership. Its program of action calls for "the state ownership and operation, by districts, of the unused water power of Nebraska, and the equal right of metropolitan cities with other cities to own and operate an electric light and power plant or other public utility"; and as though that were not enough to kill private initiative and enterprise, competition with private business is also contemplated. The plank dealing with monopolies reads thus: "The encouragement of all co-operative movements to the end of the destruction of profiteering, and where regulation fails to control a private monopoly, then by municipal or state competition similar in principle to the state serum plants and municipal ice and coal yards."

"Natural Steam" Plant Is Proposed at The Geysers in California

PRELIMINARY work is well under way at The Geysers, about 75 miles north of San Francisco, on a project for developing power with the steam which is continually escaping from the earth there. The development proposed would be similar to that at the Larderello installation in Italy, which has been using heat from the earth to operate a steam-turbine plant for a number of years. Advocates of the California project are consulting with the engineers who installed the Italian plant, particularly with reference to the means of eliminating corrosive gases. Preliminary work has included the driving of several wells to determine temperature, pressures and quantities. In the district being explored temperatures ranging up to 350 deg. Fahr. are found in many places at the surface over an area about one-half mile square, and it is believed that these temperatures increase very materially below ground.

The present plan is to install first a small plant developing 300 kw. to 500 kw. with which to supply power for further exploration and construction work. It is proposed then to install a much larger plant, possibly about 20,000 kw. The project is in charge of J. D. Grant, The Geysers, Sonoma County, Cal.

Women Employees to Be Instructed About Utility Business

THE first of a series of four lectures is about to be printed in pamphlet form by the women's committee of the Public Relations Section of the National Electric Light Association and sent to all member companies. By means of these lectures it is expected that the women employees will be called together to learn the fundamentals of the electric light and power business. The first lecture will explain the terms of the business, point out briefly the value of good public relations and explain why women employees should take an interest in the affairs of the companies that employ them.

Subsequent lectures will explain what the various departments of the business are doing so that a complete account will be available.

Electrochemists Prepare for Spring Meeting

THE spring meeting of the American Electrochemical Society is to be held in Baltimore, April 27, 28 and 29, 1922. There will be three sessions, dealing respectively with electric furnace cast iron, the electrochemical industries and electromotive chemistry. Inspection trips through industrial plants near Baltimore will be made.

Colonel Byllesby Thinks that "Worst of Storm" Is Over

THAT the worst of the storm is over and that the electrical industry is facing unprecedented activity in the construction of new generating stations and distributing equipment of all kinds during the next few years was the declaration made by Col. H. M. Byllesby in an address before the Electric Club of Chicago on Tuesday. Although the financial strain is passing and men have faced their losses, and while from now on there will be a distinct and increasing improvement, Colonel Byllesby pointed out that there would be no sudden jump from one extreme of depression to the other of great prosperity. He asserted that it would be a slow, steady and certain growth, with a tremendous demand for electrical service of all kinds as fast as it can be provided. He said that there never was a time when generating, transmission and distribution equipment were so overloaded and that this condition will entail an average annual expenditure of half a billion dollars or more for years to come. He predicted that a large part of the financing would be done through the sale of securities to customers and cited the growth of this form of financing from a beginning on the Byllesby properties in 1915 of $196,000 to $9,881,000 in 1921 as an evidence of the rapid growth of the movement.

To Work Up Electrical Construction Rules for Michigan

UNDER an order issued recently by the Michigan Public Utilities Commission a committee has been appointed to recommend electrical construction rules and regulations for that body. Up to the present time the Michigan commission has had no standard of electrical construction. While it is not expected that very many power lines will have to be reconstructed to meet the new requirements, there are other wire lines which assuredly will have to be changed.

Hartford Company Will Change New Rate After Year If People Wish

THE new combination rate for domestic consumers announced by the Hartford Electric Light Company to take effect on Jan. 1, which calls for a combination flat rate and meter flat rate, 5 cents a month for 100 ft. of floor area, plus 6 cents a kilowatt-hour (ELECTRICAL WORLD, Dec. 3, page 1139), will not be persisted in should it prove unpopular after a year's trial, but will be annulled and a return to the old 10-cent rate or, if conditions warrant, to a rate lower than 10 cents will be made. This promise, predicated on the desire of the company to conduct its business as far as possible in conformity with its customers' wishes, has been made by Samuel Ferguson, vice-president of the company, in a letter to Hartford newspapers. Mr. Ferguson says:

> The change involves a decrease in our revenue of approximately $100,000, and it is only our confidence that the new rate will correspondingly stimulate our sales that justifies this reduction, as prices of coal and labor have not yet fallen sufficiently to affect our costs materially.
>
> The new rate is fair to all and will reduce the bills of all customers in the months where an average use or more is made of the facilities which we furnish. There will, of course, be an increase of rate in any case or in any month where the use made of our facilities is abnormally low, as in some cases would occur in the summer.
>
> While we believe that the new rate is fair, logical and for the best interest of all, we realize that it is new in Hartford, and if for that reason it proves to be unpopular, it is valueless, as "good will" is our most valuable asset. We, therefore, make the following specific agreement:
>
> "If after one year's fair trial of this combination rate, it should for any reason prove unpopular, and our customers desire us to change, we will return either to the present 10-cent rate, or, if conditions warrant, to such lower rate than 10 cents as our costs at that time justify."

Electricity May Replace Gas on Buffalo Streets

RECOMMENDATIONS for the dismantling of most of the 8,238 gas lamps now in use on the streets of Buffalo and the substitution therefor of electric lamps are expected from the local committee which is to study this question. This committee, which is to be appointed by the Board of Commissioners and Supervisors, is to be headed by George Wild.

War Department Using A. E. S. C. Standards

THE Secretary of War has directed that "the supply branches of the army utilize in connection with their specifications the standards that have been or may be adopted by the American Engineering Standards Committee." This action, according to Col. George S. Gibbs, who recently addressed the American Mining Congress on "Standardization and National Defense," is part of a general policy of the War Department to co-ordinate its whole supply system with the best commercial practice and to support a national program of engineering and industrial standardization.

"It requires no imagination," said Colonel Gibbs, "to see how tremendously both the business and military interests of the War Department can be assisted by standardization. All the agencies described are keenly alive to it, and it may be safely predicted that business firms dealing with the War Department will find a steady and gratifying improvement in the clearness and simplicity of its requirements. The principle of standardization is likewise being extended to its business methods—particularly to forms of contracts."

Portland (Ore.) Contractor-Dealers Entertain Architects

A MOVEMENT to bring about closer co-operation and more friendly relations between the contractor-dealers and architects of Portland, Ore., was launched recently when the Portland members of the Oregon Association of Electrical Contractor-Dealers entertained as their guests at a banquet the members of the Oregon Chapter of the American Institute of Architects. J. H. Shroufe, president of the Oregon association, explained the purpose of the meeting, and Stephen I. Miller, Jr., manager-secretary of the Northwest Electrical Service League, discussed the fundamentals and theory of business economics. Both these speakers told of the co-operative work of the league. The other speakers were Frank Branch Riley, W. G. Purcell, president of the Oregon Chapter, American Institute of Architects; O. B. Coldwell, vice-president of the Portland Railway, Light & Power Company, and A. E. McCoy, chairman of the first district, Oregon Association of Electrical Contractors and Dealers.

The program of the evening was concluded by the presentation of a paper on "Light and Illumination" by F. H. Murphy, illuminating engineer of the Portland Railway, Light & Power Company.

New Electrical Export Classification

BEGINNING Jan. 1, electrical exports will be classified under approximately fifty-eight headings instead of nineteen as now. The present classification was not sufficiently definite to be of the value desired. A committee was organized by the Electrical Manufacturers' Council to confer with the Bureau of Foreign and Domestic Commerce under the chairmanship of Joseph McElroy, 3d. As a result of this conference, which took place earlier in the month, the accompanying detailed classification is placed before the industry for its use. The committee is preparing for the use of clerks in the various custom houses a list of standard electrical terms with additional information to indicate which class they come under for government purposes.

CLASSIFICATION FOR ELECTRICAL EXPORTS

Class No.	Commodity	Unit of Quantity
5292	Electrical glassware, except for lighting	Lb.
5314	Electrical porcelain	Lb.
5461	Carbons for electric lighting, electrodes and batteries	Lb.
6088	Insulated wire and cable (iron and steel)	Lb.
6309	Other manufactures of aluminum	Lb.
6425	Copper wire (bare)	Lb.
6426	Insulated copper wire and cable	Lb.
	Generators:	
	Direct current—	
7101	Under 500 kw.	No.
7102	500 kw. and over	No.
	Alternating current—	
7105	Under 2,000 kw.	No.
7106	2,000 kw. and over	No.
7109	Accessories and parts for generators	Lb.
7115	Self-contained lighting outfits	No.
	Batteries—	
7116	Primary—dry	No.
7117	Primary—wet	No.
7118	Storage	No.
	Transforming or converting apparatus:	
7121	Power transformers	No.
7124	Other transformers	No.
7125	Rectifiers	No.
7129	Condensers, double current and motor generators, dynamotors, synchronous and other converters.	No.
	Transmission and distribution apparatus:	
7131	Switchboards and panel boards, except telephone	No.
7133	Switches and circuit breakers	No.
7134	Fuses and fuse plugs	No.
7136	Watt-hour and other measuring meters	No.
7138	Volt, watt and ampere meters, and other recording, indicating and testing apparatus	No.
7139	Lightning arresters, choke coils, reactors and other protective devices	No.
	Motors, starters and controllers:	
7140	Motors, under 1 hp	No.
	Stationary motors—	
7141	1 to 200 hp	No.
7142	Over 200 hp	No.
7143	Railway motors	No.
	Electric locomotives—	
7144	Railway	No.
7145	Mining and industrial	No.
7146	Other motors	No.
7148	Rheostats, controllers and other starting and controlling equipment	Lb.
7155	Accessories and parts for motors	Lb.
	Electric appliances:	
7161	Electric fans	No.
	Electric lamps—	
7162	Arc	No.
	Incandescent—	
7163	Carbon filament	No
7164	Metal filament	No.
7165	Other electric lamps	No.
7166	Flashlights	No.
7167	Searchlights and projectors	No.
7170	Motor-driven household devices	No.
7172	Domestic heating and cooking devices	No
7175	Industrial electric furnaces and ovens	No
7178	Therapeutic apparatus, X-ray machines, galvanic and faradic batteries, etc.	No.
	Signal and communication devices:	
7181	Radio and wireless apparatus	Lb.
7182	Telegraph apparatus	Lb.
7184	Telephone apparatus, including telephone switchboards	Lb.
7185	Police, fire and burglar alarm apparatus	Lb.
7186	Railway signals, switches and attachments	Lb.
7189	Bells, buzzers and annunciators	No.
	Other electric apparatus:	
7190	Spark plugs, magnetos and other ignition apparatus	Lb.
7193	Insulating material *See glassware, 5292, and porcelain, 5314.*	Lb.
7194	Metal conduit, outlet and switch boxes	Lb
7196	Sockets, outlets and receptacles	No.
7198	Other wiring supplies and fixtures	Lb
7199	Other electrical apparatus not elsewhere specified	Lb.

Proposed Tariff on Fuel Oil Would Cost Electrical Industry $3,275,000

EFFORTS being made on the part of oil interests to have the Senate finance committee include an import duty of 25 cents a barrel on fuel oil and 35 cents a barrel on crude oils in the tariff bill will naturally meet with opposition in the electric light and power field. A number of companies on the Pacific Coast, in the Southwest and along the Atlantic seaboard are now burning fuel oil, and should the proposed rate go through it would necessarily mean an increased rate for electrical energy at the time when the public demand is for lower rates on everything.

With the Narragansett Electric Light & Power Company of Providence, for instance, the proposed rates would mean an added cost of almost $250,000 annually. In the case of this company, it has been stated, it would mean probably a 10 per cent increase in power rates. This company uses 900,000 barrels of fuel oil a year.

The electric light and power industry, according to the latest report of the United States Geological Survey, uses 13,100,000 barrels of fuel oil annually, and at 25 cents per barrel this would mean an addition of $3,275,000 to the operating costs of central electric light and power plants.

Providence Company Going After Off-Peak Load

THE Narragansett Electric Company and the Bristol County Gas & Electric Company, Providence, R. I., have filed with the Rhode Island Public Utilities Commission new contract riders designed to encourage off-peak use of energy without increase in the service charge.

The contract riders, made a part of present tariffs to become effective Feb. 1, provide that customers may increase the rate of taking electricity during the period from 6 p.m. to 6:30 a.m., not to exceed a certain specified number of kilowatts agreed upon, without an increase in the service charge. Additional lines, service connections and equipment may be installed by the payment of 15 per cent of the cost, annually, by the customer.

Twin Cities Fail to Agree on Mississippi River Development

JOINT tri-party control of the high-bridge hydro-electric development on the Mississippi River by the cities of Minneapolis and St. Paul and the University of Minnesota is, for the present at least, defeated. The Northern States Power Company first made application to the Federal Power Commission for the right to develop this project, and later an application was made in the names of the two cities and the university.

The Municipal Electric Corporation was formed, and one of the clauses under its bylaws requires that all votes be unanimous. At a recent meeting Mayor Bodgson of St. Paul declined to vote for the resolution of the corporation renewing its application for a lease to develop the project.

Another meeting of the corporation is called for Jan. 4, when the matter will again be brought up. Minneapolis representatives, it is understood, are most eager to push this matter. The projected development would have a capacity of 16,000 hp.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

California Commission to Investigate Standards of Construction of Overhead Lines.—The California Railroad Commission will on Jan. 16 begin an investigation into standards of construction of overhead electric lines. The investigation will cover all electric, telephone, telegraph and railroad utilities and all others, including municipalities operating power or signal lines.

Electric Welding in Making Ship's Boilers.—What the *Engineer* of London terms a very fine example of electric welding is advertised in a shipping journal of recent date. It is a marine return-tube boiler, 15 ft. 6 in. in diameter, of which the end plates and shells were welded together by the Kjellberg process without the use of any rivets. With the exception of the front and back attachments of the furnaces, all the joints of the combustion chambers were also welded, no rivets being employed. The boiler, it is said, was absolutely tight at the first test to 360 lb. per square inch without any touching up whatever being required and has since then been steamed for a period of nine months without showing the slightest sign of leakage.

Village Moves, but Electrical Service Follows It.—Because of flood prevention work in the Miami conservancy district, the village of Osborne, Ohio, was recently compelled to move to a new site some miles away from the former location, and the Dayton Power & Light Company, finding that its right-of-way, poles, lines and distribution plant were in the path of the flood prevention work and must be removed, applied to the Ohio Public Utilities Commission for permission to abandon its service to the village. The commission doubting its jurisdiction in the matter, the company finally withdrew its application, and it is understood that it will manage to furnish power to consumers at the old site as long as any remain there, and that arrangements will be made to supply consumers in the village at its new site.

New South Wales' Hydro-Electric Plans.—A report by the chief electrical engineer of the Department of Public Works of New South Wales is summarized in a late issue of the London *Electrical Times*. It deals with projected hydro-electric developments of an ambitious nature as well as with smaller developments already under way. Among the latter are two systems—the Barren Jack and the Nymboida—which are prepared to supply the surrounding districts, a maximum demand of about 6,250 kw. being reported in existence in the territory of the former and likely to increase rapidly, and a much less demand, but one also likely to grow, in the territory of the latter. Snowy River, capable of affording 150,000 kw. when finally exploited; Clarence River, affording probably 60,000 kw.; Murray River, promising a maximum of 15,000 kw., and a plan, known as the Gorge scheme, for vastly enlarging the Nymboida development, figure in the more speculative part of the report. The unregulated flow of the Snowy River, it is said, without dams being built, would generate 24,000 kw. continuously. As yet, however, the market which would justify exploitation of New South Wales' water powers on the great scale suggested is not clearly in evidence.

Expansion of Alabama Hydro-Electric Plants.—The Houston Power Company of Newton, Ala., will, one of its officials is quoted as saying, expend $300,000 in expanding its hydro-electric system, developing 3,000 hp. for industrial service in Ozark, Newton, Hartford and Slocumb, Ala., and Graceville and Chipley, Fla. The work is to be done by the company's own forces.

Radio Telephone Installed on Coast Guard Motorboat.—Through the use of radio apparatus demonstrated by the radio section of the Bureau of Standards of the Department of Commerce the lifeboats of the United States Coast Guard will be able in the future to talk to land stations of the Coast Guard even when out at sea in heavy storms or fog. During the recent annual meeting of Coast Guard officials at Atlantic City, N. J., one of the 36-ft. motor-driven surf boats that are used for rescue work was sent five miles off shore, and it was demonstrated that men in the boat could easily converse back and forth with the shore station over the radio telephone which had been installed in the boat. Not only could the men on shore hear the speaker over the telephone but they could hear the boats whistle and an airplane flying over the boat. The novel feature of this installation was the use of a special type of coil antenna instead of the ordinary elevated antenna, which cannot be used on a surf boat because of the severe weather conditions to which the boat is exposed and also because all space above the deck must be kept clear for the throwing of lines.

Redding, Cal., to Pay $57,000 for Distribution System.—The sum of $57,352.68 has been fixed by the California Railroad Commission as compensation to be paid by the city of Redding for the electric distribution system which the city is taking over in condemnation proceedings. On March 14, 1921, the commission fixed compensation at $52,708.99, including severance damage. On Oct. 28, 1921, the Superior Court of Shasta County decreed that the city of Redding should acquire the property at the compensation originally fixed by the Railroad Commission subject to modification on account of additions and betterments and depreciation subsequently occurring. It was stipulated between the city and the company that the net value of the additions and betterments, after making allowance for abandoned property and removal, was $13,416.62. Depreciation was determined by the commission to amount to $8,772.93, leaving a net increase of $4,643.69. The company contended for a depreciation of only $3,762.82 and also claimed an allowance of $1,897.96 for appreciation of plant by reason of increased market prices and $1,589.01 as additional severance construction cost. The commission disallowed these claims.

Wireless Telephony Between Paris and London.—In connection with a news service by wireless telephone from the Eiffel Tower in Paris, which is to disburse financial and political news from all over the world to banks and newspapers, it is announced that arrangements may soon be made for radio-telephonic service between Paris and London, so that any Paris subscriber can talk with a person in London by way of the Eiffel Tower.

The World's Great Waterfalls as Potential Sources of Energy.—In a lecture at Faraday House, London, by Theodore Stevens, who has personally inspected all of the world's greatest water-power sources, attention has been again directed to the magnitude of Niagara's two rivals—the Victoria Falls, on the Zambesi, South Africa, and the Falls of Yguazu, in Brazil, on the Argentinian border. Despite the fact that Yguazu has a 10,000 ft. spillway, or more than twice that of the two falls of Niagara, and that it has a drop of 210 ft. and Victoria one of 400 ft. against Niagara's maximum of 167 ft., the great watershed of the North American cataract, which drains a quarter of a million square miles, or two and a half times the area of the British Isles, will, the lecturer agreed with other authorities, maintain for it always the first place as regards total potential horsepower. Moreover, both the Yguazu and the Victoria Falls are in tropical countries, and consequently the power available from either differs widely at different seasons of the year, maximum power not necessarily coinciding with greatest flow. Mr. Stevens, as reported in the *Electrical Times*, is in accord with other investigators in seeing no near prospect of development for either the South American or the South African falls on account of their great distance from the centers of population.

More New England N. E. L. A. Chairmen Appointed.—In addition to those previously announced, the following chairmen have been appointed to New England Division, N. E. L. A., committees for 1921-2: Taxation (a new committee), Bowen Tufts, Boston (members, H. I. Harriman, Boston, and R. W. Rollins, Worcester); purchasing agents, H. L. Ogden, Boston; customer ownership securities, William Gould, Boston. In the Commercial Sections the following bureau chairmen have been named: Contact, W. F. Abely, Boston; electric vehicles, A. D. Putnam, Worcester; lighting, J. Daniels, Boston; merchandising, A. H. Allcott, Providence; power, F. S. Root, Fall River; rates, A. E. Pope, Boston; wiring, R. S. Hale, Boston. In the Technical Section these members have been appointed to head bureaus: Prime movers, R. E. Dillon, Boston; electrical apparatus, F. L. Hunt, Greenfield, Mass.; hydro-electric power, J. P. Mahoney, Shelburne Falls, Mass.; meters, C. H. Ingalls, Boston; inductive interference, W. B. Hopkins, Boston; underground construction, C. M. Yale, Hartford; overhead construction, W. P. Schwabe, Thompsonville, Conn.; safety rules, W. H. Blood, Jr., Boston. As a result of the attendance by H. M. Parsons, Palmer, Mass., at the recent Chicago meeting of the national rural lines committee, it is probable that a divisional committee on this subject will be formed in New England.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies

Protection of Customers Against Unjust Rates.—Declaring that the practical way to protect the rights of both the customers and the utility company in the case of a contested increase of rates is to permit the rate complained of to be charged pending final decision by the commission, subject to refund with interest if the ruling be against the company, the New York Supreme Court refused, in Village of Peekskill vs. Peekskill Lighting & Railroad Company, to issue an injunction against the enforcement of rates scheduled by the utility company and ordered the procedure just indicated to be taken.

Voluntary Reduction of Rates Below Those Named in Contract Does Not Amend Original Terms.—The Appalachian Power Company did not, according to a decision of the Virginia Supreme Court of Appeals, amend its contract with the town of Pulaski (against which it has brought suit) by agreeing with the municipal authorities ten years ago to reduce its rates below those named in the contract, and the company had therefore the right to restore its rates to the figures originally named. This decision is based on the fact that a public utility company may reduce its rates without the consent of the town, and that a resolution of the municipality ratifying such a reduction did not bring about an amendment of the franchise, which could only be accomplished with the consent of both the municipality and the company. (108 S. E. 885.)*

When Facts Are Admitted Contributory Negligence Becomes a Matter of Law.—A boy who climbed to the upper chord of a bridge to get a bird's nest reached above his head and grasped a sagging electric wire attached to short posts extending from the chord. The boy was instantly killed and suit for damages was brought (Austin vs. Public Service Company of Northern Illinois). The Supreme Court of Illinois has found that the trial court erred in refusing to direct a verdict for the company, because while generally the question of negligence or contributory negligence is for the jury, when the facts are admitted the question becomes one of law for the court. In the case at issue, the Supreme Court held, the question of defendant's negligence in the maintenance and operation of the line was for the jury, but the boy was not, as a matter of law, exercising ordinary care for his own safety, and his own negligence was the proximate cause of his death. In the first trial of this suit the judge did direct a verdict in favor of the company, but the Appellate Court reversed him and remanded the case with instructions to submit the issues of fact to a jury. The second trial resulted as already indicated, and now finally the Supreme Court, while holding that the question of the company's negligence was properly submitted to the jury, determines that none the less the trial judge should have ordered a verdict for the defendant on the ground stated. (132 N. E. 458.)

Constitutional Rights of Commission and Legislature Affecting Regulation of Electrical Construction.—The Supreme Court of Arizona has set aside the finding of the inferior court which in State vs. Pacific Gas & Electric Company convicted the company of violating certain statutes regulating the erection and maintenance of electric poles, wires, cables and appliances. The Supreme Court holds that the existance of a constitutional article vesting power in the Corporation Commission of the state to regulate the matters stated would not have deprived the Legislature of the power to pass a law relating thereto if the Corporation Commission had not exercised the power vested in it; but since the commission had issued an order exercising its functions, an act subsequently passed by the Legislature relating to the same subject matter was void. (201 Pac. 632.)

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities

Reward for Efficient Management.—In granting an increase of rates to a telephone company, the Ohio Public Utilities Commission based its action partly on the excellent service it found to have been rendered by the applicant. The commission said: "It is our judgment that honest, economical and efficient administration of the affairs of a public utility should be commended by all and should be considered in deciding the amount of a fair rate of return upon the company's property, since to hold otherwise would be to penalize economical, efficient and honest management and encourage extravagance and lax methods in the management thereof."

What Constitutes a Public Utility?—Notwithstanding the fact that the Supreme Court of Idaho recently upheld the lower court in its finding that the Natatorium Company of Boise, which furnishes hot water for heating and domestic purposes, is not a public utility subject to commission control, the Public Utilities Commission of the state, which had brought suit against the company because of the refusal of the latter to submit to such control, and before which hearings were resumed after the injunction originally issued had been dissolved, has again declared that the company is a public utility. The Supreme Court's decision was based upon a stipulation of facts, and in its latest decision the commission asserts that different and additional facts were before it, and that the judgment of the court was not binding upon it.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

Indiana Public Utility Association.—The annual meeting of this association will be held at the Indiana University, Bloomington, Ind., on Jan. 14, when the members of the association will be guests of the School of Commerce and Finance.

Providence Section, A. I. E. E.—"Hydro-Electric Development for the Belgian Congo" will be the subject of an address by William Frank Uhl before the Providence Section, A. I. E. F., and the Power Section of the Providence Engineering Society on Tuesday, Jan. 3, at 8 p. m.

Engineers' Club of Seattle.—On Jan. 1 this club will take possession of the quarters at Fifth and Seneca Streets formerly occupied by the Gollege Club. This building is well fitted up for club purposes with dining, lounging, card and billiard rooms, library and kitchen, besides twenty-two furnished rooms with shower baths on the second floor. An excellent schedule of entertainment and instruction has been arranged by the program committee for the winter months. J. Thomas Dovey is president and Lyman T. Banks secretary of the club.

Section Meetings of A. I. and S. E. E.—January meetings of the Iron and Steel association are scheduled as follows: Jan. 7, Philadelphia, "Relation of the Engineer to Present Industrial Activities," speaker to be announced later; Jan. 14, Cleveland, annual "get together" meeting and dance; Jan. 21, Pittsburgh, safety-switch exposition; Jan. 27, Chicago, "The Synchronous Motor," by Rae W. Davis, Allis-Chalmers Manufacturing Company; Jan. 28, Birmingham, "Value of Blast-Furnace Gases," by F. G. Cutler, Tennessee Coal & Iron Railroad.

Coming Meetings of Electrical and Other Technical Societies

A. I. E. E. Section Meetings—Providence, Jan. 3; Lehigh Valley, Jan. 12; Baltimore, Jan. [illegible]; New York, Jan. [illegible]; Salt Lake City, Jan. 27.

Massachusetts State Association of Electrical Contractors and Dealers—Springfield, Jan. 5.

American Engineering Council—Washington, Jan. 4-6.

A. I. and S. E. E. Section Meetings—Philadelphia, Jan. 7; Cleveland, Jan. 14; Pittsburgh, Jan. 21; Chicago, Jan. 27; Birmingham, Jan. 28.

Indiana Public Utility Association—Bloomington, Ind., Jan. 14.

Western Association of Electrical Inspectors—Chicago, Jan. 17-19. (For program see issue of Dec. 17, p. 1243.)

American Society of Civil Engineers—New York, Jan. 18-19

Association of Municipal Electrical Utilities of Ontario—Toronto, Jan. 26-27.

Lighting Fixture Dealers Society of America—Milwaukee, [illegible] Feb. [illegible]

New Mexico Electrical Association—Albuquerque, Feb. 13-14.

Pennsylvania State Association of Electrical Contractors and Dealers—Allentown, Feb. 15.

American Institute of Electrical Engineers Midwinter Convention—New York City, Feb. 15-17.

National Meter Committee, N. E. L. A.—Springfield, Ill., Feb. 15.

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*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel—Responsibilities and Association Appointments of Men Engaged in Professional, Executive, Operating and Commercial Branches of the Industry

Horace P. Liversidge, assistant chief engineer of the Philadelphia Electric Company, was elected a manager of the American Society of Mechanical Engineers at its recent convention in New York City. Mr. Liversidge was born in Norristown, Pa., in 1878, and graduated from the Drexel Institute in 1897. Immediately upon graduation he became connected with the Edison Electric Light Company of Philadelphia, which at a later date was merged with the Philadelphia Electric Company. Mr. Liversidge has continued his association with these companies up to the present time, his services being confined almost entirely to various branches of the engineering department.

H. P. LIVERSIDGE

During this period Mr. Liversidge served principally as assistant superintendent of operations and assistant superintendent of station design, operating engineer in charge of all plants, and finally as assistant chief engineer, which position he now holds. For a number of years Mr. Liversidge has been active in various engineering societies. He served as chairman of the Philadelphia Section of the American Institute of Electrical Engineers in 1916-17 and as chairman of the Philadelphia Section of the American Society of Mechanical Engineers during the past year. He has been a member of a number of national engineering committees and is at present chairman of the committee on steam turbines and generators of the Association of Edison Illuminating Companies, having served in this capacity since 1917. He has also acted as vice-chairman of the prime movers committee, National Electric Light Association, and as chairman of the sub-committee on turbines and chairman of the power station committee of the American Institute of Electrical Engineers.

Dr. E. P. Hyde, who is the new president of the International Commission on Illumination, which met lately in Paris, is director of research and in executive charge of the Nela Research Laboratories of the National Electric Lamp Works at Cleveland, Ohio. Dr. Hyde organized the Nela Research Laboratory in 1908 and has been responsible for a great amount of original investigation in illumination and subjects related thereto, which has gained for him world-wide renown. Dr. Hyde is a graduate of Johns Hopkins University, from which he also obtained his Ph.D. degree in 1904. For eight years thereafter he was connected with the National Bureau of Standards at Washington, devoting much of his attention to the photometry of incandescent lamps and supervising the design and installation of the bureau's new photometric laboratory. In 1905 he visited a number of European laboratories on behalf of the bureau to investigate photometric methods abroad, but in 1908 he resigned as associate physicist of the bureau in order to take charge of the new physics laboratory of the associated lamp interests at Cleveland. Dr. Hyde is a charter member of the Illuminating Engineering Society and served a term as president of the society in 1910.

Walter W. Austin, the newly elected president of the Kansas Public Service Association, is a native of Matfield Green, Kan., and was educated in the public schools of Emporia and graduated from the Kansas State Normal School. As city and county superintendent he served in the public school field for ten years, until in 1907 he purchased an interest in the properties of the Home Light & Power Company, operating at Cottonwood Falls and Strong City, Kan. He afterward acquired the entire properties, which he now owns and operates. He has served for five years as secretary-treasurer of the Kansas Public Service Association and was elected its president at the recent meeting at Hutchinson. Mr. Austin has been interested in political affairs and was the Democratic candidate for Congress from the Fourth District of Kansas in 1921.

W. W. AUSTIN

Robert Davy, the chairman of the security holders' records committee of the National Electric Light Association, is of English parentage and, though born in this country, he spent his early boyhood in England, his education being acquired partly in London and partly in Vermont and augmented by home study. Mr. Davy entered the accounting department of the General Electric Company at Schenectady in 1900 and remained there until 1905, when he went to Jackson, Mich., to accept the position of auditor for the Commonwealth Power Company. W. A. Foote was president of the Commonwealth Power Company at this time and also of the Grand Rapids & Muskegon Power Company, of which Mr. Davy was made auditor in 1906. In 1915 the Consumers' Power Company had taken over the active operations of the Commonwealth Power Company, Grand Rapids & Muskegon Power Company and other concerns, and Mr. Davy was made assistant secretary, a few years later becoming secretary in charge of accounting operations. His term of service with the Consumers' Power Company and companies preceding it extends from January, 1905, to the present time, or about seventeen years. He was elected to the chairmanship of the security holders' records committee of the N. E. L. A. at the annual convention held in Chicago in May of this year.

ROBERT DAVY

George Lee Hoadley is now head of the department of electricity in the School of Engineering, Milwaukee, Wis. Until last fall he was engaged in teaching in Washington State College at Pullman, Wash.

F. T. Wright, who recently resigned his position as assistant chief mechanical engineer of the Royal Siamese State Railways, has been appointed chief electrical engineer of the Bombay, Baroda & Central India Railway Company, with headquarters at Bombay. It is proposed to electrify the Bombay suburban line.

Daniel Fitts, for the last twelve years head of the electrical department of the H. W. Johns-Manville Company, Boston, has resigned to go into business as a member of Fitts-Morse, Inc., manufacturers' agents, at 161 Summer Street, in that city. Mr. Fitts is widely known throughout the electrical trade in New England. He is a native of Haverhill, Mass., and was graduated from Williams College in 1900. For two years he was employed in the traffic department of the American Telephone & Telegraph Company at New York City, and then went to Lowell, Mass., where he served for two years in the maintenance department of the then existent Boston & Northern Street Railway. In 1904 he was transferred to the purchasing department of the company at Boston, and in 1909 he was placed in charge of electrical sales at the New England headquarters of the Johns-Manville company. He is a member of the National Electric Light Association and of the New England Street Railway Club.

DANIEL FITTS

C. L. Hancock has been appointed sales engineer in the trolley-wire department of the Bridgeport Brass Company. He has been connected with the sales department of the Bridgeport Brass Company for the past two years, recently having had charge of the company's factory branch in Philadelphia. Mr. Hancock has had considerable experience in railroad electrification work with the Westinghouse Electric & Manufacturing Company and with the New York, New Haven & Hartford Railroad.

Robert E. Rae, who has been connected with the electrical industry for many years, has taken charge of the new New York office of the Connecticut Electric Manufacturing Company, Bridgeport, Conn. The office is at 33 West Forty-second Street. Mr. Rae entered the service of the Western Electric Company in 1897 and devoted his attention particularly to shipping service and to making special stock studies. In this work he has been associated at various times with a number of the Western Electric branches. In 1908 he was placed in charge of the local house for sales and service in New York City and in 1910 opened and managed the Buffalo house. Later the same year he left the Western Electric Company to join the organization of Stanley & Patterson, New York City, as sales manager. In 1915 he went to the Columbia Graphophone Company as assistant to the general sales manager. In March, 1921, he returned to the electrical industry as general manager of the Northwestern Electric Equipment Company, New York City. In July he resigned to enter business on his own account.

A. D. Keene, formerly electric furnace engineer with the General Electric Company at its Schenectady works, has become connected with the Pittsburgh Electric Furnace Corporation as engineer of electric furnace design and application in the steel and metal industries. He has had a number of years of practical experience in designing electric furnaces and ovens for various industrial applications. His appointment with the Pittsburgh corporation is preliminary to a broadening out of the line of furnaces made by the company, which has heretofore been confined to melting and refining furnaces for steel, iron and brass, bronze and celluloid.

H. M. McFarland has joined the sales force of the Simplex Wire & Cable Company as a sales engineer for the mining districts with headquarters at the Boston office of the company. Mr. McFarland is a graduate of Ohio State University, class of 1902, with the degree of engineer of mines. After his graduation from college he was engaged in railroad construction work for two years. Following this he spent fifteen years in coal and metal mining, nine years of that period in engineering practice and six years operating. In 1914 he joined the Jeffrey Manufacturing Company as a sales engineer and some time later opened his own office. In the last two years Mr. McFarland has been engaged in geological researches and in the management of oil-producing properties.

Harold E. Morse, who is associated with Daniel Fitts in the new Boston distributing house of Fitts-Morse, Inc., has traveled extensively in the New England electrical trade. He was born at Boston in 1886 and, after attending the local schools and Mechanics Arts High School, learned the trade of machinist at one of the Goodyear shoe plants. In 1905 he entered the Boston offices of the H. W. Johns-Manville Company as an office boy and after a year of inside work was transferred to the road. He has since been exclusively occupied in selling electrical supplies for this house and brings to his new field an unusually wide acquaintance with the territory of the New England States.

H. E. MORSE

Obituary

Gustaf Akerlund of the engineering firm of Akerlund & Semmes, New York City, died on Saturday, Dec. 10, after a lingering illness. Mr. Akerlund was born in Boras, Sweden, in 1879. He was graduated from the Boras Institute of Technology and later studied in Germany. He came to the United States about eighteen years ago. He was a member of the American Society of Mechanical Engineers.

Gustavus O. Newman, chief engineer of the San Joaquin Light & Power Company and of the Midland Counties Public Service Corporation, died on Dec. 6 at his home in Los Angeles, Cal. Mr. Newman was born in Sweden in 1844, was graduated from Carolina University, Orebro, Sweden, and then filled an engineering post on the Swedish Government Railroad. Arriving in America in 1868, his first engineering problem was the construction of a Kansas City bridge. Later he was in charge of several intricate engineering surveys. In 1881 he entered the service of the United States Geological Survey, and he was later construction engineer for the Atlantic & Pacific, South Pacific and Central Pacific railroads. In 1897 Mr. Newman was engaged as chief engineer by the San Gabriel Electric Company, and when this concern was purchased by the Pacific Light & Power Company he was retained as chief engineer of the latter company. Mr. Newman was a large factor in modernizing the hydro-electric business of the Southwest.

Robert McKay, K.C., one of the most prominent members of the legal profession in Toronto, Canada, died in a hospital in that city on Dec. 4. Mr. McKay was one of the few lawyers who have ever attained a clear conception of the real meaning of the power factor as applied to the electric light and power industry. He had a fundamental scientific knowledge which rendered it easy for him to grasp the engineering questions involved in complicated cases. For several years he had been engaged in litigation involving very intricate technical and legal questions in controversy between large power interests in Niagara, some of these questions being the outgrowth of emergency conditions arising during the war. Mr. McKay was born in Toronto in 1868 and was graduated from the University of Toronto. His large technical knowledge was gained by study and reading while pursuing the profession of law.

Trade and Market Conditions

Business Reviews, Together with Market Letters
from Important Trade Centers, on the Supply, Demand and Prevailing Prices of
Electrical Apparatus and Supplies

Conduit Manufacturers Re-establish Warehousing Charge

A NUMBER of manufacturers of rigid iron conduit have raised the charge for delivery of orders from warehouses in Chicago and New York to four points in each place. This warehousing charge formerly was six points and then was dropped entirely in Chicago and lowered to two points in New York. This move was brought about by the desire of the manufacturers to cover their warehouse costs and to afford the jobber an incentive to stock conduit. Under the old six-point system, jobbers buying in carload lots at the mills were able to undersell manufacturers selling from their warehouses. About eight months ago manufacturers grew dissatisfied with this condition and went to the other extreme. A two-point differential or none at all afforded jobbers no incentive to carry large stocks and the present system has been arrived at as an attempt at a compromise.

Dry Cell Demand Reported Good

THE market for dry cells has held up in very good shape all during the year, according to carbon manufacturers interviewed by a representative of the ELECTRICAL WORLD, and during the last four months it has shown especial activity. Sales of batteries to the automotive field are reported to be only slightly under those of the previous year in spite of the fact that automobile production fell off. Part of this slump was taken care of by greater use of gasoline tractors, farm-lighting plants and stationary gas engines in agricultural regions. The telephone industry has been another very large consumer of dry cells, and as the number of rural lines, which use dry cells almost entively, is constantly increasing there is little danger that demand from that source will fall off. The railroads have come into the market strongly since just before the period of the threatened strike, and though it was thought that they had stocked up heavily at that time, their buying continues. All over the country holiday sales of flashlamps are reported good, and this will provide a large demand for small cells for replacement purposes.

Demand for Turbines and Generators Has Not Recovered

BOTH production of and demand for large turbines, generators and motor-generator sets have failed to show an improvement during the fall, according to a large manufacturer interviewed by a representative of the ELECTRICAL WORLD. Not a great deal of improvement is looked for during January and February, he said, though it was hard to make an accurate prediction on account of the large number of factors influencing the situation.

"General industrial conditions are slightly better," was his comment, "and this should be followed, though not immediately, by improvement in demand for turbines, generators and motor generator sets. Central-station companies have not been purchasing much on account of the fact that their industrial load has fallen off. This loss has been partly made up in many cases by an increase in residential and commercial load. Many central-station companies are near their capacity, and an increase in industrial load would mean orders for the manufacturers of power equipment.

"Industrial sales also have remained low, and little is expected from that source in the near future. Many plants during the period of expansion were overequipped with this machinery, and it will be a long time before production can catch up with machine capacity. Some of this equipment was in need of repair or replacement when the slump in business came, but this business has been taken care of pretty well already."

Foreign business has been fairly good recently, he said, some large orders having been received within the last month. Some of these orders were obtained in the face of keen German competition.

Heating Appliance Prices Slightly Lower

LIST prices on electric flatirons, electric toasters, air heaters of the radiant reflector type and automobile engine heaters have been lowered slightly in the Marsh patent license schedule, effective Dec. 31. Irons of 3½ lb. up to 6 lb., plain base, single heat, have been reduced from $6.75 to $6.50. The vertical two-slice toaster, without rack, has been cut from $6.75 to $6.50, and the vertical two-slice toaster with rack has been changed from $7.25 to $7. Air heaters of the radiant reflector type have been cut to the following prices: 300-watt, 8-in. bowl, $6; 660-watt, 10-in. bowl, $7.50; 660-watt, 12-in. bowl, $9; 660-watt, 14-in. bowl, $10.50. The automobile engine heater has been reduced from $4.50 to $3.

November Electrical Exports Start Another Decline

ELECTRICAL exports for November, 1921, totaled $4,279,351, the lowest total for any month this year, and a decrease from the preceding month of $690,981, or almost 14 per cent. October had shown a slight upturn, the first since March of this year, and it had been hoped that the increase would continue, but this hope has not been realized. As compared with November, 1920, there was a loss of $6,239,277, or approximately 59 per cent, a small part of which may be accounted for by lower prices. It is mainly due however, to very unfavorable conditions in the world markets, and not much improvement may be expected for some months.

The value of exports for the year to Dec. 1 is still a trifle ahead of the total for the same period of last year. The total value up to Dec. 1, 1921, is $90,422,385, while

			Eleven Months Ended November	
	Nov., 1920	Nov., 1921	1920	1921
Batteries	[illegible]	$,175674	$5,983,773	$3,645,065
Carbons	130,447	30,607	1,354,038	[illegible]
Dynamos and generators	[illegible]	437,057	6,294,023	7,221,211
Fans	122,132	43,479	1,108,334	1,241,988
Heating and cooking apparatus	151,001	70,155	1,594,579	1,563,902
Insulated wire and cables	[illegible]	411,389	6,907,232	8,210,921
Interior wiring supplies	[illegible]	85,624	2,943,939	1,730,249
Arc lamps	3,564	2,454	7,866	4,333
Carbon-filament lamps	7,094	2,599	94,920	121,975
Metal-filament lamps	477,328	83,046	3,588,648	3,003,098
Magnetos, spark plugs, etc	304,479	70,384	3,287,234	1,340,185
Meters and measuring instruments	221,058	95,254	2,344,234	2,604,637
Motors	1,562,518	495,966	11,717,180	14,493,739
Rheostats and controllers	[illegible]	46,381	1,326,150	1,010,744
Switches	396,927	81,193	3,870,366	3,927,392
Telegraph apparatus	[illegible]	20,660	612,193	949,602
Telephones	477,492	242,603	3,354,919	4,478,155
Transformers	341,345	285,581	4,106,831	7,729,838
All other	3,472,722	[illegible]	28,325,231	26,705,748
Total	$10,518,628	$4,279,351	$88,837,283	$90,422,385

that for the first eleven months of 1920 is $88,837,283. Figures on the entire year, however, will undoubtedly show this standing reversed as December, 1920, mounted to the large total of $13,812,251, and exports for the current month are not liable to run over $5,000,000.

Eight articles showed decreases for this eleven-month period, including batteries, carbons, heating and cooking apparatus, interior-wiring supplies, arc lamps, metal-filament lamps, magnetos and spark plugs and rheostats and controllers. Batteries show the largest decrease, with magnetos second. There was an increase on ten articles, including dynamos and generators, fans, insulated wire and cable, carbon lamps, meters, motors, switches, telegraph and telephone apparatus, and transformers. Transformers continue to lead the list with the largest increase in percentage and amount being $3,623,607, or about 88 per cent ahead of last year.

Comparison of November and October of this year show that the past month exceeded October totals in only four items, carbons, fans, insulated wire and cable, and telephones. In not a single item did the month surpass November, 1920. The most impressive decrease from that month was registered by motors, which dropped from $1,562,518 to $495,966.

Figures in the accompanying table were received from the Bureau of Foreign and Domestic Commerce, Washington, D. C.

Market for Carbons Still Sluggish

SALES of carbon products, such as furnace electrodes, illuminating carbons and carbon brushes, are still slow, and the total for the current year is estimated as considerably below that of 1920.

Low steel production, according to the carbon manufacturers, is to blame for the lack of demand for furnace electrodes, a large percentage of the total production having been used there. When things will improve is more or less of a closed book. There is foundation for the opinion that the first six months of 1922 will be much like the last four months of 1921. At any rate, as one carbon manufacturer expressed himself, the capacity of the steel industry is far ahead of normal peace demand, and it will be a long time before there will be urgent need for a great deal of new equipment.

The slump in the motion-picture business has hit the production of illuminating carbons severely. Theaters in many cities have been closed down permanently or are open only twice a week. Prospects of a revival are considered bright, however. American manufacturers are said to have brought their product now to a higher standard of quality than the foreign-made carbon, though before the war the opposite was the case and foreign manufacturers obtained a large part of the business.

General industrial and automotive industry conditions have been followed by a drop in the demand for carbon brushes. Central-station companies have been buying fairly well, though not at a normal rate. Improvement is looked for here in the spring.

Electrical Toy Manufacturers See Good Year Ahead

MANUFACTURERS of electrical toys have expressed themselves as satisfied with the business of the holiday season just past and are expecting a good year during 1922 on account of the small carry-over they say prevails among dealers and jobbers. The business of the present season, they assert, might have been from 10 to 15 per cent larger than it actually was if jobbers and dealers had been willing to stock generously six weeks ago. The general tendency of the dealers has been to purchase on a hand-to-mouth basis, and the same attitude was taken by the jobbers.

These stocks, it is the claim of the manufacturers, were quickly cleaned out and more ambitious orders were sent in. By the week before Christmas re-orders were flowing in to the manufacturer in such volume that part of them had to be left unfilled. One manufacturer stated that 50 per cent of the orders received after Dec. 15 could not be filled out of stock and had to be cancelled.

Jobbers defend their policy of ordering sparingly by saying that the trend of the season could not be foretold and that a "safety first" attitude necessarily had to be followed. As a matter of fact, both producers and distributers underestimated the season, the former not having manufactured for stock as heavily as should have been done.

The business of the year as a whole, it is estimated, will run about 80 per cent of last year's. This, one manufacturer stated, is about 20 per cent ahead of the business done by the makers of non-electric toys on a relative basis of the production engaged in each industry. The truth of this would indicate that electric toys find their appeal among people who can afford to buy despite bad business conditions and also that their popularity is gaining. There were very good sales of the large train sets, the retail selling price of which is high. Low stocks in the hands of jobbers and dealers, as shown by the volume of last-minute re-orders, has encouraged the manufacturers, and plans are being made to send salesmen out early in the season to take advantage of this condition.

New Fan Prices Are Lower

NEW net retail prices on fans of certain makes have just been announced and show a reduction of from 2 per cent to 14 per cent on the various types from last year's prices.

Contracts for fans for the coming year have not yet been submitted but are expected to go out soon. There are prospects for a good year as the carry-over from last summer is small. Manufacturers state that distributers nevertheless do not show much inclination to order generously for the opening of the season.

Metal Market Situation

THE domestic copper market is quiet, but producers are satisfied on account of the continued foreign buying. Thus there is little necessity for concession to the domestic buyer and no incentive to cut prices, though, on the other hand, cessation of domestic buying has had enough effect on the market to prevent price increases of any moment. A quotation of 14 cents per pound delivered for January shipment, or under 14⅛ cents per pound for shipment over the first quarter of next year, ruled during last week. One or two small producers are understood to have quoted February and March deliveries in exceptional instances at 13⅞ cents delivered. It is reported that some wire-drawing companies who are bidding on wire shipments for next year's shipment are in the market for copper but are unable to buy under 14 cents. Export buying is prominent owing to the lack of domestic sales. During the first three weeks of December exports from the port of New York alone amounted to nearly 41,000,000 lb., and the prospect is that the total for the month may equal that of November, the largest of the current year.

NEW YORK METAL MARKET PRICES

	Dec. 19, 1921			Dec. 26, 1921		
Copper	£	s	d	£	s	d
London, standard spot	66	17	6	66	15	0
	Cents per Pound			Cents per Pound		
Prime Lake	13.87½			13.87½		
Electrolytic	13.75			13.75		
Casting	13.00			13.00		
Wire base	15.00–15.25			15.00–15.25		
Lead, Am. S. & R. Co. price	4.70			4.70		
Antimony	4.50			4.50		
Nickel, ingot	41.00			41.00		
Sheet zinc, f. o. b. smelter	9.00			8.50		
Zinc, spot	5.20—5.25			5.15—5.20		
Tin, Straits	33.50			32.62½		
Aluminum, 98 to 99 per cent	19.00			19.00		

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	11.00—11.50	12.00
Brass, heavy	5.00—5.37½	5.25—5.50
Brass, light	5.00—5.12½	4.87½—5.00
Lead, heavy	4.00—4.12½	4.00—4.12½
Zinc, old scrap	2.50—2.75	2.50—2.75

THE WEEK
IN TRADE

Prices When Quoted Are Those Prevailing at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

A LAST-MINUTE rush of Christmas buying cheered electrical jobbers and retailers last week, and reports from various sections of the country show that while the volume will be below that of last year, the season still has been satisfactory. Shortages of some appliances occurred here and there, toasters, percolators and waffle irons being conspicuous examples, but all in all holiday stocks were found to be sufficient. There is very little carry-over and jobbers thus have a pleasant prospect for next year.

Outside of this class of business, the week proved dull, a condition the inventory period explains. This is the cause of little worry, for the eyes of all branches of the industry are turned toward the new year. The opinion is heard from jobbers as far apart as New York and California that after Jan. 15 the gradual improvement of the last few months can be expected to get under way again.

Price changes of consequence are lacking. Boston reports a stronger market on rubber-covered and weatherproof wire and a weaker one on rigid conduit. Code wire has dropped about 10 per cent in Portland, and the flexible armored conductor market is strengthening in Seattle.

NEW YORK

A rush of Christmas business cheered the electrical trade last week, and jobbers generally report that the volume of sales has been larger than had been expected. It did not, of course, equal the holiday business of last year, but it has enabled both the jobbers and the dealers to move a great deal of stock that had been held over. A slight shortage was experienced on a few items of electrical devices, toasters and percolators being rather scarce at the last minute.

With the end of the year at hand the trade is busy with inventories and the usual lull in general business conditions is apparent. Careful buying of wiring material and supplies is the rule. These conditions are expected to prevail until the middle of January, when some jobbers believe that business will open up rapidly. Others are more conservative and do not look for any marked increase before the latter part of February. Present indications, however, point to better business as building is on the increase in both the commercial and the outlying districts.

Conduit.—Prices remain unchanged this week with the demand light. Jobbers' stocks are moderate in all sizes and orders are being placed by contractors only for their immediate requirements. The following prices were quoted this week: For ½-in. black pipe in 2,500-ft. lots, $46; ¾-in., $59, and 1-in., $85 per 1,000 ft. Galvanized pipe in the same sizes and quantity was quoted respectively at $51, $66 and $94 per 1,000 ft.

Rubber-Covered Wire.—Buying of wire is of a hand-to-mouth nature. The stiffening in price last week does not seem to have stimulated sales. No. 14 rubber-covered is quoted from $6.50 to $6.93 per 1,000 ft. in 5,000 ft. lots. Jobbers' stocks generally are good and in some instances large, which has a tendency to hold prices close to the previous level.

Flexible Armored Conductor.—The market for this material is holding up well as a result of activity in residential building in the suburban towns. No. 14, two-wire, single-strip, is quoted at $45 per 1,000 ft. and double-strip at $47 per 1,000 ft in lots of that quantity. Jobbers' stocks are spotty.

Metal Molding.—Demand for this material is moderate and jobbers' stocks generally are small. The three-wire size is quoted at $5.60 per 100 ft.

Lamp Cord.—Prices remain unchanged, principally because of fairly large stocks in some jobbers' hands. No. 18 cotton, twisted, is quoted at $12.90 per 1,000 ft. and the parallel at $15.60 per 1,000 ft. in lots of that quantity.

Heating Appliances.—The holiday demand for household devices has moved a large quantity of appliances, and the trade is very well satisfied with the volume of business this year in view of general conditions. Stocks held over from last year have been pretty well cleaned up, and the last-minute rush of orders found some shortage of toasters and percolators.

Vacuum Cleaners.—There has been an active demand for cleaners, and this seems to be the only one of the larger appliances which is moving well at this time.

CHICAGO

Christmas buying has overshadowed many of the more stable products this week, since selling of wiring materials has slowed up. Dealers report a very active sale of electrical appliances selling under $20. Of the heating appliances, reversible toasters, curling irons and percolators are selling the best. On Dec. 22 the majority of dealers had sold all the Christmas tree outfits and were operating with only a small stock of electrical toys. A large demand for the high-grade floor lamps has been noted.

Wire.—Jobbers and dealers report a little slowing up on the call for wiring materials due to active interest in Christmas goods. No. 14 rubber-covered is quoted at about $6.60 to $6.75 per 1,000 ft. in 5,000-ft. lots. Neither weatherproof nor bare wire sales increased during the week, although prices remained firm. The weatherproof still sells for about 16⅝ cents a pound in 1,000-lb. lots, while bare wire base remains at 16¾ cents.

Conduit.—Movement on conduit has felt the same slowing up as have wiring materials, but jobbers report a fair trade for ½-in. black pipe at $47 per 1,000 ft. in 5,000 ft. lots. Stocks in general are sufficient to supply the trade.

High-Tension Equipment.—One manufacturer tells of a sale of a 5,000-kva., 66,000-volt substation for a steel company. Another company announces the sale of a 900-kva., 22,000-volt complete substation for an anthracite coal company and a 2,400-kva. 22,000-volt outdoor substation for a cement company. Numerous inquiries on 66,000-volt equipment, both in the United States and in foreign countries, are reported this week.

Vacuum Cleaners.—Sales on cleaners have progressed slowly but steadily, and distributers state that their stocks are large enough to carry them safely over the Christmas season. Sales efforts are intensified on every prospective purchaser.

Heating Appliances.—All jobbers and dealers express their satisfaction as to the sales of these appliances. Reversible toasters, curling irons and percolators are moving very rapidly, while open-air heaters, heating pads, irons and grills are also selling quite well. The majority of dealers have ample stocks, but if this present rate of sales continues their inventories will require less time and effort than usual.

Christmas-Tree Outfits.—The sales on these outfits were so large than on Dec. 22 many dealers reported their stocks absolutely depleted. One dealer who sold only about ten outfits in 1920 states that his 1921 sales were over 600, and that these outfits went direct to customers and not to contractor-dealers.

Electrical Toys.—The demand for electric railway sets has been greater than the supply and many dealers have sold their last toy. In general, other instructive electrical toys have had the same rate of movement.

Portable Lamps.—One dealer reports an increase over last year's sales of 45 per cent, and he said that his best sales were on floor lamps ranging from $60 to $90. Other dealers state that portable table lamps are moving in a satisfactory manner.

BOSTON

The pre-Christmas trade closed with excellent sales reported in smaller appliances, moderate purchases of wiring supplies and many last-minute calls for stock to fill gaps in retail supply. Reviewing the year, jobbers report considerable variation in the volume of material disposed of. One large house states that its "tonnage" output exceeded that of 1920, but that for every $12 of receipts last year it took in but $8 this year. Other houses did less business in quantities and money in 1921, but a trend toward better conditions is evident, although the waiting policy on the part of buyers has not yet changed to activity. Stocks are ample to meet demand in virtually all staple lines.

Recent peak loads on the Boston Edison system have surpassed all previous records. Building and engineering contracts in New England for the week ending Dec. 20 totaled $4,131,000, compared with $3,373,000 for the same week last year. This total has been exceeded in but two years of the last twenty.

Wire.—Rubber-covered wire is firm in price at $6.75 per 1,000 ft. in 5,000-ft. lots, and weatherproof is stiffer, at 16½ cents base. Wire is in increased demand for utility reconstruction service after storm damages. Very heavy sales of twisted-pair telephone wire followed the disastrous effects of the late sleet storm, which still influences purchases by Massachusetts buyers. Bare wire is in light demand.

Motors.—The year closes with distributers' sales running in typical cases around 25 to 35 per cent of last year's, in money, which is a fairly good showing in view of general business conditions and of the price reductions that went into effect in 1921. Casual buying only characterizes the market as the year ends, but a better tone is apparent than existed a year ago.

Lamps.—When the records are totaled, it is believed that lamps will show a remarkably good year in sales in this district, compared with other supplies. The efforts of retailers to market lamps of the portable type have never been more energetic, and there is no doubt that the co-operative exhibit of the Bureau for Better Illumination has stimulated sales of lamps and fixtures for mercantile and industrial uses. Close competition for business in general has also enlisted the aid of sign lighting to a degree beyond that practiced for several years, old restrictions no longer cutting any figure in luminous advertising. Protracted "spells" of dull weather have also helped.

Flexible Armored Conductor.—Fair sales are coming through, with good stocks. Prices are sharply competitive, and even 2,500-lb. lots were moving at a little under $43 per 1,000 ft. at the week end. Profits are declared to be very unsatisfactory in this material.

Washers and Cleaners.—Washer sales are unusually slow for this period and cleaner sales are only a little better. Intensive sales efforts are being planned for the new year.

Appliances.—Hollow ware, irons and toasters, as well as heating pads, are moving reasonably well. In retail circles less is heard about prices as affecting purchases of these lighter socket devices. No reports of shortages had come in up to Christmas Eve, but stocks have been pretty well cut into by the holiday trade in concerns using top-notch sales efforts to move this class of goods.

ATLANTA

Reports from retailers indicate quite a satisfactory volume of business during the past ten days, though buying this year is on a reduced scale, with a certain amount of bargain hunting, particularly for the class of articles listed as luxuries and toys. Increasing sale of the appliances which are used daily are to be noted, flatirons being particularly good. Jobbers report the receipt of a fair amount of refill orders for the holiday trade during the past two weeks, though this class of business is now practically complete. Orders for construction material are almost exclusively of the hand-to-mouth variety, contractors purchasing only for immediate needs.

Notice has just been issued by some of the largest railroads in this section of the lay-off of shop forces for a ten-day period. Waycross, Ga., will be particularly hard hit because of the reduction of 600 in the working force in the shop of the Atlantic Coast Line Railway.

Wire.—A price increase in wire is effective this week, the base in rubber-covered advancing to 16 cents, while weather-proof goes up 50 cents per 100 lb. Popular sizes continue to move satisfactorily, but larger sizes are somewhat slow, with ample stocks on hand in all sizes.

Pole-Line Hardware.—The movement has been quite brisk for the past two weeks, several of the jobbers being busily engaged in filling back orders taken in the late summer. The entire line is reported to show a fair to good movement, with stocks in first-class condition. Prices are steady.

Cross-Arms.—This item is somewhat slow, though a slightly increased activity is to be noted during the past ten days. The N. E. L. A. arm is coming into more popular favor among the small central-station companies though the demand for the standard arm is still in the majority.

Mangles.—Like washing machines, these are apparently dead for the time being, though jobbers express optimism regarding the outlook for early spring sales. Local stocks are heavy and no price reductions are anticipated.

Flexible Non-Metallic Conduit.—Jobbers' sales are still below normal on account of contractors having stocked up heavily in the early fall. The $\frac{7}{32}$-in. size in lots of 5,000 ft. is quoted at $1.80 per 100.

Panelboards.—These continue to make an excellent showing, there being a growing tendency to install them in all commercial buildings throughout the section.

Conduit.—The activity continues to be quite satisfactory, though a price reduction of 5 per cent is reported this week. The past ten days have seen the largest volume of sales in the ¾ in., 2 in., 2½ in., 3 in. and 4 in. size of the black pipe, with a resultant slight shortage in the 3 in. and 4 in. sizes. Other sizes are on hand in good volume.

Insulators.—Sales are hardly up to the average in the porcelain line, but rural telephone lines are taking a fair quantity of the glass type. Jobbers' stocks are in good shape and no change in price is reported.

ST. LOUIS

The proximity of the holiday season caused comparatively dull buying in wiring supplies last week, but this was to some extent offset by late purchases of holiday appliances, so that the week as a whole compares well with the recent average. Appliances have sold about as well this year as last, and very small stocks will be carried over. In fact, some jobbers have virtually no stock of percolaters, flatirons and curling irons. The new year will start out with just sufficient stocks of appliances to fulfill the jobbing function properly.

There is a growing tendency to make municipal improvements, resulting in inquiries regarding generating equipment "white way" lighting systems, and transmission materials for extending central-station service to the smaller towns. Good sales from this source should be experienced soon after the first of the year. Some of the larger industrial firms are also making inquiries on motors, having under contemplation conversion to central-station service and the building of new factories. Indications are favorable for lower wages in the building trades after Feb. 1, and a moderately good amount of industrial construction work would quickly follow any decrease.

Credit conditions are now on a reasonably sound basis and more liberal purchases are being permitted. Jobbers still have a few long-standing accounts, but these are being gradually liquidated and the average time for collections, all obligations considered, is now about forty-five days.

Wire.—Price confusion obtains in rubber-covered, quotations for No. 14 varying from $6.25 to $6.87 per 1,000 ft. in 10,000-ft. lots. Demand is spotty. The base price on weatherproof is now 16½ cents per pound, and that on bare is 15 cents per pound. Stocks are conservative.

Porcelain.—The demand fell off somewhat last week. Residential wiring is seasonally slower and the increased industrial demand has not offset it. Stocks of both jobbers and contractors are in good condition. "Nail-it" knobs sell for $19.50 per 1,000 in barrel lots. The 2½-in. tubes are priced at $5.75 per 1,000 and 3-in. tubes at $6.35 per 1,000, both in barrel lots.

Fuses.—Good business prevailed during the week, and stocks have been increased so that they are more in line with the requirements. Plug fuses with windows are selling for $2.35 to $2.75 per 100 in lots of 1,000 or more. N. E. C. non-renewable, indicating cartridge fuses sell as follows: 1-amp. to 30-amp., $9.60 per 100; 31-amp. to 60-amp., $14.40 per 100. Non-indicating cartridge fuses are priced: 1 amp. to 30-amp., $460 per 100; 31-amp. to 60-amp., $6.90 per 100.

Lamp Cord.—Good sales of cotton cord continues, with stocks in good shape. Silk cord sales are slow but showed some improvement for the week. No. 18 twisted cord, in 5,000-ft. lots, has the following prices per 1,000 ft.: Cotton, $18; silk, $24; No. 18 parallel silk is quoted at $27 per 1,000 ft.

Conduit.—Sales were slower last week, but the condition of stocks has been improved. Following are representative prices for bundle lots: ½-in. black, $4.73 per 100 ft.; ½-in. galvanized, $5.32; ¾-in. black, $6.20; ¾-in. galvanized, $6.86.

SEATTLE—PORTLAND

The heavy rains and damaging floods of the week before last gave way this week to snow and freezing weather in the Seattle district and impeded business to an appreciable extent. Favorable weather in Portland has done much to stimulate Christmas business, and it is felt by merchants generally that the volume this year will equal that of last year. Lumber production and shipments, together with prospects for the new year, continue favorable. The domestic lumber market is improving. Indications are that some heavy buying by the railroads will follow the opening of the new year, and it is generally predicted by lumber men that the industry will be restored to normal.

Building in Seattle for November, 1921, showed a gain of 28 per cent over November of last year, while in Portland the gain for the corresponding period is 132 per cent. Industry in general throughout the Northwest seems to be picking up. Exports for Portland for the first ten months of this year show an increase of 6 per cent over the first ten months of last year, while in most other districts a decrease is shown. Thus a healthy condition is shown, although the increase is small.

Electrical appliances have enjoyed a well-sustained movement during the holiday season. Owing to the impaired financial strength of many retailers together with a timidity born of their recent bitter experiences, shortages have appeared in a number of lines of holiday goods. Jobbers in Portland report business for the last few days preceding Christmas very active and fully up to expectations. Stocks are completely exhausted on waffle irons and curlers, and while individual jobbers are out of certain other lines, they have been able to pick up the goods needed from others who were well stocked. From present indications they predict that the volume of business will at least equal that of last year.

Lamps.—While the demand for lamps has been relatively good for the past two months, the total volume of business in the Northwest during 1921 is estimated at approximately 14 per cent under that of 1920. This decrease is attributed to curtailed industrial activity.

Rigid Conduit.—Demand has been uniformly good, supported by a satisfactory building program. In Seattle prices have been steady for some weeks. Present quotations are: ½-in. black, $6.16 per 100 ft., and ½-in. galvanized, $6.61 per 100 ft. in car lots. Conduit in Portland has dropped approximately 3 per cent. Prices are now: ½-in. black, $6.95 per 100 ft., and ½-in. galvanized, $7.50 per 100 ft. in less than 10,000-ft. lots.

Wire.—Practically all code wires have shown drops in Portland ranging anywhere from 1 to 10 per cent. On the other hand, No. 14 rubber-covered wire shows a slight advance. Guy strand has advanced between 2 and 3 per cent.

Flexible Armored Conductor.—Recent sales of this material in Seattle have been very good. The market is strengthening. No. 12, two-wire, double-strip, is quoted at $56.33 per 1,000 ft. in 10,000-ft. lots. Stocks are able to meet the demand.

Farm-Lighting Plants.—The selling campaign covering farm-lighting plants in the Northwest, including Washington, Oregon, Montana and northern Idaho, extended roughly over a period of two and one-half months, beginning during the first part of October. The October campaign far exceeded the estimates made when the campaign first began. It showed in general a resumption in the buying power of the farmer. The results of the November and December sales were far less gratifying. The failure to duplicate the sales of the previous month is largely attributed to weather conditions.

SAN FRANCISCO

The past week has shown the usual intensified holiday rush, and it taxed nearly all dealer organizations to the limit. However, this will not do more than make a Christmas below the average of the past few years. Heavy rains have caused a certain amount of damage, especially in the southern part of the state, but they were greatly needed and the whole effect will be a much-needed assistance to the 1922 crops. The disarmament conference is reflected in the buying of the local navy yards and stations.

Poles.—Pole prices are now lower than they have been for years, 6-in.-top, 30-ft. round cedar poles selling for $6.35 each and 7-in.-top, 35-ft. poles for $9.90 each. These prices have not greatly stimulated business yet, the only orders reported being for repair and maintenance, but it is expected that the spring will see a fine business in connecting and distribution lines.

Motors.—This is the dull season for motors, but the movement is even slower than usual. From all indications the approaching winter will be rather dry and farmers will have to supplement natural conditions by installing pumping plants. Local stocks are high, and there is also considerable outstanding stock in the hands of motor agents.

Air Heaters.—Reorders on nearly all makes have been disappointingly slow, but many dealers are now almost sold out and are expecting to reorder at the first of the year. The assorted order for twenty-five lots with a discount of 30 and 7½ per cent seems to be the common unit of purchase.

SALT LAKE CITY—DENVER

The final week of holiday trade brought a very satisfactory volume of sales for most dealers. Electric appliances moved well and the vacuum cleaner was in high favor with gift seekers. Inventories will reveal depleted stocks on the shelves of retailers, which is a promising prospect to overloaded jobbers. An aggressive co-operative advertising campaign has been carried through by the dealers of Salt Lake City, with valuable electrical prizes distributed among the dozen or more buyers whose electrical purchases totaled highest. The offering carried single values as high as $198. It is believed that the drive stimulated considerable active interest.

There is a concerted agitation among farmers of this region for a reduced schedule of taxes. They complain that while prices on their products have fallen about 50 per cent, there has not been a corresponding drop in production costs. An effort is being made to secure a system of through freight rates to points in Montana, which, if granted, will extend and improve the jobbing business of Salt Lake City. The metal situation shows steady, though slow improvement. Copper is in better demand.

Electric Mine Hoists.—Manufacturers are making demonstrations under varying conditions of the advantages of electrical hoists over steam hoists. One manufacturer alone reports in operation installations of 162,000 hp. in motor drive for mine hoists in units of 250 hp. and larger.

Manufacturers' Activities

Devoted to the Business Side of Manufacturing, Distribution and Sales, News from Jobbers and Foreign Fields and a Record of New Devices and Trade Literature

Wald Company Again Increases Direct-Current Motor Line

A line of direct-current motors in sizes between 1 hp. and 5 hp. has been added to the production of the Wald Electric Manufacturing Corporation, 248 North Tenth Street, Brooklyn, N. Y. The company has heretofore confined its production to fractional-horsepower motors. Production of high-voltage generators and motor-generators for wireless service has been started also.

Edison Storage Battery Sees Demand Improving

Demand for storage batteries is improving steadily, according to information obtained from the Edison Storage Battery Company. The electric street truck field has proved a source of much business all during the year, and at the present time sales are characterized as excellent. Railroad buying has loosened up a great deal recently and batteries for car lighting are being sold in increasing numbers. This includes both new and replacement business. This field was very slow all during the first part of the year, and when the roads were finally forced into the market orders were for good quantities. Business in mine-locomotive batteries continues very slow, as might have been expected on account of the slump in that industry, and industrial tractor battery demand is small also.

Simms Company Seeks Southern Farm-Light Business

Sales of farm-lighting plants have been improving every month this fall, according to A. J. Poole, sales manager of the Simms Magneto Company, East Orange, N. J., manufacturer of "Homelite" plants, and the outlook is for increasingly better business during the spring. Buying during the greater part of 1921 was held up, Mr. Poole said, by the feeling that prices had not dropped to their proper levels and by bad agricultural conditions. The first condition has been changed in the last two months, he declared, and the public is becoming convinced that prices are close to rock bottom. Agricultural conditions in many parts of the country have shown improvement, though others are still bad, and wherever the farmers are better off sales are getting much more active. The South should prove a good field, he declared, as the cotton market has risen and intensive sales efforts there should bring a good sales total.

L. F. Acker, assistant sales manager of the company, is in Florida at the present time, and agents and dealers will be named in the principal cities of that state. The Simms company until a year ago manufactured only automobile ignition systems and automobile electrical accessories. At that time it decided to go into the production of farm-lighting plants and enlarged its manufacturing space to double its former size. At the present time it is in active production.

Engineering Company Moves to Larger Quarters

The George A. Johnson Company, Inc., consulting engineer, has moved to larger quarters in the building at 150 Nassau Street, New York City. The change was made necessary by the steady increase in scope and amount of the work of the company, according to Nelson B. Wolfe, one of the members of the firm. In commenting on increasing business during the last few months, Mr. Wolfe said that the electric drive for water supply and sewage-pumping stations is going on in considerable amounts.

Conference on Electrical Slate Specifications

A conference to discuss the testing of slate to determine its electrical characteristics and the proper mounting of it for electrical uses was recently held in Washington between United States government officials and representatives of the Structural Slate Company, Philadelphia. The Structural Slate Company represents a large number of slate quarries in Pennsylvania. Since the government is one of the large users of electrical apparatus mounted on switchboard material this conference was one of the first arranged for. The characteristics and properties of slate and its applications were discussed in detail and many points were brought out relative to the testing of slate to determine its dielectric properties and in regard to its mounting. The conference was attended by officials of the Bureau of Mines, the Supervising Architect's Office, War Department, Navy Department, Geological Survey and the Bureau of Standards.

In addition to this conference, it is announced, the structural service bureau of the Structural Slate Company is working on a specification for slate suitable for electrical uses, a series of tests upon the physical, chemical and electrical properties of slate being under way at Lehigh University. Other conferences are to be called to discuss the results of these tests and to establish minimum requirements which should be stated in specifications for slate for electrical uses. This specification is to be submitted to the American Society for Testing Materials, the American Institute of Electrical Engineers and the Underwriters' Laboratories, in the hope that it will eventually be developed into a national standard specification to be used by the slate and electrical industries.

Merger of General Electric Jobbers Off Temporarily

Plans which were being made earlier this fall to establish a basis upon which to merge three New York distributers and one Newark distributer of the General Electric Company, it is revealed, have been laid aside for the time being. The companies concerned were E. B. Latham & Company, the Royal Eastern Supply Company, the Sibley-Pitman Electric Corporation, all of New York, and the Tri-City Electric Company, Newark, N. J. This latest development was brought about by the belief of several of the interested parties that the move was not proper under present business conditions and also by the difficulty of establishing a basis for the consolidation which was satisfactory to all concerned. There is a possibility that the matter will be taken up again at some later date when business is more nearly normal. The interested companies serve a large market along the Atlantic seaboard, and the capitalization of the proposed merger would have run into very high figures.

Brass Manufacturers Elect Officers for Year

At the December meeting of the National Association of Brass Manufacturers, recently held in New York City, officers for 1922 were elected as follows: President, L. D. Lownin; first vice-president, R. B. Hills, and second vice-president, H. F. Albers. General business conditions were discussed at the convention, various delegates reporting conditions fair to good with a higher tendency in the copper market. That the base price of copper would be 15 cents a pound by the first of March was predicted. Inquiries for brass products were declared more general, while orders, though small, are more numerous. Good building conditions are anticipated.

The report of the standardization committee was received, and the convention authorized the appointment of delegates to the National Bureau of Standardization. About fifty delegates from all parts of the country attended the convention. The next meeting will be held in Cleveland, March 7, 8 and 9. 1922.

More Insurance Companies Enter Electrical Field

Announcement has just been made by the Maryland Casualty Company, the London Guarantee and Accident Company and the Hartford Steam Boiler Insurance Company of their intention to write electrical machinery insurance. Two other companies, the Ocean and the Travelers, announced their policies a short time ago. The Steam Boiler and Fly Wheel Service Bureau has ten American members and three Canadian. At a recent meeting it was decided to enter the field of electrical machinery insurance after Jan. 1, and the bureau has drawn up rates which have been mailed to the member companies. Two English companies operating only in the British Isles have been writing this coverage for some years with success.

The electrical machinery policy of the above three companies will follow the same lines of coverage as their steam-boiler, engine or flywheel contracts—namely, against all immediate loss or damage from breakdown of the machine or machines, covering the machines themselves, all other property of the assured, wherever located, and the property of others for which he would be liable—and, furthermore, will defend on behalf of the assured any suit against him arising from breakdown. The policy may be extended to cover damages arising out of the death or injury of any person caused by breakdown of the insured machinery.

It is the growth of the use of all kinds of electrical machinery in the world of power, according to the announcement of the Maryland company, that has made the introduction of insurance of this kind so important.

Des Moines Jobbing House Under New Name

The business of the Iowa Electrical Supply Company, electrical jobbers, 203-5-7 Grand Avenue, Des Moines, Iowa, has been taken over by the Collins Electric Company, according to the announcement of the new company. The business will continue under the same management and will be located at the old address. John Collins is president of the company and Edward T. Collins is secretary and treasurer.

Hot Flo Distributing Faucet Water Heater

The distribution of the "Hot Flo" electric faucet water heater has been taken over from the Hot Flo Faucet Corporation, formerly at 1,400 Broadway, by the Hot Flo Electric Company, Seventh Avenue and Thirty-ninth Street, New York. The heater is made in a 1,500-watt size and is intended for household use. Arthur Abrams is general manager of the Hot Flo Electric Company.

Save Electric Corporation to Open Toledo Factory

The Save Electric Corporation, manufacturer of incandescent lamps, which operates one factory at 220-254 Thirty-sixth Street, Brooklyn, N. Y., has opened a factory recently completed in Toledo, Ohio, and has gone into production of incandescent lamps there. The Toledo factory is situated on property fronting 100 ft. on Main Street by 390 ft. deep. The first unit of the plant to be completed is 70 ft. x 390 ft. and is two stories high with 50,000 sq.ft. of floor space. As soon as operations in this first unit are well under way, it is planned to add more buildings. The building just completed cost about $125,000 and is equipped with about $200,000 worth of special machinery of the company's own make. The plant of the company in Brooklyn, is capable of turning out about 20,000 lamps per day, and the capacity of the first unit of the Toledo plant is about the same, with space available to bring this figure up to 25,000 lamps per day. Between 300 and 400 operators have been employed in Toledo.

The corporation has representatives in fourteen cities and warehouses in San Francisco, New Orleans, Minneapolis, Chicago, St. Louis and Buffalo. Distribution is obtained through these channels. Max Ettinger is president and J. J. Steinharter is director of sales of the corporation.

Too Much "Putting Off" in American Business

Those who are working hard and intelligently are getting results right now, says F. J. Gottron, general manager of the P. A. Geier Company, Cleveland, in an editorial in the December house organ of that company. There would be more results, he continues, if the rest of the business world would lay aside the habit of procrastination and do now what is being put off until after some date in the future.

"As a matter of fact," the editorial says, "we Americans have a most unbusinesslike habit of 'putting off' our opportunities. In the summer we put off effort till after the vacation period; in the autumn we stall around until after Labor Day and then decide to await the outcome of elections; a lot of us procrastinate between election time and Thanksgiving; a lot more put off planning and buying until after the Christmas rush, and finally a few weeks before Christmas we all settle down to await the first of the year.

"In times like these there is no valid excuse for waiting. There's nothing to wait for. Business will be as good as we make it, and we can't make it good by procrastinating and telling ourselves fairy stories about what we'll do two weeks or a month from now. The cash register rings when you make the sale, not when you make up your mind that you're going to make a sale some day. If we were able to 'ring up' all the business we promised ourselves to do, we'd all be millionaires."

Fitts-Morse, Inc., Boston Manufacturers' Representatives

Daniel Fitts and Harold E. Morse, formerly of the H. W. Johns-Manville Company, Boston, have established a new manufacturers' representation house to be known as Fitts-Morse, Inc., with offices at 161 Summer Street, Boston. The new concern will represent I. P. Frink, Inc., of New York, manufacturer of lighting fixtures and equipment, and the C. & P. Electric Works, Inc., Springfield, Mass., manufacturers of barrier panels.

Bates Company to Manufacture Independently

The Bates Manufacturing Company, which for the past thirty years has been a subsidiary of the Thomas A. Edison Company, Inc., has announced that it is now branching out for itself as a separate and distinct company. The new company will continue the business of manufacturing numbering machines and devices and has recently moved into a new plant at Orange, N. J. The new plant, which was formerly owned by the General Electric Company, will permit the Bates company to expand its business greatly and also to devote more attention to the repair and service departments. C. S. A. Williams, for several years assistant to Charles Edison, is president and treasurer of the company. S. M. Babson, for the past ten years with the National Lead Company, during part of which time he was sales manager of the die-casting department, is vice-president of the Bates company in charge of sales.

The policy of the company, according to Mr. Williams, will be maintained along conservative lines, no radical changes in selling methods being considered. Business in the foreign markets is to be sought. Production in the new factory has been started. The New York office is at 50 Church Street, where the sales and service end of the business will be conducted. Mr. Babson is in charge of this office.

Mutual Lamp Buys Building and Will Expand

The Mutual Lamp Manufacturing Company, New York, has purchased the building at Houston and Crosby Streets, in that city, part of which it has occupied for some time, and is making plans for expansion of its production. The building is seven stories high and is 64 ft. x 120 ft. It is not planned to use the whole building at the present time, but 10,000 sq.ft. of floor space will be added to the factory now, with the prospect of using more as business improves.

Sales since the first of September have shown a very gratifying increase, according to S. Phau of the company, and though 1921 production and sales will undoubtedly be below those of the previous year, the total will be a satisfactory one under the conditions prevailing. The next two months, Mr. Phau said, may be expected to be slow as they have proved slow in previous years. January and February, 1919, were slow, even though that year was a very successful one, and as general business conditions are worse now than then, correspondingly low sales during these months will not be surprising. Prospects for the year otherwise, he stated, appeared to be very good, and the company was showing its faith in the future by enlarging its factory space to some extent now and providing for greater expansion later.

The Magnus Electric Company, manufacturer of plugs and other electrical goods, has removed its offices from 109 Broad Street to 113-115 Broad Street. The company reports improvement in sales and has moved to its new quarters in order to secure increased space for manufacturing facilities. Max Manheim is president of the company.

The Chain Belt Company, Milwaukee, Wis., has opened offices at 735 Ellicott Square, Buffalo, N. Y., and has appointed T. E. Cocker as district manager of that territory. Mr. Cocker for ten years was connected with the engineering department of the New York Central Railroad at Buffalo. He is a graduate of Rensselaer Polytechnic Institute.

The Driver-Harris Company, Harrison, N. J., manufacturer of electrical wire and other wire products, is planning to build a new one-story building to cost about $10,000. A new rolling mill, 100 ft. x 275 ft., is being erected by the company at the present time.

The Acme Electric & Manufacturing Company, Cleveland, Ohio, has appointed the Corte Engineering Company, Woolworth Building, New York, as its sales representative in Connecticut, New York and New Jersey. The Acme company manufactures vertical alternating-current and direct-current motor-generator sets and a complete line of switchboards and chargers for automatic and non-automatic operation for battery charging.

Foreign Trade Notes

NEW INSULATION MATERIAL DEVELOPED IN ITALY.—Much interest has been aroused in Italy by the development of a new insulation material, according to reports received by the Department of Commerce. The material, which is known under the name of "Xilite," [illegible] resulting from a chemical synthesis and is said to be an ideal substance for insulating wire and other electrical apparatus. The material is already being manufactured on a large scale within the city limits of Vienna in a new factory, covering an area of 22,000 sq.yd.

USE OF ELECTRICITY IN LATVIA.—The use of electricity as a motive power for industrial and agricultural enterprises in Latvia, according to *Electrical Industries*, is gaining ground. As all coal supplies have to be imported and owing to the low rate of exchange, are very costly, the Latvians have turned to water and peat for power. The chief source of water power would be the Daugava River, but the cost of its development is beyond the means of local enterprise and will have to await the participation of foreign capital. Several limited liability and co-operative societies have been formed with a view of utilizing the water power of the smaller rivers. The proposed generating plants are estimated to produce from 500 hp. to 10,000 hp. Four such companies have already been formed to utilize the water powers of the rivers of Jugla, Brasla, Amata and Guata, all in Livonia. Courland, being mostly flat country, has no rapid rivers, but there are extensive peat bogs in the vicinity of various towns. Electric generating plants, which would use peat as fuel, are being planned by several communities. Electricity generated at these plants would be utilized to operate mills and small factories, for lighting and for driving agricultural machinery.

ELECTRIC PLANT FOR GRAHAMSTOWN, SOUTH AFRICA.—The City Council of Grahamstown, South Africa, the *Electrician* states, has been authorized to raise a loan, not to exceed £65,000, to establish an electric lighting system in the city. The municipality, it is understood, will not ask for tenders before July, 1922.

HYDRO-ELECTRIC PROJECTS IN NEW ZEALAND.—The great demand for cheaper hydro-electric power in New Zealand, according to Commerce Reports, has caused the development of hydro-electric plants to take precedence over all other public work. There is scarcely a district of New Zealand where proposals for power generation are not under consideration, if not already provided for or included in one of the main government schemes. Among the main projects under way are: Waipori Falls, Dundin City Council, 8,000 hp., to be extended in the near future to 16,000 hp. and possibly to 25,000 hp.; Lake Coleridge, Public Works Department, 8,000 hp., to be increased to 16,000 hp., with an ultimate development of 40,000 hp.; Horahora Rapids, installed by the Waihi Gold Mining Company and recently purchased by the Public Works Department, 8,000 hp., to be extended to 10,000 hp.; Wairoa Falls, Dominion Portland Cement Company, 3,000 hp.; New Plymouth Borough Council, 1,000 hp., to be extended to 6,000 hp.; Tauranga Borough Council, Omanawa, 1,000 hp. and possibly more; Hawera Electric Supply Company, 600 hp. There are about twenty smaller schemes calling for about 3,000 hp., and definite commitments have been made for other schemes as follows: Southland Electric Power Board, 8,000 hp. with possible extension to 20,000 hp.; Mangahoa Public Works Department, 24,000 hp.; Waikaremoana Public Works Department, 40,000 hp., with an ultimate development of 136,000 hp. (an initial development of this scheme provides for 1,000 hp. to be taken by the Wairoa Power Board); Waikato, 96,000 hp. Up to the present time eleven power boards have been licensed to operate in the following districts: Southland, Thames Valley, Te Awamutu, Cambridge, Banks Peninsula, Wairarapa, Central (Waikato), Wairoa, Springs-Ellesmere, Westland and Tevoit. The complete scheme for the Dominion laid down by Evan Parry allows for a total development of 270,000 hp.—160,000 hp. for the North Island and 110,000 hp. for the South Island. Efforts today are in the main concentrated on the Mangahoa scheme for supplying the whole of the southern district of the North Island. At the present rate of progress, power should be available in 1923 or 1924. Work is also proceeding on the Waikaremoana and Waikato schemes, which do not appear to involve any serious engineering difficulties.

NEW HYDRO-ELECTRIC PROJECT IN ITALY.—Some interesting details regarding the hydro-electric plant which is in course of construction on the River Sila in the Province of Catanzaro are given in the November issue of *Popolo Romano*, according to the *Commerce Reports*. The Società per le Forze Idrauliche della Sila has received authority from the government to contract bank loans to the extent of 200,000,000 lire, and inasmuch as the undertaking will cost more than 500,000,000 lire, it is proposed to interest private capital in furnishing necessary funds. Engineer Omodeo, who has charge of working out the scheme for the project, proposes to make use of the natural topography of the place. In addition to being situated at an altitude of some 1,235 m., the locality is furnished with several natural basins, which after the work is completed will form large reservoirs. From these, by two falls, one 597 m. high and the other 405 m. water power will be utilized to develop electrical energy. Work has begun on the larger of the reservoirs, and shops with necessary machinery are in operation, together with experimental work on the geologic structure of the place. Roads have been built leading to the site of the works. The present plans provide for an initial installation of 67,227 hp., a second of 80,960 hp. and a third of 20,800 hp., making a total of 168,267 hp.

ELECTRICAL APPARATUS TO BE MANUFACTURED IN CHINA.—The Electrical Appliances Manufacturing Company, recently organized according to *Commerce Reports*, has purchased seventy-five acres of land in Soochow, China, for a site for its proposed plant. Arrangements have been made with the German Siemens Company in Germany whereby the Chinese company will use the Siemens patents in exchange for a certain percentage of profits. The Siemens company will furnish the Chinese company with a corps of experts to install and assist in the operation of the plant. The company will manufacture electric motors and all kinds of electrical appliances suitable to the Chinese market. The present capital is given as 1,500,000 yen (silver). S. T Sze, a brother of the Chinese minister to Washington, is manager of the new company.

PROPOSED WIRELESS SERVICE BETWEEN SWEDEN AND FINLAND.—Application for permission to establish a wireless telephone service between Finland and Sweden, according to a report from Leslie A. Davis, consul, has been made by a Helsingfors company. If the application is granted, it is planned to form a new company especially for operating the concession. Further details of the project can be obtained from the Electrical Equipment Division of the Bureau of Foreign and Domestic Commerce by referring to file No. 40,613.

Foreign Trade Opportunities

SERVICE METERS AND TRANSFORMERS FOR PALMERSTON, NEW ZEALAND.—The Borough Council of Palmerston North, New Zealand, *Electrical Industries* states, is desirous of receiving tenders for nineteen 50-kva., single-phase transformers; one complete winding, high and low tension, for one leg, spare parts and accessories; also for the following service meters: Single-phase, 230 volts, 400 5-amp., 150 50-amp. and fifty 15-amp. meters; three-phase, balanced-load, 400 volts, 100 10-amp., thirty 25-amp., fifteen 50-amp., ten 75-amp. and five 100-amp. meters. The original date for receipt of the tenders was Sept. 24, but has been postponed. The date for closing has not yet been decided upon.

New Apparatus and Publications

WATER HEATER.—An electric water heater for use with water tanks of 30 gals. capacity or less has been brought out by the Duraelectric Corporation, Highland Building, Pittsburgh.

TOASTER.—The Ess & Ess Distributing Company, 160 North Wells Street, Chicago, has developed a reversible toaster, which can also be used as a grill.

CLOTHES WASHER.—An electric washer for stationary tubs, known as the "Aurora 1922," has been developed by Wallace B. Hart, 6 East Thirty-seventh Street, New York City.

RANGES AND COOKERS.—The H. G. Weeks Manufacturing Company, Hamilton, Ohio, is distributing bulletin No. 26, describing its lighting circuit, cabinet and "master" electric ranges and lighting circuit hot plates and "cookerette," bulletin No. 27, covering its "R[illegible]" high-[illegible] [illegible] [illegible] [illegible], bulletin No. 28, describing its two-hole plate and electric range for children and also bulletin No. 29, covering its "electric" steam-pressure cooker.

FANS.—The Robbins & Myers Company, Springfield, Ohio, has issued domestic catalog No. 1177, covering the Robbins & Myers electric fans for alternating-current and direct-current circuits.

GAS FILTERING SYSTEM.—A new filter intended primarily for supplying clean flue gas to its CO_2 recording equipment has recently been developed by the Uehling Instrument Company, 71 Broadway, New York City.

LIGHT METER.—Bulletin No. 343 issued by the engineering department of the Holophane Glass Company, 342 Madison Avenue, New York City, describes the "Holophane" lightmeter.

RADIO GENERATORS.—The Robbins & Myers Company, Springfield, Ohio, has developed a new line of high-voltage, direct-current generators and motor-generators for service with wireless-telephone outfits.

RHEOSTATS.—The Ward Leonard Electric Company, Mount Vernon, N. Y., has issued a small booklet describing its various types of vitrohm (vitreous-enameled) field rheostats. The company is also distributing a four-page leaflet covering the "Ward Leonard" automatic motor starter, counter EMF style.

DISHWASHER.—The Conover Manufacturing Company, 331 West Ohio Street, Chicago, is distributing a circular describing the "Conover" electric dishwasher.

CURRENT TAP.—Harvey Hubbell, Inc., Bridgeport, Conn., is distributing bulletin 17-4a, covering the Hubbell "Te-Cap"-"Te."

WIRING SUPPLIES.—The Connecticut Electric Manufacturing Company, Bridgeport, Conn., has issued a new pocket-size catalog (No. 6), covering its "Up-to-date" electrical supplies.

PORTABLE ELECTRIC PLANT.—The Simms Magneto Company, East Orange, N. J., is distributing a twelve-page booklet describing its "Homelite" portable electric light and power plant. The company is also distributing an eight-page leaflet calling attention to the use of the "Homelite" electric plant on poultry farms.

CENTRIFUGAL PUMPS.—Bulletin No. 123 issued by the Goulds Manufacturing Company, Seneca Falls, N. Y., describes and illustrates the different types of the "Goulds" steam turbine driven centrifugal pumps.

POLYPHASE MOTOR.—A four-page leaflet distributed by the Wagner Electric Manufacturing Company, St. Louis, describes its new "Pow-R-full" polyphase motor.

New Incorporations

THE EAST UTICA ELECTRIC SUPPLY COMPANY, INC., has been incorporated with a capital stock of $5,000. The directors of the company are Frank A. Salerno, 702 Rutger Street; Francisco Cappello, 739 Bleecker Street, and Woodward W. Guilt, 110 Genesee Street, all of Utica, N. Y.

THE LONDON STEAM TURBINE COMPANY, Troy, N. Y., has filed articles of incorporation under the laws of Massachusetts, with a capital stock of $500,000. The company has acquired the property of the Steam Motors Company of Springfield, Mass., and will manufacture steam turbines and appliances.

THE OKARCHE (OKLA.) LIGHT & POWER COMPANY has been incorporated with a capital stock of $[illegible] by George C. Hoebing, John Barkstein, R. H. Hunter.

THE BLUMENTHAL LIGHTING FIXTURE COMPANY, New York, N. Y., has been incorporated with a capital stock of $25,000 by A. Bernardik and I. Shapiro. B. F. Schwartz, 305 Broadway, is attorney.

THE ELECTRIC DEVICES COMPANY, Newark, N. J., has been incorporated with a capital stock of $[illegible] by H. S. Brown, Newark; P. S. Holsworth, Rockville Centre, N. Y., and F. C. Nash, Forest Hills, N. Y.

THE ICENOMOR ELECTRIC REFRIGERATOR COMPANY, [illegible], has been incorporated with a capital stock of $50,000 by E. D. Pellegrin, A. H. Owen and F. W. Rank.

THE AURORA, ELGIN & FOX RIVER ELECTRIC COMPANY, Aurora, Ill., has been incorporated by [illegible] L. [illegible], E. F. [illegible] and Ralph [illegible] [illegible].

Record of Electrical Patents

Notes on United States Patents

(Issued Dec. 6, 1921)

1,398,956. ELECTRIC FIXTURE; Arthur B. Allworth, Meriden, Conn. App. filed Oct. 29, 1920. Wall or ceiling.

1,398,972. CHIME-OPERATING APPARATUS; Frederick B. Little, Chicago, Ill. App. filed May 23, 1921. Electromagnetic.

1,399,005. SPARK GAP; George B. Crouse, Brooklyn, N. Y. App. filed June 14, 1918. Radio transmitting apparatus.

1,399,062. LIGHTING FIXTURE; Charles R. Leimecke, Detroit, Mich. App. filed May 27, 1920. Semi-direct.

1,399,066. TELEPHONE-EXCHANGE SYSTEM; Fritz Lubberger, Berlin-Halensee, Germany. App. filed Sept. 20, 1915. Overflow trunking systems.

1,399,083. TELEPHONE MUFFLER; Louis C. Scher, New York, N. Y. App. filed April 21, 1921. To prevent being overheard.

1,399,084. ELECTRIC CONTROLLING APPARATUS; John L. Schermerhorn, Newark, N. J. App. filed Aug. 2, 1920. To effect variations of voltage or current by small increments over a relatively wide range.

1,399,116. ELECTRICALLY CONTROLLED SWITCH MECHANISM; William G. Hartwig, Chicago, Ill. App. filed July 9, 1917. Two-point thermostat.

1,399,120. SPOTLIGHT; Earl H. Howard, Los Angeles, Cal. App. filed Aug. 11, 1919. Automobile.

1,399,129. DIMMER SWITCH; Henry F. Laub, Logan, Utah. App. filed April 5, 1920. Push-button type.

1,399,140. CONDUCTOR CLAMP; Samuel S. Matthews, Mansfield, Ohio. App. filed April 6, 1921. Trolley support.

1,399,161. APPARATUS FOR TREATING ARTICLES BY DISRUPTIVE CONDUCTION; Franklin S. Smith, Philadelphia, Pa. App. filed March 27, 1919. For killing insects in grain, beans, cereals, furs, woolens and the like.

1,399,162. APPARATUS FOR TREATING PRODUCTS BY DISRUPTIVE CONDUCTION; Franklin S. Smith, Philadelphia, Pa. App. filed Sept. 4, 1920. For the purpose of destroying insect life.

1,399,1[illegible]. ELECTRICAL BOILER; William M. White, Milwaukee, Wis. App. filed Dec. 23, 1919. Electrical steam boilers.

1,399,251. MEANS FOR CHANGING THE INTENSITY OF SIGNALS IN RADIODYNAMIC RECEIVING SYSTEMS; Emory L. Chaffee, Belmont, Mass. App. filed July 31, 1917. Radio receiver.

1,399,2[illegible]. SYSTEM OF RADIODYNAMIC CONTROL; John Hays Hammond, Jr., Gloucester, Mass. App. filed June 30, 1917.

1,399,268. TELEPHONE APPARATUS; Fritz P. Mansbendel, Brooklyn, N. Y. App. filed June 13, 1917. For use by deaf persons or with loud-talking apparatus.

1,399,307. ELECTRODE FOR ELECTRICAL WELDING MACHINES; Thomas E. Murray, Jr., and Joseph B. Murray, Brooklyn, N. Y. App. filed July 3, 1920. For welding pipe.

1,399,309. METHOD OF AND MEANS FOR COOLING ELECTRICAL CONDUCTORS WHEN INCLOSED IN CONDUITS OF CONCRETE OR THE LIKE; Thomas E. Murray, Brooklyn, N. Y. App. filed Jan. 25, 1921. Material of the conduit sufficiently pervious to permit a cooling liquid to seep through it.

1,399,350. ELECTROMAGNET; Louis Larsen, Brooklyn, N. Y. App. filed Oct. 29, 1918. For the operation of the switches of motor controllers.

1,399,361. CONTROL OF ELECTROMAGNETIC TRACK BRAKE SYSTEMS; Gottlieb L. Meyfarth, Geneva, Switzerland. App. filed Sept. 18, 1919.

1,399,420. METHOD OF MENDING ELECTRIC RESISTANCE ELEMENTS; Noel Carrico, Sidney, Mont. App. filed Sept. 11, 1920. For spiral wound elements.

1,399,428. ELECTRIC HEATER; Frank C. Hughes, Chicago, Ill. App. filed Oct. 9, 1920. Wire fixed in grooves with cement.

1,399,502. ELECTRICAL PROTECTIVE DEVICE; James J. Lodge, New York, N. Y. App. filed Dec. 18, 1918. Prevents removal of lamp from socket.

1,399,515. ELECTRIC WATER HEATER; Sebring I. Phelps, Wilmette, Ill. App. filed Jan. 26, 1920.

1,399,529. WEED KILLER; James R. Stewart, Minneapolis, Minn. App. filed June 19, 1919. Electrically heated spike touched to root of weed.

1,399,531. DIAPHRAGM FOR ELECTROLYTICAL CELLS; Richard Walter, Villach, Austria. App. filed Jan. 30, 1918. Of ceramic or the like material.

1,399,545. FLASHLIGHT; Richard M. Eaton, Niagara Falls, N. Y. App. filed March 22, 1920. Single unitary fastening device for searchlight caps and strip contacts.

1,399,560. CUSHION BRAKE; Frederick Hymans, Glen Ridge, N. J. App. filed Nov. 27, 1917. Quick release without injury to the brake-releasing mechanism.

1,399,598. FLASHLIGHT; William W. Anderson, Michigamme, Mich. App. filed March 1, 1921. Hand-driven generator.

1,399,605. DUAL SYSTEM OF ELECTRICAL CONTROL EMBODYING THE USE OF MAIN AUXILIARY SOURCE OF CURRENT SUPPLY; Edwin G. Davis, New York, N. Y. App. filed Jan. 5, 1918. For electric elevators.

1,399,664. SYSTEM OF CONTROL FOR ELECTRIC MOTORS OPERATING CRANES AND ANALOGOUS APPARATUS; William H. Scott and John Bentley, Norwich, England. App. filed Jan. 30, 1920.

1,399,688. ELECTRIC HEATER; Samuel M. Carmean and James H. Carmean, Kansas City, Mo. App. filed Feb. 25, 1921. Has circulating fan.

1,399,695. ELECTRICAL TESTING CIRCUITS; Charles S. Demarest, New York, N. Y. App. filed Nov. 6, 1919. For testing telegraph circuits superimposed on telephone lines.

1,399,696. MOISTURE TESTER; Cornelius P. De Roo, Flint, Mich. App. filed Sept. 9, 1920. For determining the moisture present in grains.

1,399,722. INCANDESCENT ELECTRIC LAMP; John A. Heany, New York, N. Y. App. filed July 29, 1916. Incandescent glower of porous material.

Construction News

Projects, Plans, Bids and Contracts Contemplated or Under Way

New England States

SOUTH BREWER, ME. — Plans have been prepared by Brastow & Son, operating a local flour mill, for equipping their mill for electrical operation. Electricity will be supplied by the Eastern Manufacturing Company, which has acquired the water-power rights heretofore furnished for hydraulic power for the mill.

UNION FALLS, ME.—The Clark Power Company, Clarks Mills, contemplates the development of a hydro-electric project, including the construction of a dam across the Saco River at Union Falls. The dam will be 1[illegible] ft. high, and have a head of from 74 ft. to 80 ft.; it will be fitted with six flashboards. The initial installation will provide for an output of 22,000 hp., with an ultimate development of 30,000 hp.

TORRINGTON, CONN.—New bids have been asked for the installation of an ornamental lighting system on Main Street.

Middle Atlantic States

AMSTERDAM, N. Y.—The Adirondack Power & Light Company, it is reported, has plans under consideration for extensions and improvements during the coming year.

ARKPORT, N. Y.—The Board of Trustees is considering the erection of a transmission line from Arkport to Hornell to secure electricity from the Hornell Electric Company. Electricity will also be furnished to residents along the route of the proposed line. C. A. Higgins is president of the board.

BUFFALO, N. Y.—Bids will be received by the State Hospital Commission, Capitol, Albany, until Jan. 11, for renewing wiring and conduit (completion Wards 16, 17 and 18), Buffalo State Hospital, Buffalo. L. H. Farrington is secretary of the commission.

DOLGEVILLE, N. Y.—Negotiations are under way, it is reported, by the Utica Gas & Electric Company for extensions to its lighting system from Dolgeville to Salisbury Center.

DUNKIRK, N. Y.—Preliminary plans are under way by the City Council, it is reported, for a municipal power plant, to cost about $500,000. F. W. Ballard, Swetland Building, Cleveland, Ohio, is engineer.

FAR ROCKAWAY, N. Y. — Plans are under consideration by the Queens Borough Gas & Electric Company for extensions and improvements to its electric power plant on Clifton Street to cost about $35,000.

NEW YORK, N. Y.—Plans are under way by the New York Edison Company for the construction of a one-story power house, 50 ft. x 100 ft., at Park Avenue and 188th Street to cost about $150,000. William Whitehill, 12 Elm Street, is architect.

NEW YORK, N. Y. — Plans are being prepared by F. M. Schildwachter, 4,130 Park Avenue, for the construction of a four-story ice-manufacturing plant, 76 ft. x 110 ft., on Webster Avenue, to cost, including machinery, about $1,000,000. Koch & Wagner, 32 Court Street, Brooklyn, are architects.

SHELTER ISLAND, N. Y.—The Shelter Island Electric Light & Power Company, recently organized, plans to secure electricity from the Long Island Lighting Company by means of a submarine cable under the South Ferry from Sag Harbor.

UTICA, N. Y.—The Utica Gas & Electric Company contemplates the construction of a transformer station.

MORRISTOWN, N. J.—The acquisition of the properties of the Boonton Electric Company and the United Electric Company of New Jersey by the Morris and Somerset Electric Company, Morristown, has been approved by the Public Utility Commission.

HANOVER, PA.—The General Gas & Electric Company contemplates the installation of additional machinery in connection with the establishment of its new lighting equipment and electric products plant.

HARRISBURG, PA.—Bids will be received by the Board of Education until Jan. 6, 1922, for the installation of vocational shop units at the new senior coeducational high school at Third and Division Streets. The plans include the construction of a power house. D. D. Hammelbaugh is secretary.

PHILADELPHIA, PA. — The construction of a one-story power house on Willow Street is under consideration by the William Amer Company, 152 North Third Street.

PHILADELPHIA, PA.—The good roads committee of the Chamber of Commerce has recommended the installation of a new lighting system in Fairmount Park. Alan Corson is chief engineer of Fairmount Park.

WAYNESBORO, PA.—A movement has been started by citizens of Leitersburg, it is reported, to secure electricity for lighting the villages from the Waynesboro Electric Company.

WILKINSBURG, PA.—The Wilkinsburg Ice Company, Centre Street, is planning to build a new one-story ice-manufacturing and power plant at Turtle Creek, to cost about $125,000.

BALTIMORE, MD.—Property at Nanticoke and Bayard Streets, 276 ft. x 479 ft., has been acquired by the Consolidated Gas, Electric Light & Power Company, to be used some time later for power-house operations.

BALTIMORE, MD.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Dec. 27 for the installation of an electric light and power plant in the United States Quarantine Station, Baltimore. James A. Wetmore, Washington, is acting supervising architect.

FROSTBURG, MD.—The Town Council is considering the installation of electric pumping machinery to replace the steam-operated pumps now in use at the municipal waterworks. The Hagerstown & Frederick Electric Railway Company will furnish the electricity.

BLUEFIELD, W. VA.—Plans have been prepared by the Bluefield Ice & Cold Storage Company for the construction of a new ice-manufacturing and cold-storage plant.

WOODSTOCK, VA.—The Valley Light & Power Company contemplates rebuilding the portion of its power plant recently destroyed by fire.

WASHINGTON, D. C.—The Bureau of Supplies and Accounts, Navy Department, Washington, D. C., will receive bids for the following: Until Jan. 17, 1922, Mare Island, Schedule 9262—one power unit. Schedule 9263—one telephone switchboard. Until Jan. 21, Schedule 9131—six [illegible] cranes.

North Central States

BIG RAPIDS, MICH.—The Rogers Dam plant of the Consumers' Power Company, six miles south of Big Rapids, was recently destroyed by fire. The loss is placed at between $300,000 and $400,000.

BIG RAPIDS, MICH.—The City Commission has directed the city manager to obtain estimates for the laying of conduits for an ornamental street-lighting system.

DAYTON, OHIO.—Bids will be received by the Engineering Division, Air Service, Dayton, Ohio, until Jan. 9, 1922, for furnishing ninety generator control panel assemblies. (Circular 2293.)

HILLIARDS, OHIO.—The Hilliards Light & Power Company has filed notice of an increase in its capital stock from $10,000 to $35,000.

OSBORN, OHIO.—The Dayton Power & Light Company plans to install new equipment to serve electricity to Osborn, when the village has been removed to its new site. The company has applied to the State Public Utilities Commission for permission to tear down the old equipment.

TOLEDO, OHIO.—The Toledo-Edison Company, formerly the Toledo Railways & Light Company, plans to start work April 1, 1922, on the installation of a 28-mile electric transmission line, to cost about $1,500,000. The high-tension cables will be carried on 20-ft. steel towers, four of which have already been completed.

PORTLAND, KY.—The Portland Civic Club has taken steps to secure the installation of an ornamental lighting system on Portland Avenue and on Twenty-sixth Street.

TERRE HAUTE, IND.—Plans are under way for a one-story power house at the Indiana State Normal School, Terre Haute. Shrouds & Stoner, 511 Tribune Building, are architects.

VINCENNES, IND.—The Vincennes Electric Company, sold recently under foreclosure to the Merchants' Trust Company of St. Louis for $160,000, has been reorganized and has been authorized by the Public Service Commission of Indiana to issue $100,000 in stock and $200,000 in bonds for purchasing the electric railway properties.

WILLIAMS, IND.—The Southern Indiana Power Company, Bedford, is considering plans for a new electric power plant to cost about $75.000. Holland, Ackerman & Holland, 106 Liberty Avenue, Ann Harbor Mich., are architects.

CHICAGO, ILL.—The Commonwealth Power Company has purchased a site of fifteen acres in the extreme northwest corner of Indiana from the Eggers Estate, on which it will eventually erect a large power plant to supply electricity to the entire steel belt, including Gary, Hammond, Whiting, East Chicago and other cities in Indiana, and possibly in South Chicago.

HERRIN, ILL.—A sum of $150,000 has been raised by citizens of Herrin to guarantee an extension of the traction line of the Murphysboro & Southern Railway Company from Carbondale.

MILWAUKEE, WIS.—Bids, it is reported, are being received for the Otto Pietsch Dye Works, 254 West Water Street, through the Birkholz, 216 West Water Street, for boilers, motors and other equipment for its new power house, 40 ft. x 60 ft., to be used in connection with its plant now under construction at Third Street and Atkinson Avenue.

OSHKOSH, WIS.—Contract has been awarded to the Monroe Electric Company, Chicago, Ill., for the installation of a street-lighting system in Oshkosh, to consist of 213 concrete posts mounted with Novalux lamps, to cost about $11,000.

ALTA, IOWA.—The question of issuing $22,000 of electric light bonds is under consideration. R. H. Wilkinson is clerk.

CORNING, IOWA.—Bids, it is reported, will be received by the City Council about Jan. 15, 1922, for the construction of a municipal electric power plant, to cost about $60,000. C. K. Munn is engineer.

COLUMBIA, MO.—The City Council is considering extensions to the municipal electric light and water plant, to cost about $40,000.

WINSDOR, MO.—The installation of an ornamental lighting system in Windsor is under consideration by the Town Council.

RISING CITY, NEB.—Plans are under way, it is understood, for the construction of a power plant building in Rising City.

Southern States

CHARLOTTE, N. C.—The Southern Power Company, through its subsidiaries the Catawba Manufacturing & Electric Power Company and the Great Falls Power Company, has awarded contracts for the construction of a new hydro-electric plant, including dam, power station and equipment, at Mountain Island, N. C., and a new power house at Great Falls S. C. Contract for the Mountain Island plant has been awarded to Rhinehart & Dennis of Charlottesville, Va., at a cost of $8,000,000. About 80,000 hp. will be developed. Scott, Stewart Jones Company of Greenville and Rock Hill, S. C., has been awarded contract for the Great Falls plant, which will have a generating capacity of 60,000 hp.

DUNN, N. C.—The proposal to sell the municipal electric system to the Carolina Power & Light Company was carried.

DURHAM, N. C.—Arrangements have been made by the Durham Public Service Company to issue $100,000 in bonds, the proceeds to be used in part for extensions.

FAYETTEVILLE, N. C.—The Cape Fear Railway, Inc., recently incorporated, plans to build a traction line from Fayetteville to Camp Bragg on the west of the city, and the mill villages on the south. The new company succeeds the old Cumberland Railway & Power Company. L. H. Couch, Raleigh, is vice-president of the new company.

LENOIR, N. C.—A. M. Kistler, Morgantown, is having surveys made for the erection of an electric transmission line from Wilson Creek to Lenoir. It is proposed to utilize water from the creek for the development of power.

PILOT MOUNTAIN, N. C.—Bonds to the amount of $40,000 have been voted for the construction of a municipal electric light and power plant. P. E. Simmons is secretary of the Board of Town Commissioners.

SOUTHPORT, N. C.—The city officials are considering municipal improvements, including the installation of oil engines, electrical apparatus, water meters, etc. S. I. Dosher is Mayor.

WARSAW, N. C.—The City Council is considering issuing $25,000 in bonds for improvements to the municipal electric and water systems.

VALDOSTA, GA.—Manufacturing concerns in Valdosta, it is reported, have decided to organize an independent company for the purpose of building an electric plant. The cost is estimated at $60,000.

VALDOSTA, GA.—F. E. Hatch, Albany, Ga., is considering the development of a hydro-electric power project at Banks Mill Pond.

FORT MEADE, FLA.—The installation of a municipal electric plant is under consideration by the Council.

MOBILE, ALA.—The construction of a municipal electric light and power plant in Mobile is under consideration by the City Commissioners.

HARDY, ARK.—Application has been made by A. Sebert, Tuscumbia, Ala., for a franchise to install an electric lighting system and waterworks in Hardy, Ark.

HOT SPRINGS, ARK.—The City Council is considering extensions to the lighting system on Benton Street and on Malvern Avenue.

RED ROCK, OKLA.—Steps have been taken by citizens of Red Rock to establish a municipal electric light plant.

SULPHUR, OKLA.—Bonds to the amount of $10,000 have been voted for the installation of an ornamental lighting system in Sulphur.

EDNA, TEX.—The Edna Light, Ice & Water Company contemplates changing its system from 220 volts, direct current, to 2,300 volts, three-phase, 60 cycles. New equipment, including a 120-hp. Diesel engine, will be installed. The company also plans to increase the capacity of its ice plant.

RIO HONDO, TEX.—The local light plant, it is reported, was recently destroyed by fire.

SAN ANTONIO, TEX.—The Medina Valley Irrigation Company, it is reported, is considering the development of an irrigation and power project including the construction of a dam across the Guadalupe River, installation of a hydro-electric plant, and raising the height of the present dam across the Medina River, 8 feet. The proposed dam will store flood waters of the Guadalupe River which are to be conveyed by means of a tunnel into the reservoir formed by the existing dam, after first serving to generate sufficient electricity for light and power to cities, towns and industries within a radius of 150 miles. The cost of the project is estimated at about $10,000,000.

SAN AUGUSTINE, TEX.—An issue of $30,000 of electric light and power plant bonds has been approved by the Attorney-General.

VERNON, TEX.—At an election to be held Jan. 3, 1922, the proposal to issue $100,000 in bonds for the construction of a municipal electric light plant will be submitted to the voters.

Pacific and Mountain States

EUGENE, ORE.—The Water Board of Eugene has filed applications with the State Engineer for location of two power sites on the Mackenzie River. The first application asks permission to appropriate 400 sec.-ft. of water from the river to provide for an increase in the capacity of the municipal power plant, and the second requests authority to utilize 2,500 sec.-ft. for a new power plant.

HOOD RIVER, ORE.—The Oregon Lumber Company contemplates the construction of a large dam just below the Punch Bowl for developing electric power.

WALLOWA, ORE.—The Minnaugh Lumber Company is considering the erection of a hydro-electric generating plant on the Wallowa River for general mill service.

EUREKA, CAL.—The Board of Supervisors has adopted plans and specifications for the construction of a power plant and laundry at the county hospital. Newton Ackerman is architect.

LONG BEACH, CAL.—A petition has been submitted to the City Council for the installation of street lamps on Winnipeg Avenue.

LOS ANGELES, CAL.—The public welfare committee of the City Council is considering issuing a permit to the Los Angeles Railway Corporation to build a substation near the corner of Kingsley Drive and Melrose Avenue.

ONTARIO, CAL.—The Ontario (Cal.) Power Company has been authorized by the State Railroad Commission to issue $44,500 in notes and $20,000 in stock, of which $44,279 will be used for the construction of a power house in San Antonio Heights.

SAN BERNARDINO, CAL.—The Southern California Edison Company has purchased a site, 125 ft. x 200 ft., at Rialto Avenue and Livingstone Street on which it plans to erect outdoor and indoor substations, to cost about $169,000. Later on the company will also build a garage and storehouse at a cost which is estimated at about $35,000.

BEAVER CITY, UTAH.—An agreement has been entered into by the city authorities of Beaver City and the Telluride Power Company, Salt Lake City, whereby they will co-operate to develop the water power of Beaver River.

Canada

CALGARY, ALTA.—The Calgary Power Company, it is reported, contemplates the construction of an auxiliary hydro-electric power plant at Kananaskis Falls. The proposed extension will cost about $1,500,000.

EDMONTON, ALTA.—W. J. Cunningham, superintendent of the municipal power plant, has submitted to the City Commissioners estimates amounting to $200,000 for proposed expenditures on the municipal power plant during the year of 1922. The improvements include a new high-lift pump, $18,000; feed-water heater, $[illegible]; circulating water main from the pumping plant to the power plant and sedimentation basin, $40,000; extension to the river intake, $[illegible]; stokers and equipment for [illegible] boilers, $[illegible]; draft plant, $16,000.

CALEDONIA, ONT.—Surveys are being made for the installation of an electric light and power distribution system in Oneida Township, to cost about $12,000. A. Wilson, [illegible] University Avenue, Toronto, is engineer.

GALT, ONT.—Bylaws have been passed by the City Council providing for the installation of an ornamental lighting system on Dundas Street from Beverly to Chalmers Street and on Wellington Street from Dickson to Beverly Street. Joseph McCartney is city clerk.

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	Kw.		Speed
1	48	[illegible]	1200
1	50	Gen. Elec., type ATI, [illegible]	1200
1	50	Westinghouse, type C, [illegible], 220 or 440 volt	1200
1	50	Crocker-Wheeler, revol. field, 2300-volt	1200
1	50	Gen. Elec., type ERB, rev. field, 2300 or 480-volt, to New York [illegible]	300
1	[illegible]	Westinghouse, 2300-volt [illegible]	1200
1	[illegible]	Westinghouse, revolving field, 2200-volt, direct, for [illegible]	257
2	60	Electric Machinery, rev. field, 2300-volt	900
	70	Westinghouse, rev. field, 2300-volt to [illegible] Fleming steam engine...	300
1	75	Ridgway [illegible] 220-volt to Ridgway [illegible]	300
1	75	Crocker-Wheeler, rev. field, 2300-volt, 2 or 3 phase to McEwen steam engine...............	275
1	75	Westinghouse-Parsons Turbo Generator, 240-volt, 2 or 3 phase....	1200
1	100	Westinghouse, revolving field 2200-volt	900
1	150	Allis-Chalmers revolv. field, 2300-volt, direct con. to Buckeye steam engine	225
1	160	Elec. Machinery Co., 440 revolv. field............	600
1	200	Gen Elec, type ATI, rev. field, 2300-volt....	600
1	225	Gen. Elec., type ERB, rev. field, 2300-volt	[illegible]

250-VOLT, D. C. GENERATORS

	Kw.		Speed
1	6	[illegible]	[illegible]
1	7½	[illegible]	[illegible]
1	15	[illegible], 125-250-volt, 3-wire ...	[illegible]
1	20	[illegible]	[illegible]
1	20	[illegible], to Ideal steam engine.	[illegible]
1	25	[illegible]	[illegible]
1	25	Milwaukee to Erie-Ball steam engine	340
1	25	[illegible]	[illegible]
1	30	[illegible]	[illegible]
1	30	[illegible]	[illegible]
1	30	[illegible]	[illegible]
1	[illegible]	[illegible]	[illegible]
1	[illegible]	[illegible]	[illegible]
1	[illegible]	[illegible]	[illegible]
1	60	Gen. Elec., [illegible], 125-250 [illegible]	925
1	150	Gen. Elec.-Curtis Turbo Generator	2000
2	200	Westinghouse, 6-Pole to [illegible]	200

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	Hp		Speed
7	5	Gen. Elec.	[illegible]
6	7	[illegible]	[illegible]
16	7½	Gen. Elec.	[illegible]
2	[illegible]	[illegible]	[illegible]
1	10	Westinghouse, slip-ring	[illegible]
14	10	Gen. Elec	750
1	15	Westinghouse, slip ring..	7 0
8	15	Gen. Elec	[illegible]
11	20	Gen. Elec	[illegible]
1	[illegible]	[illegible]	[illegible]
1	25	Westinghouse	730
1	[illegible]	Allis-Chalmers	[illegible]
1	40	Westinghouse, slip ring.	730
7	50	Westinghouse .	735
6	[illegible]	Gen. Elec.	[illegible]
1	60	Allis-Chal	720
1	[illegible]	Allis-Chal	[illegible]
1	75	Gen. Elec...............	750
1	100	Ft. Wayne.	[illegible]
1	150	Burke...................	375
2	200	[illegible]	[illegible]
[illegible]	[illegible]	Allis-Chal., slip ring	[illegible]

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	Hp		Speed
4	20	G. E., form K	[illegible]
1	20	Westinghouse, type CS	[illegible]
1	20	Gen. Elec , type KT....	1200
1	20	Gen. Elec., type MT....	1200
1	20	Gen. Elec., type MT, slip-ring, variable speed	1200
1	20	Westinghouse, type CCL	1120
1	20	G. E., type KT	[illegible]
1	20	G. E., wound rotor	[illegible]
2	20	[illegible]	[illegible]
2	20	Westinghouse, type HF, slip-ring, variable speed	[illegible]
1	20	Crocker-Wheeler	[illegible]
1	20	Westinghouse, type CS	[illegible]
1	20	Wagner, type [illegible]	[illegible]
1	[illegible]	[illegible]	[illegible]
1	[illegible]	[illegible]	[illegible]
1	25	Crocker-Wheeler	[illegible]
1	25	[illegible]	[illegible]
1	25	Crocker-Wheeler	[illegible]
1	30	G. E., type KT	[illegible]
1	30	Allis-Chalmers	[illegible]
1	30	Wagner, wound rotor	[illegible]
1	30	Westinghouse, type CX.	1120
1	30	Wagner (wound rotor)	[illegible]
1	30	Westinghouse, type HF, slip-ring..............	850
1	[illegible]	G. E., type MT, slip-ring	720
1	[illegible]	Westinghouse, type MS	[illegible]
1	[illegible]	Richmond.............	850
1	[illegible]	G. E., type I, form M, slip-ring ...	[illegible]
1	[illegible]	G. E., type I, form M, slip-ring	[illegible]
[illegible]	[illegible]	G. E., form K	[illegible]
[illegible]	40	G. E., type KT	[illegible]
2	40	[illegible]	[illegible]
1	40	G. E., type KT	[illegible]
1	50	G. E., type KT.	1800
1	50	Westinghouse, type CS	[illegible]
2	50	G. E., [illegible]	[illegible]
1	50	Allis-Chalmers	[illegible]
1	50	[illegible]	[illegible]
1	[illegible]	Allis-Chalmers	[illegible]
2	75	G. E., form K	[illegible]
1	75	[illegible], type HF, slip-ring, to Wilson-Snyder, 3-stage, centrifugal pump	[illegible]
1	75	[illegible]	[illegible]
[illegible]	100	Gen. Elec., form K	[illegible]
1	[illegible]	Gen. Elec., form L	[illegible]
1	150	Gen. Elec., type I, form M, slip-ring...........	600
1	[illegible]	Westinghouse, type C[illegible]	[illegible]
1	200	[illegible]	[illegible]
[illegible]	250	Gen. Elec., type I, form K, [illegible]	[illegible]
[illegible]	250	[illegible]	[illegible]
[illegible]	300	Westinghouse, CW, slip ring, [illegible]	[illegible]
1	[illegible]	Westinghouse, HF, slip-ring, [illegible]	[illegible]

JOHN A. STEWART ELECTRIC CO.

S. W. Corner Water & Vine Sts., Cincinnati, Ohio

1814 Continental Bank Bldg., Chicago, Ill.
2112 Central Street, Kansas City. Mo

MOTORS

1—[illegible] hp. Westinghouse Type CW. Slip-ring Rolling mill type Motor, 3-ph., 60-cy., 2300 volts, [illegible] r.p.m., with magnetic control panel complete. This motor is brand new and in [illegible].

1—[illegible] kva. Westinghouse Synchronous, 6600 volts, 3-ph., 25-cy., 150 r.p.m., with starting [illegible].

1—[illegible] hp. New Allis-Chalmers, 3-ph., 60-cy., [illegible] volts, slip-ring, [illegible] r.p.m., with starter.

1—[illegible] hp. New Allis-Chalmers, 3-ph., 25-cy., 440 volts, [illegible] type, with [illegible].

1—[illegible] hp. New G. E., 3-ph., 60-cy., 550 volts, 600 r.p.m., [illegible].

1—200 hp. General Electric, 3-ph., 60-cy., 2200 volts, 1760 r.p.m., slip-ring motor, with starter.

1—[illegible] hp. Allis-Chalmers, brand new, 3-ph., 60-cy., 2200 volts, 514 r.p.m., slip-ring induction motor, with Westinghouse primary, Cutler-Hammer [illegible] starter.

1—[illegible] hp. Allis-Chalmers, 3-ph., 60-cy., 2200 volts, 870 r.p.m., slip-ring induction motor, with Westinghouse [illegible] and Cutler-Hammer [illegible].

2—[illegible] hp. Allis-Chalmers, 3-ph., 60-cy., 440 volts, [illegible] squirrel cage motors, with [illegible].

1—[illegible] hp. [illegible], 2 or 3-ph., 60-cy., 2300 volts, [illegible] motor, with direct-[illegible] and starting panel.

200 Motors ranging from 7½ to 75 hp., 3-ph., 60-cy., [illegible] volts, [illegible] with controllers, [illegible] rebuilt [illegible] and sell at a [illegible]. Details list mailed upon request.

TURBINES

3—500 kw. Gen. Elec., [illegible] 60-cy., 1800 r.p.m., [illegible] 2000 sq. ft. surface condensers, with pumps & heaters. [illegible] delivery.

2—[illegible] kw. Westinghouse [illegible] 2 or 3-ph., 60-cy., [illegible] 3600 r.p.m., condensing with 2500 sq. ft. surface condenser.

FREQUENCY CHANGERS

1—[illegible] kw. G. E., 3-ph., 25-cy., 6000 volts, to 3-ph., 60-cy., 2100 volts, [illegible] r.p.m., four bearings, can be separated, making 2 motors.

1—100 kw. G. E., same as above, [illegible] r.p.m.

1—[illegible] kw. G. E., same as above, 375 r.p.m.

2—1250 kva. G. E., 3-ph., 25-cy., 6600 volts, 375 r.p.m. motor, type A.T.I., to A.C. generator A.Q.B. [illegible] volts, [illegible], reconnectable for 3-ph., 2300 volts, 62½-cy., with [illegible] connected exciter. Located near New York.

1—[illegible] kva. Westinghouse, [illegible] volt, 375 r.p.m. motor, to 2-ph., 62½-cy., 2700 volts generator, reconnectable for 3-ph., no exciter. Located near New York.

1—400 kva. G. E., [illegible] 375 r.p.m. motor, to 2-ph., 62½-cy., 2400 volts generator [illegible] exciter. Located near New York.

CONDENSERS

2—Westinghouse No. [illegible] Jet Condensers, complete with motor-driven pumps, [illegible] and [illegible] perfect condition. [illegible] delivery. [illegible]

GENERATOR AND ENGINE

1—240 kw. Ft. Wayne, 3-ph., [illegible] volts, 150 r.p.m., [illegible] direct connected to [illegible] tandem compound [illegible] engine. Excellent condition. [illegible] shipment Cincinnati.

MOTOR GENERATOR SETS

Immediate Delivery

Installed Brand New— Never Operated

2—2110 kw. Allis-Chalmers 275-volt Direct-Current Generator, direct connected to synchronous motor, 3-ph., 25-cy., 12,000 volts, with [illegible] kw. 275 volt (D.C.) 3-ph., 25-cy. Rotary Converter [illegible] exciter) and complete switchboard equipment.

1—1200 kw. [illegible] 400 r.p.m. [illegible], 2[illegible]00 volt, 400 r.p.m. synchronous mo[illegible]. Located [illegible].

3—150 kw. Westinghouse, [illegible] r.p.m. generator, with 225 hp. Westinghouse, 3-ph., 25-cy., 6600 volt, 500 r.p.m. synchronous [illegible]. Located [illegible].

1—100 kw. Westinghouse, [illegible] D.C. 1100 [illegible] Westinghouse [illegible] 1100 r.p.m. with [illegible]. Located [illegible].

BOILERS

2—[illegible]

6—[illegible] B. & W. [illegible]

4—[illegible]

20—[illegible] These [illegible]

ROTARY CONVERTER

1—[illegible]

1—[illegible] 11,000 volts A.C., 550 volts D.C., with transformers, [illegible] available for different ratios.

1—[illegible] G. E. [illegible] D.C., 185 volts A.C., [illegible]

1—[illegible] G. E. [illegible] as above.

1—[illegible] G. E. [illegible] to 125 volts D.C. [illegible] with 150 kw. [illegible]. Located near New York.

ENGINE GENERATOR SETS

Write for [illegible] excellent [illegible] most attractive prices and immediate delivery.

TIFFANY ELECTRIC COMPANY INC

POWER EQUIPMENT ENGINEERS

165 BROADWAY, NEW YORK

Telephone
Cortlandt 4204-4205

Telephone
Cortlandt 4204-4205

MOTORS—GENERATORS *IMMEDIATE SHIPMENT*

TURBO-GENERATOR SETS

1—375-kva., 480/240-volt, 3600-r.p.m., 3-phase, 60-cycle General Electric Curtis, non-condensing, with direct connected exciter and switchboard. Practically new.

1—125-kva., 480/240-volt, 3600-r.p.m., 3-phase, 60-cycle General Electric Curtis, non-condensing, with direct connected exciter and switchboard. Practically new.

ENGINE-GENERATOR SETS

1—375-kva., 480 or 240-volt, 3-phase, 60-cycle, 150-r.p.m. General Electric "ATB" revolving field with switchboard panel, direct connected exciter and direct connected with 22 x 27 Erie Ball, left hand, side crank, non-condensing engine, complete.

1—240-kva., 480 or 240-volt, 3-phase, 60-cycle, 164-r.p.m. General Electric "ATB" revolving field with switchboard panel, direct connected exciter and direct connected to 16 x 22 Erie Ball, right hand, side crank non-condensing engine, complete.

1—125-kva., 2200-volt (also 220 or 440-volt), 200-r.p.m. General Electric "ATB", 3-phase, 60-cycle, direct connected to 16 x [illegible] left hand, side crank Erie City double eccentric, slide valve engine, complete.

LARGE MOTORS (Complete)

H.P.	*Volts*	*Speed*	*Ph.*	*Cy.*	*Make and Type*
500	2200	600	3	60	Gen. Elec., Slip Ring, 3 bearing
400	2200/550	450	3	60	Westg. CW., Slip Ring, 2 bearing
350	440/220	500	3	25	Burke 3 bearing, slip ring
300	440/220	600	3	60	Gen. Elec. "M" slip ring, 3 bearing
300	2200	720	3	60	Gen. Elec. "KT," sq. cage, 2 bear.
300	440/220	500	3	25	Gen. Elec. slip ring, 3 bearing
250	230	475	DC	DC	Westg. 2 bearing
200	2200	600	3	60	Gen. Elec. sq. cage, 2 bearing
200	500	430	DC	DC	Gen. Elec. "CLB"
150	440/220	690	3	60	Gen. Elec. slip ring
125	220	690	2	60	Gen. Elec. slip ring
100	2200	900	3	60	Gen. Elec. "K," sq. cage
100	220	690	2	60	Gen. Elec. form "L"
75	440/220	900	3	60	Westg. "HF" slip ring
75	440/220	514	3	60	Gen. Elec. "M" slip ring

Complete stock of smaller motors — quotations upon request.

SYNCHRONOUS MOTORS

300	2300	600	3	60	Gen. Elec. "ATI" direct connected exciter
270	2300	600	3	60	Gen. Elec. "ATI" belted exciter
125	2300	900	3	60	Gen. Elec. "ATI" direct connected exciter

MOTOR-GENERATOR SETS

(Each complete with starter, rheostat, etc.)

Gen.	200-Kw, 250-V, 600-RPM, Westg. compound wound
Motor,	300-HP, 2300-V, 600-RPM, 3 ph, 60 cy, Westg. synchronous
Gen.	200-Kw, 125-V, 600-RPM, Westg. compound wound, 6 pole
Motor	300-HP, 2300-V, 600-RPM, 3 ph, 60 Cy, Westg. synchronous
Gen.	185-Kw, 550-V, 600-RPM, Gen. Elec. "CLB" 6 pole
Motor,	300-HP, 2300-V, 600-RPM, 3 ph, 60 cy, General Elec. "ATI" syn.
Gen.	100-Kw, 1200-RPM, 250-V, 6 pole, "RC" Gen. Elec.
Motor,	150-HP, 1200-RPM, 440/220-V, 3 ph, 60 cy, Gen. Elec. sq. cage KT
Gen.	90-KW, 250-V, 1200-RPM, comp. wd. "RC" Gen. Elec.
Motor,	135-HP, 2300-V, 1200-RPM, 3 ph, 60 cy, Gen. Elec. "ATI" syn.
Gen.	50-Kw, 250-V, 900-RPM, comp. wd. "RC" Gen. Elec.
Motor,	75-HP, 440-V, 900-RPM, Gen. Elec. 3 ph. 60 cy. "KT"
Gen.	50-Kw, 125-V, 900-RPM, comp. wd. Gen. Elec. "DLC"
Motor,	75-HP, 440/220-V, 900-RPM, 3 ph, 60 cy, Gen. Elec. "KT"
Gen.	40-Kw, 250-V, 700-RPM, Westg. comp. wd. type "S"
Motor,	60-HP, 440/220-V, 720-RPM, 3 ph, 60 cy, Westg. sq. cage
Gen.	15-Kw, 250-V, 1140-RPM, comp. wd. Crocker-Wheeler, "CCD"
Motor,	25-HP, 440 or 220 V, 1140-RPM, 3 ph, 60 cy, sq. cage

A. C. BELTED GENERATORS

Kw	*Volts*	*Speed*	*Phase*	*Cycle*	*Make and Type*
450	480/240	450	3	60	Gen. Elec. "ATB" 3 bearing
250	480/240	450	3	60	Gen. Elec. "ATB" 2 bearing
200 2	2300	600	3	60	Gen. Elec. "ATB" 2 bearing
175	240	900	3	60	Westg. Rev. field
75	2200	900	3	60	Gen. Elec. "ATB"
60	240/480	1200	3	60	Westg. Rev. field

NOTHING BUT GOOD EQUIPMENT

New and Used—Guaranteed Condition—Ready to Ship

Slip Ring Motors—3-Phase 60-Cycle

Hp	*Volt*	*Speed*	*Make*	*Type*
250	2200	600	General Electric	M
200	2200	600	General Electric	M
[illegible]	220/440	600	General Electric	M
200	220/440	630	Allis-Chalmers	ANY
150	2200	600	General Electric	M
150	220/440	600	General Electric	M
150	440/220	720	General Electric	M
100	440/220	720	General Electric	M
100	2200	720	General Electric	M
100	440/220	900	General Electric	MT
100	2200	600	General Electric	M
75	220/440	720	General Electric	M
75	440/220	900	General Electric	MT
60	2200	600	General Electric	MT
60	220/440	1200	General Electric	M
60	440/220	900	General Electric	MT
50	550	900	General Electric	MT
50	440/220	1200	General Electric	MT
50	220/440	900	General Electric	MT
50	2200	900	General Electric	MT
50	2200	600	General Electric	MT
40	2200	900	General Electric	MT
40	440/220	1200	General Electric	MT
30	440/220	900	Allis-Chalmers	ANY
20	440/220	900	General Electric	M

Squirrel Cage—3-Phase 60-Cycle

100	440/220	900	General Electric	K
100	440/220	720	General Electric	K
75	440/220	900	General Electric	KT
50	440/220	1200	General Electric	KT
50	440/220	900	General Electric	K
50	550	900	Westinghouse	CCL
40	220/440	[illegible]	General Electric	KT
35	220/440	[illegible]	Westinghouse	CS
30	220/440	1200	Allis-Chalmers	AN
25	440/220	600	General Electric	K
25	440/220	900	General Electric	L
25	440/220	600	Allis-Chalmers	AN
25	220/440	1200	General Electric	KT
25	440/220	1200	Westinghouse	CS
20	440/220	1200	General Electric	L
15	440/220	1200	General Electric	L
10	440/220	1200	General Electric	L
10	440/220	900	General Electric	KT

3-Phase, 25-Cycle

300	440	500	General Electric, sl. rg
200	440	500	General Electric, sl. rg
150	440	500	General Electric L
100	440	750	Westinghouse, sq. cage

DIRECT CURRENT MOTORS

Hp	*Volts*	*Speed*	*Make*	*Type*
120	230	720	Westinghouse	SK
100	230	950	General Electric	RC
100	230	1150	General Electric	RC
90	230	500	General Electric	CL-A
75	230	1150	General Electric	RC
75	230	950	General Electric	RC
75	230	1100	Westinghouse	S
75	115	475	Westinghouse	SA
75	500	750	Westinghouse	M
65	230	550	Sprague	D
50	115	565	Westinghouse	SK
35	230	850	Westinghouse	S
30	230	600	Westinghouse	M
30	230	700	G. E. Sprague	D
25	230	750	Crocker-Wheeler	D
15	230	1000	General Electric	CQ
10	230	1150	General Electric	RC
10	115	1400	Allis-Chal	P

DIRECT CURRENT GENERATORS

Kw	*Volts*	*Speed*	*Make*	*Type*
100	250	[illegible]	Westinghouse	SK
90	250	1100	General Electric	RC
85	125	750	General Electric	MP-H
75	[illegible]	1100	General Electric	RC
75	250	575	General Electric	CL-A
70	125	575	Westinghouse	SA
[illegible]	[illegible]	725	General Electric	Sprague
30	230	850	G. E. Sprague	D
25	230	850	Crocker-Wheeler	D
17	125	1125	Westinghouse	S

MOTOR GENERATOR SETS

1—100-kw., 250-volt, 900-r.p.m. Westinghouse SK Generator, coupled to Westinghouse 2200-volt, [illegible] phase 60-cycle S[illegible] motor.

1—75-kw., 250-volt, 1150-r.p.m., Gen. Elec., RC Interpole Generator, coupled to 100-hp. 440/220-volt, 3-phase, 60-cycle Gen. Elec. S Cage motor.

1—70-kw., 125-volt, 580-r.p.m. Westinghouse SA interpole Generator, coupled to 100-hp., 440/220-volt, 3-phase, 60-cycle Gen. Elec. S Cage motor.

1—17[illegible]-kw., 125-volt, 1150-r.p.m. Westinghouse S Generator, coupled to 25-hp., 220/440-volt, 3-phase, 60-cycle Westinghouse S Cage motor.

2—[illegible]-kw., 125-volt, 1700-r.p.m. Westinghouse SK Generators coupled to 15-hp., 220/440-volt, 3-phase, 60-cycle, Westinghouse C.S motors.

ALTERNATING CURRENT GENERATORS

1—200-kw. Allis-Chalmers, 2300-volt, [illegible] r.p.m. 3 or 2-phase, 60-cycle, RF Generator with direct connected Exciter.

1—[illegible]-kw. General Electric, 2300/480/240-volt [illegible] r.p.m., 3-phase 60-cycle RF Generator, with direct connected exciter.

1—[illegible]-kw. General Electric, 2300/480/240-volt, 3-phase 60-cycle RI Generator with belted exciter.

ENGINE GENERATOR SETS

1—100-kw., 250-volt, 250-r.p.m. General Electric, type "MP" form 1, direct current Generator direct connected to 17 x 16 Harrisburg standard side crank engine.

1—150-kw., 250-volt, 225-r.p.m. General Electric, form RB, direct current Generator, direct connected to 16 x 18 Harrisburg side crank left-hand engine.

1—[illegible] 220/440-volt, 2 or 3-phase, 60-cycle, [illegible] r.p.m. Westinghouse Generator direct connected to 14 x 21 Hamilton Corliss four-valve heavy duty Engine practically new.

1—[illegible]-kw. [illegible]-volt [illegible] r.p.m. Western Electric Generator direct connected to 15 x 12 Ball-Wood center crank engine.

1—[illegible]-kw. [illegible] [illegible] r.p.m. direct connected to [illegible] Ball-Wood center crank engine.

We also have a number of other desirable Engine Generator Sets—both A.C. and D.C. and a large stock of 2-phase Motors.

STEPHEN HALL & CO., Inc., 90 West St., New York

TELEPHONES:
Rector 3891, 3892, 3893

Picked at random from our large stock

Compare These Motor Prices

These are only a few of the bargains we offer:

NEW MOTORS

Hp.	*Make*	*Ph.*	*Type*	*Cy.*	*Rpm*	*Volts*	*Price*
550	Cr.-Wh.	3	Slip ring	60	1170	2200	$1,875.00
60	Gen. Elec.	3	KT	60	1160	220	555.00
4— 50	Gen. Elec.	3	Slip ring	60	690	440	775.00
8— 50	Gen. Elec.	3	Slip ring	60	1200	220	600.00
12— 25	Gen. Elec.	3	KT	60	1200	220	302.00
5— 20	Gen. Elec.	3	KT	60	1200	220	267.00
4— 15	Gen. Elec.	3	KT	60	1800	220	216.00
5— 10	Bell	3	Compen.	60	1800	220	216.00
6— 7½	Bell	3	Compen.	60	1800	220	190.00
13— 5	R. & M.	3	Compen.	60	1700	220	94.00
15— 3	Gen. Elec.	3	KT	60	1800	550	75.00
6— 10	Gen. Elec.	2	KQ	60	1200	220	216.00
200— ¼	West. Elec.	1	SA	60	1725	110	17.75
55— ¼	West. Elec.		SD		1725	110	18.75

USED MOTORS

Hp.	*Make*	*Ph.*	*Type*	*Cy.*	*Rpm.*	*Volts*	*Price*
400	Wghse.	3	Synchro.	60	450	2200	$1,000.00
200	Gen. Elec.	3	Slip ring	60	600	2200	1,400.00
200	Gen. Elec.	3	Wd. ro.	60	580	220	975.00
2—100	Gen. Elec.	3	Slip ring	60	514	440	1,100.00
75	Gen. Elec.	3	Slip ring	60	900	2200	825.00
2— 50	Fbks.-M.	3	Sq. cage	60	900	220	325.00
2— 50	Burke	3	Slip ring	60	1200	220	475.00
2— 37	Gen. Elec.	3	Slip ring	60	750	220	450.00
3— 35	Lincoln	3	Sq. cage	60	1200	440	245.00
2— 30	Ideal	3	Sq. cage	60	1150	440	300.00
2— 25	Wagner	3	Slip ring	60	1150	440	375.00
200	Wghse.	2	Slip ring	60	580	220	1,275.00
133	Gen. Elec.	2	Synchro.	60	900	2200	600.00
150 kva.	Stanley	2	Alternat.	60	900	2400	550.00
75	Burke	2	Sq. cage	60	360	220	750.00
90	Diehl		Shunt	460		240	575.00
90	Gen. Elec.		Compound	625		220	775.00
90	Wghse.		Compound	675		220	625.00
75	Diehl		Shunt	340		220	575.00
4— 47	Wghse.		Compound	600		500	375.00

Some have not been used over 60 days

All of the above carry our usual ONE YEAR GUARANTEE—LARGEST STOCK OF ITS KIND IN AMERICA

NATHAN KLEIN & CO.

MOTORS HOWARD & CENTRE STS., N.Y. **DYNAMOS**

Brand New
Generating Units

For Short Delivery

1—75 KW., 250 Volts, General Electric direct current generator directly connected to a single non-releasing Corliss Engine. Includes a standard, single panel switchboard

1—200 KW., 250-275 Volts General Electric direct current generator directly connected to a simple non-releasing Corliss Engine. Includes a standard single panel switchboard

1—400 KW., 250-275 Volts General Electric direct current generator directly connected to a simple non-releasing Corliss Engine. Includes a standard, single panel switchboard

1—120 KVA., 2300 Volts, 60 cycles, 3 phase, Western Electric Alternator directly connected to a simple, non-releasing Corliss Engine. Includes a belted exciter.

1—312 KVA., 480 Volts, 60 cycles, 3 phase Western Electric Alternator directly connected to a simple non-releasing Corliss Engine. Includes a belted exciter

1—312 KVA., 2300 Volts, 60 cycles, 3 phase Western Electric Alternator directly connected to a Condensing Poppet Valve Uniflow Engine. Includes a belted exciter

1—312 KVA., 2300 Volts, 60 cycles, 3 phase Western Electric Alternator directly connected to a simple, non-releasing Corliss Engine. Includes a belted exciter.

1—450 KVA., 2300 Volts, 60 cycles, 3 phase, General Electric Alternator, directly connected to a simple, non releasing Corliss Engine. Includes a belted exciter.

1—450 KVA., 480 Volts, 60 cycles, 3 phase General Electric Alternator, directly connected to a simple, non-releasing Corliss Engine. Includes a belted exciter

Chuse Engine & Manufacturing Co.

Mattoon, Illinois

ROTARY CONVERTERS

1—220 kw., 250 volt, 880 amp., 1200 r.p.m., type HCC6-220 1200, form 1, 60 cycle, General Electric rotary, complete with type H.J.T.H., form D.D., circular coil design General Electric transformer 11,000 volt Y to 187, cycles 60, capacity 240 kva.

1—330 kw., 250 volt, 1320 amp., 1200 r.p.m. type HCC6-330-1200, form P, 60 cycle, General Electric rotary, complete with H.J.T.H., form D.D. circular coil design General Electric transformer 11,000 volt Y to 187, cycles 60, capacity [illegible] kva.

The above transformers could probably be changed to 13,200 volts. They are now "Y" connected and can be used on 6600 volts.

MOTOR GENERATOR SETS

2—New 1000 kw., 250 volt no load, 240 volt full load 3850 amps., 720 r.p.m., type MCF, General Electric generators direct connected to 1100 hp., 2300 volt 3 phase, 60 cycle synchronous motors. Standard outfits mounted on sub bases with rheostats and compensators.

1—100 kw. 125-250 volt Westinghouse generator with two 6/10 kw. balancing transformers and a 150 hp. 220 volt 3 phase 60 cycle type "CS" 1200 r.p.m. induction Westinghouse motor both mounted on cast-iron base, complete with starter and switchboard

ALTERNATING CURRENT UNIFLOW OUTFITS

2—Erie City Iron Works engines, Lentz Patent 105 hp., Poppet valve 200 r.p.m. 150 lb. pressure, 14 x 21 direct connected to General Electric generators, alternating current, P. F. S. type ATB-[illegible]-312-200, form E, 312 kva., 60 cycles, with belted exciter General Electric, continuous current shunt wound type CVC 875 r.p.m. 9½ kw. 125 volts 76 amps. The generators can be connected for any phase and voltage up to [illegible] volts.

GEORGE SACHSENMAIER CO.

926-32 N. Third St., Phila., Pa.

Send for our Catalog

WESTINGHOUSE MOVING COIL REGULATING TRANSFORMERS

The following for 60 cycles, 2200 volts, 6.6 amps.

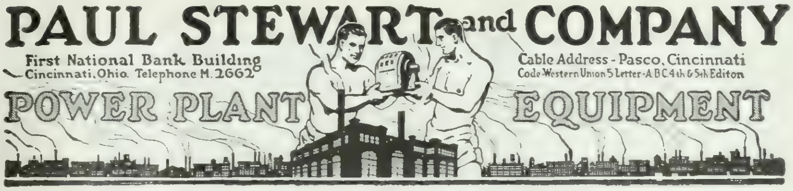
3—34 kva., Style No 200611. 1—24 kva Style No 200611.
2—17 kva., Style No. 200608

Also

4—Control panels, 2 circuit, single throw

See Westinghouse 1921-22 *Catalog, pages* 1058-1060 *for complete data*

George Sachsenmaier Co., 926-32 N. Third St., Phila., Pa.



PAUL STEWART and COMPANY

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Special Offerings, A No. 1 Units—*Immediate Delivery*

HORIZONTAL TURBO UNITS.

A. 1—10,000 K.W. 80% power factor Allis-Chalmers Condensing Turbo Alternator Unit, 60 Cycle, 3 Phase, 2300 4600 or 11,000 Volts, 200 lbs. [illegible] 150 to 200 degrees superheat. Complete with Surface Condenser and Auxiliaries.

B. 1—6500 K.V.A. Allis-Chalmers Condensing Turbo Unit, 60 Cyc., 3 Ph., 2300 Volt. Complete Plant including Jet Condenser and all Auxiliaries. Delivery April 1.

C. 1—3000 K.W. Westinghouse (Actual capacity approx. 4000 K.W.) 60 Cyc. 3 Ph., 2300 or [illegible] Volt, Condensing Turbo Unit.

D. 1—1500 K.W. Westinghouse Condensing Turbo Alternator Station 60 Cyc. 3 Ph. 2400 Volt, [illegible] R.P.M. Including Leblanc Jet Condenser, Boiler Plant and Piping.

E. 1—2000 K.W. Allis-Chalmers Condensing Turbo. Actual capacity 3000 K.W., 60 Cyc., 3 Ph. 2300 Volt. Complete with Jet Condenser and Auxiliaries.

F. 2—1250 K.W. Westinghouse Condensing or Non-Condensing Turbo Units. Actual capacity 1500 1800 K.W., 60 Cyc., 3 Ph., 480, 2300 or 11,000 Volt 1200 R.P.M. Complete with LeBlanc Condensers.

G. 2—600 K.W. Westinghouse Non-Condensing Turbo Unit 60 Cyc., 2 or 3 Ph., 220 480 or 2400 Volt. Units newly rewound and rebladed.

H. 1—500 K.W. Westinghouse Condensing Turbo Unit 60 Cyc., 2 or 3 Ph., 2200 Volt. 3600 R.P.M. Complete with Surface Condenser.

VERTICAL TURBO ALTERNATORS.

I. 1—1000 K.W. General Electric Curtis Turbo Unit 60 Cyc., 3 Ph., 2300 Volt. 1200 R.P.M. Complete with Jet Condenser.

J. 1—1500 K.W. General Electric (Actual capacity [illegible] K.W.) 60 Cyc., 3 Ph., 2300 Volt, 900 R.P.M. Complete with Surface Condenser, Piping and all Auxiliaries.

K. 1—5000 K.W. General Electric-Curtis Condensing Turbo Unit 60 Cyc., 3 Ph., 2300 or 4500 Volt, 720 R.P.M. Complete with Surface Condenser. Piping and all Auxiliaries; Complete Installation.

L. 1—10,000 K.W. General Electric Condensing Turbo Unit 60 Cyc., 3 Ph. 6600 or 11,000 Volt. 720 R.P.M. Complete with Surface Condenser and Auxiliaries.

M. 1—10,000 K.W. General Electric Condensing Turbo Unit 25 Cyc., 3 Ph., 6600 Volt. Complete with Surface Condenser and all Auxiliaries.

N. 1—1500 K.W. General Electric Condensing Turbo Unit 25 Cyc., 3 Ph., 11,000 Volts.

DIRECT CURRENT UNITS.

O. 1—240 K.W. General Electric M. P., Form L., 220-240 Volt. Generator. Direct connected to Cross Compound semi-heavy duty Corliss Engine. Complete Unit.

P. 1—300 K.W. Triumph Multipolar Engine Type Generator, 225-250 Volt, Direct connected to Cross Compound Corliss Engine.

Q. 1—425 K.W. General Electric M.P. Engine type Generator 250 or 500 Volts. Direct connected to Simple Heavy Duty Corliss Engine.

R. 1—600 K.W. General Electric Unit, consisting of: 2—300 K.W., D.C. 250-550 Volt Generators. Direct connected to horizontal simple heavy duty Corliss Engine.

S. 1—800 K.W. General Electric M.P. Engine type Generator 250 500 Volts, Direct connected to Tandem compound heavy duty Corliss Engine.

T. 1—[illegible] K.W. Same as above.

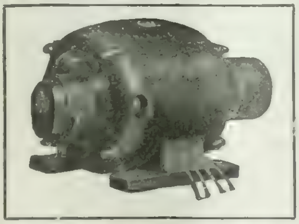
U. 1—1500 K.W. Westinghouse Engine type Generator, 220-550 Volt Direct connected to Horizontal heavy duty Cross Compound Corliss Engine.

BOILERS.

2—250 H. P. Stirling B & W Boilers. 200 lbs. Allowance. Without Grates or Stacks.

5—500 H. P. B & W Sectional Header Water Tube Boilers. [illegible] Tubes Wide. 21 Tubes High. 200-lb Allowance. Complete with Stokers and all Fittings.

1—500 H. P. Stirling B & W Water Tube Boiler. 200-lb. Allowance. Complete with Stoker and all Fittings.



300

NEW MOTORS

in original crates

General Electric

repulsion type R. S. A.

½-H. P. 110/220 volts, single phase, 60 cycles, 1725 R. P. M.

$39.30

(2 per cent—10 days)
discounts in quantities

complete stock of new General Electric motors

Vim Electric Co.

INCORPORATED

68 Cortlandt Street
New York

VIM SERVICE

Independent Electric Machinery Co.

Twentieth and Central Sts., Kansas City, Mo.

SEE THE INDEPENDENT FIRST

PARTIAL STOCK LIST

All Apparatus Listed
Below in Stock for
Prompt Shipment

3 ph., 60-cy., 220 440 volt Motors

No.	*Hp*	*Make*	*Speed*
1	30	G. E., New	1200
4	30	Robbins & Myers	1150
2	30	Allis-Chalmers, Rebuilt	860
1	30	W. E., Rebuilt	960
1	30	G. E. Slip ring, New	900
2	30	G. E., Rebuilt	1200
1	30	F. M., Rebuilt	1200
1	30	West., 2200-v., Reblt	1150
1	35	Wagner, Rebuilt	1750
6	40	Watson, Rebuilt	1200
1	40	Allis-Chalmers, Rebuilt	865
4	40	Watson, New	1200
1	50	Allis-Ch., Re., 2200-v	865
1	50	G. E slip ring, Rebuilt	695

3-PH., 60-CY., ALTERNATORS

1—62-kw., 2200-volt, 60-cycle, 3-phase, 300-r.p.m. Bullock Alternator, direct connected to an Ames steam engine, all complete

1—[illegible]-kva., 2300 volt, 60-cycle, 3-phase, 225-r.p.m. Ft. Wayne Alternator, direct connected to 110-hp. Buckeye producer gas engine, complete

1—100-kva., 2300 volt, 3-phase, 60-cycle, 900-r.p.m., W. E.

2—100-kw., 440-volt, 60-cycle, 3-phase, 3600 r.p.m. General Electric Curtiss type turbines, complete with jet condensers for each machine, driven by steam pumps, two [illegible] motor generator or exciter sets, one Curtiss turbine exciter set, all complete with necessary rheostats and three-panel switchboard

3-ph., 25-cy., 220 440 volt Motors

No.	*Hp*	*Make*	
2	7	R & M	1400
1	7	Burke	750
1	9	G. E.	750
1	15	Burke	1500
1	15	R & M	720
1	15	G. E.	1500
1	15	Ideal	1470
1	15	Ideal	750
2	15	Burke	750

220-VOLT, D. C. GENERATORS

	Kw	*Make*	*Speed*
1	75	Fairbanks-Morse	750
1	80	Thompson-Ryan	600

110-VOLT D.C. GENERATORS

	Kw	*Make*	*Speed*
2	40	Triumph	850
1	50	Westinghouse	850
1	55	Fairbanks-Morse	950
1	75	W. E., Engine type	275

220-VOLT, D.C. MOTORS

	Hp	*Make*	*Speed*
1	25	Crocker-Wheeler, Re.	750
2	30	G. E. (vertical).	1500
1	35	Westinghouse	1420
1	35	Crocker-Wheeler	750
1	40	Jenny	2000
1	100	Westinghouse	450
1	110	Crocker-Wheeler	560

Direct Current Engine Sets

1—75-kw., 220-volt, 280-r.p.m., compound wound Westinghouse Generator, direct connected to 10x12 Ideal steam engine

1—100-kw., 220-volt, 400-amp., 250-r.p.m., 3-wire Western Electric Generator, direct connected to a Fitchburg tandem steam engine

1—100-kw., 220-volt Westinghouse compound wound Generator, 255-r.p.m., direct connected to 11x14x20 Ideal steam engine.

1—100-kw., 220-volt, 400-amp., 275 r.p.m. compound wound Jenney Generator, direct connected to 11x18 Four valve Ideal steam engine

2—150-kw., 220-volt, 150-r.p.m. Western Electric Generator, direct connected to Fitchburg tandem compound steam engine.

1—100-kw., 220-volt, Western Electric compound wound Generator, 140 r.p.m., direct connected to [illegible] Fitchburg tandem compound steam engine.

MOTOR GENERATOR SETS

1—[illegible]-kw., 125-volt, 720-r.p.m. Westinghouse Generator, direct connected to 30-hp., 3-phase, 25 cycle Westinghouse motor

1—40-kw. 80 or 100 volt Westinghouse Generator, direct connected to 60-hp. 220-volt, Westinghouse, 3-phase motor.

Apparatus in Stock For Immediate Delivery

J. L. HEMPHILL & CO., INC.

1118-1120 Clinton Street
HOBOKEN, NEW JERSEY

Telephone Hoboken 3618

2200* 3-Ph., 60-Cy., 220/440-Volt Motors

No.	Hp	Rpm	Make
1	400	900	G. E., syn.
1	300	600	G. E., syn.*
1	250	450	G. E., M
[illegible]	200	600	G. E., M
1	50	900	G. E., syn.*
2	200	900	G. E., L
1	150	514	G. E., M*
2	100	720	G. E., K
1	75	900	Allis-Chal., ANY
2	75	720	G. E., K
1	60	300	West., CW
1	50	900	Cr.-Wh.
1	25	900	Cr.-Wh.
1	25	1200	West., CS
1	7½	1200	G. E., K
1	5	1800	West., A

2-Phase Motors on request

D.C. Motors, 230-Volt

No.	Hp	Rpm	Make
1	300	500	G. E.
1	100	800	G. E.
1	50	1250	Allis-Chal.
1	50	700	[illegible]
1	35	575	West.
4	25	600/1200	Allis-Chal.
2	20	800	[illegible]
1	15	1250	[illegible]
1	10	1200	[illegible]
5	10	275/1375	[illegible]
1	10	[illegible]	Cr.-Wh.

D.C. Motors, 125-Volt

No.	Hp	Rpm	Make
3	20	[illegible]	Allis-Chalmers
2	7½	1150	G. E.
1	5	700	Diehl
3	3	1100	G. E.
2	3	1700	G. E.

A. C. Generators, 440 and 2300-Volt

No.	Kw	Rpm	Make
1	300	900	G. E., form P
1	200	600	G. E., form P
1	150	900	G. E., form PB

D.C. Generators, 250-Volt

No.	Kw	Rpm	Make
1	200	575	G. E.
1	100	900	G. E.
1	50	800	Cr.-Wh.
1	30	1000	West.
2	15	900	Allis-Chal.

Engine Generator Sets

1—250-kw., 250-volt Allis-Chal. Generator with 18 x 36 Corliss engine.

1—100-kw., 200 rev., 220/440-volt Westinghouse Generator with 14 x 24 Hamilton Corliss engine.

Motor Generator Sets

300-kw., 720-rev., 125/250-volt, 3-unit set consisting of (2) 150-kw., 125-volt D.C. G.E. gen. (1) 450-hp. 440/2300-volt G. E. K motor.

200-kw., 600-rev., 250-volt Gen. Elec. Gen., 350-hp., 440/2300-volt, syn.

100-kw., 600-rev., 125/250-volt West. Gen., 150-hp., 220/440-volt Motor

100-kw., 250-volt Gen. Elec. Gen., 150-hp., 900 rev., 440/2200-volt syn.

50-kw., 720-rev., 250-volt West. Gen., 75-hp., 220/440-volt Motor

10-20-25-40-kw., 125-v. Balancer sets.

2—100 KW, Type M, Westinghouse Generators

125 Volt d.c., 550 r.p.m., with rheostats, pulleys, and slide rail bases. $650 each.

1—300 HP. General Electric Type I, Form M Motor

slip ring, 3 phase, 60 cycle, 2200 volt, 500 r.p.m. with base, pulley, controller, with variable speed resistance. Excellent condition. $2000.00.

1—150 HP. Westinghouse Type SK Motor,

3 bearing, 230 volt, d.c., 550 r.p.m., with base, pulley, and Monitor control panel. $1350.00.

And 2000 other Motors and Generators in stock—new and rebuilt apparatus that is priced to sell.

When you want to buy, sell, rent or exchange electrical, always get in touch with

R. SCHEINERT COMPANY
123-125 N. Third Street, Philadelphia, Pa.

MOTORS

In Stock—Immediate Shipment

VARIOUS SIZES AND SPEEDS

For complete list see our advertisement in first issue each month of Electrical World.

DAVIS MACHINE & MOTOR CO.
59 Mechanic Street, Newark, N. J.
Phone Market 8580

MAC GOVERN & CO., Inc.

114 Liberty Street, New York, N Y.

POWER PLANT EQUIPMENT
(Reconditioned)

TURBINES, ENGINES, GENERATORS, ROTARIES, TRANSFORMERS, BOILERS, CONDENSERS, PUMPS, ETC.

READY TO SHIP

Branch Offices:

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RETURN TUBULAR
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BOILERS

WATER TUBE
SCOTCH MARINE

A LARGE STOCK OF HIGH-GRADE BOILERS OF PRACTICALLY ALL SIZES, TYPES AND MAKES, TAKEN OVER FROM DU PONT CHEMICAL COMPANY'S AND OTHER PLANTS WITH PRODUCTION RECORDS—RECONDITIONED, OFFERED SUBJECT TO ANY INSPECTION. AVAILABLE *NOW!*

"SAVE TIME AND MONEY ON YOUR POWER INSTALLATION—LET DAVIS FURNISH THE BOILERS"

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1122-1123-1124
HARRIS TRUST BUILDING
CHICAGO, ILL.

"HONESTLY REBUILT" ELECTRICAL MACHINERY

3 Ph., 60 Cy., 220/440 Volt Motors

Qu.	*Hp*	*Make*	*Type*	*Speed*
	5	G. E.	KT	1,200
	5	Wagner	BM	1,720
6	7½	GE.	KT	1,800
2	10	Allis	AN	1,200
	10	G. E.	KT	1,800
2	10	G. E.	KT	900
50	15	G. E.	KT	900
75	20	G. E.	KT	900
45	25	G. E.	KT	900
3	30	Westinghouse	CX	1,200
1	30	Westinghouse	CCL	1,800
55	30	G. E.	KT	900
40	35	G. E.	KT	900
21	40	G. E.	KT	900
1	50	Westinghouse	CCL	900
5	50	G. E.	KT	1,200
6	60	G. E.	KT	1,200
1	60	Westinghouse	CS	900
1	75	G. E.	KT	1,200
1	100	G. E.	KT	1,200

Direct Current Motors

Make	*H P*	*R P.M.*	*Volts*
General Electric	105	665	250
General Electric	100	290	250
Crocker Wheeler	100	900	250
General Electric	75	1,200	250
General Electric	75	1,200	500
General Electric	75	850	250
General Electric	70	700	250
General Electric	55	845	250
Westinghouse	50	850	250
General Electric	50	550	500
Westinghouse	50	550	250
General Electric	35	550	250
General Electric	30	1,700	250
General Electric	25	750	250

3 Ph., 25 Cy. 220 440 Volt Motors

Qu.	*H P*	*Make*	*Type*	*Speed*
2	10	Gen. Elect.	KT	750
7	25	Westinghouse	CS	750
1	35	Gen. Elect.	CS	750

MILLER-OWEN ELECTRIC CO., Inc.

LEXINGTON AVE. AND THOMAS BOULEVARD PITTSBURGH, PENNA.

Direct Current Generators

Make	*Kw.*	*R.P.M.*	*Volts*
General Electric	500	360	250
General Electric	400	150	250
Allis Chalmers	200	425	250
General Electric	150	550	250
General Electric	100	550	250
Crocker Wheeler	75	1.200	250
General Electric	60	900	250
Westg. Erie City	100	250	250
Allis Skinner	100	250	125
G. E. Buckeye	150	200	250
Westg. Ball	200	200	250
Westg. Buckeye	300	150	250
G. E. McIntosh	450	150	250
G. E. Hamilton	500	150	250

Also a number of very attractive offerings in Alternating Current Belted and Engine Driven Generators

Motor Generator Sets

Make	*KW*	*D.C. Volt*	*A.C. Volt*
General Electric	200	250	2300
General Electric	150	250	2300
Allis	150	500	2300
General Electric	100	250	2300
Burke	75	500	2300
Crocker Wheeler	75	250	220 440
Allis	75	250	2300
General Electric	65	250	220 440
General Electric	50	250	220/440
Westinghouse	50	125	220/440

A. C. Motors

Make	*H P*	*R P M.*	*Cycle*
General Electric	750	514	60
General Electric	750	750	25
Crocker Wheeler	600	514	60
Westinghouse	400	450	60
General Electric	300	500	25
General Electric	275	600	60
General Electric	200	450	60
General Electric	150	720	60

"25 CYCLE"

MOTORS, TRANSFORMERS, MOTOR GENERATOR SETS

Over 1200 25 cycle motors, single and three phase, totalling 15,000 hp. in sizes from 1 to 750 hp. various speeds.
Single and three phase 25 cycle transformers from 1 to 200 kw.
Motor Generator Sets 25 to 60 cycle 500, 1000 and 1250 kva capacity
Many items almost new and all guaranteed to be in good operating condition on shipment. This equipment on hand due to a recent change from 25 to 60 cycle in our power plant installation

For details and prices, address

Kansas City Power & Light Co.
Kansas City, Mo.
Attention: R. S. Mauney, Industrial Eng.

To Reduce the Stock of

3-Phase, 40-Degree **MOTORS**

we offer at a low price

Qu.	*Hp.*	*Rpm.*	*Type*	*Make*
3	20	900	K.Q.	General Electric
2	25	900	K.Q.	General Electric
3	30	870	C.S.	Westinghouse
1	30	1170	C.S.	Westinghouse
3	35	680	K.Q.	General Electric
1	35	1170	C.S.	Westinghouse
1	40	1170	C.S.	Westinghouse
1	50	870	C.S.	Westinghouse

And a Large Stock of Slip-Ring Motors

RELIABLE ELECTRIC MOTOR CO.
165-167 Grand St., New York

GENERATORS FOR SALE

1—175 kw. [illegible] r.p.m. 2300 v., [illegible] Allis-Chalmers.
1—175 kw. [illegible] r.p.m. 2300 v., [illegible] Allis-Chalmers.
1—60 kw. [illegible] 125 v. D.C. [illegible]
1—[illegible] kw. [illegible] D.C. Western Electric [illegible] direct connected to [illegible]
1—[illegible] kw. [illegible] 125 v. D.C. General Electric direct connected to [illegible] engine and [illegible].

[illegible] Motors, AC and DC; [illegible] rebuilt

V. M. Nussbaum & Company, Fort Wayne, Indiana

Newark Electric Repair Co.

109 Bank St., Newark, N. J.

Electrical machinery of every description repaired RIGHT.
Also new and second-hand motors for sale.

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The value of getting electrical repair work done when you want it and the way you want it. Nelson is the man. Jobs of any size.

I. R. NELSON COMPANY
BOND STREET, NEWARK, N. J.

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Power Machinery Exchange

1 Montgomery Street
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SPECIAL—250 K. V. A. Wghse. 3 or 2 Phase Alternator, Direct Connected Erie Ball 4 Valve Corliss engine; two years' service.

A.C., 60-CYCLE UNITS

Kw.	*Generator*	*Engine*
625	Wghse.	Parsons Turbine
600	G. E.	Rice-Sargent-Corliss
500	Allis-Chal.	Allis-Chal. Turbine
500	G. E.	Skinner [illegible]
500	G. E.	Allis-Chal. Corliss
475	G. E.	Skinner Uniflow
400	Wghse.	Erie Ball Corliss
375	G. E.	Curtis Turbine
360	G. E.	Hamilton Corliss
300	Allis-Chal	Skinner 20 x 20
200	G. E.	Erie 4-valve
250	Wghse.	Erie-Ball Corliss
250	Allis-Chal.	Hamilton non-releasing
185	G. E.	Chandler Taylor, 4 c.
150	Wghse.	Rice-Sargent-Corliss
150	Allis-Chal.	Ideal Tandem
100	C.-W.	Harrisburg
75	G. E.	Terry Turbine
75	G. E.	Harrisburg
50	G. E.	Erie Ball

230-250-VOLT, D.C. UNITS

Kw.	*Generator*	*Engine*
250	Triumph	Skinner Tandem
200	Wghse.	Erie Ball
150	Wghse.	Erie Ball
100	Wghse.	Erie Ball
100	G. E.	Curtis Turbine
100	Allis-Chal.	Skinner
75	G. E.	Curtis Turbine
75	Allis-Chal.	Erie Ball
60	G. E. 3-wire	Skinner Uniflow
50	Wghse.	Ideal
50	Wghse., 3-wire	Ames
40	G. E., 3-wire	Skinner Uniflow
35	G. E., 3-wire	Harrisburg
25	G. E., 3-wire	Troy Vert.
25	Ridgway	Ridgway
10	G. E.	G. E. Marine

110-125-VOLT, D.C. UNITS

Kw.	*Generator*	*Engine*
300	G. E.	Fleming, 4-valve
200	G. E.	Fleming, 4-valve
100	Wghse.	Skinner
75	G. E.	Harrisburg
65	Burke	Harrisburg
60	G. E.	Harrisburg
50	G. E.	Harrisburg
50	Wghse.	Skinner
30	G. E.	G. E. Marine
30	G. E.	Ames
30	C. W.	Erie Ball
25	Wghse.	Erie Ball
20	Burke	Chand.-Tay.
20	Akron	Harrisburg
15	Burke	Marine, Vertical
10	G. E.	G. E. Marine
7	G. E.	Marine
2½	G. E.	Engberg Marine

Complete Stock of A.C. and D.C. Generators, Motors, also Corliss Engines, etc.

ARCHER & BALDWIN, Inc.,

114-118 Liberty St., New York City

Telephones 4337-4338 Rector

ROTARY CONVERTERS

2—[illegible] D.C., 25 cycle, [illegible] A.C., 500 r.p.m., complete with transformers.

2—200 kw. Westg. 250 volt, D.C., 3 phase, 60 cycle; 185 volt A.C., 900 r.p.m. Rotary Converters, complete with A.C. and D.C. panels and regulators. We have suitable transformers for any of the following voltages: 2,300, 4,000, 4,600, 6,600, 13,200.

MOTOR GENERATOR SETS

1—200 kw. Gen. Elec., 250 v., Type MP, 900 r.p.m. Generator, dir. ctd. to 300 hp. G. Elec. [illegible] v., 2 or 3 ph., 60 cy., [illegible] r.p.m., Type K Motor.

1—100 kw. Elec. Machy. Co., 250 v., 900 r.p.m. Generator, [illegible] 60 cy., 440 v., 900 r.p.m. synchronous motor.

1—150 kw. Westg., 250 volt, Compound Wound Generator, [illegible] to 15[illegible] hp. 2,200 volt squirrel cage induction motor.

250 VOLT DIRECT CONNECTED DIRECT CURRENT UNITS

1—[illegible] kw. Westg., 250 v. (3-wire), 130 r.p.m. Generator, dir. ctd. to 2[illegible] x 50 in. Porter-Allen [illegible] engine.

2—150 kw. Westg., 250 v. ([illegible]) Generator each dir. ctd. to Harrisburg engine.

[illegible] kw. G. E., 180 r.p.m. Generators, dir. ctd. to Ball & Wood center crank engines.

[illegible] Westg. [illegible] r.p.m. Generator, dir. [illegible] 11 [illegible] 11 [illegible] Westg. [illegible]

1—[illegible] kw. G. E. Generator dir. ctd. to Ball & Wood engine.

125 VOLT DIRECT CONNECTED DIRECT CURRENT UNITS

1—[illegible] Westg. 250 r.p.m. Generator [illegible] 11 [illegible] 18 x 1[illegible] B. & W. engine.

1—[illegible] Sturtevant [illegible] r.p.m. Generator, dir. ctd. to 9 x 9 Sturtevant engine.

1—[illegible] Westg. [illegible] r.p.m. Generator, dir. ctd. to 10 x 10 in. Harrisburg engine.

1—[illegible] Westg. Generator dir. ctd. to 8½ x [illegible] Westg. [illegible] engine.

500-550 VOLT DIRECT CURRENT GENERATORS

1—[illegible] Sprague-Lundell, 170 r.p.m.
1—125 kw. Sprague-Lundell, 620 r.p.m.
[illegible] Westg., 720 r.p.m.

250 VOLT DIRECT CURRENT GENERATORS

1—300 kw. [illegible] r.p.m. [illegible]
1—150 kw. [illegible] r.p.m. [illegible] type.

125 VOLT DIRECT CURRENT GENERATORS

1—200 kw. [illegible] r.p.m. [illegible]
1—200 kw. [illegible]
1—100 kw. G[illegible] r.p.m.
1—[illegible] kw. W[illegible]

250 VOLT DIRECT CURRENT MOTORS

1—[illegible] Crane Motor.
1—[illegible]
1—[illegible]
1—1[illegible]
1—[illegible]
1—[illegible] r.p.m.

125 VOLT DIRECT CURRENT MOTORS

1—[illegible] hp. Gen. [illegible]
1—[illegible]
1—[illegible] r.p.m.
1—[illegible] W[illegible]
1—[illegible] hp. W[illegible] r.p.m.
1—1[illegible]
1—1[illegible] hp. [illegible] W[illegible] r.p.m.

ELECTRIC PUMPS

4—8 x 10 Gould Vertical Triplex, 350 GPM., 150 pounds water pressure, brass valves, direct driven by 40 hp., 440 volt, 3 phase, 60 cycle Westinghouse Slip Ring A.C. Motors.

1—5 in. Gould three stage Centrifugal Pump, capacity 500 GPM., against 225 pounds water pressure, direct driven by a 100 hp., 2,200 volt, 3 phase, 60 cycle Lincoln A.C. Motor, speed 1,720 r.p.m.

2—3 in. Lea-Courtenay single stage Centrifugal Pumps, capacity 350 GPM., against 50 ft. head, direct driven by a 10 hp., 220 volt Allis-Chalmers, 3 phase, 60 cycle, A.C. Motor, 1,720 r.p.m.

300 Other Steam and Power Pumps for Sale including Fire Pumps.

Send for our December list of the largest stock in the United States of slightly used or thoroughly overhauled Machine Tools, Power, Electrical and Contractors' Equipment. Satisfaction Guaranteed or Money Refunded

Wickes Machinery Co.
Jersey City, N. J.
Established 1900.

POWER

A. C. ENGINE SETS

90-kva Westinghouse 2-phase, 60-cycle, 2300-volt, with [illegible] side crank engine.

100-kva Crocker-Wheeler 3-phase, 60-cycle, 2300-volt, with American Ball engine.

150-kva General Electric, 3-phase 60-cycle, 2300-440-220-volt with Hamilton 4-valve engine.

D. C. ENGINE SETS

10-kw C&C, 125-volt, with 6 x 6 vertical Racine engine.

20-kw Diehl 115-volt, 350-r p m , with American blower engine.

20-kw Crocker-Wheeler, 125-volt, with Harrisburg, [illegible] engine.

30-kw General Electric, 125-volt with Harrisburg, side crank engine.

50-kw. Westinghouse, 125-volt with Ames, center crank engine.

50-kw Westinghouse 250-volt with Skinner, automatic, center crank engine.

75-kw [illegible] 125-volt with Ames Engine.

100-kw Crocker-Wheeler, 250-volt with Harrisburg, side crank engine

150-kw Westinghouse 250-volt with Erie Ball, [illegible] engine.

15[illegible]-kw General Electric, 3-wire, 125-250-volt with Erie Ball, [illegible] engine.

150-kw [illegible] 125-250-volt engine type generator, 200-r.p.m., armature bore 10 in , no engine.

[illegible]-kw [illegible] 250-volt, with Hamilton, 4-valve engine.

D. C. TURBO GENERATOR SETS

50-kw Diehl, 250-volt with Terry non-condensing turbine

BELTED ENGINES

12 x 12 center crank Buffalo [illegible] automatic
15 x 11 Ames, [illegible]

CORLISS ENGINES

50 to 500-hp

SQUIRREL CAGE MOTORS

3 Phase 60 Cycle

Hp	*Volts*	*Speed*	*Make*	*Type*
10	440-220	[illegible]	Westinghouse	C S
10	440	[illegible]	[illegible]	B-8 5
10	440	[illegible]	Allis-Chalmers	
10	440	[illegible]	Fairbanks-Morse	N I.
50	440-220	[illegible]	General Electric	I.
50	440-220	[illegible]	Fort Wayne	
75	440-220	[illegible]	General Electric	I.
50	440	865	[illegible]	Y.

SQUIRREL CAGE MOTORS

2 Phase 60 Cycle

35	220-440	[illegible]	General Electric	I Q
35	220-440	720	General Electric	I Q

DIRECT CURRENT MOTORS

Hp	*Volts*	*Speed*	*Make*
½	110	1100	General Electric
1	110	1780	[illegible]
2	115	1700	[illegible]
3	115	1700	General Electric
3	115	1700	Western Electric
3	115	1775	[illegible]
3	110	1800	[illegible]
3	110	1750	Fairbanks-Morse
3	110	1750	Roth Brothers
5	115	1850	Crocker-Wheeler
5	115	1700	Western Electric

Other Engine Sets in Stock

COLEMAN-SHOEMAKER, Inc.

Commercial Trust Building, PHILADELPHIA

MOTORS—DYNAMOS

Bought, Sold, Exchanged and Rented

JAWITZ ELECTRIC MOTOR CO.

211 Center St — Canal [illegible]
236 Canal St. — Franklin [illegible]
NEW YORK CITY

MOTORS - DYNAMOS

Write us what you want to buy or sell

L. J. LAND

Successor to Schwartz & Land

207 Centre Street New York

For Every Business Want: "Think SEARCHLIGHT *First"*

0110

Surety Motors

Performance Guarantee
Backed by
Surety Bond

BONDED

What the Label Means

The license label of the Surety Motor Bonding Company is on every renewed motor sold by its licensees.

It is the guarantee to the purchaser that the motor has been rigidly inspected and tested for faults; has been taken down and defective parts replaced; that it has been so thoroughly overhauled and renewed that it will perform as efficiently as a standard motor just out of the factory.

The licensee issues a Certificate of performance to the purhaser, which may be exchanged for a Surety Bond, underwritten by one of the leading surety companies of the country.

Write the following licensees for full information and stock lists of rebuilt equipment available for immediate delivery:

Duquesne Elec. & Mfg. Co., Frankstown & Hamilton Aves., Pittsburgh, Pa.
Elliott Electric Co.............813 Superior Ave., N. W., Cleveland, O.
Guaranteed Motor Co.............2814 Wentworth Ave., Chicago, Ill.
Miller-Seldon Electric Co............1259 Park Pl., W., Detroit, Mich.
Willey-Wray Electric Co...........118 West Third St., Cincinnati, O

Surety Motor Bonding Company

SURETY RENEWED MOTORS BONDED
SURETY MOTORS (BONDED)

133 W. Washington St., Chicago

Surety Motors

Performance Guarantee
Backed by
Surety Bond

BONDED

Engine Type Generator

1—200- kw., 275 volt, 195 r.p.m., compound wound, Type CCD, renewed Crocker-Wheeler D.C. generator, direct connected to an 18¾ by 21 inch right hand Buckeye engine.

1—2 Panel Vermont marble switchboard with circuit breaker, ammeter, field rheostat and main generator switch.

Engine complete with throttle valve, gravity feed oiling system, cylinder lubricator and drain valves.

Opproximate floor space of foundation 17 ft. by 19 ft.

Complete stock of new General Electric motors and renewed motors for immediate delivery. Write for full information regarding renewed bonded motors.

The Elliott Electric Company.
OF CLEVELAND

Licensee—Surety Motor Bonding Co.

SURETY RENEWED MOTORS BONDED
SURETY MOTORS (BONDED)

BUY BONDED MOTORS!

NEW and RENEWED

Alternating Current Motors

3 ph. 60 cy.—40 Rating.

No	Hp	Rpm	Volt		Type	Make
6	50	1200	220	440	AN	Allis-Chal.
1	50	1200	220	440	BW	Wagner
1	50	720	220	440	ANY	Allis-Chal.
1	50	1200	220	440	CCL	Westg'hse
1	50	900	220	440	AN	Allis-Chal
1	50	900	220	440	CS	Westg'hse
2	75	900	220	440	AN	Allis-Chal
1	75	720	220	440	AN	Allis-Chal.
5	75	600	220	440	Sl rg.	Lincoln
1	100	900	220	440	AN	Allis-Chal
3	100	720	220	440	AN	Allis-Chal
1	100	870	220	440	CW	Westg'hse
1	125	720	220	440	CW	Westg'hse
1	150	900	220	440	AN	Allis-Chal
1	150	700	220	440	CS	Westg'hse
1	200	580	220	440	CS	Westg'hse
1	200	[illegible]	220	440	AN	Allis-Chal.

Motor Generator Sets

1—[illegible] cycle, [illegible] r.p.m., cp.w. Westinghouse Rotary Converter with trans. formers [illegible] starting equipment and [illegible]

1—[illegible] volt D.C. [illegible] r.p.m., cp.wd. [illegible] Generator direct connected to and mounted on common base with 1—2200-volt [illegible] 60-cycle Ridgway synchronous motor, complete.

Duquesne Electric & Mfg. Co.

New and Renewed Electrical Equipment

Office and Factory: Pittsburgh, Pa.
(Opp E. Liberty Sta.)

Cable address "Demco" Write, wire or telephone

SURETY RENEWED MOTORS BONDED
SURETY MOTORS (BONDED)

Licensees—Surety Motor Bonding Co.

MILLER-SELDON ELECTRIC COMPANY

MOTOR SUPPLIES
ELECTRICAL CONSTRUCTION

Authorized General Electric Motor Dealers

Motors and Generators

Rewound and repaired. Coils of every description. Our shops are equipped with superior facilities, manned by expert repairmen. Prompt and efficient attention to repairs and replacements on any type or size of equipment.

General Offices:
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Shops and Warehouse:
2600 Isabella St., Detroit, Mich.
M. C. R. R. private siding.

Send for Our Stock List of New and Used Motors.

SURETY RENEWED MOTORS BONDED
SURETY MOTORS (BONDED)

LICENSEES:

Surety Motor Bonding Company

Willey-Wray Electric Company

SURETY RENEWED MOTORS (Bonded)

3 Ph., 60 Cy., 220/440 V., 40 deg. Rating

No.	H.P.	R.P.M.	Type	Make
3	40	1200	IK	Gen. Elec.
4	40	1200	CS	Westingh.
1	50	1200	B	Fair.-Mor.
1	75	720	IM-Sl.Rg.	Gen. Elec.
1	100	900	CS-Sq.Cg.	Westingh
1	135	900	ATB Syn.	Gen. Elec.
1	180	900	Sq. Cage	Burke

3 Ph., 60 Cy., 240 480 V. Alternators

No.	Kva.	R.P.M.	Type	Make
1	90	900	AB	Fair-Mor.
1	125	900	ATB	Gen. Elec.

250 V. Direct Current Generators

No.	Kw.	R.P.M.	Volts	Type	Make
1	150	575	250		Ridgeway
1	50	950	250	H	Bullock

1—30 Kw., 125 V. Ideal Generator direct connected to 3 Ph., 60 Cy., 220 V. Ideal motor.

SURETY RENEWED MOTORS BONDED
SURETY MOTORS (BONDED)

LICENSEES

118 W. Third St., Cincinnati, Ohio

Guaranteed Motor Company

ELECTRICAL MACHINERY

2814 Wentworth Ave., Chicago

BUY

SURETY RENEWED MOTORS BONDED
SURETY MOTORS (BONDED)

BONDED MOTORS

EQUIPMENT BARGAINS

At

Old Hickory

Machinery, of all kinds, from the World's greatest Powder Plant, now offered to American Industry at prices far below present cost.

Just a few of the offerings:

44—823 hp. Stirling Boilers.
3—500 hp. Keeler Boilers.
27—350 hp. Corliss Engines.
1—3000 kw. Generators.
2—630 ft. Air Compressors.
2—2570 ft. Air Compressors.
10—14 in. 8,600 g.p.m. Pumps.
2—10 in. 3,750 g.p.m. Pumps.
4—14 in. 7,500 g.p.m. Pumps.
6—16 in. 8,500 g.p.m. Pumps.
6—14 in. 8,100 g.p.m. Pumps.
2—Underwriters Fire Pumps.
16—Hydraulic Pumps.
200—Boiler Feed Pumps.
200—Blowers.
2000—Steel Tanks, all sizes.
1—50 ft. 20 ton, R.R. Crane.
1—110 ft. Fixed Radius Crane.
1—2-6-0 Locomotive.
2000—Wood Tanks, all sizes.
35—Electric Locomotives.
5000—Narrow Gauge Cars.
500—Electric Motors.
11—Sulphuric Acid Plants.
5—Nitric Acid Plants.
Transmission Equipment.
Process Equipment.
Chemical Equipment.
Miscellaneous Equipment.
Etc. Etc. Etc.

Write for Special Bulletins as follows:

No. 7—Tanks, all kinds.
No. 8—General Equipment.
No. 10—Pumps.
No. 11—Blowers.
No. 12—Industrial Cars.
No. 14—Chemical Equipment.
No. 15—Transmission.
No. 16—Building Material.

Nashville Industrial Corp.
Jacksonville, Tenn.

Power Plant Apparatus

Several Bargains in

"ODDS AND ENDS"

Synchronous Condensers

1500 Kw. Allis-Chalmers Revolving Field, 60 Cyc. 3 Ph. 2300 V. 1800 r.p.m. Alternator suitable for operation as Synchronous Condenser. Self oiling; [illegible]

1600 Kw. Westinghouse. Same as above 1200 r.p.m.

625 Kva. Crocker Wheeler Revolving Field Engine Type Alternator, 60 Cyc., 3 Ph., 440 Volt. Amortisseur wound

MISCELLANEOUS

1500 Kw. 25 Cyc. 3 Ph., 2300-6600 volt Synchronous Motor or Generator

2—300 Kw. Westinghouse 25 Cycle, 3 Ph., 390-440 Volt, Alternators, direct conn., to:—Allis-Chalmers heavy duty Cross compound bored guide Corliss Engines at 107 r.p.m.

325 Kva. Westinghouse, Engine Type Alternator, 60 Cyc., 3 Ph., 2300 Volt for direct connection at 164 r.p.m.

400 Kw. Westinghouse, 250-500 Volt, 3 Bearing Belted D. C. Generator.

625 Kva. Crocker Wheeler Engine Type Alternator, 60 Cyc., 3 ph., 440 Volt, or Synchronous Motor, 225 r.p.m.

500 Hp. Heine Steel Header Water Tube Boiler. Excellent condition. 150 lb. Non-Code District

350 Hp. Harris Corliss Engine. Cylinders 24 x 48.

2000 Kw.—3000 Kw. Standard Panel for 60 Cycle, 3 Ph., 2300 Volt Alternator.

20 Ton Crane Bridge Only. 32 ft. 1 in. Span

20 Kw. Motor Generator Set, 60 Cyc., 3 Ph., 2300 Volt. A.C. End. 250 Volt. D.C. End.

50 Kw. Westinghouse Turbo Exciter Set, 250 Volt. Practically New

Paul Stewart & Company
Cincinnati, Ohio

Water Tube Boilers

4—382 hp. Stirling 150 lb.
4—318 hp. B. & W. 150 lb.
2—400 hp. B. & W. 150 lb.
1—350 hp. B. & W. 150 lb.
2—400 hp. Erie City 150 lb.

Also

H.R.T., Marine and Firebox Boilers of all sizes.

The Markman Engineering Co.
111 W. Monroe St., Chicago

Plating Generators Sacrifice

1—5000 amp. 8 volt, 400 R.P.M. double commutator. Nearly new.
1—3500 amp. 8 volt, 500 R.P.M. Nearly new.

Nathan Klein & Co.
[illegible] Centre St.
New York City

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60 Cycle, 3 Phase Belted

ALTERNATORS

1—115 kw. Gen. Elec. ATB form P. 3 phase 400 r.p.m. 550 volts 80% PF. Belted alternator, complete.
1—75 kw. Gen. Elec. ATB. form P 3 phase 220 volts 900 r.p.m. 80% PF. complete.

Both alternators equal to new. Attractive prices.

MILL SUPPLY COMPANY
226 H. St. Troy N. Y.

D. C. METERS

FOR SALE

A quantity of direct current meters, single phase, alternating current watt meters and polyphase meters of various ampere and voltage capacities. All in first class operating condition.

Terms of sale: F.O.B. cars, Pittsburgh, Pa., at book price less 50%. List of meters submitted on application to

J. F. Torrence, General Storekeeper, Duquesne Light Co.
435 Sixth Ave., Pittsburgh, Pa.

Immediate Delivery
60 CY., 3 PH. TURBOS, ETC.
[illegible] kva. ALLIS TURBO, [illegible]
[illegible] 1250 1750 kva. 1100-2200 v. West. and G. E.
[illegible] kva., [illegible] Mixed Pressure Westg.
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
NEW [illegible] 720 [illegible] 60 cy., 550 v. Syn. Motor.
[illegible] 750 kva. [illegible] 3 ph. Syn. Motors.
NEW [illegible] 187 [illegible] 2300 v. [illegible] Syn. Motor.
[illegible] Boilers [illegible]
625 kva., 480 v., 240 v. Corliss Set.
[illegible] NEW [illegible]
Rock Crushers, Air Compressors, etc.
ROSS POWER EQUIP. CO.
[illegible]

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on the
Searchlight
and your
Advertisements in it

0197

USED POWER EQUIPMENT

Released from service by a number of public utility companies

Electrical—Hydraulic—Mechanical

Our summary contains a complete list of equipment under above classification

WRITE TODAY FOR YOUR COPY A

Phoenix Utility Co., 71 Broadway, New York City

FOR SALE

GENERATOR

At a real Bargain G. E. Co. [illegible] type MP form B. 115 volts, [illegible] 125 [illegible] 800 amps., 600 r.p.m. best [illegible].

Walker Electric and Plumbing Company
Rome, Ga.

FOR SALE

350—U. S. Navy Standard Electric

HEATERS

120 Volt, A. C. or D. C., 500 Watts, $5.00 each net f. o. b. Phila.

CHAS. J. GRANT SUPPLY CO.
1211 Arch Street, Philadelphia, Pa

FOR SALE

MOTOR,

Electric Machinery Company 2200 volt, 3-phase, 60 cycle, 15.6 ampere per [illegible], 750 H.P., 514 R.P.M. Weston A.C. [illegible] 156 with shunt Weston D.C. ampmeter model 24, one Packard [illegible] transformer 2200 volt. Also starting panel with oil switch.

FULTON MARKET COLD STORAGE CO.
Fulton & Morgan Sts., Chicago

STERLING BOILERS

14—823 H.P. Sterling Boilers Type M-30, 200 pound pressure. Equipped with Westinghouse 8 retort stokers. Vulcan soot cleaners, flow meters, 100,000 cu. ft. capacity, forced draft fan, direct connected to turbine. Practically new, at a bargain

The Nashville Industrial Corporation
Old Hickory, Tenn.

Engine Generator Units

2—15 kw direct connected 115 volt D.C Engberg Steam electric Generator outfit, new in original crates.

MICHIGAN SURPLUS MATERIALS CO
238 West Larned Street, Detroit, Michigan

NEW CORLISS ENGINES

27—18 x 36 Heavy Duty Allis-Chalmers Corliss Engines both right hand and left hand, 350 H.P. at 125 r.p.m. 11 ft. by 32 inches. Band wheel. Operated on 140 lb. steam pressure, 1½ inch gauge back pressure double eccentric.

The Nashville Industrial Corporation
Old Hickory, Tenn.

DIRECT CONNECTED SET

1—100 kva. Crocker-Wheeler, 2400 volt, 60 cycle 3 phase generator direct connected to 15 in. x 14 in. American Ball, automatic engine. With exciter.

L. F. SEYFERT'S SONS, Inc.
437 N. 3d St., Philadelphia, Pa.

ELECTRIC LIGHT
and
ARTIFICIAL ICE PROPERTIES

BOUGHT—SOLD—FINANCED

Correspondence invited

Address P. O. Box 5079, Boston 1, Mass.

Notice to Advertisers!

Owing to the holiday—Monday, January 2nd—the "*Searchlight*" pages of the January 7th issue of *Electrical World* will close for press earlier than usual. Copy should reach us as follows:

For January 7th issue

Display Ads

Copy required by 5 P. M.,
Friday, December 30th

Want Ads

Copy received as usual up to 10 A. M.,
Tuesday, January 3rd.

PUMPS

From Old Hickory Powder Plant

MOTOR DRIVE CENTRIFUGAL

10—14-in. Worthington [illegible] double suction, 8,600 G.P.M. at 152 feet head, at 1,170 W.P.M. direct connected to 300 hp. G. E., 3 phase, 60 cycle, 2,300 volt 1,700 R.P.M. motors.

4—14-in. Allis-Chalmers, Type S, 7,500 G.P.M. at 30 feet head, at 1,760 W.P.M. direct connected to 150 hp General Electric, 3 phase, 60 cycle 2,300 volt motors.

2—10-in. Allis-Chalmers, Type S, 3,750 G.P.M. 150 feet head direct connected to 100 hp G. E., 3 phase, 60 cycle, 2,300 volt motors.

Steam Turbine Driven Centrifugal

[illegible]—16-in. Allis-Chalmers, Type S, 8,500 G.P.M. at 90 feet head direct connected to Type L 300 hp., 200 W.P.M. steam turbine.

[illegible]—14-in. Allis-Chalmers, Type S, [illegible],500 G.P.M. at 150 feet head, 8,100 G.P.M. at 90 feet head direct connected to 300 hp., 2,000 R.P.M. steam turbine.

STEAM ACTUATED HYDRAULIC

[illegible]—14 and 20 x 7½ x 18 Worthington Compound Duplex outside and pocket plunger, 400 R.P.M. at 300 lb. pressure

10—25 and 38 x 17½ x 24 Worthington Tandem Compound Duplex outside end pocket [illegible] lb. pressure 1,500 G.P.M. at 20 R.P.M

2—20 x 12 x [illegible] Worthington Duplex Underwriters Fire Pumps, 1,500 G.P.M., 100-lb. pressure

200—New and used boiler feed Worthington Pumps, [illegible] x 2 x 3, 1½ x ¾ x 5, 5¼ x 3½ x 5, 6 x 4 x 8, 12 x 7 x 10.

Nashville Industrial Corporation
Jacksonville, Tenn.

FOR SALE

WATTHOUR METERS

On account of 25 to 60 cycle and 550 volt to [illegible] cycle changeover we have the following watthour meters for immediate delivery—all in operating condition.

2[illegible]—5 to 75 amp. GE type C-6 and C-7, 550 volt, DC, 2 wire.

8—10 to 100 amp. Fort Wayne, type K-3, 220 volt, AC, 3 phase, 3 wire, 25 cycles.

4—5 to 150 amp. GE type D-3, 220 volt, AC 3 phase, 3 wire, 25 cycle.

Address all inquiries to

Rutland Railway, Light & Power Co.
Meter Department
Rutland, Vermont

WANTED

Wanted—In Good Condition

One Used General Electric Curtis non-condensing

Turbo Generator Set

125 Kva., 100 Kw., 8 P.F., 2 phase, 60 cycle, 240 volts, 360 amp., 3600 rpm. turbine.

In Exchange for

One 100 Kw., Direct Current General Electric Curtis Turbine, 2000 r.p.m., 220 volts.

Standard Motor Construction Company
Jersey City, N. J.

WANTED

225—2¼ in. x 9-ft.

BOILER FLUES

B. F. POPE
32[illegible] Law Building, Baltimore, Md

WANTED

GOOD USED MOTORS

110-220 Volt, Single Phase
220 Volt, Two Phase

THE H. P. BALDWIN CO.
[illegible] Grand St., Jersey City, N. J.

ELECTRICAL WORLD

Think "SEARCHLIGHT" First

ADVERTISING RATES

POSITIONS VACANT—Business Opportunities and other classified ads 8 cents a word, minimum $2.00 an insertion.

POSITIONS WANTED—Evening work wanted, interviews, etc., other undisplayed ads of individuals looking for employment 4 cents a word, minimum 75 cents, payable in advance.

ADD 5 WORDS for box number in undisplayed ads, if replies are to go care of our office. There is no extra charge for forwarding replies.

DISCOUNT OF 10% if one payment is made in advance for 4 consecutive insertions of undisplayed ad.

ADS IN DISPLAY TYPE—Space is sold by the inch (30 in. to a page), the price depending upon total space used within a year, some space to be used each issue.

RATE PER INCH for ads in display space:
1 to 3 in., $[illegible] an in. 15 to [illegible], $[illegible] an in.
4 to 7 in., $[illegible] an in. 30 to [illegible] in., $4.49 an in.
8 to 14 in., $[illegible] an in. 50 to [illegible] in., $[illegible] an in.

POSITIONS VACANT

EMPLOYMENT

POSITIONS WANTED

POSITIONS VACANT

A RECENT electrical engineering graduate wanted for position as sales engineer with a large electrical manufacturing concern in Middle West. Splendid opportunity for the right young man. State age and qualifications in detail in the first letter. P-613, Elec. World, Old Colony Bldg., Chicago, Ill.

CONTRACT agent wanted. Must be capable of taking entire charge of the new business department in a growing company in Eastern Pennsylvania. Experience must cover all phases of commercial work, including the handling of customer's complaints and lighting and power sales engineering. State experience, salary expected and furnish references. P-586, Elec. World, Real Estate Trust Bldg., Phila., Pa.

DISTRIBUTION engineer wanted. Must be experienced. Graduate electrical engineer preferred. State salary expected, experience and give references. Splendid opportunity in a growing community in Pennsylvania. P-585, Elec. World, Real Estate Trust Bldg., Phila., Pa.

INSTRUCTOR—Graduate mechanical engineer preferred with good training in mechanics and mathematics to teach hydraulics, mechanics of materials, and Laboratory. To begin February 1. State experience and salary desired. F. P. McKibben, Schenectady, N. Y.

SALESMAN for New York City wanted by manufacturers of fractional horse-power motors. State experience, training and salary expected. P-615, Elec. World.

TECHNICAL graduate of experience wanted to take charge of the engineering department of Gas, Electric and Street Railway. State age, qualifications, salary desired and send photograph. P-606, Elec. World, Old Colony Bldg., Chicago, Ill.

WANTED machinery salesman with thorough aquaintanceship in the trade of New York City and vicinity, for position as manager of heavy machinery branch house. Only men of highest grade, technically trained considered. P-605, Elec. World.

ENGINEERS

The growth of our Telephone Engineering Division offers electrical engineers, particularly those with telephone experience, an opportunity to advance in the telephone field.

Give full information in first letter as to age, education and experience.

Western Electric Co., Inc.
48th Ave. and 24th St., Chicago, Ill.

POSITIONS VACANT

YOUNG man with technical education for sales work with a controller manufacturer. Position open is in Chicago district and presents an exceptional opportunity for energetic and hard worker. Give complete information in reply. P-567, Elec. World.

EMPLOYMENT SERVICE

EXECUTIVES qualified for salaries of $2,500 to $25,000 and upward, are invited to communicate confidentially with the undersigned, who will conduct preliminary negotiations for such positions. A procedure is used which places you in the position of being approached, avoids jeopardizing present connections, and conforms to the most exacting personal and ethical requirements. Of particular advantage as a test of conditions, to determine the advisability of changing. Details mailed confidentially on receipt of name and address only, without obligating or committing you in any way. Established 1910. R. W. Bixby Inc., 310 Lockwood Building Buffalo, New York.

EMPLOYMENT AGENCIES

GENERAL Engineering Agency, Pittsburgh, Pa., require professors, instructors, trade teachers, electrical and power engineers for sugar centrals, hydro-electric construction, operation, southern-western. Paper mill master mechanics, steel works electricians, superintendent electric jobbing shop, New York City, switchboard manufacturing superintendent. Several sales engineers, signs, radio, switchboards, furnaces, motors.

POSITIONS WANTED

ARMATURE winder, A1 man on A. C. and D. C. Have twelve years of repair shop experience on motors, generators, alternators, transformers. Can make all changes on windings. Understand all trouble work and mechanical. Have had three year course of mechanical drawing. Can furnish best reference. Twenty-eight years old, married, go anywhere. PW-618, Elec. World, Old Colony Bldg., Chicago, Ill.

DRAUGHTSMAN of power plant, elevator installation and shop experience, able machine designer, wants steady position anywhere in United States. Moderate expectations. Danubian, 625 Jackson Ave., N. Y. City, Bronx.

EXECUTIVES

seeking superior positions find our confidential service extremely satisfactory. Let our Mr. H. H. [illegible] confidentially negotiate for you suitable positions with proper employers, as he has successfully done for thousands of others since 1909. [illegible] invited.

THE NATIONAL BUSINESS BOURSE
Confidential Negotiators
[illegible] S. La Salle St., Chicago

POSITIONS WANTED

ELECTRICAL-mechanical engineer, technical graduate, 8 years' experience covering design, construction, operation and management of public utility and industrial plants. Age 31, married. Desire position in engineering department of public utility, industrial plant or construction organization. PW-581, Elec. World, Old Colony Bldg., Chicago, Ill.

ELECTRICAL engineer transformer expert desires connection power and lighting company supervising design, manufacture and repair transformers. PW-601, Elec. World.

ELECTRICAL and mechanical engineer, ten years' experience in industrial plant equipment including designing and constructing sub-stations, progressive assembly equipment and electric heating and enameling plants. Have been connected with large automobile concern in capacity of resident engineer for last five years. PW-590, Elec. World.

ELECTRICAL engineer, single, age 31, university graduate, seeks position with manufacturing concern or power company. Ten years' general experience as electrician, draftsman, designer and assistant plant engineer in manufacturing plants having both hydro and steam equipment. Available immediately. Location immaterial. References. Apply PW-594, Elec. World, Rialto Bldg., San Francisco, Cal.

ELECTRICAL engineer, technical graduate, 6 years' experience, in testing laboratory, radio, chief engineer of marine installation and maintenance, remote con·rol, machine tool applications, estimating and construction work. Desires position with well established construction company, securing business, planning, estimating and following up progress of jobs. Location, Newark or New York City, available one month. PW-619, Elec. World.

ELECTRICAL and mechanical engineer, technical graduate, with broad experience in electric, steam power plants and power transmission, open for position. Can design, estimate costs, take charge of construction or operation. Fifteen years' practical experience. Position with a growing electric light and power company preferred. PW-616, Elec. World, Real Estate Trust Bldg., Phila., Pa.

ELECTRICAL engineering graduate wants position as sales or application engineer or with consulting engineer. Two years sales and layout. Westinghouse technical courses. Now employed. Prefer Chicago or West. PW-6[illegible], Elec. World, Real Estate Trust Bldg., Phila., Pa.

ELECTRICAL engineer, age 32, married. Technical graduate in electrical engineering. 11 years' experience in power plant construction, equipment installation and industrial plant operation, good executive. PW-614, Elec. World, Real Estate Trust Bldg., Phila., Pa.

POSITIONS WANTED

ELECTRICAL engineer, technical graduate, five years' experience—one year laboratory and standardization work with electrical manufacturer; one year on power records, Electrical Superintendent office, General Electric Co.; two and a half years General Electric testing department; one half year assistant superintendent and operator, steam-electric power plant. Age 29, unmarried. Desires position with public utility or manufacturer in engineering department. PW-610, Elec. World, Old Colony Bldg., Chicago, Ill.

ELECTRICIAN, age 26, married, technical graduate, 8 years' experience power industrial plant, electrical construction and maintenance work on both A.C. and D.C. of all voltages. PW-584, Elec. World.

EXECUTIVE engineer; Cornell graduate, married, 17 years' broad experience, sales engineering and management in Public Utility and manufacturing work. Now studying "Business Management" course at LaSalle Extension University. PW-570, Elec. World.

GRADUATE engineer with several years' technical and sales experience, desires executive position or sales engineer. References furnished. Correspondence invited. PW-609, Elec. World, Leader-News Bldg., Cleveland, O.

MANAGER or superintendent by a young man thoroughly trained in the details of management and operation of combination properties in cities of 20,000, who would like to secure opening with opportunities for advancement. Has had fifteen years' electrical, nine years artificial gas and eight years natural gas experience. Held present position of manager with syndicate nine years. Prospects for advancement rather than salary important. PW-602, Elec. World, Old Colony Bldg., Chicago, Ill.

MECHANICAL - electrical engineer, technical graduate, fourteen years' experience, design, construction, operation. Desires position as industrial engineer, power superintendent or maintenance engineer. PW-577, Elec. World.

SALES engineer; technical-electrical graduate, age 35; ten years' electrical, mechanical sales construction and inspection experience; prefer district sales supervision. PW-617, Elec. World, Real Estate Bldg., Phila. Pa.

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By a house in the West, salesman of good address and with experience in complete Power Pole Line Construction Materials, including Hi-tension Insulators, Conductors, etc., and capable of figuring specifications and handling and closing large transactions. Must have a clean, successful record and good references. First reply should give sufficient details to warrant opening negotiations. Address E. K. Bibb, Box 324, Kenova, W. Va.

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HIGH grade electric specialty salesman, either street railway or general supplies. Traveling out of Chicago preferred. At liberty Jan. 1. AS-607, Elec. World, Old Colony Bldg., Chicago, Ill.

MANUFACTURERS' attention — Graduate electrical engineer, 15 years' experience selling electrical supplies, motors and generating equipment, wants to represent manufacturers in Western territory with headquarters in Denver, Salt Lake or Minneapolis. If interested in securing services of capable sales engineer, well acquainted with retail and wholesale trade in Minnesota, South Dakota, Wyoming, Colorado and Utah, please correspond at once. AS-571, Elec. World, Old Colony Bldg., Chicago, Ill.

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of this is the variety of this journal's Searchlight ads. Without a constant and appreciable *demand* for such machinery or service, by its readers, the market-place which these advertisements represent could not exist for any length of time.

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It will do everything a house bracket or swinging knob will do and some more besides, and it will do it all cheaper and better.

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It's electrically correct; drains readily in all positions, has a wet arc over voltage of 1900 volts and a good factor of safety for all secondary voltages.

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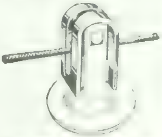

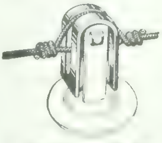

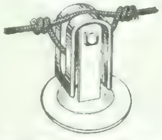

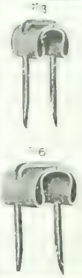

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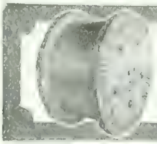

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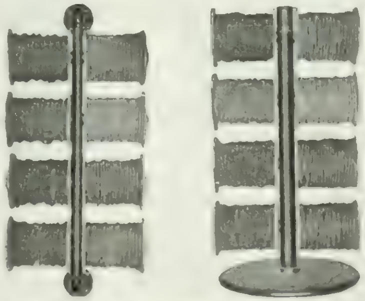

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Made for users who want the best. "XDUCT" is a high-grade conduit designed and made with a view to meeting all the requirements essential to precise work in electrical wiring.

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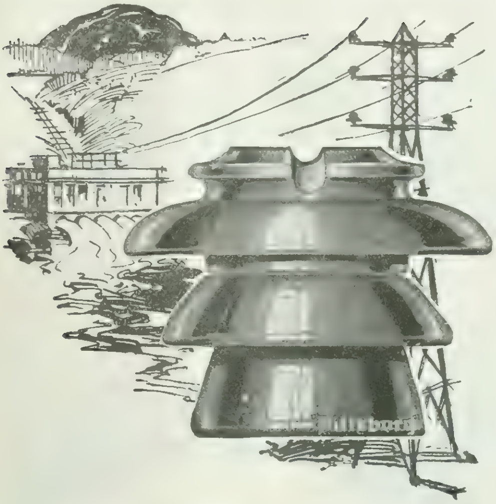

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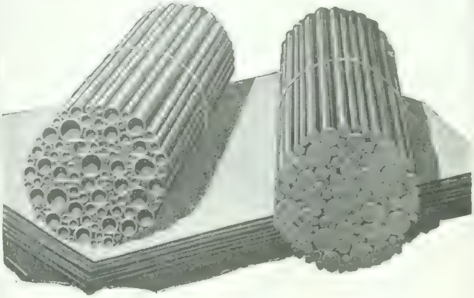

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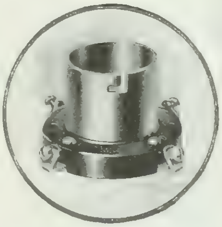

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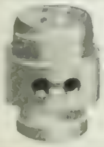

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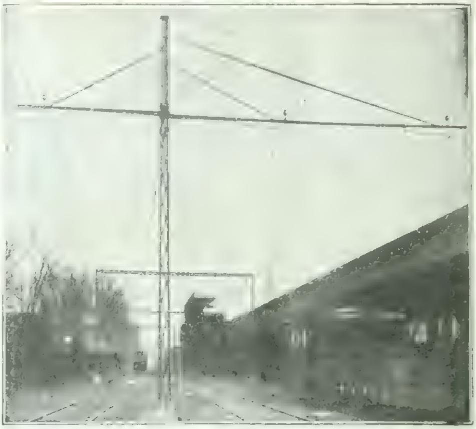

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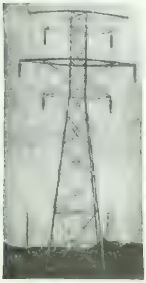

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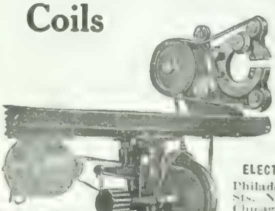

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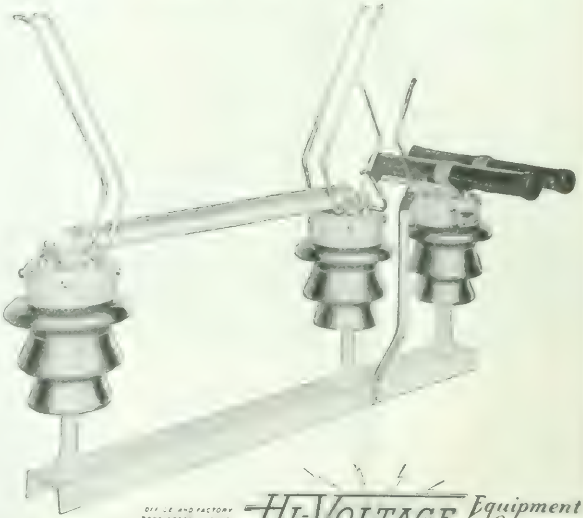

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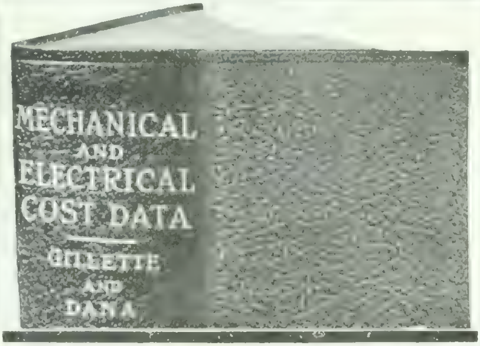

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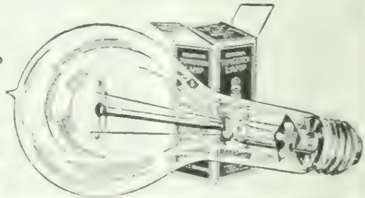

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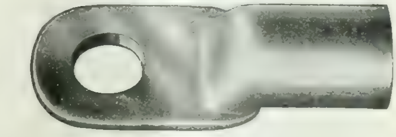

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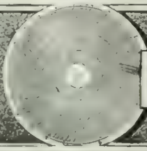

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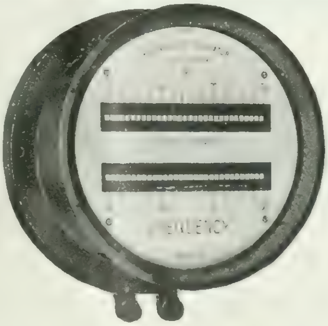

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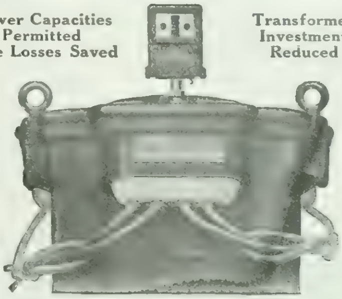

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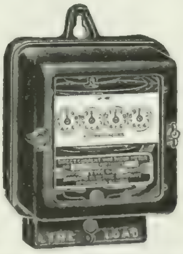

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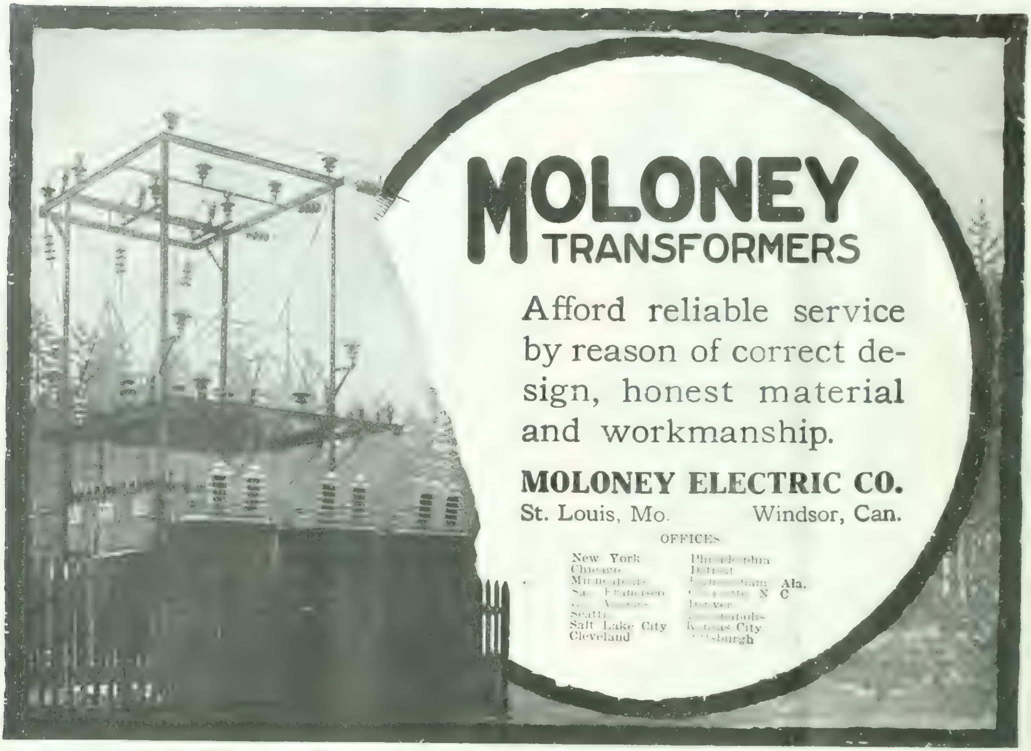

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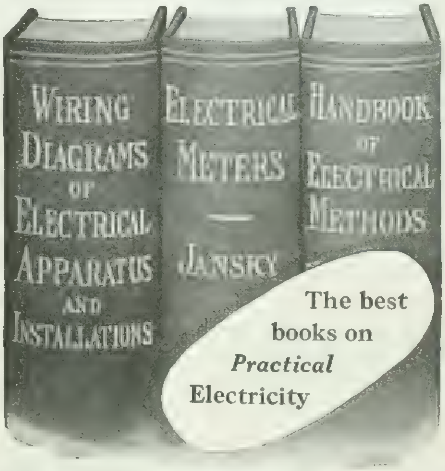
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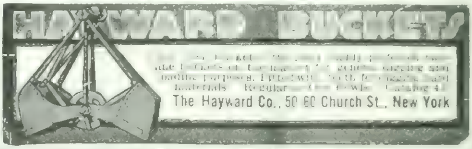

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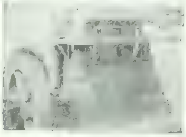

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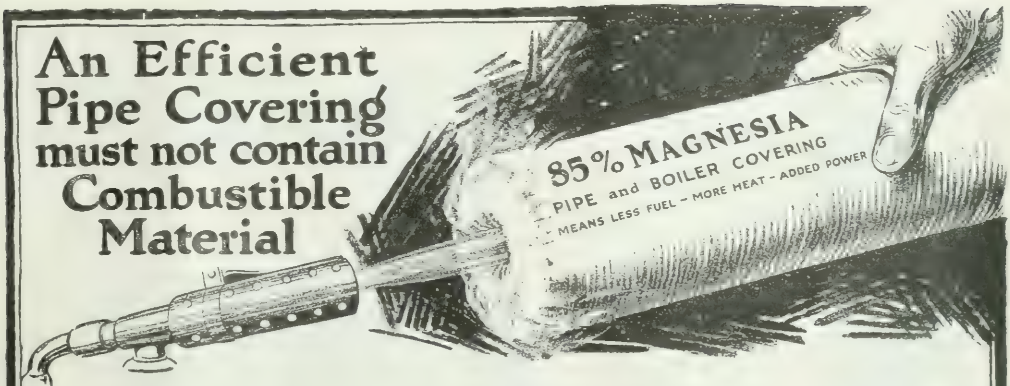

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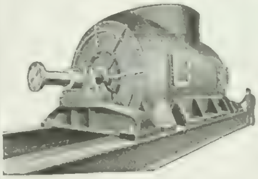

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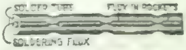

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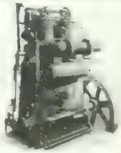

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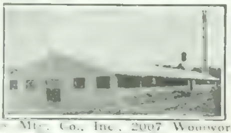

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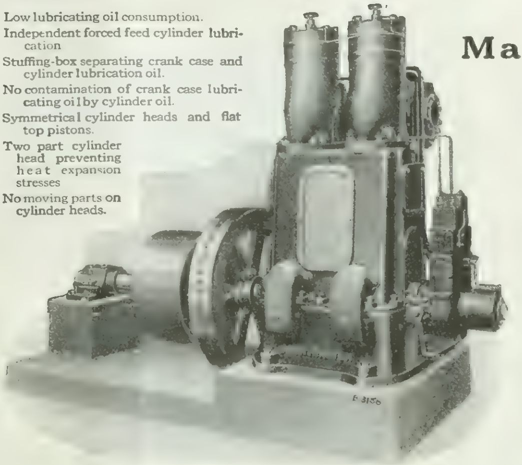

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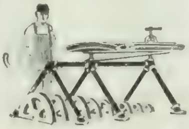
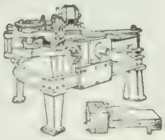


Model A

HAND
AND
MOTOR
OPERATED



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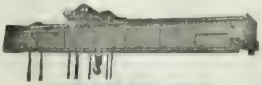

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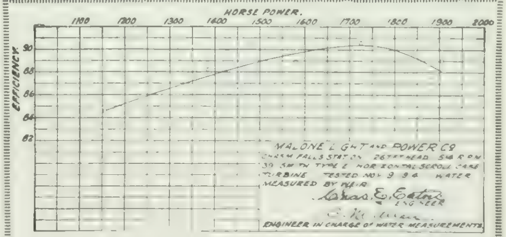

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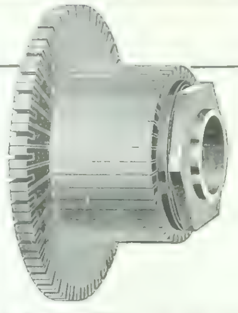

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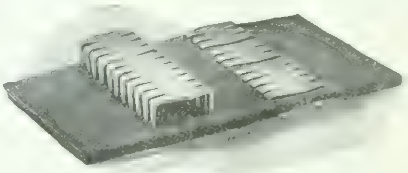

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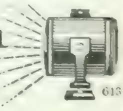

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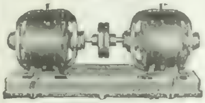
Built to a Standard



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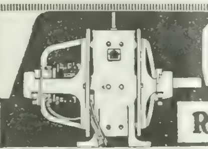

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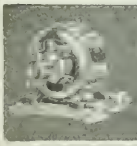

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Chattering brushes, pitted commutators, worry and Sunday work are all unnecessary.

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Readers interested in any articles not listed in these pages are cordially invited to inform us of their wants and every effort will be made to put them in touch with the proper manufacturers.

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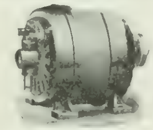

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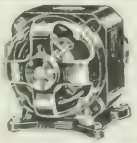

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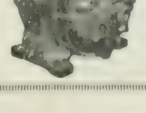

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will be *demanded* in 1922

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Universal Motors.

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Single phase fans—18 in. to 30 in. diameter.
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Roller-Smith Co.
Wagner Electric Mfg. Co
Westinghouse Elec. & Mfg. Co.
Integrating
Biddle, James G
Duncan Elec. Mfg. Co
General Electric Co
Roller Smith Co
Sangamo Electric Co
Westinghouse Elec. & Mfg. Co
Scientific and Testing
Biddle, James G
General Electric Co
Leeds & Northrup Co.
Roller-Smith Co
Westinghouse Elec. & Mfg. Co.

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American Ins. Machinery Co.
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Condensite Co. of America
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Garfield Mfg. Co.
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Mica Insulator Co
Redmanol Chem. Prod. Co.
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Continental Fibre Co
Lava
American Lava Co.
Steward Mfg. Co., D. M.
Mica
Mica Insulator Co.
Molded
Belden Mfg. Co
Condensite Co. of America
Formica Insulation Co.
Garfield Mfg. Co.
Johns-Manville, Inc.
Redmanol Chem. Prod. Co.
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Candy Company, Inc.

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Insulators
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Lapp Insulator Co., Inc.
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Electric Power Equip. Corp.
Imperial Porcelain Works
Johns-Manville, Inc.
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Mica Insulator Co.
Ohio Brass Co.
Pittsburgh High Voltage Insulator Co
Thomas & Sons Co., R
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Post Type
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Electrical Development & Mach. Co.

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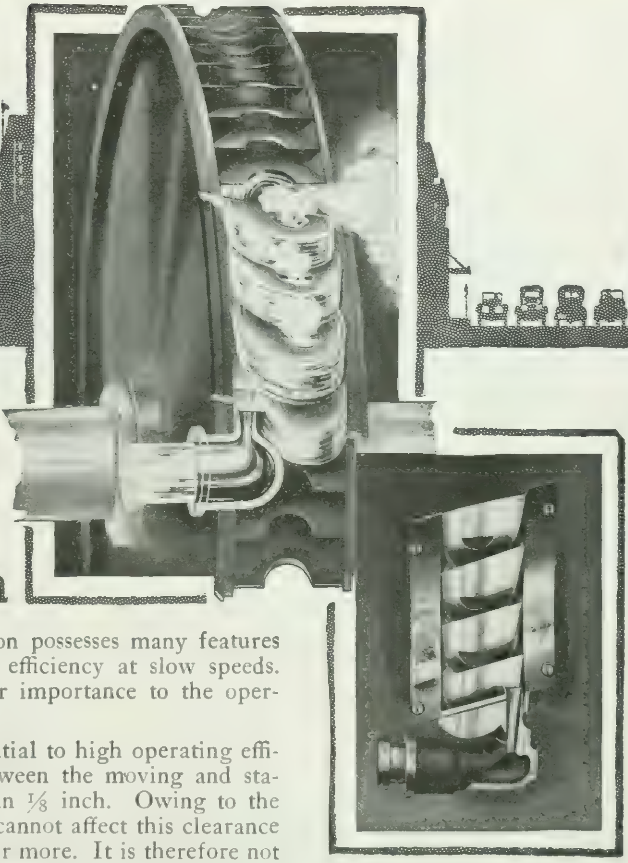

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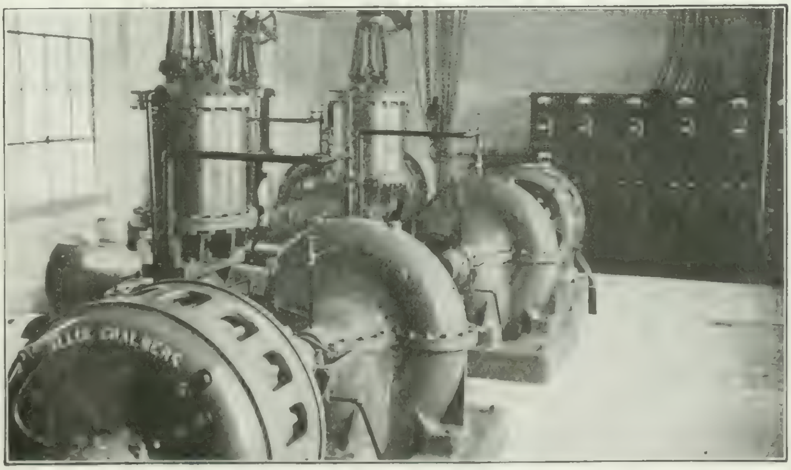

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